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Original Article

Patellar Tendon Graft for Anterior Cruciate Ligament When to Use It

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Abstract

Background: Anterior cruciate ligament (ACL) reconstruction being one of the most common procedures being done, graft selection is very important, the length of the patellar tendon being fixed, and it has to match the required length of intra-articular portion of graft as closely as possible.

Objective: The objective of this study is to assess if there is any correlation between the length of patellar tendon and the length of the ACL in a particular knee.

Materials and Methods: A total of 20 cadaveric knees were dissected to study if there is any correlation between the length of ACL and patellar tendon of the particular knee.

Results: There were wide variations in the length of the patellar tendon when compared to ACL and does not have a correlation.

Conclusion: As the length of patellar tendon graft and ACL do not accurately correlate with each other and pre-operatively, dimensions of both should be evaluated for proper graft selection.

Key words: Anterior cruciate ligament, Arthroscopy, Cadaver, Patellar tendon, Ptb length mismatch

INTRODUCTION

Anterior cruciate ligament (ACL) reconstruction is one of the most common procedures being done nowadays in the field of sports medicine. The debate on ideal graft is always there with patellar tendon and Hamstring tendons being the most commonly used ones. Achilles tendon, quadriceps tendon, and allograft are also being used but with less frequency. Bone-patellar tendon graft has the advantage of immediate strong fixation stability and bone to bone healing but has the problem of increased incidence of anterior knee pain and patellar problems such as fracture or chondromalacia. The hamstring tendon graft does not have the problem of anterior knee pain but lacks the immediate strong fixation. Bone to bone union in patellar tendon graft is always better than tendon to bone healing in hamstring graft. The advantage of aperture fixation in patellar tendon graft is achieved when the tendon length matches the length of ACL which is not seen in all the cases. There are various ways to predict patellar tendon length pre-operatively but whether it correlates to the length of the corresponding ACL is what to be studied. Various measures to assess the patellar tendon graft are available, such as the one from lateral knee X-ray, but no precise measuring tool for ACL length is used routinely pre-operatively though magnetic resonance imaging can give a reasonable idea. Pre-operative assessment can probably guide the surgeon to choose graft wisely to prevent intraoperative complications or unnecessary additional steps to accommodate the graft length-ACL mismatch.

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Objective

The objective of the study was to assess the length of the patellar tendon and ACL length in a knee and to study whether there is any correlation between them or is there any discrepancy among them and if so is it predictable or variable.

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MATERIALS AND METHODS

It was a cross-sectional type of the study. A total of 20 well-preserved adult cadaveric knees in the Department of Anatomy, Government Madurai Medical College, were taken up for the study. The cadaveric knees were dissected using a longitudinal midline incision, subcutaneous tissue dissected, and the patellar tendon was identified and delineated. The length and width at the midpoint of the patellar tendon were measured using a compass with the knee in 90° flexion, and then, medial parapatellar arthrotomy was done, and ACL was identified from tibial attachment to femoral attachment. Then, its length was measured similarly using a compass, and the results were tabulated and analyzed.

RESULTS

A total of 20 knees were dissected and the length and width of the patellar tendon and ACL were measured. The results of the study and analysis are given as follows. Table 1 shows the lengths of ACL compared against the length of the patellar tendon and their differences in each knee. Table 2 shows the pearson correlation statistics between lenghths of ACL and patellar tendon.

There is no significant correlation between length of the patellar tendon and length of the ACL at $P > 0.05$ and Pearson correlation ($r = 0.399$, $P = 0.081$). Limitation of the study was its small sample size.

Table 1: Results

Length of the patellar tendon	Versus length of the ACL	Difference
4.7	3.4	1.3
4.6	3.0	1.6
3.85	2.7	1.15
4.2	2.7	1
4.0	3.0	1
4.05	3.2	0.85
5.0	3.0	2
5.0	2.7	2.3
5.15	3.4	1.75
5.3	3.4	1.9
4.3	2.8	1.5
4.3	2.8	1.5
4.3	3.2	1.1
4.3	3.0	1.3
3.95	3.1	0.85
3.95	3.2	0.75
4.2	2.9	1.3
4.3	2.7	1.6
4.4	3.0	1.4
4.8	3.3	1.5

ACL: Anterior cruciate ligament

Table 2: Statistical analysis correlation

	Length of the patellar tendon	Length of the ACL
Length of the patellar tendon		
Pearson correlation	1	0.399
Significant (two-tailed)		0.081
N	20	20

ACL: Anterior cruciate ligament

DISCUSSION

Patellar tendon graft initially was the gold standard graft for all ACL reconstruction initially. With the usage of Hamstring grafts, the popularity of bone-patellar tendon-bone (BTB) graft has gradually declined but is still used by those who prefer it anyway. The advantages of the patellar tendon graft are the strong bone to bone fixation it provides with interference screw fixation. The strong bone to bone fixation achieved by interference screws is unparalleled by other fixation techniques which can facilitate early rehabilitation which is very important in the outcome of the procedure. Aperture fixation as achieved in patellar tendon graft has been shown to be biomechanically superior than suspensory fixation. The common problems encountered in harvesting the patellar tendon graft are patellar fracture and post-operative anterior knee pain. Some studies have even demonstrated residual quadriceps weakness though it seems to improve gradually over a period of time. Patella Baja also has been described in some studies as a post-operative complication but has not been substantiated well in other studies. The problem of anterior knee pain can be minimized by carefully resuturing the paratenon after graft harvest. Patellar fracture and damage to the chondral surface can be prevented by careful surgical technique. The width of the patellar tendon is usually adequate so as the central one-third is adequate to provide a graft with a width of at least 8 mm. The patellar tendon graft is usually slightly long and to facilitate fixation the femoral bone plug has to be slightly advanced in the tunnel or has to be flipped on the tibial side to achieve bone to bone fixation by interference screws, but again the concept of aperture fixation is lost and hence its advantages. If the advantage of rigid bony fixation and aperture fixation is lost, then Hamstring tendon graft with less donor site morbidity has an advantage over the BTB graft. Aglietti *et al.*[1] found that with good surgical technique results with PTB and hamstring grafts are the same. Colombet and Bouguennec[2] described that suspensory fixation with PTB graft had good results. Aune *et al.*[3,4] showed interference screw fixation to be better with PTB than hamstring tendons. Twisting of PTB graft does not have predictable effect on graft force.

Otsuka *et al.*[5] in their paper have concluded that anatomic fixation of PTB graft decreased tunnel length. Poehling *et al.*[6,7] in his systemic review showed equal long term results with PTB and hamstring grafts. Gaines *et al.*[8] described screw fixation as best option in graft length mismatch. Navali *et al.*[9] showed there is only a weak correlation between patient height and the length of the patellar tendon. Grave *et al.*[10] used single bone plug technique to avoid graft length mismatch. Patellar tendon length measured on true lateral radiograph is usually predictable. Denti showed poor correlation between intra-articular portion of ACL graft and PTB graft with body weight and height.[11,13]

CONCLUSION

Bone-patellar tendon graft which was the gold standard graft previously still is as good alternative for Hamstring tendon graft. However, the dimensions of the graft and intra-articular length of the graft required should be assessed and evaluated to choose the best possible option available.

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Original Article

A Retrospective Survey to Assess the Skin Lightening, Skin Moisturization and Sensorial Properties of a Broad Spectrum Sunscreen Formulation in Indian Patients

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Abstract

Introduction: Indian people primarily use sunscreens to prevent tanning and maintain a fair complexion rather than preventing sunburns and cancers which are the internationally recommended reasons for use of sunscreens. Considering these factors, a broad spectrum sunscreen formulation with anti-tanning and skin lightening properties will be an ideal formulation for Indian skin types.

Materials and Methods: A retrospective survey was conducted to assess the skin lightening, skin moisturization, and sensorial properties of a broad spectrum sunscreen formulation (octinoxate + diethylamino hydroxybenzoyl hexyl benzoate + bis-ethylhexyloxyphenol methoxyphenyl triazine + titanium dioxide, silicon dioxide, and dimethicone + diethylhexyl butamido triazone + melanostatine + tyrostat) in 30 patients at a single dermatology and cosmetology center at Amritsar. Both the patients and the treating physician rated the skin lightening, skin moisturization and sensorial properties of the sunscreen at 6 and 12 weeks.

Results: The patient's and physicians positive rating for skin lightening and skin moisturization had increased significantly at the end of 12 weeks compared to that of 6 weeks. The patients rating for sensorial properties at the end of 12 weeks were as follows: Non-irritation in 83.32% (*n* = 24), non-greasiness in 89.99% (*n* = 26), compatibility with other cosmetics in 90% (*n* = 27), non-interference with outdoor activity in 85.72% (*n* = 25), spreadability in 93.33% (*n* = 27), and sensation of softness and freshness in 89.99% (*n* = 26) at 12 weeks.

Discussion: Indian skin types react differently to chronic ultraviolet exposure compared to Caucasian skin. Uneven skin tone due to persistent pigmentation and tanning are major concerns in Indian patients; therefore, it requires a broad spectrum sunscreen with additional skin lightening (anti-tanning) properties. The sunscreen used in this survey contains two skin lightening agents' melanostatine and tyrostat which indicates why patients rating was positive for skin lightening effect for the sunscreen in this survey. It is also made in silicone base which imparts good sensorial properties.

Conclusion: A broad spectrum sunscreen with skin lightening properties may increase the adherence of patients to use sunblock regularly. Long-term, comparative studies are required.

Key words: Sunscreen, Skin lightening, Skin moisurization

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INTRODUCTION

The damage of ultraviolet (UV) sun exposure has been well documented in literature since many years now. It has been theoretically established that regular use of sunscreens is useful in preventing long-term UV associated chronic damage such as freckles, lentigines, and preventing skin

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cancer risk in Caucasians. It is also known that UV-A rays are more detrimental for skin health compared to UV-B rays as their depth of penetration is up to the dermis, and they induce free radicals (reactive oxygen species) causing damage to cell DNA.[1] Adequate and proper sun protection methods can reduce the incidence of sunburn, skin irritation, and photoaging. Sunscreen application is recommended as the primary skin cancer prevention strategy as appropriate application of sunscreen limits the penetration of UV rays in the skin.

The people in Indian subcontinent commonly have Fitzpatrick skin type 4, 5, or 6 which is darker compared to lighter Caucasian skin type.[2] There are many inbuilt protective mechanisms in darker skin types to protect against UV damage. Thicker epidermis and greater amount of melanin allow little amount of UV-A and UV-B radiation to filter through in dark skin types compared to lighter skin types. The melanosomes in darker skin are also resistant to degradation by lysosomal enzymes.[3]

Indian people primarily use sunscreens to prevent tanning and maintain a fairer complexion rather than preventing sunburns and cancers which are the internationally recommended reasons for the use of sunscreens.[3] Considering these factors, a broad spectrum sunscreen formulation with additional skin lightening properties will be an ideal formulation for Indian skin types. If it also has a good sensory profile, it may ensure optimum usage and compliance to the treatment.

We had conducted a retrospective survey based on a simple questionnaire to assess the skin lightening, skin moisturization, and sensorial properties of a broad spectrum sunscreen formulation which is marketed as La Shield Lite by Glenmark Pharmaceuticals Ltd. India. The composition of La Shield Lite sunscreen is shown in Table 1.

MATERIALS AND METHODS

A survey was conducted using a pretested questionnaire from March 2015 to May 2015. In this survey, we had included patients who were prescribed the broad-spectrum sunscreen for twice daily application on face for a minimum duration of 12 weeks. The questionnaire was designed to assess the skin lightening effect, skin moisturization effect, and sensorial properties of the anti-tanning sunscreen formulation. The responses were analyzed as to whether the questions were understood or not and necessary modifications were incorporated in the questionnaire. Instructions for filling the questionnaire were explained by the treating physician to all patients at the first visit. The patients were instructed to rate the skin lightening effect and skin moisturization effect on a 5 point scale as poor (1), below average (2), average (3), good (4), and excellent (5) at the end of 6 weeks and 12 weeks, respectively. Similarly, the treating physician also rated the skin lightening effect and skin moisturization effect at the end of 6 weeks and 12 weeks on another questionnaire for each patient separately.

Table 1: List of ingredients of LaShield lite sunscreen formulation

Melanostatine
Tyrostat-09
Octinoxate
Diethylamino Hydroxybenzoyl Hexyl Benzoate (DHHB)
Bis-Ethylhexyloxyphenol Methoxyphenyl Triazine (BEMT)
Titanium Dioxide, Silicon Dioxide & Dimethicone
Diethylhexyl Butamido Triazone

At the end of 12 weeks, the patients were also instructed to rate the sensorial properties of the sunscreen. They were as follows: Non-irritation, non-greasiness, compatibility with other cosmetics, non-interference with outdoor activity, spreadability, and sensation of softness and freshness for the anti-tanning sunscreen formulation. The patients were instructed to rate the sensorial properties on 5 point scale as poor (1), below average (2), average (3), good (4), and excellent (5) at the end of 12 weeks, respectively.

RESULTS

At the end of the survey period at 12 weeks, the filled survey forms were collected from the physician and 30 patients who completed the survey. The entire data were collected and analyzed.

In this survey, the anti-tanning sunscreen was prescribed post-procedure in 78.26 % of patients (n = 23), followed by melasma in 21.74% of patients (n = 7).

In this survey, the physician's rating for skin lightening effect of the anti-tanning sunscreen was average to excellent in 73.3 % of patients (n = 22) at the end of 6 weeks, which increased to 89.9 % of patients (n = 26) at the end of 12 weeks. The physician's ratings for skin lightening effect of anti-tanning sunscreen are shown in Figure 1.

In this survey, the physician's rating for skin moisturization effect of the anti-tanning sunscreen was average to excellent in 72.4% of patients (n = 21) at the end of 6 weeks, which increased to 89.6 % of patients (n = 26) at the end of 12 weeks. The physician's ratings for skin moisturization effect of anti-tanning sunscreen are shown in Figure 2.

In this survey, the patient's rating for skin lightening effect of the anti-tanning sunscreen was average to excellent in

80% of patient's (n = 24) at the end of 6 weeks, which increased to 96.6 % of patients (n = 28) at the end of 12 weeks. The patient's rating for skin lightening effect of anti-tanning sunscreen is shown in Figure 3.

In this survey, the patient's rating for skin moisturization effect of the anti-tanning sunscreen was average to excellent in 79.32 % of patient's (n = 23) at the end of 6 weeks, which increased to 89.6 % of patients (n = 26) at the end of 12 weeks. The patient's rating for skin moisturization effect of the anti-tanning sunscreen is shown in Figure 4.

In this survey, the patient's rating for the sensorial properties was average to excellent at the end of 12 weeks as follows: Non-irritation in 83.32% (n = 24), non-greasiness in 89.99% (n = 26), compatibility with other cosmetics in 90% (n = 27), non-interference with outdoor activity in 85.72% (n = 25), spreadability in 93.33% (n = 27), and sensation of softness and freshness in 89.99% (n = 26). The patient's rating for the sensorial parameters of the anti-tanning sunscreen are shown in Figure 5a and b.

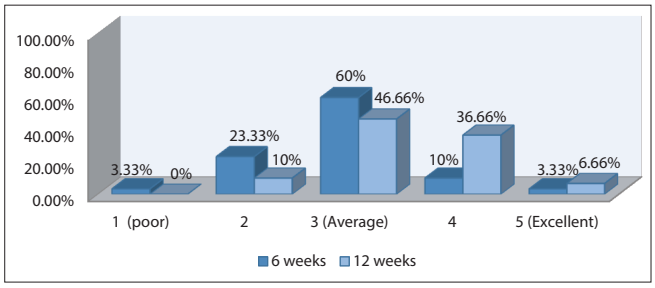

Figure 1: Physicians rating for skin lightening effect of anti-tanning sunscreen

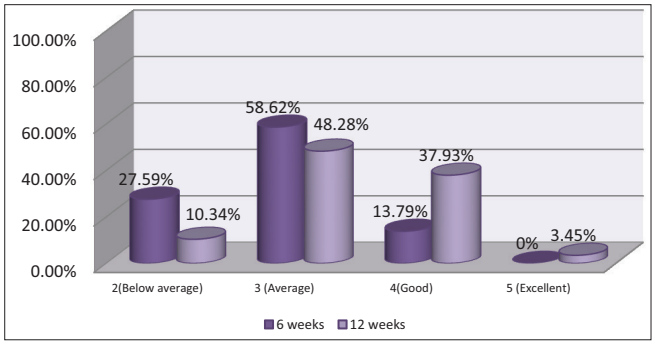

Figure 2: Physicians rating for skin moisturization effect of anti-tanning sunscreen

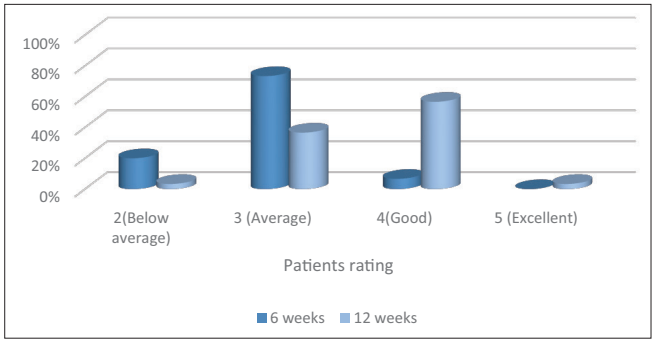

Figure 3: Patient's rating for skin lightening effect of anti-tanning sunscreen

DISCUSSION

The major appearance concern in ethnic Indian people with skin is tanning and uneven tone due to immediate and

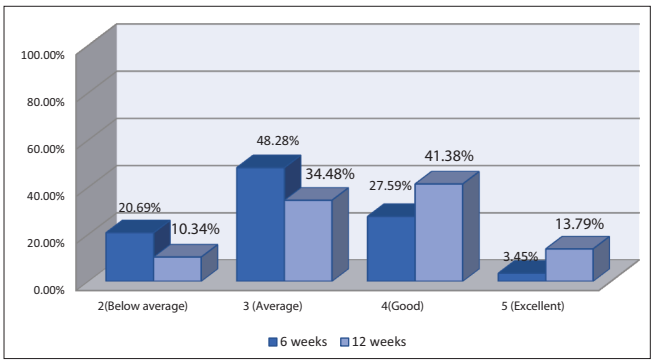

Figure 4: Patient's rating for skin moisturization effect of anti-tanning sunscreen

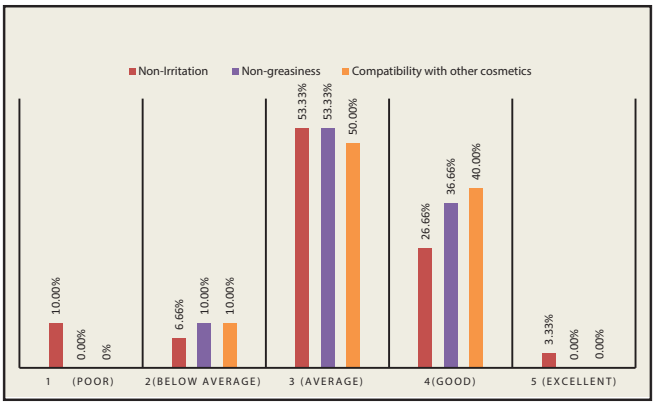

Figure 5: Patient's rating for sensorial parameters: non-irritation, non-greasiness & compatibility with other cosmetics

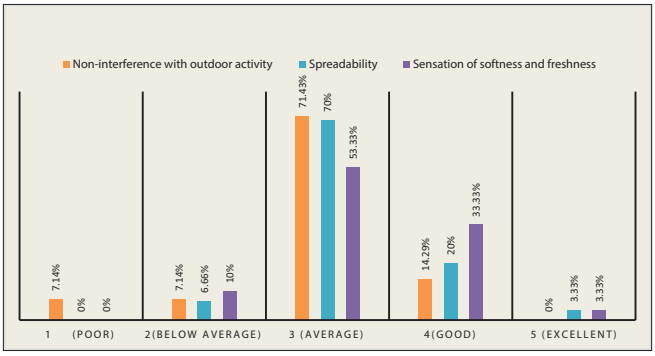

Figure 6: Patient's rating for sensorial parameters: interference with outdoor activity, spreadability, sensation of softness and freshness

delayed hyperpigmentation. These pigmentary changes are magnified by photodamage either in the form of temporary UV-A-induced tanning or the more permanent formation of lentigines. Furthermore, skin aging in the ethnic skin is not as prominent as Caucasian skin. Therefore, products designed for Fitzpatrick skin Types 1, 2, or 3 may not meet these needs. Experience from day-to-day clinical practice suggests that broad spectrum sunscreens with a mix of organic and inorganic filters with additional protection against immediate and persistent pigment darkening may be more suitable for Indian skin types particularly in Indian women who want to maintain fair complexion. There is a high incidence of postinflammatory pigmentation post esthetic procedures and light-based treatments in darker skin types.[4] This is why essential protection of Indian Skin especially following any dermatology procedure by application of a broad spectrum sunscreen agent containing both UV-A and UV-B filters is very important to prevent further damage.

At molecular level,[5,6] it is well established that UV exposure increases levels of alpha- melanocyte-stimulating hormone (α-MSH), interleukin (IL-1), corticotrophin which, in turn, increase the melanogenesis. α-MSH binds to melanocortin 1 receptor (MC1-R) receptor, stimulates adenylate cyclase, which increases the intracellular levels of cAMP. This results in increased tyrosinase activity through increased tyrosinase mRNA and protein levels, leading to the induction of melanogenesis. The sunscreen formulation assessed in this survey contains a skin lightening active agent melanostatine. It is an oligopeptide with a high affinity for MC1-R receptor.[6,7] As an antagonist, it competes against the natural ligand (α-MSH) on its specific receptor (MC1-R) by preventing any further activation of the tyrosinase, and thus blocking melanin synthesis.

Melanogenesis is controlled by an enzymatic cascade which is regulated by tyrosinase, tyrosinase-related protein-1and tyrosinase-related protein-2 (*TYRP1* and *TYRP2*).[8] The modulation of tyrosinase activity, therefore, represents a key-process for the regulation of skin pigmentation. The sunscreen formulation assessed in this survey also contains another skin lightening agent tyrostat. Tyrostat is obtained from a plant species Rumex occidentalis that is native to Northern Canada.[6,8] It is an inhibitor of enzyme tyrosinase and helps to even out skin tone by reducing age spots. One study showed that tyrostat down-regulated the expression of tyrosinase and tyrosine-related proteins genes which are involved in the regulation of melanogenesis indicated by decreased expression of *TYR, TYRP1,* and *TYRP2* genes.[8] Down-regulation of these genes leads to inhibition of melanogenesis as shown by decreased tyrosinase activity and decreased melanin content in skin melanocytes.[9]

In this survey, both the physician and patients rating for skin lightening at 6 weeks was average to excellent in 73.3% ($n = 22$) and 80% ($n = 24$) of patients. This suggests that the complementary and synergistic melanogenesis inhibiting activity of both melanostatine and tyrostat reduced sun spots, freckles, uneven pigmentation for a lighter and luminous skin tone. Further, at 12 weeks, the physicians rating for skin lightening increased from 73.3% to 89.9%, and patients rating increased from 80% to 96.6% of patients. This indicates that the skin lightening effect of this sunscreen formulation and its active agents is directly proportional to the duration of its use.

The sunscreen assessed in this survey, also contains octinoxate, diethylamino hydroxybenzoyl hexyl benzoate, bis-ethylhexyloxyphenol methoxyphenyl triazine, diethylhexyl butamido triazone, titanium dioxide, silicon dioxide, dimethicone, and cyclopentasiloxane crosspolymer. The absorption profile and photostability of these filters are well documented in literature.[10] It is made on silicone gel base which is a novel form of drug delivery for other formulation ingredients and imparts silky feel, non-greasiness and superior spreadability. This justifies the high rating by patients for skin moisturization and sensorial properties of the sunscreen.

This survey has certain limitations. Due to the observational design of the survey, the possibility of selection bias cannot be ruled out. The survey was conducted at a single dermatology and cosmetology clinic on a small sample. Treatment with other skin lightening agents such as topical agents or laser procedures was not taken into consideration which may have impacted the final outcome. Long-term comparative studies in different skin types, indications and different sunscreen formulations to address the shortcomings of this survey are warranted.

CONCLUSION

Photoprotection in ethnic Indian skin is challenging due to tropical humid climate and high incidence of pigmentary changes in Indian skin types. A broad spectrum sunscreen formulation with organic filters, inorganic filters along with skin lightening agents will ensure optimum usage and better compliance to therapy by patients.

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Original Article

Comparative Evaluation of Mesiodistal Width of Six Maxillary Anterior Teeth in J&K Population

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Abstract

Introduction: Teeth selection is an important aspect which is mostly governed by the age and personality of the individual with little or no respect to gender and positioning. Even manufacturers prepare the mold for artificial teeth keeping in mind the arch size and shades. Since teeth selection is multifactorial in nature, replacement of missing teeth cannot be fulfilled by a single size, shape, or shade of artificial teeth.

Aim: The aim of the study is to evaluate the mesiodistal width of maxillary six anterior teeth in J&K region based on the sex of the patient.

Materials and Methods: The study was conducted on 100 students comprising of 50 males and 50 females. Alginate impressions were made of maxillary arches using manufacturer's recommendations, and impressions were poured in Type III dental stone. Casts were recovered, and measurements were done using Vernier caliper for individual tooth. Thread was used to measure mesiodistal width of three teeth on both right and left sides and entire mesiodistal width of 6 teeth.

Results: The mean values of six individual teeth on both left and right sides, mean mesiodistal values of combined three teeth on the right and left, and combined mesiodistal width of six anterior teeth were measured and statistically analyzed. The mean difference in combined mesiodistal width of three anterior teeth in the right side and left side for males and females was found to be 0.4 mm.

Conclusion: Males have more mesiodistal width than females in J&K population. The right side maxillary anterior teeth have more mesiodistal width than the left side.

Clinical Implication: Manufacturers as well as dentists should consider sex along with particular position while designing prosthesis to achieve more lifelike prosthesis.

Key words: Anterior, Maxillary, Mesiodistal, Vernier

INTRODUCTION

Rehabilitation of a dental patient not only requires functional replacement but also achieves a predictable and successful outcome, a triad of functional demands, biological fulfillments, and esthetic demands must be fulfilled. The quest of humans to look more attractive has encouraged dentists to explore new avenues to satisfy the demands of patients. The word esthetic implies beauty, naturalness, and youthfulness appearance relative to ones age. Face plays a key role in attractiveness of an individual. Symmetry is a law of nature, and all the living things including humans follow this rule. Symmetry is one of the key factors contributing to facial harmony and in cases of oral rehabilitation determines the success of treatment provided.[1] Humans along with other animals have a high affinity for symmetry, and any deviation is easily appreciated by them.[2] Several authors Lau and Clark[3], Farhan *et al.*[4], Tjan *et al.*[5] suggested that deviation more than 0.5 mm is easily noticeable from a distance also. A smile is a tool that is appreciated by entire world irrespective of age, race, and region. Frush and Fisher[6] prescribed dentogenesis concept

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or SPA concept which considers sex, personality, and age of an individual before fabrication of prosthesis. William leon[7] stated that shape of the teeth is also influenced by the facial form and demonstrated a positive interaction between teeth and facial form. Several authors Miller *et al.*[8] and Harper[9] stated the interrelationship between races and teeth. They stated dark black complexion people have broader, yellower teeth as compared to white ones. Since teeth selection is multifactorial in nature, replacement of missing teeth cannot be fulfilled by a single size, shape, or shade of artificial teeth. The molds used in the fabrication of artificial teeth are differentiated on the basis of size and color, but no consideration to the sex of an individual was considered. The aim of the study is to evaluate the mesiodistal width of maxillary six anterior teeth in J&K region based on the sex of the patient. Null hypothesis states no difference in teeth selection with sex as criterion.

MATERIALS AND METHODS

The study was conducted on 100 students in MNR Dental College and Hospital, Sanngareddy, J&K, comprising of 50 males and 50 females. Inclusion criteria were followed (Table 1), and alginate impressions were made of maxillary arches using manufacturer's recommendations (Tropicalgin). Impressions were poured in Type III dental stone. Casts were recovered, and measurements were done using Vernier caliper for individual tooth. A line following the maximum contours of teeth was drawn perpendicular to the long axis of teeth, and measurements were carried out for all 100 maxillary casts (Figure 2). Thread was also used to measure mesiodistal width of three teeth on both the right and left sides and entire mesiodistal width of 6 teeth. Data were collected and statistically analyzed.

RESULTS

The mean values of six individual teeth on both the left and right side, mean mesiodistal values of combined three teeth on the right and left, and combined mesiodistal width of six anterior teeth were measured and statistically analyzed (Table 2). In males, the mean values obtained for the right side central incisor, lateral incisor, and canine are 8.8 mm, 7.6 mm, and 8.5 mm, whereas values obtained for the left side central incisor, lateral incisor, and canine are 8.7 mm, 7.4 mm, and 8.4 mm, respectively. In females, the mean values obtained for the right side central incisor, lateral incisor, and canine are 8.6 mm, 7.5 mm, and 8.2 mm, whereas values obtained for the left side central incisor, lateral incisor, and canine are 8.5 mm, 7.3 mm, and 8.1 mm, respectively. The mean difference in combined mesiodistal width of three anterior teeth in the right side and left side for males and females was found to be 0.4 mm.

Table 1: Inclusion criteria

Absence of missing maxillary anterior teeth
Absence of congenital defects
Absence of macro or microdontia
Absence of supernumerary tooth
Absence of spacing or midline diastema
Absence of maxillofacial defects
Absence of crowding
Absence of medical history
Absence of orthodontic treatment
Absence of abrasion, erosion, and attrition

Table 2: Mean values of mesiodistal width

Tooth number	Males	Mean calculated	Total	Females	Mean calculated	Total
11	8.8			8.6		
12	7.6	24.9 right side		7.5	24.3 right side	
13	8.5		49.4	8.2		48.2
21	8.7			8.5		
22	7.4	24.5 left side		7.3	23.9 left side	
23	8.4			8.1		

DISCUSSION

The aim of prosthodontics is not only to replace missing teeth but also to restore form, function, and esthetics.[10] Esthetics is not only a subjective thing but also a collection of objective evaluations. Studies[11] are carried out to study esthetics, and they concluded esthetics to be a different science which mainly depends on patient's perception with little regard to dentist's evaluation. The present study was undertaken with the objective to study the width of maxillary anterior teeth in J&K population and to find any association between gender and width of maxillary anterior teeth.

Null hypothesis that no discrepancy exists between teeth on the basis of gender in J&K region stands rejected as a positive interaction was found between the groups. Proportioning is the law of nature, and teeth are no different from it. Various proportions such as golden proportion[12] and red proportion were introduced with the aim to evaluate esthetics and provide a baseline of rules for fabrication of real-type prosthesis. Aristotle was first to observe the value of golden proportion in esthetics.[13] Egyptians found the golden number and correlated length-to-width ratio.[14] Lombardi was first to propose the application of golden proportion in dentistry.[15] Width is one of the most important proportionings which determines the overall personality of an individual.[16] Various standard textbooks have described anatomical variations in size between the left and right sides, but none of the textbooks have differentiated the size on the

basis of gender. Manufacturers also prepare teeth molds according to the left and right side with no consideration to the sex of an individual. Textbooks[17,18] recommend the size of 8.5 mm and 8.6 mm for central incisor, 6.5 mm and 6.6 mm for lateral incisor, and 7.5 and 7.6 mm for maxillary canine.

In Group A (males), 11 was found to have mean width of 8.8 mm and that of 21 was 8.7 mm, 12 was having mean width of 7.6 mm and 7.4 mm for 22, and mean width of 13 was 8.5 mm and 8.4 mm for 23, whereas in Group B (females), 11 was having mean width of 8.6 mm and that of 21 was 8.5 mm. The mean width of 12 and 22 was 7.5 mm and 7.3 mm, respectively, and mean width of 13 and 23 was 8.2 mm and 8.1 mm. This demonstrates the variability in mesiodistal width between maxillary anterior teeth among males and females (Figure 1). The values obtained were different from that provided in books which could be due to regional differences or due to non-discrimination between subjects into males and females.

Figure 1: Measurement of mesiodistal width of individual tooth by Vernier caliper

Figure 2: Line following maximum contours of teeth

Richardson[19] and Malhotra[20] and McAurthor[20] conducted similar studies without differentiating in males and females and found different values in North Indian and Caucasian populations when compared with textbooks. This signifies the racial influence on the size of the teeth.

Furthermore, it was found that, in both males and females, right side maxillary central incisor was found to be larger than left side maxillary central incisor by 0.1 mm. Wazzan *et al.*[21] stated that difference of 0.1 mm between the two central incisors to be normal which further supports the present study. The results of the study demonstrate that, in both males and females, the right side maxillary central incisor, right side maxillary lateral incisor, and right side maxillary canine were found to be bigger by 0.1 mm, 0.2 mm, and 0.1 mm, respectively, than the left side. Garn *et al.*[22] conducted a similar study and found a difference of 0.3 mm on both sides of midline to be physiologic and normal in nature. The mean mesiodistal width found in both males and females was found to be 0.4 mm more in the right side than left side. This signifies that teeth on the right side are always broader than on the left side. Pamecha and Dayakara[23] conducted a similar study and found right and left sides to be never exactly the same. The total width of maxillary six anterior teeth found in males was 49.4 mm, whereas in females, it was 48.2 mm. This suggests males have 1.2 mm broader teeth than females, thus strengthening the dynesthetic interpretation of dentogenic concept. This study is in accordance to the study by the Lysell and Myrberg[24] which suggest males have greater mesiodistal width than females. Garn *et al.*[22] also confirmed the results of the present study and stated that tooth crown size is mediated by X or Y chromosome. Females also have greater variability in teeth morphology as crown size is mediated by X chromosome in diploid females as compared to haploid males. This suggests that same teeth on opposite sides are never mirror images and should be taken in consideration while restoring the esthetics of an individual. Further studies are directed to study the mesiodistal width of mandibular anteriors, to find relations between maxillary and mandibular midlines, and to correlate facial and dental midlines. It is also suggested that manufacturers should also consider sex as a factor while preparing molds for artificial teeth.

CONCLUSION

1. Males have more mesiodistal width than females in Telangana population.
2. Right side maxillary anterior teeth have more mesiodistal width than the left side.
3. Gender is also an important criterion while designing prosthesis to achieve lifelike appearance.

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Original Article

Yield of Acid-fast Bacilli by Direct Sputum Smear Examination with Bronchial Washings and Post-bronchoscopy Sputum Smear Examination

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Abstract

Backgrounds and Objectives: The objective of the present study is to evaluate the yield of acid-fast bacilli (AFB) by direct sputum smear examination with bronchial washings and post-bronchoscopy sputum smear examination.

Materials and Methods: This prospective study was conducted on 50 patients with suspected pulmonary tuberculosis (TB) for a period of October 2009-September 2011 at Kamineni Institute of Medical Sciences Hospital, Narketpally, Nalgonda.

Results: Out of 50 clinically suspected, sputum smear-negative cases, 19 cases were diagnosed as active pulmonary TB. Bronchial washings for AFB smear were positive in 16/50 (32%) of cases, and post-bronchoscopic sputum smear was positive in 8/50 (16%) of cases. Both bronchial washings and post-bronchoscopic sputum smear for AFB were positive in 5 (10%) cases. 3/8 additional cases are diagnosed by post-bronchoscopic sputum smear over the bronchial washings. A total yield of bronchoscopy in the diagnosis of sputum-negative pulmonary TB was 38.00%, of which bronchial washing smear samples are superior in the diagnosis and is contributed to 32%.

Conclusion: It has shown that additional yield of 38% more than direct sputum smear examination helps to initiate early treatment of TB.

Key words: Bronchial wash, Bronchoscopy, Post-bronchoscopy sputum for acid-fast bacilli, Smear negative PTB

INTRODUCTION

India has the highest burden of tuberculosis (TB) in the world and accounts for nearly one-fifth of the global burden of TB per year.[1] Evidence of pulmonary TB can be frequently obtained from sputum smear stained for *Mycobacteria*, yet TB prevalence surveys have shown that in a substantial proportion of persons with active TB sputum smear for acid-fast bacilli (AFB) bacilli negative but culture for Mycobacterium TB is positive which has been observed in 22-61% of the cases.[2] The difficulty is compounded by the fact that the growth of Mycobacterium TB requires up to 8 weeks pose diagnostic problems and therapeutic dilemma to the chest physicians. Fiber-optic bronchoscopic studies provide various types of specimens (bronchial washings, bronchial lavage, bronchial biopsy, and bronchial brushings) for early diagnosis of sputum smear-negative pulmonary TB.

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MATERIALS AND METHODS

Study Design

This prospective study was conducted on 50 patients with suspected pulmonary TB for a period of October 2009-September 2011 at Kamineni Institute of Medical Sciences Hospital, Narketpally.

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Data Collection

The patients involved in this study are two (spot and overnight) sputum smear-negative with clinically and radiologically suspected cases of pulmonary TB. All sputum-negative cases were subjected to bronchoscopy.

Statistical Analysis

Data were analyzed by the Statistical Package for Social Sciences Version 16.0. Numerical data were summarized by mean ± standard deviation for continuous normal data and median ± interquartile range for continuous non-normal data/ordinal data. Categorical data were summarized by count and percentages. The association between categorical variables was done by Chi-square test. All the $P < 0.05$ were considered as statistically significant.

RESULTS

The total number of patients involved in this study was 50, of which 32 were male patients (64%) and 18 were female patients (36%). The most common age group involved in this study was in between 15 and 30 years (42%). The youngest patient was aged 18 years, and the oldest was 72 years. Most of the patients presented to the hospital in <2 months of onset of symptoms, that is, in 42%, cough was the most common symptom, present in all the patients (100%), followed by fever (70.0%) and constitutional symptoms (64.0%). The other symptoms include expectoration (34.0%), dyspnea (26.0%), hemoptysis (14.0%), and chest pain (0.10%) (Table 1). 34 (68%) patients had unilateral lesions (right or left), and 16 (32%) had bilateral lesions. 12 (24%) had cavitary lesions, and 38 (76%) had infiltrations without cavitations on chest radiography.

The most common (Table 2) bronchoscopic finding was congestion with mild-to-moderate hyperemia with whitish plaques of variable size in between, and it observed in 41 (82%) cases. In the remaining cases, erosions and ulceration in 16 (32%), intrabronchial bleeding in 8 (16%), and intrabronchial growth in 2 (4%) were observed (Table 3). Bronchial washing smear for AFB was positive in 16/50 (32%) cases, of this predominant age group that shows more positivity belongs to 15-30 years (42.85%) followed by 31-45 years (40.0%). Post-bronchoscopic sputum smear for AFB was positive in 8/50 (16%) cases, of this predominant age group that shows more positivity belongs to 15-30 years (23.80%).

Bronchial washing smear for AFB was positive in 16/50 (32%) cases, post-bronchoscopic sputum smear for AFB was positive in 8/50 (16%) cases, and in 5 (10%) cases, both post bronchoscopic sputum and bronchial washings are positive (Table 4). A total yield of bronchoscopy in the diagnosis of sputum-negative pulmonary TB was 38.00%, of which bronchial washing smear samples are superior in the diagnosis and are 32%.

Table 1: Symptomatic distribution of patients

Symptoms	Number of patients (%)
Cough	50 (100)
Expectoration	17 (34.0)
Fever	35 (70.0)
Dyspnoea	13 (26.0)
Hemoptysis	7 (14.0)
Chest pain	5 (10.0)
Constitutional	32 (64.0)

DISCUSSION

The WHO Expert Committee on TB recommends that patients of pulmonary TB in whom the disease has not been confirmed bacteriologically should be classified as "suspects" till the presence of AFB is demonstrated, and a patient with persistent symptoms whose sputum does not contain AFB should be followed up and anti-tubercular treatment should be given only if the diagnosed bacteriologically.

In our study, we had selected 50 patients with sputum smear negative on two occasions, of which 32 were males and 18 were females. This was comparable to the study done by Purohit *et al.*,[3] wherein the sample size of 50 cases, they had 35 males and 15 females.

Out of the 50 patients in our study, 50 patients (100%) presented with cough, 17 patients (34%) had cough with

Table 2: Distribution based on bronchoscopy findings

Finding	Number of patients (%)
Congestion/hyperemia	41 (82)
Erosions, ulcerations	16 (32)
Bleeding	8 (16)
Growth	2 (04)

Table 3: Radiological distribution of patients

Radiological manifestations	*n* (%)
Site of lesion	
Right	21 (42.0)
Left	13 (26.0)
Bilateral	16 (32.0)
Total	50 (100)
Type of lesion	
Cavitary	
Single	9 (18.0)
Multiple	3 (06.0)
Infiltrations without cavity	
Diffuse	15 (30.0)
Localized	23 (46.0)
Total	50 (100)

Table 4: AFB yield in different age groups in 2 procedures

Age in years	Number of cases	Bronchial washings for AFB		Post-bronchoscopy sputum for AFB	
		Positive (%)	Negative (%)	Positive (%)	Negative (%)
15-30	21	9 (42.85)	12 (57.14)	5 (23.80)	16 (76.19)
31-45	14	4 (28.57)	10 (71.42	2 (14.24)	12 (85.71)
46-60	9	2 (22.22)	7 (77.77)	1 (11.11)	8 (88.88)
>60	6	1 (20.00)	5 (83.33)		6 (100)
Total	50	16 (32)	34 (68)	8 (16)	42 (84)

AFB: Acid-fast bacilli

expectoration, 35 (70%) patients had fever, 7 patients (14%) had hemoptysis, and 5 patients (10%) presented with chest pain. These patient characteristics were similar to the study done by Kulpati and Heera.[4]

In our study, the bronchoalveolar lavage fluid smears were taken in all 50 cases and were positive for AFB in 16 (32%) patients. In the previous studies, it varied from 7.5% to 57.1% in studies done by Charoenratanakul *et al.*[5] and Malekmohammad *et al.*,[6] respectively.

In our study, post-bronchoscopy sputums were collected on 3 occasions and subjected to smear for AFB yielding 8% (16/50). This was comparable to the 23% positivity (7 out of 30 cases) in post-bronchoscopy sputum studied by Wongthim *et al.*[7] Kulpati *et al.* also noted 25% positivity (5 out of 20 cases) by phosphate-buffered saline culture, and 26% AFB smear positivity was noted by Purohit *et al.*[3] During our study, we were able to diagnose cases out of 50 cases (38%) by combining 2 procedures.

CONCLUSION

The study concludes that flexible fiber-optic bronchoscopy along with post-bronchoscopy sputum examination is a useful tool in early diagnosis of pulmonary TB in sputum smear-negative patients. Bronchoscopy reveals a higher bacteriological confirmation of diagnosis in patients with strong clinical and radiological evidence suggestive of pulmonary TB. Thus, bronchoscopic-aided procedures should be undertaken in sputum smear-negative pulmonary TB patients with a high index of clinicoradiological suspicion.

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Original Article

QT Dispersion in Acute Coronary Syndrome and Its Significance in Predicting Life-threatening Arrhythmias

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Abstract

Introduction: QT interval prolongation is known to occur in Acute Myocardial Infarction and it is known that temporary QT prolongation during Acute Myocardial Infarction predicts ventricular tachyarrhythmia.

Purpose: To assess whether increased QT dispersion (QTd) in Acute Myocardial Infarction predicts the development of ventricular arrhythmias and effects of thrombolysis on QTd with its relation to inhospital mortality. This study aims to measure the QT dispersion in patients with acute myocardial infarction.

Material and Methods: Sixty Patients of STEMI in ECG and meet the inclusion and exclusion criterias were included. Both the QTd apex and QTd end was calculated and corrected QTd (QTcd) was obtained using Bazett's formula.

This study was designed as a case control study and cases were further divided as (i) thrombolyzed and nonthrombolyzed group and (ii) VES, VT and VF group and nonarrhythmic groups. This study aims to measure the QT dispersion in patients with acute myocardial infarction.

Results: Out of total 60 cases, The mean QTd among the AWMI was significantly higher with this cut off ($p<0.001$) and In this study the mean QTd of 79.14% of cases was observed to be above this cut off value. All indices of QTd dispersion on admission in IWMI cases were significantly higher when compared to control group ($p<0.0001$). An arbitrary cut of value for all QTd indices, which predicts occurrence of IWMI was considered>50mm/sec and In this study mean QTd of 69.23% of cases was observed to be above this cut off value.

Thrombolysed group showed significant reduction in all QTd indices after 72 hrs as compared with their respective observation on admission ($p<0.01$). As compared to 44.1% of AWMI Cases only 19.2% of IWMI cases developed arrhythmia's (VES, VT, VF) during the course of study. Overall 25% of the total cases developed arrhythmias. All indices of QTd were significantly higher among the arrhythmic groups. All QTd indices were significantly increased in arrhythmic group when compared to non-arrhythmic group ($p<0.0001$).

Conclusion: QT dispersion in acute STEMI cases was found to be significantly higher in comparison with normal subjects. QTd was significantly higher in patients with AWMI and in cases who developed ventricular arrhythmias than patients with IWMI and with non-arrhythmic group. In STEMI case thrombolysis significantly decreased the QTd and the risk to ventricular tachyarrhythmias.

Key words: QT dispersion QTd, Acute coronary syndrome, STEMI, Arrythmias, Thrombolysis

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INTRODUCTION

Coronary artery disease has been defined as more than 50% angiographic narrowing of any of the three major coronary arteries. The World Health Organization has drawn attention to the fact that coronary heart disease is our modern "epidemic"

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Coronary artery disease is a major cause of mortality and morbidity worldwide. It is held responsible for about 30% of deaths in men and 25% of deaths in women in most western countries.[1] The most common cause of death in acute myocardial infarction is the development of arrhythmias, especially ventricular tachyarrhythmias.

Experimental data have demonstrated a strong link between vulnerability myocardium to serious tachyarrhythmias and increased temporal dispersion of refractoriness.

From the beginning of the century, EGG has been used in the diagnosis of different cardiac structural and functional abnormalities and the identification and prediction of different serious arrhythmias. QT interval prolongation is known to occur in acute myocardial infarction, and it is known that temporary QT prolongation during acute myocardial infarction predicts ventricular tachyarrhythmia.

Day *et al.*[2] first proposed that inter lead variability of QT interval in a standard 12 lead EGG, QT dispersion (QTD) reflects dispersion of ventricular recovery time. QTD is defined as the difference in the duration between the longest and the shortest QT interval in a standard 12 lead EGG. QTD has been suggested to reflect regional variation in ventricular repolarization.

In diseased heart, increased heterogeneity within the heart muscle is assumed to be responsible for the increased difference in QTD. New data suggest that in acute myocardial infarction, QTD demonstrates ventricular instability better than QT prolongation. Thus, QTD appears to be a non-invasive marker for inhomogeneity of ventricular recovery within the myocardium, which in turn may lead to arrhythmias.

This study aims to measure the QTD in patients with acute myocardial infarction. Dynamic behavior of QTd was examined in patients with acute myocardial infarction and was related to thrombolysis, arrhythmia, and death as compared to healthy controls.

MATERIALS AND METHODS

This prospective study was conducted on patients admitted in coronary care unit of tertiary medical centre in central India. 60 patients, who have ST elevation myocardial infarction (STEMI) in electrocardiography (ECG) and meet the inclusion and exclusion criteria required for this study, were included. 30 age and sex-matched healthy individual served as control.

Detailed history and clinical examination were undertaken in all cases. Apart from routine investigations (including complete blood count, urine analysis, and blood sugar level renal function tests) lipid profile, serum electrolyte, and serial creatine phosphokinase-MB levels were done. All the cases were subjected to ECGs (within 24 h of admission, after 72 h and also whenever the situation demanded) as well as echocardiography.

For recording the EGGs a "cardiart 6028" model which has simultaneous 12 lead acquisitions was used. The recording was made at a paper speed of 25 mm/s with standardization of 1 mv = 10 mm deflection. Two complexes from each lead were analyzed for measurement, and the QT interval was measured in milliseconds (ms).

QTD measurement was done as suggested in the study by Higham and Campbell[3] (1994) The OT interval was measured from the onset of the QRS to end of QRS, QTd apex is taken as a point of maximum amplitude of "T" wave, and QTd end is at the end of T wave.

The most crucial aspect of the methodology is the protocol to define the end of the T wave. Since this definition is especially difficult when T waves merge with U or P waves the end of the T wave was defined as the point of return to T-P baseline. If U wave was present, the QT interval was measured till the nadir of the curve between the T and U waves. QTd was calculated as:

QTd= Maximum QT interval-minimum QT interval.

Both the QTd apex and QTd end were calculated and corrected QTd (QTcd) was obtained using Bazett's formula[4] which is:

$$\frac{QT}{\sqrt{R\text{-}R\text{interval(sec)}}}$$

All patients were under continuous EGG monitoring for at least 48 h after admission and patients were followed up to 1 week. Thrombolysis was given as per standard indications.

This study was designed as a case–control study and cases were further divided as thrombolysed and non thrombolysed group and ventricular extra systoles (VES), ventricular tachycardia (VT) and ventricular fibrillation (VF) group, and non-arrhythmic group. Endpoints assessed were the development of isolated VES, VT, VF, and death. Only those patients who had ST elevation Ml and admitted within 24 h of the onset of symptoms were included in the study.

Myocardial infarction was diagnosed as per the WHO diagnostic criterion that is presence of at least two of the following three criteria's - typical chest pain suggestive of myocardial infarction of more than 30 min duration, typical ECG changes of ST elevation more than 1 mm in at least two contiguous leads or Q-waves and T-wave inversion or a typical rise and fall of cardiac-specific enzymes.

Patients having history of long QT syndromes, on drugs which prolong QT intervals, known case of hypertrophic cardiomyopathy, patients with chronic congestive heart failure, patients with heart blocks, patients with electrolyte imbalance, patients with previously documented ventricular arrhythmias or myocardial infarction, history of cerebrovascular accident in the past, immeasurable "T" wave in the ECG in more than 3 leads and patients admitted >24 h after the onset of symptoms were excluded from the study.

The significance of each of the results was analyzed using a student's *t*-test for continuous variables. *Z*-test was used for predicting cut off values. $P < 0.05$ was considered significant. Result is reported as mean + standard deviation.

RESULTS

Between September 2016 and August 2017 patients of acute coronary syndrome coming to the medicine outpatient department and the emergency departments and coronary care unit of NSBMCH, Jabalpur, India, were studied.

Out of total 60 cases majority (81.2%) were male, almost equal number of male cases (83.3%) were observed in the control group. Majority of male cases (61.2%) were in 40-59 age group, and 28.3% of the cases were observed in >60 years of age, while in females majority of the cases (81.8%) were concentrated in >60 years age group. Out of total 34 cases of AWMI majority (61.74%) of the cases were thrombolysed. In the studied cases of IWMI, 65.38% of cases belonged to thrombolysed group and 34.6% of cases to non-thrombolysed group.

In cases of AWMI, the average (mean) of all QTd indices on admission were significantly increases when compared with their respective values in control group ($P < 0.0001$). In contrast to QTd, QTcd showed highly significant increase in comparison with controls ($P < 0.0001$). Thus, QTcd was found to be a better parameter in differentiating between AWMI and normal subjects. There was no significant difference between QTd APEX and QTd end ($P < 0.05$). An arbitrary cut off value for all indices of QTd above which risk of occurrence of AWMI is increased was considered >75 mm/s. The mean QTd among the AWMI was significantly higher with this cut off value using a (z score) student *t*-test ($P < 0.001$) and in this study the mean QTd of 79.14% of cases was observed to be above this cut off value.

All indices of QTd dispersion on admission in IWMI cases were significantly higher when compared to control group ($P < 0.0001$). An arbitrary cut off value for all QTd indices, which predicts the occurrence of IWMI was considered >50 mm/s and in this study mean QTd of 69.23% of cases was observed to be above this cut off value.

Thrombolysed group showed significant reduction in all QTd indices after 72 h as compared with their respective observation on admission ($P < 0.01$) and the mean reduction was 20 ms for all QTD indices, and in non-thrombolysed group there was no significant change between mean QTd on admission and after 72 h ($P > 0.05$).

As compared to 44.1% of AWMI cases only 19.2% of IWMI cases developed arrhythmia's (VES, VT, VF) during the course of study. Overall, 25% of the total cases developed arrhythmias. All indices of QTd were significantly higher among the arrhythmic groups. All the 7 cases of ventricular arrhythmia after 72 h occurred in non-thrombolysed group and showed QTd prolongation after 72 h when compare to their respective admission values.

All QTd indices were significantly increased in the arrhythmic group when compared to non-arrhythmic group ($P < 0.0001$) (Tables 1-3).

DISCUSSION

Non-uniform recovery of excitability has been demonstrated to play an important role in the pathogenesis of ventricular arrhythmias. According to Day *et al.*[2] QTD reflects dispersion of ventricular recovery time. Thus, QTd appears to be a non-invasive predictor of ventricular tachyarrhythmias following myocardial infarction.

This prospective study was conducted in 60 acute myocardial infarction patients admitted in coronary care unit of NSCB Medical College, Jabalpur. Patients who had STEMI and met the inclusion and exclusion criteria for the study were included. Males constituted 81.2%, and females constituted 18.3% of the cases. The mean age of the males and females was 52.31 (±13.93) years and 64.36 (±7.43) years, respectively. 30 age and sex-matched healthy individuals served as controls.

In normal individuals (control) QTd of 42.00 (±13.23) ms was observed. Similar values of QTd have been reported

Table 1: Mean QTD in control and cases of AWMI

Parameter	QTd apex	QTcd apex	Qt end	QTcd end
Normal	42.00±13.23	44.16±13.81	39.33±12.29	41.45±13.36
AWMI	88.24±23.67	92.98±24.79	90.00±22.70	94.85±23.77
Significance	Z=3.83	Z=9.88	Z=11.20	Z=11.24
	P>0.001	*P*>0.0001	*P*>0.0001	*P*>0.0001

QTD: QT dispersion

Table 2: Mean QTD in controls and cases of IWMI

MI	QTd apex	QTcd apex	Qt end	QTcd end
Normal	42.00±13.23	44.16±13.81	39.33±12.29	41.45±13.3 6
AWMI	63.08±20.15	65.22±20.96	67.69±21.22	69.94±21.56
P	Z=4.44	Z=4.37	Z=6.00	Z=5.84
	P>0.001	*P*>0.0001	*P*>0.0001	*P*>0.0001

QTD: QT dispersion

Table 3: Mean QTD in arrhythmic and non-arrhythmic group

Arrhythmia	QTd apex	QTcd apex	Qt end	QTcd end
Yes	100.67±20.93	111.17±21.19	108.00±19.1	112.62±20.1
No	75.78±19.52	80.64±20.88	77.89±18.7	82.86±19.8
Signification	Z=4.40	Z=4.40	Z=4.52	Z=4.31
NCE	*P*<0.0001	*P*<0.0001	*P*<0.0001	*P*<0.0001

QTD: QT dispersion

earlier by "Ciolli *et al.*[5] (1999)," Paventi *et al.*[6] (1999), and Moreno *et al.*[7] (1994). Somewhat lower values have been reported in few other studies conducted by Van de Loo *et al.*[8] (1994), Yunus *et al.*[9](1996), and Dnyaneshwar *et al.*[8] (2004). It was observed that QTc dispersion 44.16 (±13.61) ms was greater than QTD 42 (±13.23) ms. Although in the present study this difference was statistically insignificant ($P > 0.05$) but Paventi *et al.*[6] in his studies have reported a significant difference between QTcd (53.9 ± 16.2) ms and OTd (43 ± 13.2) ms in normal subjects ($P < 0.01$).

In this study, there were 34 cases with AWMI and 26 cases with IWMI, constituting 56.67% and 43.3%, respectively, of the study group QTd in patients with AWMI ranged from 40 ms to 140 ms with a mean of 88.24 (±23.67) ms which was significantly higher ($P < 0.0001$) when compared to controls 42 (±13.23) ms. This observation was consistent with some of the earlier studies conducted by 'Gabrielli *et al.*[10] (1991) Gupta *et al.*[11] (2002), and Ciolli *et al.*[5] (1999).

Although all QTd indices were increased when compared to their respective value in control group. QTcd was more significantly increased ($P < 0.001$ [for QTd], $P < 0.0001$ [for QTcd]). Thus, QTcd was found to be a better parameter in differentiating between AWMI and normal subjects.

To find whether we can derive a cut off value for QTd, which could predict the cases of AWMI, an arbitrary value was considered and its significance was tested using student's *t*-test (χ-test) tested. It was found that a QTd >75 ms could predict anterior wall as the site of infarct, with the sensitivity of 79.4% and specificity of 83.9%. This was highly significant ($P < 0.0001$). In this study, the mean QTd of 79.14% of AWMI cases was observed to be above this cut off value.

In somewhat similar studies by Calder *et al.*[12] QTd was considered as a dicho matas variable that defines the "at risk category" for developing acute Ml, as having QTd >50 ms and significance was tested using *t*-test which was found to be significant ($P < 0.01$).

QTd inpatients with IWMI ranged from 40 ms to 100 ms with mean QTd of 63.75 (±24.29) ms. All QTd indices were significantly increased when compared to control ($P < 0.0001$). Again QTcd (65.22 ± 20.46) ms showed greater dispersion, but the difference was statistically insignificant ($P > 0.05$).

When compared to the cases with AWMI, all QTd indices were significantly lower in cases with IWMI ($P < 0.0001$). Paventi *et al.*[6] and Ciolli *et al.*[5] and some other studies have reported similar observations earlier. Cowan *et al.*[13] (1988) and Gabrielli *et al.*,[10] however, did not observed any significant difference in QTd with the different territory of Ml.

Out of total 21 thrombolysed AWMI cases, majority (16 cases) showed a reduction in QTd. Only two cases that had other ECG evidence of failed thrombolysis showed an increase in QTd, with QTd remaining unchanged in rest. AWMI cases who were thrombolysed showed a significant reduction ($P < 0.01$) in mean QTd (20.00 ± 28.48) after 72 h. Moreno *et al.*[7] (1994) have attributed the fall in QTd to a reduction in the infarct size and improvement in LV contractility. Some of the previous studies by Gabrielli *et al.*[12] (1997), Gupta *et al.* (2002), and Rasim *et al.* (2001) also showed a significant decrease in QTd while Ciolli *et al.*[5] (1999) and Paventi *et al.*[6]

Endoh *et al.*[14] (1997) demonstrated QTD during the acute phase (2.0 ± 0.9 days) and during the recovery period (14 ± 6 days) after STEMI. They showed a significant reduction in the amount of OT dispersion in patients with successful reperfusion therapy whereas changes in QTD were insignificant in patients who did not undergo recanalization of the infarct-related artery. Yunus *et al.*[9] (1996) observed that mechanical relief of ischemia by percutaneous transluminal coronary angioplasty (PTCA) decreased QTD (from 60 ± 9 ms pre-PTCA to 29 ± 18 ms post-PTCA) which returned back to pre-PTCA levels with restenosis, studies involving larger number and patients

with comparable QTD values between the two groups are needed to confirm the results. Patients who did not receive thrombolysis showed a mean increase in QTd, but this rise of QTd was insignificant ($P > 0.05$), which was in accordance with the observations made by "Ciolli *et al.*[5]" and Paventi *et al.*[6]

Both thrombolysed, as well as, in non-thrombolysed group, did not show any significant change in QTD after 72 h. This was in accordance with the observations made by Ciolli *et al.*[5] and Paventi *et al.*[6]

20 cases constituting 25% of total study group developed ventricular arrhythmias during the course of study. As compared to 19.23% of IWMI cases, 44% of AWMI cases developed arrhythmias suggesting greater myocardial damage and hence greater electrical instability in cases with AWMI.

In this study, QTD was significantly higher ($P < 0.0001$) in cases with ventricular arrhythmias group (100.67 ± 20.93) compared with those without it (95.78 ± 19.52). Although QTd was prolonged in all the three arrhythmic group (YES, VT, and VF) but it was significantly higher in those with VTNF (117.14 ± 30.87) ($P < 0.0l$) than in those with only VES (86.67 ± 11.55) $P > 0.05$. Similar observations have been reported earlier by Paventi *et al.*[6] and Ciolli *et al.*[5]

This simply illustrates the fact that there is a gradual increase in heterogeneity of ventricular recovery from normal subjects to patients with uncomplicated Ml to those with severe ventricular arrhythmias.

Oikarinen *et al.*[15] (1988) concluded that increased QTd is associated with susceptibility to VF and was independent to the extent of coronary artery disease, and use of beta-blockers.

An arbitrary cut off value for QTd, which predicts the risk of developing ventricular arrhythmias was considered, and significance was tested using student's *t*-test. Cut off QTd value for predicting VES was considered 85 ms ($P < 0.0001$). Cut off QTcd value for fatal ventricular tachyarrhythmias was considered >100 ms, ($P < 0.0001$.)

In our study, 71.4% of cases of ventricular tachyarrhythmias were observed to have cut off QTd values >100. However, a cut off value could not differentiate development of VT and VF. A similar study conducted by Gornek *et al.* showed that QTd >80 ms was associated with VPC's with 68% sensitivity and 88% specificity.

Arbitrary cut off value for predicting ventricular arrhythmias in IWMI cases was considered 80 ms. The mean QTd among IWMI cases with arrhythmias was significantly higher with this cut off value using a student's *t*-test $P < 0.0001$.

Mean QTd (120 ± 43.20) of the patients who died after 72 h was higher than its respective admission value (105.19 ± 15). This is in accordance with the studies conducted by Ciolli *et al.*[5] which suggests that risk of in-hospital mortality was more when QTd was same or increased after 72 h compared to QTd on admission.

CONCLUSION

QTD in acute STEMI cases was found to be significantly higher in comparison with normal subjects. QTd was significantly higher in patients with AWMI and cases who developed ventricular arrhythmias than patients with IWMI, and with non-arrhythmic group hence QTd could reasonably predict the site of infarct and risk of arrhythmias depending on the amount of myocardial damage. Thrombolysis significantly decreased the QTd and the risk to ventricular tachyarrhythmias in cases with STEMI.

Given the lack of infrastructure for costly investigations and the easy availability of EGG in developing countries like ours, QTd may serve as a cost-effective tool in the prediction of fatal ventricular tachyarrhythmias following STEMI, which still remains the major deadly complication in the acute phase.

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Original Article

Study of Critical Illness in Pregnancy

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Abstract

Background: Critical care is bonafide part of obstetric practice. A critically ill obstetric patient is one, who, because of normal or abnormal pregnancy, delivery, and puerperium or because of effects of systemic disease develops complications threatening her life for which she needs intensive monitoring, therapy or life support system. In view of this, the present study makes an attempt to study these disorders threatening the lives of both mother and the child, recognizing the various risk factors associated in a given scenario so as to have a high index of suspicion and their outcome in a given setup. Once established, early prevention of these risk factors and effective treatment of these complications can have dramatic impact on the maternal mortality.

Methods: The present study entitled "study of critical illness in pregnancy" was carried out in the Medical Intensive Care Unit (MICU) of Dr. D.Y. Patil Hospital and Research Center, Nerul, Navi Mumbai, Maharashtra, India, with participants being all pregnant and postpartum females (up to 42 days after delivery) transferred to intensive care unit for period of 2 years (2013-2014).

Results: Majority of patients requiring MICU admissions were in age group between 21 and 25 years. The mortality rate was significantly higher in age group of ≤20 years and majority of pregnant females were Primigravida.

Conclusion: Maternal age <20 years is associated with significantly high mortality in critically ill obstetric population (40%). Thus younger age and not the ideal reproductive age is a high risk group. In third world countries (medical/infective) indirect obstetric (52.4%) cause are more rampant for mortality. The most common medical complications requiring critical care were infective causes such as malaria, viral hepatitis, and sepsis. Pregnancy induced hypertension was most common indication for MICU care followed by malaria though mortality was highest by malaria and respiratory failure was most common organ system failure (51.3%) seen in our study.

Key words: Critical illness, Obstetric patients, Pre-eclampsia

INTRODUCTION

Critical care is bonafide part of obstetric practice. A critically ill obstetric patient is one, who, because of normal or abnormal pregnancy, delivery, and puerperium or because of effects of systemic disease develops complications threatening her life for which she needs intensive monitoring, therapy or life support system. In India, one woman dies every 5 min from a pregnancy-related cause.[1] It is estimated that 15% of deaths of women in reproductive age in India are maternal deaths. Following table shows difference in maternal mortality rate between developing countries like India and developed countries (Table 1). India has a maternal mortality rate of 450 deaths per 100,000 live births.[2]

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The main reasons behind high maternal mortality in India are:

1. Deliveries not attended by trained personnel: National Family Health survey (NFHS-2) (the NFHS, conducted in 1998) reports that only one-third (34%) of deliveries in India take place in health-care facilities and two-fifth (42%) of deliveries are unattended by a trained medical professional.
2. Women not seeking antenatal care; more than 1 out of 3 women (34%) in India did not receive an antenatal check-up for births in the 3 years preceding the survey. Only 7% received antenatal check-up in third trimester.
3. Postnatal care is grossly deficient.

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Table 1: MMR among different countries

Country	MMR (maternal deaths per l00,000 live births)
India	450
Canada	7
United Kingdom	8
Germany	4
United States of America	11

MMR: Maternal mortality rate

Thus, it is imperative to study the various medical complications contributing to the maternal mortality. In view of this, the present study makes an attempt to study these disorders threatening the lives of both mother and the child, recognizing the various risk factors associated in a given scenario so as to have a high index of suspicion and their outcome in a given setup. Once established, early prevention of these risk factors and effective treatment of these complications can have dramatic impact on the maternal mortality.

METHODS

Study Design

It is a prospective observational study.

Setting

This study was conducted in the Medical Intensive Care Unit (MICU) of a tertiary care teaching hospital.

Participants

All pregnant and postpartum females (up to 42 days after delivery) transferred to intensive care unit for period of 2 years.

All the routine investigations done in MICU patients were taken into consideration. This included withdrawing around 20cc of blood on day of admission or within 24 h of admission in MICU and on the day of discharge from MICU. Furthermore, urine sample and required culture samples were taken.

Interventions

All the patients were given routine MICU care appropriate for the disease condition. Appropriate antibiotics according to prevalent sensitivity patterns and specific culture sensitivity reports were given.

Supportive therapy was given to these patients as follows:

- Central venous line insertion - in hypotension, cardiac failure, etc.
- Endotracheal intubation - as a prophylactic measure in unconscious patients or those requiring artificial respiration.
- Ventilatory support - in respiratory distress or failure.
- Nutrition was maintained with IV fluids and Ryle's tube feeding in drowsy or unconscious patients and oral feeding in conscious patients.
- Severe anemia was treated with packed cell transfusion.
- DIC with fresh frozen plasma and blood ± platelets.
- Renal failure with hemodialysis or conservative management.
- Hypoglycemia with dextrose infusions.
- Metabolic acidosis with sodium bicarbonate administration or dialysis.

All the treatment was at the discretion of the ICU physicians. The treatment strategy was individualized for each patient and was the sole prerogative of the treating physician outcome: Outcome of each patient was classified as either survived or expired. Data thus obtained were tabulated and statistically analyzed, using Pearson Chi-square test with the help of SPSS version 18.

RESULTS

Majority of patients requiring MICU admissions were in age group between 21 and 25 years. This group contributed almost 42.31% of obstetric admission in MICU (Table 2).

The mortality rate was significantly higher in age group of ≤20 years. The Pearson Chi-square test $P = 0.045$ which is significant.

Majority of females died who were admitted in their third trimester.

Mortality rate was highest in third-trimester antepartum period 22.7%.

The Pearson Chi-square test $P = 0.771$ which is not statistically significant.

Following table shows different indications for which pregnant females were transferred to MICU (Table 3).

Majority of the patients required MICU care due to eclampsia and pre-eclampsia 36.5%, 19 patients out of 52.

Malaria was most common cause of death, 30%, 3 patients out of 10 who died (Table 4).

High mortality was observed during 6-10 days of MICU stay.

The Pearson Chi-square test $P = 0.522$ which is not statistically significant.

Table 2: Correlation of age with mortality

Age	Died	Died%	Survived	Survived%
≤20	2	40	3	60
21-25	7	31.82	15	68.18
26-30	0	0	18	100
>30	1	14.29	6	85.71
Total number	10	19.2	42	80.76

Table 3: Indications for MICU care in pregnant and postpartum females

Diagnosis	Count (%)
Eclampsia/pre-eclampsia	19 (36.5)
Malaria	12 (23.1)
Sepsis	8 (15.4)
DIC	4 (7.7)
RHO	3 (5.8)
OBS-HMG	3 (5.8)
HEP	3 (5.8)
Anemia	2 (3.8)
Ectopic	2 (3.8)
Dengue	2 (3.8)
Viral atypical pneumonia	1 (1.9)
GTC	1 (1.9)
H1N1	1 (1.9)
GDM	1 (1.9)
COPD	1 (1.9)

Table 4: Correlation of duration of MICU stay with mortality

Days	Died	Survived	Died%	Survived%
1-5	7	33	17.5	82.5
6-10	3	7	30	70
>10	0	2	0	100

Majority of the patients who died in MICU care had hemoglobin levels of 6-8 g/dl.

The Pearson Chi-square test $P = 0.163$ which is statistically significant (Table 5).

Majority of the patients who died in MICU care had a platelet count of <60000.

The Pearson Chi-square test $P = 0.447$ which is statistically significant (Table 6).

High bilirubin levels 6-lOmg/dl were associated with significantly high mortality.

The Pearson Chi-square test $P = 0.412$ which is statistically significant (Table 7).

High APACHE II score> 34 on admission was associated with significantly high mortality 100%.

Table 5: Correlation of platelet count with mortality

Platelets	Dead	Alive	Dead%	Alive%
<60	3	7	30	70
60-120	4	11	26.67	73.33
120-180	1	12	7.69	92.31
180-240	1	3	25	75
240-300	0	4	0	100
≥300	1	5	16.67	83.33

Table 6: Correlation of bilirubin levels with mortality

Bilirubin	Died	Survived	Died%	Survived%
<1	5	26	16.1	83.9
l-5	3	13	18.8	81.3
6-10	2	2	50	50
≥10	0	1	0	100

Table 7: APACHE II score on admission and comparison of observed and predicted mortality

APACHE II score	Total patients	Died	Observed mortality (%)	Predicted mortality
0-4	14	0	0	4
05-09	8	0	0	8.00
10-14	8	0	0	15
15-19	5	0	0	25
20-24	7	3	42.85	40
25-29	4	2	50	55
30-34	5	4	80.00	75
>34	1	1	100.00	85

The Pearson Chi-square test $P = 0.033$ which is statistically significant.

DISCUSSION

Our hospital being tertiary referral center, many patients are transferred from private nursing homes and other hospitals. With rising awareness in medical care, more and more patients can be salvaged, only if these references are made early and with some of the necessary resuscitative measures.

Present study which spanned a period of 2 and a half years aimed at studying the clinical profile of obstetric patients admitted to Medical Critical Care Unit. This included an evaluation of age, parity, gestational age, and primary diagnosis at time of MICU admission. Data regarding the number of days of stay in MICU the number of days on mechanical ventilation, the number and type of invasive procedures performed were collected and tabulated. The severity of condition and its prognosis assessed with APACHE II score system and the number of organs involved at the time of admission. The inferences that

were made from our study were then compared to those from other relevant studies.

Total number of obstetric admissions in critical care unit is a vital indicator to incidence of life-threatening complications in pregnant mother.

The data from various studies show variable results of MICU admission statistics (Table 8).

The mean distribution of age in various other studies is tabulated (Table 9).

These studies thus show that majority of obstetric patients requiring critical care are in age group 21-30 years which is comparable to our study.

Two other studies by Bhattacharya *et al.*[7] and Patel *et al.*[8] also showed the maternal mortality comparable to our study (27.5%) in the age group of 21-30 years. Mortality in age group of <20 years in our study was 40% whereas these studies[8,9] showed a mortality ranging from 1.7 to 11.9% in above age group. Mortality rate was 14.29% in females more than 30 years of age. Thus, the above results indicate that younger age group has higher chances of adverse outcome in critically ill obstetric patients.

In our study, majority 52.4% of patients were admitted with pregnancy or delivery related complications (direct causes), the most common being pregnancy induced hypertension (PIH) (36.5%), followed by puerperal sepsis (15.4%).

The rest of the patients (47.6%) were admitted with causes that medical (infectious) illness aggravated in pregnancy (indirect causes) most common being malaria (23.1%). Since Navi Mumbai is a malaria endemic zone, the second highest cause being malaria is explained.

Table 8: MICU admission statistics

Authors	Obstetric admission rate (%)
Mabie *et al*. (1990)[3]	0.90
Lewinsohn *et al*. (1994)[4]	3.40
Present study	6.40

Table 9: Distribution of age in MICU

Authors	Age group (years)	Total numbers (%)
Patkar *et al*. (1996)[5]	21-30	56
	>30	14.7
Rochat *et al*. (1988)[6]	21-30	72
	>30	11
Present study	21-30	76.92
	>30	13.46
	<20	9.62

It has been shown in other studies that hypertension in pregnancy is one of the most common indications requiring MICU care:

- Study in Netherlands by Zeeman CG, Obstetric critical care: A blueprint for improved outcome.[9]
- Study in France by Bouvier-Colle MH, Eur J Obstet Gynecol Reprod Biol. 1996 Mar; 65(1):121-5.[10]
- Study at Parkland hospital ICU, 40% admissions were due to hypertensive disorders and in various studies,[11-14] which is comparable to our study.

MMR in our study was 19.23% (10 patients out of 52).

Direct maternal mortality was 30%. Indirect maternal mortality was 70%.

The most common (pregnancy-related cause) direct cause of mortality in our study press syndrome and eclampsia (20% of total mortality). The most common (medical/infective) indirect cause of mortality was malaria (30% of total mortality).

Prevalence of anemia was 75% in the malaria patients which can be attributed to the parasitemia causing hemolysis.

PIH was another significant complication present in 41.7% of the malaria patients in our study.

The correlation between malaria and PIH as complication is further supported following studies to which our results are comparable (Table 10).

Following table shows mortality with hypertensive disorders of pregnancy reported by some authors (Table 11).

Table 10: Correlation between malaria and PIH as complication

Authors	Total numbers (%)
Adam *et al*., Central Sudan 2011, Malaria Journal Volume 10[15]	80.4
At is Muehlenbach's *et al*. 2006 PLOS medicine, www.Piosmedicine.org[16]	59
Pearson, PLoS Med. 2007 March;[17]	63.7

Table 11: Mortality with hypertensive diorders of pregnancy

Authors	Mortality in Micu due to pre-eclampsia/eclampsia (%)
Baskett *et al*. (1998)[11]	33
Rochat *et al*. (1988)[7]	14.8
Pritchard *et al*. (1984)[18]	0.4
Sibai *et al*. (1990)[19]	10
Bhagwanjee *et al*. (2000)[20]	10.8
Present study	20

Figures 1 and 2 show age distribution among cases in MICU and gestational age correlation with mortality in pregnant and postpartum patients respectively. Mortality due to PIH in our study is comparable to studies by Sibai, Rochat, and Bhagwanjee. Patients died due to PIH alone (10%), and the other due to press + gestational diabetes mellitus (10%). Still making infective causes a more significant factor for mortality.

Few studies[7,11] reported the mortality of 27% due to sepsis and 18% due to obstetric hemorrhages. As seen in Figure 3 malaria accounts for highest mortality (30%). In our study, we found 20% of mortality in critically ill obstetric patients due to sepsis which is comparable with the above studies. The most common causes for sepsis were lower respiratory tract infections, puerperal sepsis. There was no mortality due to obstetric hemorrhage in our study as against high mortality reported in various other studies.[7,11,21] Figure 4 shows low haemoglobin to be responsible for increased mortality whereas Figure 5 depicts mortality due to direct and indirect causes.

Only one patient was admitted due to H1N1 who died in the next 5 days. The patient had received Oseltamivir on the 2nd day. The patient developed acute respiratory distress syndrome (ARDS) and required ventilatory support. But she succumbed to the infection.

The most common organ failure seen in our patients was respiratory failure (51.3%) comparable to the respiratory failure seen in studies by Collop NA 1993[22] second was cardiovascular (43.6%) failure. Figure 6 shows anemia as a major complication of malaria.

Third was hematological (41%) failure. (The percentages do not add up to 100% as patients simultaneously had more than one organ failure).

The high percentage of respiratory failure can be attributed to ARDS due to malaria H1N1, viral pneumonia, and sepsis. (Malarial ARDS being responsible for 30% of mortality).

The need for mechanical ventilation and various invasive procedures was also evaluated in this study 29.3% of total patients required support of artificial mechanical ventilation. ARDS, cardiogenic pulmonary edema, neurological involvement, and circulatory shock were among major causes of respiratory failure requiring artificial ventilatory support. Figure 7 shows most common organ failure is respiratory failure and Figure

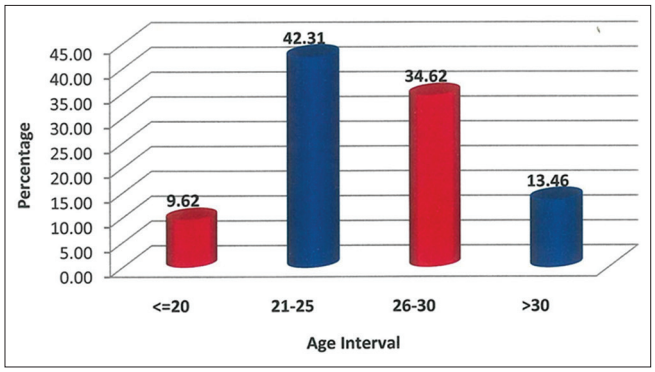

Figure 1: Age distribution among the cases

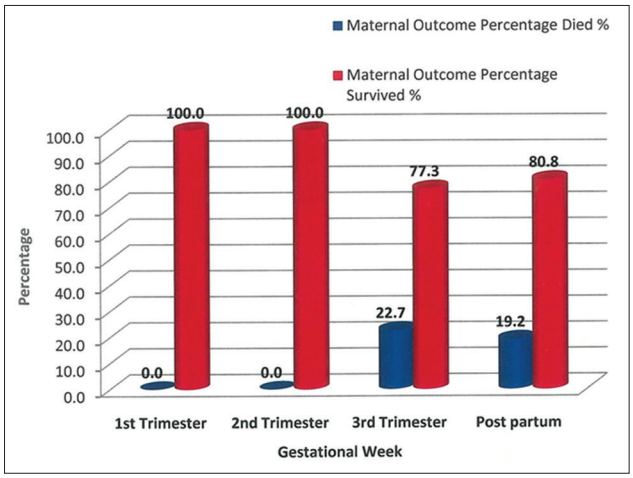

Figure 2: Gestational age correlation with mortality

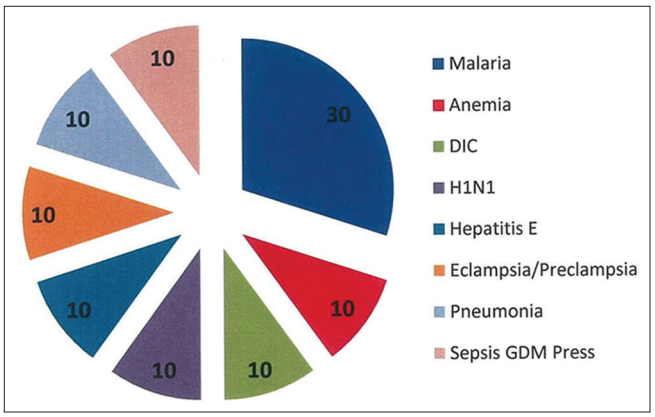

Figure 3: Mortality in pregnant and postpartum patients

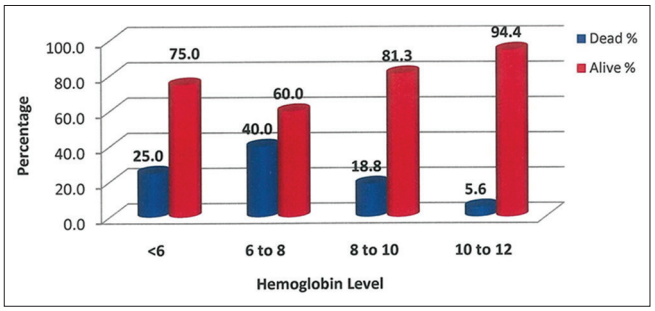

Figure 4: Correlation of hemoglobin levels with mortality

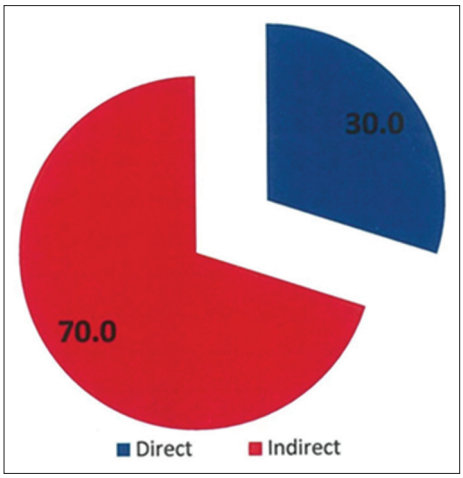

Figure 5: Mortality in pregnant and postpartum females

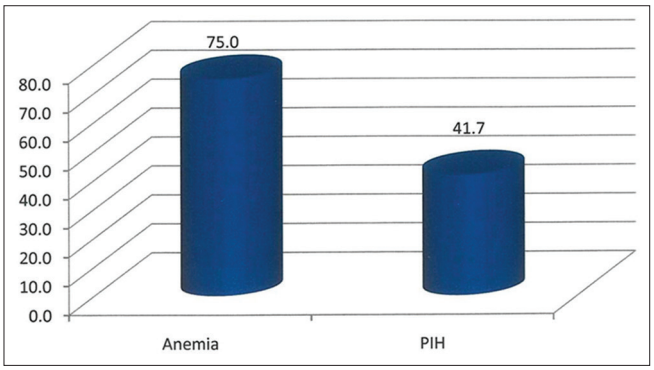

Figure 6: Malaria complication

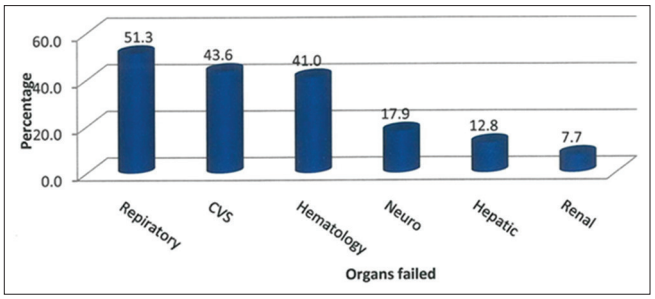

Figure 7: Organs failed

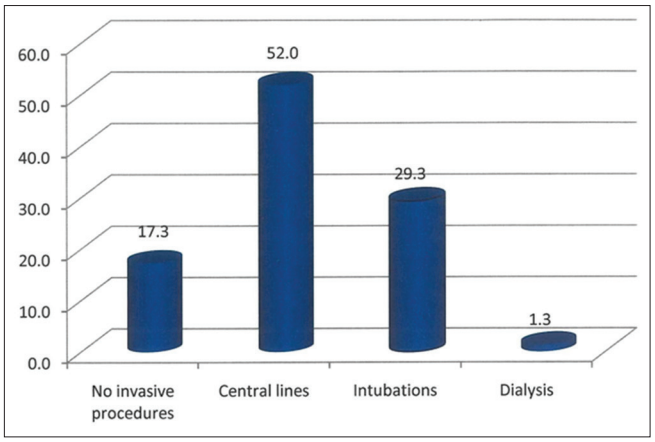

Figure 8: Invasive procedures

8 shows the various invasive procedures done in such patients.

Bekele *et al.* (2001) showed that 45% of critically ill obstetric patients required mechanical ventilation. In this study, the most common organ failure was respiratory failure and 15% of total patients developed ARDS.[13] Tang *et al.* and Lapinsky *et al.* (1997) in their studies showed that mechanical ventilation required in 12-55% of obstetric patients admitted to intensive care unit.[23,24] Which is comparable to our study (29.3%).

One of the aim of our study was to calculate APACHE II score of all obstetric patients on admission and to determine whether it can used as a tool to predict mortality in critically ill obstetrics patients.

Described in 1985 by Knaus,[25] the APACHE II prognostic system is one of the most widely used general outcome models. Developed for use with unselected groups of critically ill adults, the system uses three types of data to provide the user with a probability of death at hospital discharge: These data are the acute physiology score, based on the most deranged physiological and laboratory values during the first 24 h in the ICU; the premorbid status, based on a list of chronic diseases and conditions apparent at admission to hospital; and the diagnostic category, based on a list of 29 medical and 24 surgical diagnoses. After the initial score has been determined within 24 h of admission, no new score can be calculated during the hospital stay. If a patient is discharged from the ICU and readmitted, a new APACHE II score can be calculated. An increasing score (range 0-71) was closely correlated with the subsequent risk of hospital death for 5815 intensive care admissions from 13 hospitals. This relationship was also found for many common diseases. When APACHE II scores are combined with an accurate description of disease, they can prognostically stratify acutely ill patients and assist investigators comparing the success of new or differing forms of therapy. This scoring index can be used to evaluate the use of hospital resources and compare the efficacy of intensive care in different hospitals or over time.

In our study, we found that as APACHE II score increases mortality also increases significantly. Furthermore, we found that observed mortality in our study was comparable to predicted mortality ascertaining the fact that APACHE II scoring system is good predictor of mortality in critically ill obstetric patients and can be used as effective tool to

determine outcome and accordingly modify treatment strategy in these patients. Overall, predicted deaths in our study were 17 while observed deaths were 10 giving a standardized mortality ratio (predicted deaths/observed deaths) of 1.7 as against ratio of 0.78 in the study by.[14] Thus from our study, we conclude that APACHE II score is good predictor of mortality in critically ill obstetric patients.

CONCLUSION

Thus in our study of 52 critically ill pregnant and postpartum females in MICU we conclude that:

1. Maternal age <20 years is associated with significantly high mortality in critically ill obstetric population (40%). Thus, younger age and not the ideal reproductive age is a high-risk group.
2. In third world countries (medical/infective) indirect obstetric (52.4%) cause are more rampant for mortality. The most common medical complications requiring critical care were infective causes such as malaria, viral hepatitis, and sepsis.
3. PIH was most common indication for MICU care followed by malaria. However, PIH was not responsible for higher mortality though it was responsible for higher fetal mortality and longer maternal and fetal ICU stay.
4. Malaria was responsible for highest mortality (30%).
5. Malaria was associated with malaria-induced hypertension and anemia as complication.
6. Mortality rate in our study was 19.23%. (Which is total number of patients died from total number of MICU admissions) (10 out of 52).
7. Respiratory failure was most common organ system failure (51.3%) seen in our study.
8. Mortality was high in first 5 days of MICU admission (76.92%). Highlighting importance of close supervision during this period. *6-10 days were (19.23%) and >10 days (3.82%).
9. High bilirubin levels (levels more than 5 mg/dl) on admission were associated with significantly high mortality. (50% mortality). **>1 mg/dl of bilirubin (16.13%) mortality and 1-5 mg/dl bilirubin (18.75%) mortality.
10. High APACHE II score on admission was associated with significantly high mortality and APACHE II score predicts mortality well in critically ill obstetric patients. Thus, it can be used as tool to predict mortality in this population.
11. H1N1 infection in pregnancy is associated with high rate of complications and prompt treatment with Oseltamivir is associated with good maternal and fetal outcomes.
12. Thus medical disorders should be treated in the antenatal period itself by the appropriate specialties. Early recognition of the patient going downhill before one or multiple systems start failing is important as is the importance of good intensive care once this does occur.
13. Finally a short period of training in the MICU for all residents of obstetrics and gynecology should be mandatory. Lifesaving procedures would be useful when managing these patients till MICU bed is obtained.

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Original Article

Comparison of Fixation of Mandibular Angle Fractures Using Single Miniplate versus Curved Angle Rectangular Strut Plate - A Prospective Randomized Clinical Study

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Abstract

Aim: To compare and evaluate the treatment outcome and post-operative complications in mandibular angle fractures using single miniplate versus curved angle strut plates.

Materials and Methods: This study consisted of a sample of 20 patients divided randomly but equally (single-blind control trial study) into two groups. Each group contains 10 patients. Group I was treated with open reduction and internal fixation using curved angle rectangular strut plate. Group II was treated using single 2-mm miniplates.

Results: The results of this study suggested that there is no statistically significant difference in terms of infection, occlusal discrepancy, and union. The mean duration of rectangular plating in our study was 83.9 ± standard deviation (SD) 27.299 min while as in single miniplate, it was 47.6 ± SD 6.552 min with $P < 0.001$ which is statistically highly significant. It proves that single miniplate can be accomplished quicker than rectangular plating. Swelling increased after the 2nd day of procedure and then after decreased up to the 7th day of the procedure in each group with statistically insignificant difference in both the groups. Visual analog score increased after the 2nd day of the procedure and then after decreased up to 7th day of the procedure in each group with statistically insignificant difference in both the groups. Occlusion at 1st week, 6 weeks, 3rd month, and at 6 months were compared and it is found statistically insignificant with P value of 1. Paresthesia at 1st week, 6 weeks, 3rd month, and at 6 months were compared, and it is found statistically insignificant with P value of 1. Post-operative infection at 1st week, 6 weeks, 3rd month and at 6 months were compared, and it is found statistically insignificant with $P = 1$. In both the groups, none of the patient developed wound dehiscence. Radiographic evaluations for reductions and fixation were confirmed at 1st week which was satisfactory in all patients in both the groups. Radiographic evaluation for union or non-union was confirmed at 20th week after the procedure in both the groups, and it was found that there is the statistically insignificant difference. In both the groups all patients return to their normal activity such as speech, mastication, and social interaction in 10-14 days with no statistical difference.

Conclusion: Till now no philosophy of treatment of mandibular fractures has proved superior over Champys except in cases of comminution defect or atrophic mandible.

Key words: Conventional 2.0-mm miniplates, Mandible angle fracture, Rectangular strut miniplates

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INTRODUCTION

Despite many advances in internal fixation, angle fracture remains among the most difficult and unpredictable fracture to treat compared to those of other areas of the mandible. Large number of studies on mandibular angle fracture treatment attests to the fact that no single

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approach has been shown to be ideal, and that treatment of mandibular angle fractures remains conceptually controversial, with a bothersome complication rate. During the last decade, significant attention has been paid on a variety of plate fixations for mandibular angle fractures.[1-12] Fixation using miniplates has been shown to simplify surgery and reduce surgical morbidity but failed to surpass the predictability of rigid fixation.[13-24] Although there have been number of studies on linear and curvilinear plates for mandibular fixation, only a few reports on the use of low profile three-dimensional (3-D) strut or mesh plates are reported in literature.[1-6] In fact, majority of studies on rectangular strut plates were *in vitro* biomechanical studies. The geometry of rectangular strut conceptually allows for an increased number of screws, stability in 3-D, and resistance against torque forces while maintaining a low profile and malleability.[25-34]

The 2.0 mm titanium 3-D curved angle strut plate allows for almost no movement at the superior and inferior borders with manual torsional and bending forces, as opposed to when a single linear plate is applied to the superior border area.[35-57] When only one linear plate is placed on the superior border, torsional and bending forces usually cause movement along the axis of the plate with buccal-lingual splaying and gap formation at the inferior border, respectively. Because the screws are placed in box configuration of 2.0 mm titanium 3-D curved angle strut plate on both sides of fracture rather than on a single line, broad plate forms are created that may increase the resistance to torsional forces along the axis of the plate.[58-72]

Because the design of 2.0 mm titanium 3-D curved angle strut plate is essentially that of 2.0 mm plates connected by reinforcing vertical struts, they may, therefore, provide greater resistance against gap opening at the inferior border with biting forces compared with when a single plate is applied at the external oblique ridge or superolateral border. The use of 3-D plates in mandibular fractures has not yet become established. Only few follow-up studies are presented in literature with few studies emphasizing easy application, simplified adaptation to bone without distortion or displacement of fracture,[6] simultaneous adaptation at both superior and inferior borders hence less operating time.[58]

Aims and Objectives of the Study

The patients were evaluated and compared for:

1. Stability of fractured segments clinically and radiographically.
2. Post-operative occlusion.
3. Post-operative complication such as infection, wound dehiscence, neurosensory deficits (paresthesia of the area involved), non-union, malunion, and delayed union.

MATERIALS AND METHODS

Source of Data

Twenty patients with mandibular angle fracture reporting to the Department of Oral and Maxillofacial Surgery were selected for this study and were divided into two groups.

- Group 1: 2 mm titanium 3-D curved angle strut plate.
- Group 2: 2 mm titanium 4 hole miniplates.

Methods

Twenty patients aged more than 18 years were randomly selected for open reduction and internal fixation. Fixation was done using 2 mm titanium rectangular curved angle strut plate and 2×6 mm titanium screws in 10 patients in Group A and single miniplate on the superior border in 10 patients in Group B patients (Figures 1-14).

Inclusion Criteria

1. Adult patients.
2. Single or multiple fractures of mandible requiring open reduction with internal fixation for treatment with angle fracture.
3. Subject willingness.

Exclusion Criteria

Following patients were excluded.

Patients with systemic disease are contraindicating general anesthesia.

Patients with a history of uncontrolled diabetes mellitus, prolonged steroid therapy, compromised immunity and associated bone pathology Patients with fracture comminution.

EVALUATION

Pre-operative and post-operative evaluations were done by clinical and radiographic means. It includes:

- Orthopantomogram.
- PA view.

All patients will be followed for a minimum of 6 months postoperatively.

Clinical assessment will be done on the 7th day, 3 weeks, 12 weeks, 3 months, and 6 months postoperatively.

RESULTS

In our study, in 3-D plating group of patients most common cause was renal tubular acidosis, 8 out of 10 (80%) and two-dimensional (2-D) plating group the most common

Figure 1: Incision

Figure 2: Fracture

Figure 3: fixation by 3 D strtu plate

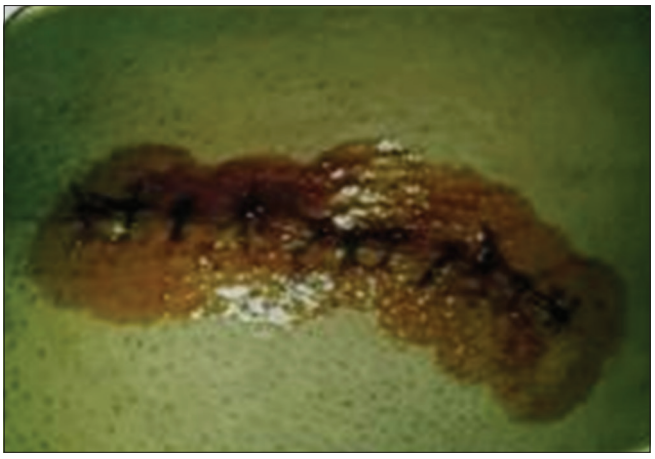

Figure 4: Closure

Figure 5: Post-operative occlusion

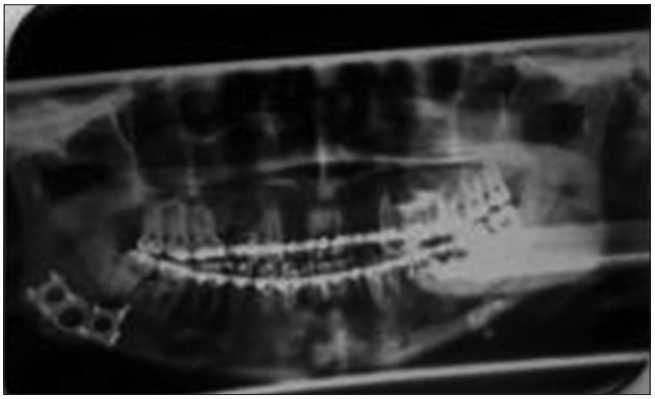

Figure 6: Post-operative orthopantomogram

cause was same 9 out of 10 (90%) (Figure 17). In both the groups of patients the most common fracture site was angle, 80% in each group (Figure 18). The mean duration of 3-D plating in our study was 83.9 ± SD 27.299 min while as in 2-D plating 47.6 ± SD 6.552 min with $P < 0.001$ which is statistically highly significant. It proves that 2-D plating can be accomplished quicker than 3-D plating (Figure 19). Swelling increased after the 2nd day of the procedure and then after decreased up to the 7th day of the procedure in each group with the statistically insignificant difference in both the groups (Figure 20). Visual analog score increased after the 2nd day of the procedure and then after decreased up to the 7th day of the procedure in each group with the statistically insignificant difference in both the groups (Figure 21).

Figure 7: Pre-operative

Figure 8: Pre-operative occlusion

Figure 9: Pre-operative orthopantomogram

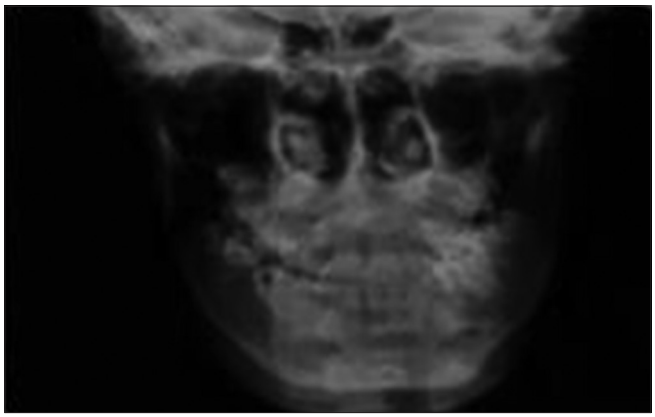

Figure 10: Pre-operative PA

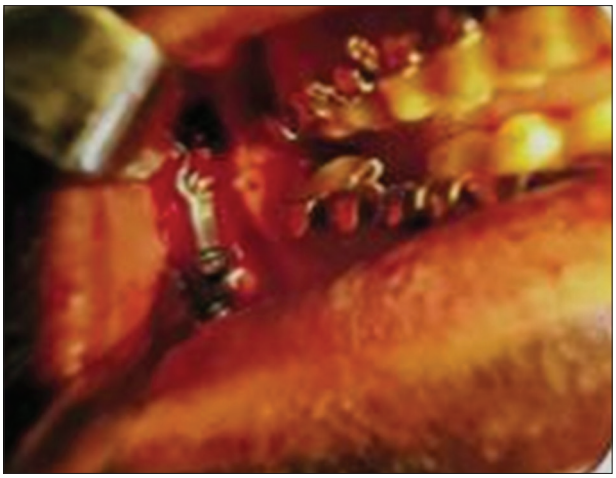

Figure 11: Fixation by single plate

Figure 12: Post-operative occlusion

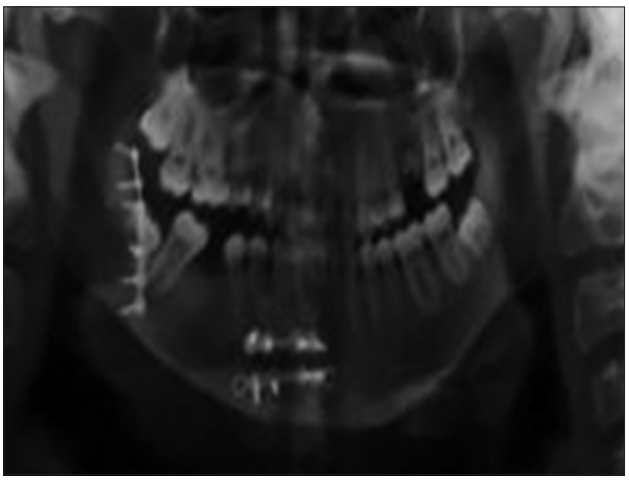

Figure 13: 6 months orthopantomogram

Occlusion at 1st week, 6 weeks, 3rd month, and at 6 months were compared in 3-D plating and 2-D plating groups, and it is found statistically insignificant with $P = 1$ (Figure 22). Paresthesia at 1st week, 6 weeks, 3rd month, and at 6 months were compared in 3-D plating and 2-D

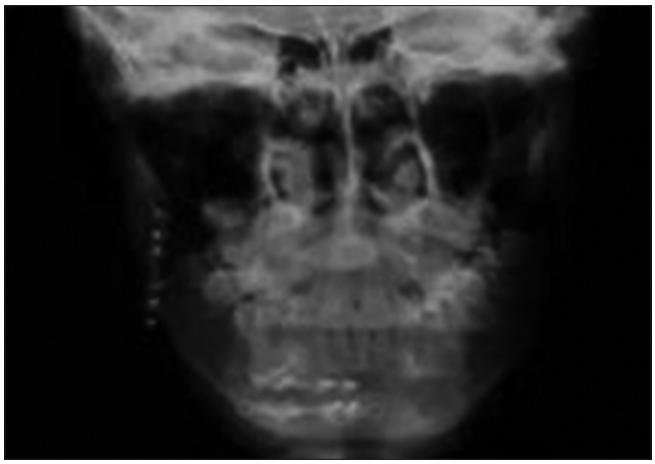

Figure 14: 6 months PA

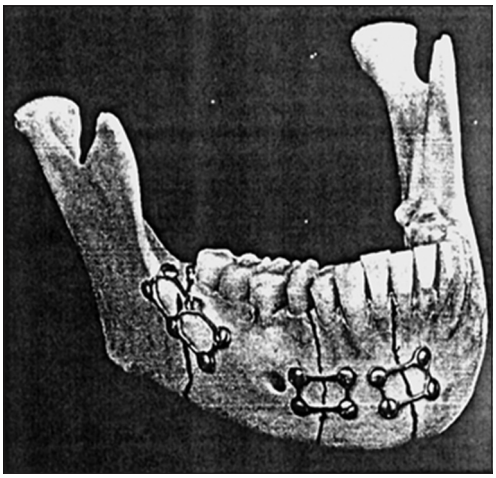

Figure 15: 3 D plate over angle region

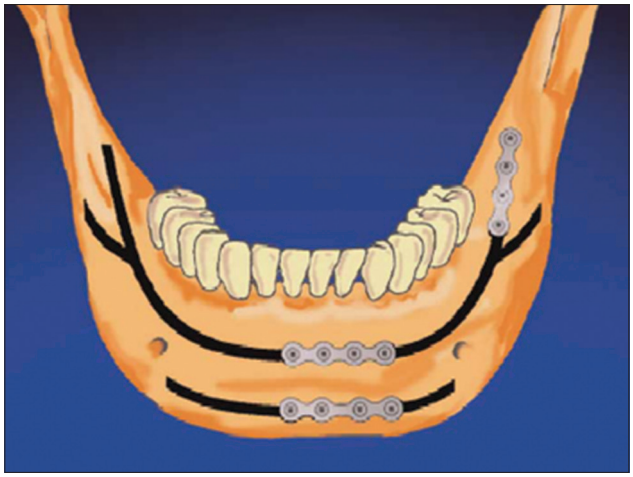

Figure 16: 2 D plate over external oblique ridge

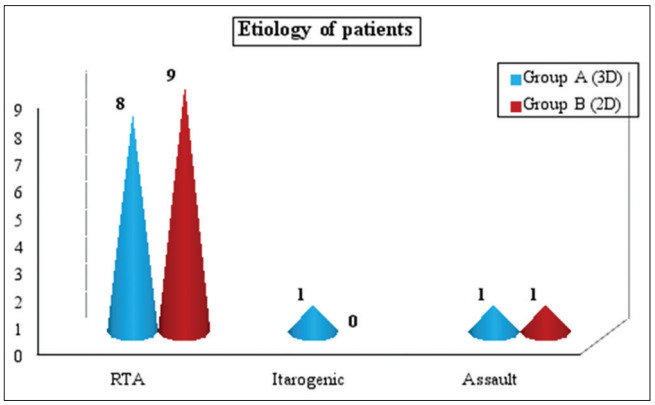

Figure 17: 2 D plate over external oblique ridge

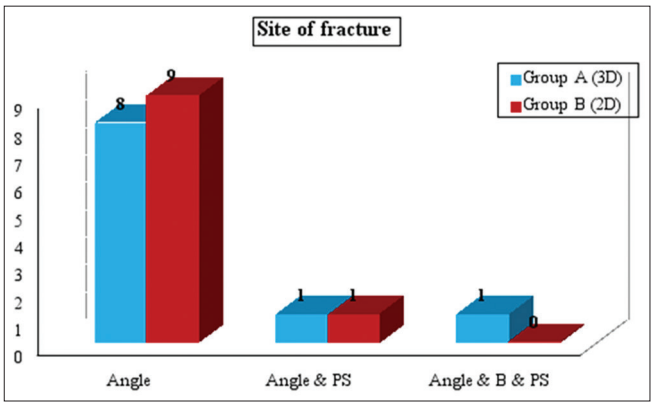

Figure: 18: Site of fracture

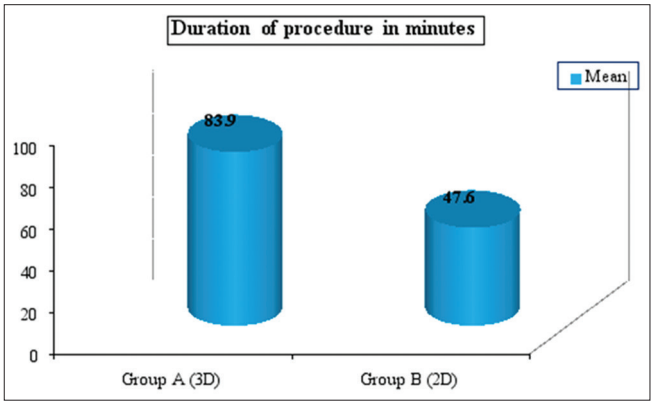

Figure 19: duration of procedure in minutes

plating groups, and it is found statistically insignificant with $P = 1$. Post-operative infection (Figures 23 and 24) at 1st week, 6 weeks, 3rd month, and at 6 months were compared in 3-D plating and 2-D plating groups, and it is found statistically insignificant with $P = 1$. In both the groups, none of the patient developed wound dehiscence (Figures 25-27).

Radiographic evaluations for reductions and fixation were confirmed at 1st week which was satisfactory in all patients in both the groups. Radiographic evaluation for osteogenic changes was confirmed at 9th week after the procedure in both the groups, and it was found that there is the statistically insignificant difference. Radiographic evaluation for union or non-union was confirmed at 20th week after

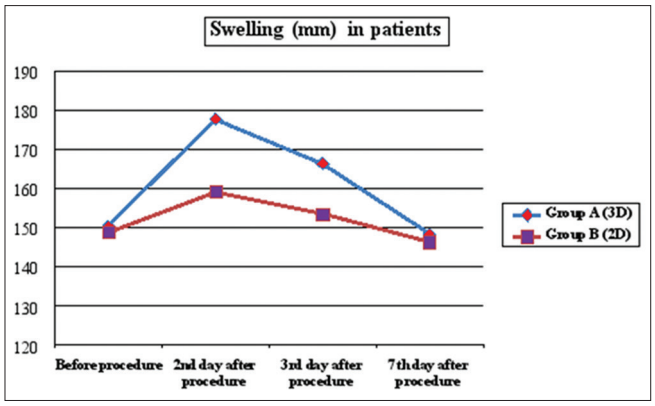

Figure 20: Swelling in patients

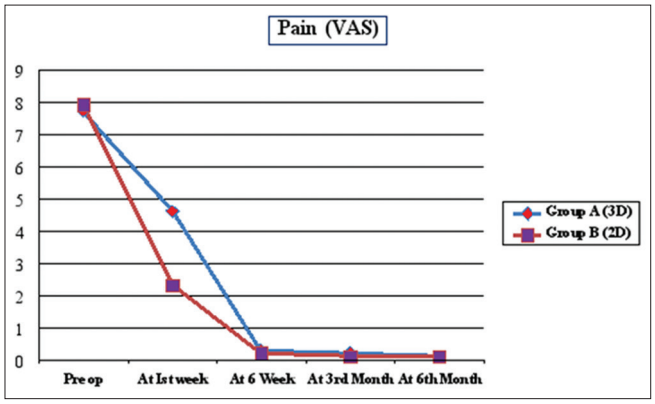

Figure: 21: Pain

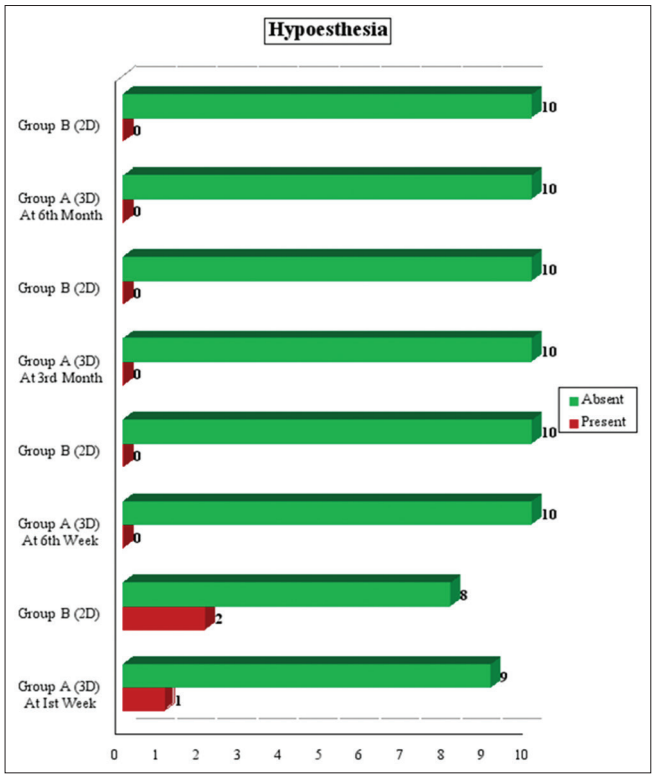

Figure 22: Hypoesthesia

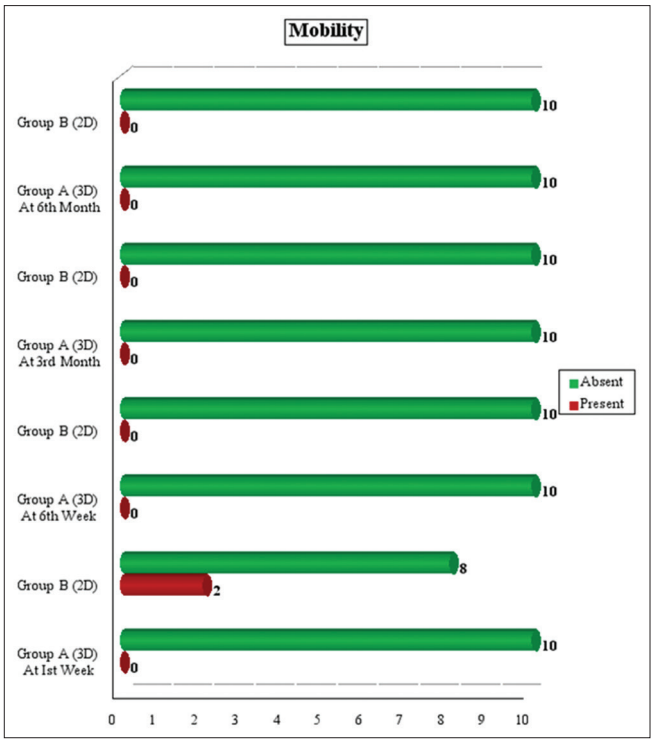

Figure 23: Mobility

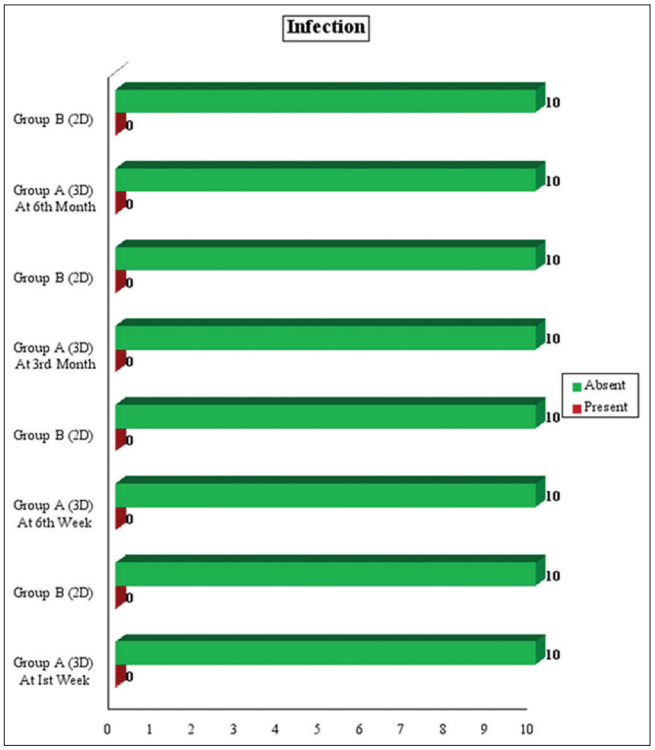

Figure 24: Infection

the procedure in both the groups, and it was found that there is statistically insignificant difference (Figure 28).

In both the groups all patients return to their normal activity such as speech, mastication, social interaction

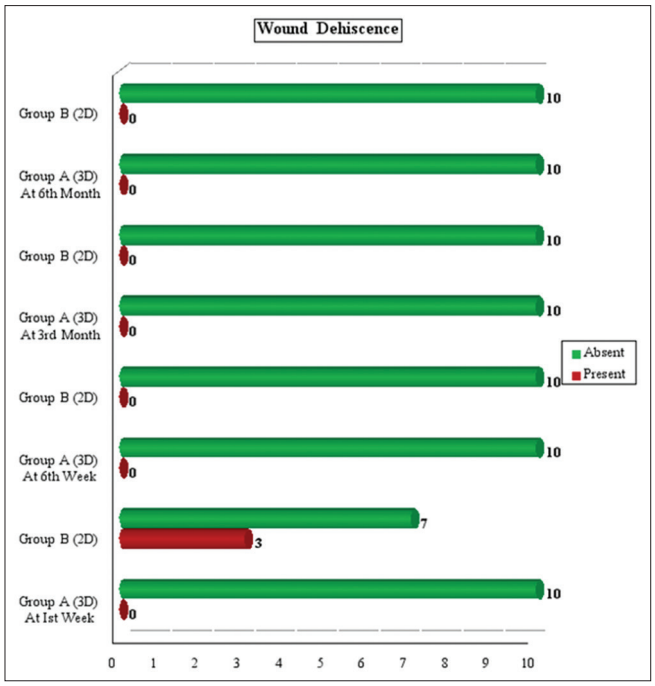

Figure 25: Wound dehiscence

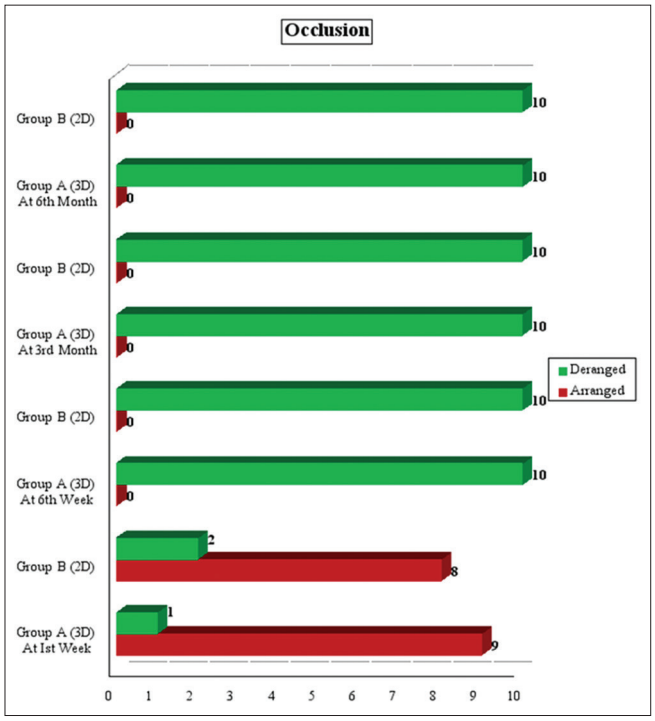

Figure 26: Occlusion

in 10-14 days with no statistical difference. There is no major difference in terms of treatment outcome in both systems, and both are equally effective in mandibular angle fracture treatment. However, in the symphysis/para symphysis region, 3-D miniplate fixation is an easy-to-use alternative to conventional miniplates in terms of less surgical time and simultaneous stabilization at both the

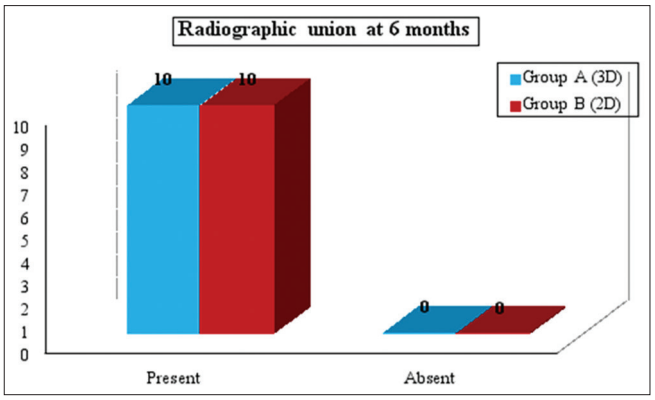

Figure 27: Radiographic union at 6 months

superior and inferior border by one plate; in the angle region, a single conventional miniplate fixed according to Champy's technique is easy to place intraorally with less surgical time and less surgical trauma and has similar clinical results. Due to the superior design of 3-D maximum number of screws lie near the fracture site thus providing better stability and thus open up doors for its satisfactory use in the management of displaced fractures. Although this study is promising, small sample size is limitation of this study. A more comprehensive conclusion can only be drawn when a larger sample size is taken.

DISCUSSION

Restoration of function and appearance with particular care to re-establish the occlusion is the basic aim of the treatment of mandibular fractures. For a long period of time, intermaxillary fixation was the only method of treatment. With the introduction of modern anesthesia, antibiotics and blood transfusion, open reduction with fixation of fragments have become routine in the treatment of fractures with gross displacement, comminution and the edentulous mandible. Through decades various plate and screw osteosynthesis have been introduced such as AO plating system, miniplating system, resorbable plates, and screws and 3-D titanium plates.

3-D titanium plates have been used sporadically by few surgeons for fixation of the mandibular angle fractures.[6,12] Its use in the maxilla has remained skeptical, with Farmand[6] being the only surgeon to have used them for the maxillary fracture osteosynthesis.

The principle of 3-D plate osteosynthesis is:

1. Tissue dissection only in vicinity of planned osteotomy or fracture line.
2. The 3-D plates are positioned parallel to the osteotomy or fracture line.

3. The connecting arms of the plate should be positioned rectangular to the osteotomy or fracture line (Ananad Sanker, Thangavelu 2004).

The use of 3-D plates in mandibular fractures has not yet become established. Only few follow-up studies are presented in literature with few studies emphasizing easy application, simplified adaptation to bone without distortion or displacement of fracture,[6] simultaneous adaptation at both superior and inferior borders hence less operating time.[58]

Guimond[53] and Jeurgen[56] found the fixation with 3-D plates predictable, the plate strong yet malleable facilitating stabilization both at superior and inferior borders. They concluded that 3-D titanium plates are easy to use alternative to conventional miniplates but contraindicated its use in fractures with less inter fragmentary bone contact.

Monocortical miniplate osteosynthesis has been used successfully for the management of facial fractures. Michelet *et al*.[20] developed the concept of miniplate osteosynthesis in the late 1960s. In 1973, they published a report documenting the successful use of a small plate and monocortical screws for the treatment of mandibular fractures. The original goal of miniplate osteosynthesis was to provide stable mandibular fracture reduction without requiring interfragmentary compression or maxilla mandibular fixation. Studies performed in the early 1970s at the Groupe d'Etudes en Biomecanique Osseuse et Articulaire de Strasbourg demonstrated that the miniplate achieves this goal by neutralizing undesirable tensile forces while retaining favorable compressive forces during function. Champy *et al*.[22] elaborated on Michelet's work with the intraoral application of the monocortical miniplate for the treatment of mandibular angle fractures.

The reduced size of the miniplate system offers several advantages over the larger mandibular plates. Smaller incisions and less soft tissue dissection are required for their placement. In addition, miniplates can often be placed intraorally, thereby avoiding an external scar. Due to the smaller size and thinner profile of the miniplates, they are less likely to be palpable, possibly reducing the need for subsequent plate removal. The smaller size of the miniplates may decrease the degree of stress shielding seen following rigid fixation; however, this remains to be demonstrated. Finally, because the screws are monocortical, the plates may be placed in areas of the mandible adjacent to tooth roots with minimal risk of dental injury.

The rationale of using monocortical plate in the mandibular fracture is that osteosynthesis by plate screwed on the outer cortical plate is solid enough to support the strain developed by masticatory muscle. On the horizontal ramus, the masticatory forces create elongation strain along the alveolar border and compressive strain along the lower border within the mandible. Only the traction strain is injurious and has to be neutralized. The study of moments with regard to the mathematical model of the mandible[21] showed that at the level of horizontal ramus, there are almost only flexion moments, the value of which increases from the front backward. In the anterior part of the mandible, anterior to 1st premolar, there are mainly moments of torsion. They are higher, the nearer they are to the mandibular symphysis. Therefore, the principle of osteosynthesis is to re-establish, the mechanical qualities of the mandible, taking into account the anatomical conditions.

The clinical effectiveness of 3-D plate needs to be verified or substantiated by biomechanical studies. Wittenberg[9] in his biomechanical experiment found that entire 3-D titanium plate was formed by joining two miniplates with interconnecting vertical cross bars which reinforced each other, thereby the plate acting as a single unit and interconnections of the plate reduced the vertical displacement and shearing of bone to minimal (Figure 15).

The 3-D miniplate is positioned in such a way that the horizontal cross bars are perpendicular to the fracture line and the vertical ones are parallel to it. At the angle, the plate can be bent over the oblique line so that the vertical crossbars are aligned perpendicular to the external oblique ridge. This technique follows the principle of 3-D fixation given by Farmand.[5]

As for as 2-D plates are concerned posterior to mental foramen, one plate is sufficient, while anterior to the mental foramen, one should place two miniplates separated by 4-5 mm to neutralize torsional force. In case of angle, fracture plating is done over the external oblique ridge (Figure 16).

Our study consisted of 20 patients with 10 patients in Group A with 3-D plating and Group B 1 patients with 2-D plating with no underlying medical compromising condition.

Champy *et al*.,[21] Cawood,[24] Smith,[29] and Kuriakose *et al*.[35] used miniplate for patients with mandibular fracture and found uneventful healing. The same finding was reported in our study.

Intermaxillary fixation was done preoperatively only when needed to achieve the optimum habitual occlusion and

post-operative intermaxillary fixation for 1-2 weeks which is in accordance with the many authors.[29,33,56,59,60]

CONCLUSION

There is no major difference in terms of treatment outcome in both systems, and both are equally effective in mandibular angle fracture treatment. However, in the symphysis/parasymphysis region, 3-D miniplate fixation is an easy-to-use alternative to conventional miniplates in terms of less surgical time and simultaneous stabilization at both the superior and inferior border by one plate; in the angle region, a single conventional miniplate fixed according to Champy's technique is easy to place intraorally with less surgical time and less surgical trauma and has similar clinical results. Due to the superior design of 3-D maximum number of screws lie near the fracture site thus providing better stability and thus open up doors for its satisfactory use in the management of displaced fractures.

Although this study is promising, small sample size is a limitation of this study. A more comprehensive conclusion can only be drawn when a larger sample size is taken.

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Original Article

Prevalence of HIV, HBV, and HCV Markers in Multi-transfused Patients

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Abstract

Background: Transfusion-transmitted infections (TTIs) are a major challenge to the transfusion services all over the world. The problem of TTIs is directly proportional to the prevalence of the infections in the blood donor community. Proper vigilance and quality control are needed to prevent this problem.

Materials and Methods: The study was conducted in the Department of Pathology, Pt J.N.M. Medical College and DR. B.R.A.M. Hospital, Raipur C.G., from January 2012 to August 2013 among the patient who are admitted for blood transfusion and are having a history of multiple blood transfusions. Serological detection of HIV-1 and 2, HBV, and HCV was done by third-generation enzyme-linked immunosorbent assay method.

Results: The study included 100 multi-transfused patients (MTPs), 56 (56%) were of sickle cell anemia, 26 (26%) were of thalassemia, 14 (14%) were of leukemia, and 4 (4%) were of aplastic anemia. 64 were males and 36 were females, with M/F ratio of 1.77:1. Majority were in age group of 6-10 years (36%). Out of 100 MTPs, 13 patients (13%) were found seropositive for viral markers. Out of 13 seropositive patients, 3 (3%) were seropositive for HIV 1 and 2, 10 (10%) were seropositive for HBV, and none of the patient was seropositive for HCV.

Conclusion: The overall prevalence of anti-HIV, HBsAg, and anti-HCV in MTPs was found to be 3%, 10%, and 0%, respectively. Possible risk factor for seropositivity of MTPs may be blood transfusion as elicited by taking a history of the patient. Thus, the results of this study "raise an alarm to the existence of a significant risk" of TTIs in our society.

Key words: Leukemia, Multi-transfusion, Seropositivity, Sickle cell, Thalassemia, Transfusion-transmitted infections

INTRODUCTION

Every day, millions of people require blood transfusion. This requirement of blood could be met only by its collection from human sources. Safe blood is the blood, which is antigenically compatible, and free of all transfusion-transmitted infections (TTIs) - HIV, hepatitis B, hepatitis C, syphilis, and malaria. TTIs are a major challenge to the transfusion services all over the world. The problem of TTIs is directly proportional to the prevalence of the infections in the blood donor community.[1] Infusion of blood and blood product is one of the most efficient means of transmission of these infections. Blood donors may carry a variety of pathogens in their blood despite their apparent healthy status.[2] Knowledge of prevalence of TTIs among multi-transfused patients (MTPs) in developing countries is an appropriate indicator of the risk of TTIs. Furthermore, a thorough understanding of the epidemiological characteristics of TTIs in MTPs may be of major assistance in elucidation of important aspects of the transmission chain of these infections, and so further improvement in the safety of the blood supply. These studies enabled the identification of useful procedures for further increasing the safety of blood.[3]

The present study is under taken to assess the seroprevalence of HIV, HBV, and HCV in relation to multiple transfusions of blood and blood products.

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Aims and Objectives

The aims of this study are as follows:

1. To evaluate the prevalence of HIV, HBV, and HCV infections in MTPs.
2. To identify possible risk factors related with the prevalence.

MATERIALS AND METHODS

This is a retrospective and prospective study.

Study Area

The study area was the Department of Pathology, Pt J.N.M. Medical College and DR. B.R.A.M. Hospital, Raipur, Chhattisgarh, India.

Study Duration

The period of study is 20 months, from January 2012 to August 2013.

Inclusion Criteria

Known cases of sickle cell anaemia, thalassemia, aplastic anemia, leukemia, hemophilia, and patients on chronic hemodialysis and those who have received at least 3 units of blood and blood products, 3 months before the day of sampling were included in the study.

Exclusion Criteria

Patients who have been transfused less than three units of blood were excluded from the study.

Methods

After obtaining informed/written consent of the patients and/or from parents, complete bio-data including postal address and phone number (mobile/telephone no) obtained for timely follow-up.

A thorough medical history with relevant clinical data with emphasis on age at diagnosis, age at first transfusion, frequency of transfusion, status of Hepatitis B vaccination, any other positive history for risk of HIV, HBV, and HCV infection, and serostatus of HIV, HBV, and HCV infection is taken.

Physical examination is carried out on each patient, which included checking for pallor, jaundice, pulse rate, lymphadenopathy, and organomegaly.

Procedure

3 ml of venous blood is collected in a plain glass test tube and is allowed to clot at room temperature, to yield serum or 3 ml venous anticoagulant blood is collected and centrifuged, to yield plasma from each patient, for screening of virological marker. Serum or plasma obtained is utilized for serological detection of HIV-1 and 2, HBV, and HCV by the third-generation enzyme-linked immunosorbent assay method.

Observation

The study included 100 MTPs, 56 (56%) were of sickle cell anemia, 26 (26%) were of thalassemia, 14 (14%) were of leukemia, and 4 (4%) were of aplastic anemia (Table 1). 64 were males and 36 were females, with M/F ratio of 1.77:1 (Figure 1). Majority were in age group of 6-10 years (36%) (Figure 2).

Table 2 shows that, out of 100 MTPs, 13 patients (13%) were found seropositive for viral markers. Out of 13 seropositive patients, 3 (3%) were seropositive for HIV 1 and 2, 10 (10%) were seropositive for HBV, and none of the patients was seropositive for HCV.

Table 3 shows diseases-wise distribution of seropositivity in MTPs: It was found highest (50%) in leukemia patients which was highest in age group of 16-20 years (40%). Prevalence was higher (15.62%) in male patients, with M/F ratio of 1.87:1.

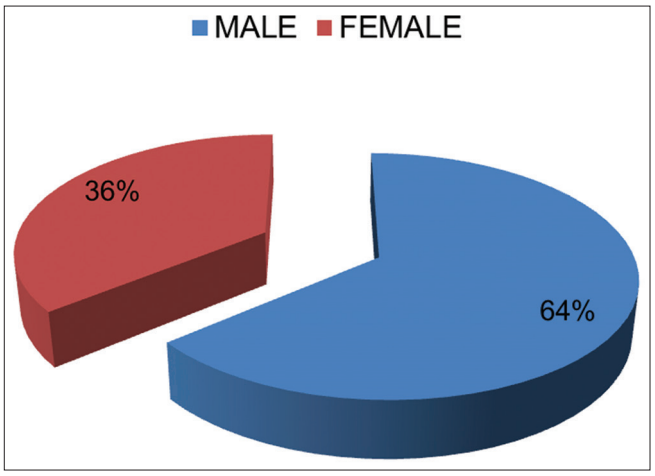

Figure 1: Gender wise distribution of Multi-Transfused Patients

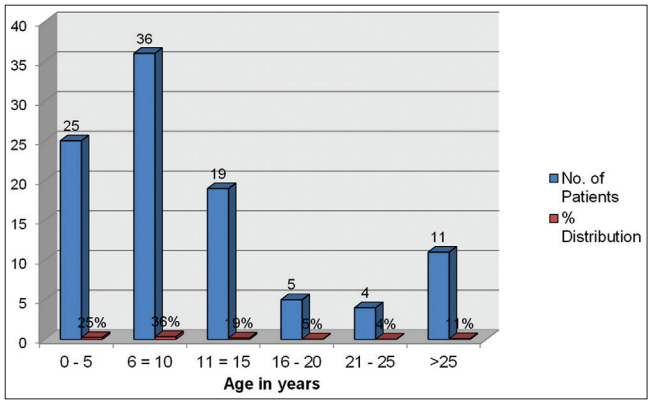

Figure 2: Age wies distribution of Multi- Transfused Patients

Distribution of seropositivity for different viral markers in multi-transfused sickle cell anemia patients: Out of 56 multi-transfused sickle cell anemia patients, 3 patients (5.35%) were found seropositive for viral markers. Out of 3 seropositive patients, one (1.78%) was seropositive for HIV 1 and 2, 2 (3.57%) were seropositive for HBV, and none of the patients was found seropositive for HCV. Seropositivity was found highest in the age group of 0-5 (25%) and 16-20 years (25%). Prevalence is higher (5.88%) in male patients compared with female (4.54%), with M/F ratio of 1.29:1.

Distribution of seropositivity for different viral markers in multi-transfused thalassemia patients: Out of 26 multi-transfused thalassemia patients, 3 patients (12%) were found seropositive for viral markers. Out of 3 seropositive patients, one (4%) was seropositive for HIV 1 and 2, 2 (8%) were seropositive for HBV, and none of the patients was found seropositive for HCV.

Seropositivity was found highest in the age group of 6-10 years. Prevalence was highest (17.64%) in male, and none of the female patients was seropositive.

Distribution of seropositivity for different viral markers in multi-transfused leukemia patients: Out of 14 multi-transfused leukemia patients, 7 patients (50%) were found seropositive for viral markers. Out of 7 seropositive patients, one (7.14%) was seropositive for HIV 1 and 2, 6 (42.85%) were seropositive for HBV, and none of the patients was found seropositive for HCV. Seropositivity was found highest in the age group of 16-25 years. Seropositivity was equal in both sexes (Table 4).

Rate of HBV seropositivity in unimmunized MTPs was 14.08%, while in immunized MTPs, it was 0% (Table 5).

- There was no correlation between number of transfusions and percentage of seropositivity.

Table 1: Disease-wise distribution of MTPs (*n*=100)

Diseases	Number of patients	% Distribution
Sickle cell anemia	56	56
Thalassemia	26	26
Leukemia	14	14
Aplastic anemia	04	04

MTPs: Multi-transfused patients

Table 2: Distribution of seropositivity for different viral markers in MTPs (*n*=100)

Viral markers	Number of seropositive	% of seropositivity
HIV 1 and 2	3	3
HBV	10	10
HCV	0	0
Total	13	13

MTPs: Multi-transfused patients

DISCUSSION

Blood transfusion still remains the mainstay of treatment for children with thalassemia, sickle cell anemia, aplastic anemia, and leukemia which present them with an increased risk of TTIs.[4] This study was designed to evaluate the prevalence of HIV, HBV, and HCV Infections in MTPs and to identify possible risk factors.

The probability of acquiring TTIs is related to the probability of being exposed to the infected units of blood. This probability depends on the prevalence of carriers among the blood donors in the population and the number of units transfused. Thus, the infection rate of TTIs increases with age in subsequent years.[5]

In the present study, overall seroprevalence of anti-HIV in MTPs was found to be 3%, and this was quiet comparable with the study of Vidja *et al.* 2011 from Jamnagar, India (3%),[1] Choudhary *et al.* 1998 from Lucknow, India (2.6%),[6] Kumar *et al.* 2010 from Pune, India (2%),[7] and Shah *et al.* 2010 Ahmadabad, India (2%).[8]

In the absence of treatment, the median time from HIV seroconversion to the onset of AIDS in transfused patients is about 7-11 years. Factors affecting progression include symptomatic primary infection, age at infection, and viral load.

The study done in India and abroad in MTPs indicates the seroprevalence for HBV varying from 0% to 41%. In the

Table 3: Diseases-wise distribution of seropositivity in MTPs (*n*=100)

Diseases	Number of patients	HIV 1 and 2	HBV	HCV	Number of seropositive	% of seropositivity
Sickle cell anaemia	56	1	2	0	3	5.35
Thalassemia	26	1	2	0	3	11.53
Leukemia	14	1	6	0	7	50
Aplastic Anemia	04	0	0	0	0	0
Total	100	3	10	0	13	13

MTPs: Multi-transfused patients

Table 4: Distribution of HBV seropositivity in MTPs in relation to status of hepatitis B vaccination

Status of vaccination	Number of patients	Number of seropositive	% of seropositivity
Immunized	28	0	0
Unimmunized	71	10	14.08
Not know	01	0	0

MTPs: Multi-transfused patients

Table 5: Frequency distribution of seropositivity rate for different viral markers in blood donors (year 2012) (*n*=8900)

Virus markers	Number of seropositive	% of seropositivity
HIV	13	0.14
HBsAg	96	1.07
HCV	4	0.04

MTPs: Multi-transfused patients

Table 6: Comparison of prevalence of anti-HIV, HBsAg, and anti-HCV in blood donors with MTPs

Virus marker	Prevalence of seropositivity in blood donor	Prevalence of seropositivity in MTPs
HIV	0.14	3.00
HBsAg	1.07	10.00
HCV	0.04	0.00

MTPs: Multi-transfused patients

present study, overall seroprevalence of HBsAg in MTPs was found to be 10%, and this was quiet comparable with a study of Vinelli and Lorenzana 2005 from Honduras (11%),[9] Mollah *et al.* 2003 from Bangladesh (13.85%),[4] and Kapoor *et al.* 2007 from Quetta, India (14%).[2]

Hepatitis B is a special problem in India since it is a medium endemic area. Routine HBsAg screening in blood units does not eliminate the risk of transmission. HBsAg test may be negative in the window phase of HBV infection, in the convalescence phase and also in chronic HBV infection, with very low viremia. Prevention of post-transfusion hepatitis starts with selection of non-remunerated blood donors[5] and an active immunization for HBV to all patients on repeated blood transfusion therapy.[1]

A study done in India and abroad in MTPs indicates the seroprevalence for HCV varying from 2% to 59.4%. In the present study, overall seroprevalence of HCV in MTPs was found to be 0%. Hence, it could not be compared with other study. However study done by Vidja *et al.* 2011 from Jamnagar, India[1] showed lowest prevalence rate (2%). Zero seropositivity for HCV in our study may be due to the relatively very low prevalence of HCV infection in this region, and hence, in the blood donor, and probably due to limited number of patients are being included.

In blood donors, there is high seroprevalence of HBsAg (1.07%) and HIV (0.14%), while seroprevalence of HCV (0.04%) is very low (Table 6).

Above finding shows that prevalence of TTIs in MTPs is higher as compared to donor population.

CONCLUSION

The risk of transmission of an infection is always associated with any transfusion and remains a major health problem for the patients. The implementation of measures such as donor education programs, stringent donor selection criteria, and improved serological screening protocols reduces the risk of TTIs. To further reduce the incidence of liver infection in multiple blood transfused patients, we should recommend an active immunization for HBV to all patients on repeated blood transfusion therapy. The results of this study "raises an alarm to the existence of a significant risk" of TTIs in our society. "Hence, we recommend more advance technique, like nucleic acid testing, for donor screening program."

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Original Article

Amniotic Membrane in Periodontics - A Research Study

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Abstract

Background: Periodontal diseases leading to deterioration of tooth-supporting structures are a serious concern for clinicians. The clinical application of amniotic membrane for guided tissue regeneration (GTR) while fulfilling the current mechanical concept of GTR amends it with the modern concept of biological GTR. Amniotic membrane not only maintains the structural and anatomical configuration of regenerated tissues but also contributes to the enhancement of healing.

Aim: The aim of our study was to evaluate the effectiveness of amniotic membrane in the treatment of various types of recession defects.

Materials and Methods: The sample size for the study was six cases, which were Miller's Class I or Class II gingival recession. Recession depth, recession width, keratinized gingiva, tissue width, and clinical attachment level (CAL) were recorded at baseline, 3, and 6 months postoperatively.

Results: 6 months after the root coverage procedures, the mean root coverage was found to be 72.3% ± 4.7%. CAL significantly decreased from 5.9 ± 0.62 mm preoperatively to 3.2 ± 0.7 mm postoperatively at 6 months, while keratinized gingiva showed significant improvement from 2.8 ± 0.26 mm preoperatively to 6.1 ± 0.58 mm postoperatively at 6 months.

Conclusion: The clinical application of amniotic membrane not only maintains the structural and anatomical configuration of regenerated tissues but also contributes to the enhancement of healing through reduction of post-operative scarring and subsequent loss of function and providing a rich source of stem cells.

Key words: Amniotic membrane, Guided tissue regeneration, Recession

INTRODUCTION

Periodontal disease is a chronic inflammatory condition that occurs in response to predominantly Gram-negative bacterial infection originating from dental plaque.[1]

Before the 1950s, periodontitis was treated mostly by tooth exfoliation or extraction and that is still the predominant treatment for most of the world's populations today. Until the 1980s, the most commonly used treatment consisted of scaling and root planning, followed by resective surgery aimed at achieving zero pocket depth. During the 1980s, data were obtained demonstrating that the thoroughness of root debridement and subgingival infection control, not the presence or absence or periodontal pockets, is the major determinant of successful periodontal therapy, and non-surgical therapy became a commonly used treatment. Neither resective surgery nor non-surgical therapy results in significant regeneration of periodontal attachment. Recent data clearly show that regeneration of the previously destroyed periodontal attachment tissues is biologically possible, and regeneration has become the goal of therapy for the 1990s.[2]

Regeneration by grafting may be further enhanced by the use of barrier membranes that exclude gingival fibroblasts

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and epithelium from the healing site. Still, further enhancement seems to be possible by local application of various growth factors, although studies in this important area are now only in their infancy. The future of periodontal therapy is exceedingly bright.[1]

However, current regenerative procedures have limitations in attaining complete and predicable regeneration, especially in advanced periodontal defects.[3]

For successful periodontal regeneration, the formation of a functional epithelial seal, insertion of new connective tissue fibers into the root, reformation of a new acellular cementum on the tooth surface, and restoration of alveolar bone height are required. The complex events associated with periodontal regeneration involve recruitment of locally derived progenitor cells that can differentiate into periodontal ligament cells, mineral-forming cementoblasts, or bone-forming osteoblasts.[4,5]

Advances in stem cell biology and regenerative medicine have presented opportunities for tissue engineering and gene-based approaches in periodontal therapy.[6,7] These new approaches offer interesting alternatives to existing therapies for the repair and regeneration of the periodontium.

Applications of amnion membrane include chemical or thermal burns, correction of corneal epithelial defects, neurotrophic corneal ulcers, leaking blebs after glaucoma surgery, reconstruction of conjunctival and ocular surfaces, ocular cicatricial pemphigoid or Stevens-Johnson syndrome, and bullous keratopathy. These membranes have also been used in furcation defects, intrabony defects, and gingival recession coverage.[8]

Periodontal plastic surgical procedures aimed at coverage of exposed root surface. Owing to the second surgical donor site and difficulty in procuring a sufficient graft for the treatment of root coverage procedures, various alternative additive membranes have been used. A recent resorbable amniotic membrane not only maintains the structural and anatomical configuration of regenerated tissues but also enhances gingival wound healing and provides a rich source of stem cells. Therefore, amniotic membrane is the choice of material these days in augmenting the better results in various periodontal procedures.

Diño *et al.*[9] demonstrated for the first time that amniotic membrane could be separated, sterilized, and safely used at a later date. Amnion-derived cells with multipotent differentiation ability have attracted a lot of attention in the regeneration of periodontal tissues.

Amnion lines the innermost portion of the amniotic sac of the placenta. Its structure consists of a single layer of epithelium cells, thin reticular fibers, a thick compact layer, and a fibroblast layer. The basement membrane contains collagen Type III, IV, and V and cell-adhesion bioactive factors including fibronectin and laminins.[10] Data suggest that the amnion basement membrane closely mimics the basement membrane of human oral mucosa.[11]

Despite the introduction of allograft dermis tissue products and biologic mediators, autograft tissue remains the "gold standard" of periodontal plastic surgery as it provides excellent predictability, improved long-term root coverage, and superior esthetics over other treatment options.[12] Despite these clinical outcomes, the use of autograft tissue has drawbacks. Autogenous graft tissue is limited in supply, and its procurement significantly increases patient morbidity while also lengthening the duration of surgery.[13]

The utilization of amniotic membrane diminished in the early 1980's because of increase in the communicable diseases such as H.I.V and hepatitis. Amnion reappeared in the cryopreserved form for the treatment of ophthalmic wounds in the late 1990's and early 2000's.[4] Lawson in 1985 was the first who studied the use of amniotic membrane along with pectoralis major muscle for oral cavity reconstruction. He concluded that placement of amnion over the deep aspect of the muscle that is exposed to the oral cavity resulted in a more rapid development of mucosa. When muscle was used without amniotic membrane, the healing process usually took twice as long. Furthermore, when amnion was not used, it showed a significant amount of wound contracture.[14]

Amnion Structure and Function

The amniotic membrane encases the amniotic fluid and fetus and is highly flexible because of which it is easily be separated from the chorion.[1] Amniotic membrane has two types of cells - epithelial cells derived from embryonic ectoderm and amnion mesenchymal cells from embryonic mesoderm. At ultrastructural level, it is a thin, transparent, avascular composite membrane composed of three major layers, which is a single epithelial layer, a thick basement membrane, and an avascular mesenchyme consisting mainly of collagen, respectively. Amniotic membrane has no blood vessels or nerves; instead, the nutrients it requires are supplied directly by diffusion out of the amniotic fluid and/or from the underlining decidua. The amniotic epithelial cell (AEC) layer is a single layer of flat, cuboidal, and columnar cells that are in direct contact with the amniotic fluid. It is from this layer that amniotic mesenchymal stem cells are isolated and stored for further regenerative use.[15]

Extracellular Matrix

Extracellular matrix materials form the structural components of the architecture of the membrane

and contain a variety of specialized proteins including fibronectin, proteoglycans, glycosaminoglycan, laminin, and other similar materials. The basal lamina contains a large amount of proteoglycans such as heparin sulfate that is one of the major proteoglycans in the gingiva. The spongy layer on the stromal portion of the amnion has an abundance of hydrated proteoglycans and glycoproteins that form a non-fibrillar network along with collagen.[16]

The matrix of human amniotic membrane contains abundant growth factors such as keratinocyte growth factor, basic fibroblast growth factor, transforming growth factor-beta (TGF-β), nidogen growth factor, and epidermal-derived growth factor which promote periodontal regeneration. These growth factors provide a natural healing environment, accelerate healing, and mimic the stem cell niche for *ex vivo* growth.[17]

Benefits

Epithelialization

Amniotic membrane facilitates migration of epithelial cells, reinforces basal cell adhesion, promotes epithelial differentiation, prevents epithelial apoptosis, and promotes epithelialization in healing of wounds. The basement membrane of amniotic membrane serves as a safe and suitable bed for the growth of epithelial cells. Sufficient oxygenation for epithelial cells is provided by its good permeability in contrast to other synthetic materials. Thus, amniotic membrane is an ideal tissue which facilitates the growth of epithelial cells, helping in their migration and differentiation.[8]

Anti-inflammatory

The mesenchymal stem cells in the amniotic membrane decrease the secretion of proinflammatory cytokines such as tumor necrosis factor alpha and interferon while increasing the production of anti-inflammatory cytokines interleukin-10 and interleukin-4.[1] The pro-inflammatory mediators, interleukin-1α and interleukin-1β, are also suppressed by the matrix of stroma of amniotic membrane. The inhibitors of matrix metalloproteinases (MMPs) found in the amniotic membrane decreases MMPs released by infiltrating neutrophils and macrophages.[1,8] Various tissue inhibitors of metalloproteinases 1, 2, 3, and 4, interleukin-10, and interleukin-1 receptor antagonists and endostatin which inhibit endothelial cell proliferation, angiogenesis, and tumor growth are also expressed by human amniotic epithelial and mesenchymal cells.[8] It also reduces the recruitment of various other inflammatory cells including polymorphonuclear cells, CD3 cells, CD4 T cells, and CD11b cells to the injured site, thereby reducing the inflammation.[1,8]

Antiviral and antimicrobial

Amniotic membrane firmly adheres with the wound through fibrin and elastin linkages that seal the wound and prevent contamination.[1] This tight adherence helps in restoring lymphatic integrity, protects circulating phagocytes from exposure, and allows faster removal of surface debris and bacteria from the wound.[18] Its antiviral properties are exhibited by the presence of a powerful antiviral agent, cystatin E which is an analog of cysteine proteinase inhibitors.[8,15]

Anti scarring

Amniotic membrane secretes vascular endothelial growth factor (VEGF) and hepatocyte growth factor that maintains a proper balance between TGF-1 and TGF-3 that prevents scarring.[1]

Angiogenesis

The cells of the amniotic membrane enhance the production of VEGF by activating the VEGF receptors 1 and 2. Extensive neovascularization after the application of amniotic membrane is due to the release of angiogenic factor such as insulin-derived growth factor that promotes granulation tissue formation and epithelialization.[15]

Immunomodulatory

The unique molecular surface architecture and biochemical properties of amniotic membrane that is derived from the layer of trophoblast cells renders it unsusceptible to maternal immune attack.[1] The native AECs express the non-polymorphic, non-classical human leukocyte antigen (HLA-G) but lack the polymorphic antigens HLA-A, B (Class IA) and HLA-D related (Class II) on their surfaces. The Class I antigen is seen in almost all cells of the amniotic membrane unlike the Class II antigen which is only present in some fibroblasts. These mesenchymal stem cells are different from other nucleated mammalian cells as they show little allogenic reactivity when administered to major histocompatibility complex-unmatched adult immune competent recipients.[15]

Processing of Amniotic Membrane

For clinical use, amniotic membrane can be prepared in the following forms:[1]

- Fresh membrane
- Dried membrane
- Frozen membrane
- Stabilized amniotic membrane
- Cryopreserved membrane
- Freeze-derived irradiated membrane.

Amniotic Membrane in Dentistry

The use of amniotic membrane has recently increased clinically as an allograft material for chronic and acute

wound care management, for scar tissue reduction, as a barrier membrane, and as a soft tissue regeneration graft.[19] The graft of amniotic membrane is a viable and reliable method to cover the exposed periosteum as they serve as a good alternative to mucosal and skin grafts.[20] Amnion allograft might be a suitable alternative to connective tissue graft in procedures to cover denuded root surfaces and can reduce recession depth.[21,22]

It is easily available and preserved and is a cost-effective material.[23]

Limitations of Amniotic Membrane

The use of amniotic membranes requires immense skill; thus, doctor's inexperience is a limitation. There is always an associated risk of infection transmissions. Amniotic membranes are fragile membranes, so they need to be dealt with very carefully. Cryopreserved membranes are expensive. The procedure associated with the use of these membranes is technique-sensitive and also depends on morphology of the defect.[8]

MATERIALS AND METHODS

Procurement of Amniotic Membrane

The procurement of the amniotic membrane was done by the Tissue Bank (Tata Memorial Hospital, Mumbai).

Subject Selection

Six subjects with the Miller's Class II gingival recession, who visited the Department of Periodontology, Indira Gandhi Government Dental College, Jammu, were included in the study. These patients were explained about the surgical procedure in detail and were included for the study with their consent. Maxillary canine site was selected for all the cases. All the patients were subjected to thorough scaling and root planning and were educated to maintain proper oral hygiene.

Clinical Evaluation

All the subjects were clinically evaluated by a single clinician trained for the specific purpose to measure the respective clinical parameters.

Recession depth, recession width, clinical attachment level (CAL), and width of keratinized gingiva at baseline, 3, and 6 months postoperatively for isolated recession on maxillary canine. Reference point for CAL was taken from cementoenamel junction (CEJ) up to the base of the gingival sulcus. Width of the keratinized gingiva was measured from the margin of the gingiva up to the mucogingival junction.

Surgical Procedure

Double papilla flap technique was executed by giving two horizontal incisions at the CEJ followed by the vertical incisions placed at the line angles. The releasing incision was extended into alveolar mucosa. A partial thickness pedicle flap was raised by internal bevel incision, and the interdental papilla was undermined and separated from the underlying connective tissue.

Amniotic membrane was placed on the denuded root, and flap was sutured. Subjects were advised not to brush on the operated site for 21 days, and 0.2% chlorhexidine rinse was prescribed along with antibiotics and analgesics postoperatively. The patient was examined at 1st and 4th weeks to assess healing and then followed up at 3 and 6 months.

RESULTS

Post-operative results at 6 months show a mean decrease in recession depth from 3.75 ± 0.35 mm to 0.65 ± 0.25 mm. The recession width showed a mean decrease from 5.58 ± 0.52 mm to 1.9 ± 0.2 mm. The CAL showed mean decrease from 6 ± 0.9 mm to 3.65 ± 0.45 mm. The width of the keratinized gingiva showed a mean increase from 3.2 ± 0.3 mm to 6.3 ± 0.3 mm (Tables 1 and 2).

DISCUSSION

Gurinsky[13] concluded an average increase of 3.2 mm (±1.71) of new gingival tissue representing 97% (±0.5) defect coverage in gingival recession with amnion allograft. Processed dehydrated allograft amnion demonstrated excellent esthetic results in terms of texture and color match. There were no adverse reactions during the course of this study, and patients reported relatively little post-operative discomfort. The ability of processed dehydrated allograft amnion to self-adhere eliminates the need for sutures, making the procedure less technically demanding and significantly decreasing surgical time.

Table 1: Pre-operative clinical evaluation

Subjects	Recession depth (mm)	Recession width (mm)	CAL (mm)	Width of keratinized gingiva (mm)
1	3.9	6.1	6.9	3.5
2	4	5.6	6	3
3	3.2	5.3	6.1	3
4	3.5	5	4	3.2
5	4.1	5.6	6.7	3.5
6	3.8	5.9	6.3	3

CAL: Clinical attachment level

Table 2: Post-operative clinical evaluation - 3 months

Subjects	Recession depth (mm)		Recession width (mm)		CAL (mm)		Width of keratinized gingiva (mm)	
	At 3 months	At 6 months	At 3 months	At 6 months	At 3 months	At 6 months	At 3 months	At 6 months
1	1.2	0.9	2.2	2.1	4.2	4.1	5.8	6.1
2	0.5	0.3	2	1.9	2.5	2.3	6.4	6.5
3	1	0.8	2	1.7	4	3.8	6.3	6.6
4	0.7	0.5	2.1	2	4.3	4.1	5.3	5.8
5	1	0.7	2	1.8	3.9	3.7	6.4	6.5
6	0.9	0.7	2	1.9	4	3.9	6.1	6.3

CAL: Clinical attachment level

Shetty *et al.*[24] compared bilateral multiple recession coverage with platelet-rich fibrin (PRF) to amniotic membrane. They concluded that the clinical outcome of the surgical procedure accounted for 100% root coverage, an enhanced gingival biotype, with both the membranes. The results were stable even after 7 months in the amniotic membrane-treated site. Thus, the use of amniotic membrane as a novel approach to root coverage is more advantageous than PRF due to the laboratory preparation of the autologous biomaterial and the use of the amniotic membrane as an additive material alternate to subepithelial connective tissue in reducing the need for a second surgical site is better advocated.

Velez *et al.*[25] concluded that the use of cryopreserved amniotic membrane provides significant cicatrization and wound healing after dental implant surgery. CAM supports the growth of epithelium, thus facilitating migration and reinforcing adhesion.

In accordance with the results of this study, amniotic membrane can be considered as a reliable alternative to autogenous connective tissue graft in the treatment of gingival recession as it avoids multiple surgeries in comparison to the latter.

CONCLUSION

Human amniotic membrane is a uniquely suited material for the use as an allograft in wound management and is rising in various fields of tissue engineering, medicine, regeneration biology, and stem cell research. The clinical application of amniotic membrane not only maintains the structural and anatomical configuration of regenerated tissues but also contributes to the enhancement of healing through reduction of post-operative scarring and subsequent loss of function and providing a rich source of stem cells. To conclude, amnion from discarded placenta can be an interesting source of cells for regenerative medicine.

However, further research and long-term clinical trials are required for exploring the full potential of this stem cell reservoir.

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Original Article

Better Material for Final Impression in Complete Dentures: An *In Vivo* Study

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Abstract

Introduction: The impression making is the first and the basic structure-forming unit in complete dentures. The impression basically is a negative replica of border-sealing area, denture-bearing area, and denture-stabilizing area of the oral tissues of the mouth. The purpose of the present study is to find the better material for carrying out the secondary impression in complete dentures.

Aim: 30 patients were divided in three subgroups of 10 patients. One group was having 10 complete denture prostheses with the secondary impression made with zinc oxide-eugenol (ZOE) paste, other group with 10 prostheses with addition silicone light body consistency, and remaining 10 patients with polyether as a secondary impression material.

Materials and Methods: In intergroup comparison for bubbles, group 3 recorded minimum amount followed by group 2 and maximum bubbles were found in group 1. In intergroup comparison for cracks, group 1 had maximum cracks, followed by group 3 and least in group 2.

Result: Analysis of variance was carried out, and all the three groups were found to be significant at $P < 0.05$ for the amount of bubbles and cracks in impressions. All the three materials tested can be used satisfactorily for secondary impression purpose.

Conclusion: Impression made of polyether material developed least bubbles, and maximum were developed by ZOE. Complete dentures made by all the three materials tested had no significant difference in patient satisfaction level.

Key words: Bubbles, Cracks, Eugenol, Impression, Prosthesis

INTRODUCTION

A complete denture is a mechanical device that serves the purpose to restore the missing dentition and rehabilitate its function. The prime requirement of a successful complete denture is the ability to record maximum tissue details for proper support and trace the borders properly for retention purpose.[1] The impression making is the first and the basic structure-forming unit in complete dentures which is carried on by the impression compound, heavy putty, or high viscosity alginate. A special tray is fabricated, and peripheral tracing of borders is carried out using low fusion impression compound or additional silicone putty consistency which is followed by scrapping of the relief wax and taking out a wash impression or secondary impression with the zinc oxide-eugenol (ZOE), addition silicone light body, or polyether material.[2] These materials are used interchangeably by the dentist depending on the availability, cost, or requirement. The purpose of the present study is to find the better material for carrying out the secondary impression in complete dentures. Null hypothesis states no difference in carrying out secondary impressions with any of the three materials tested in the study (Figure 1).

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MATERIALS AND METHODS

The study was carried out on 30 patients that reported to the Indira Gandhi Govt. Dental College, Jammu. All the subjects were divided in three subgroups of 10 patients in each group (Table 1). One group was having 10 prostheses with

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secondary impression made with ZOE paste (Figure 2), other group with 10 prostheses with secondary impression made with addition silicone light body consistency (Figure 3), and remaining 10 patients with polyether as secondary impression material (Figure 4). Inclusion criteria were followed, and patients were informed about the objective of the study followed by consent by the patient. Primary impressions were made with impression compound (DPI Pinnacle), and casts were poured in type 2 gypsum. Complete spacer design advocated by Boucher was fabricated, and special trays were fabricated with autopolymerizing acrylic resin. Peripheral tracing was carried out using greenstick compound, and 3 vent holes in the midline were made in maxillary trays, whereas 2 in canine region in mandibular trays were made. The secondary impression was carried out for all the 30 dentures depending on the group they were segregated. Minute cracks and bubbles were calculated with the help of scanning microscope at the power of ×10. Jaw relations were carried out for all the complete dentures, followed by trial and insertion of the dentures. On insertion, the patient was interviewed about fit, pinching, and other complaints. Post insertion complaints were welcomed after 24 h of insertion. Data were collected and statistically analyzed.

Table 1: Inclusion criteria

Inclusion criteria
Age <75 years
Absence of any systemic disease
Absence of any abnormality
Absence of any tori or palatal defect

Figure 1: Materials used

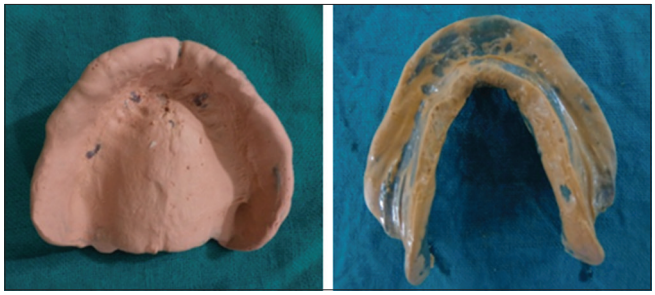
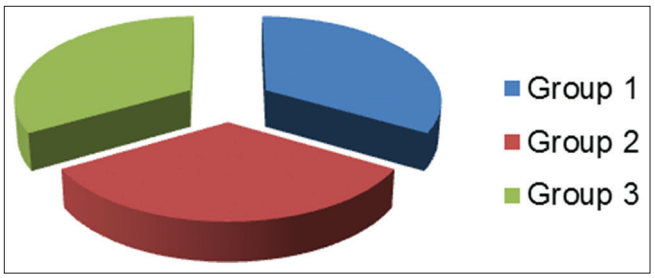


Figure 2: Secondary impression made with zinc oxide-eugenol paste

RESULTS

The mean values and median values were calculated for each group (Graph 1). Standard deviation was calculated, and data



Graph 1: Distribution setup

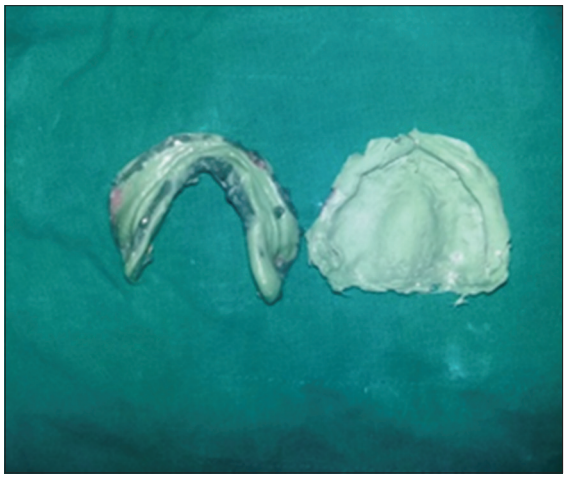


Figure 3: Secondary impression made with addition silicone paste

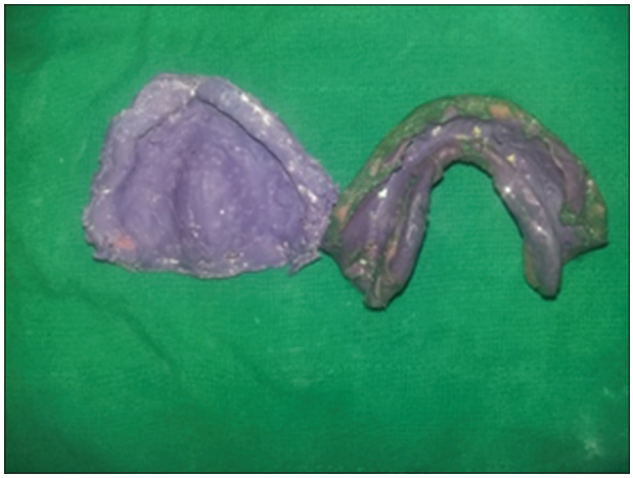


Figure 4: Secondary impression made with polyether material

were analyzed with ANOVA. In intergroup comparison for bubbles, group 3 (58) recorded minimum amount followed by group 2 (64), and maximum bubbles were found in group 1 (94). Analysis of variance was carried out, and all the three groups were found to be statistically significant at $P < 0.05$ for the amount of bubbles in impressions (Tables 2-4).

In intergroup comparison for cracks, group 1 had maximum cracks, followed by group 3 and least in group 2. The results were found to be statistically significant at $P < 0.005$ (Tables 5-7).

Table 2: Observational values of bubbles in three groups

ZOE	Light body	Polyether
8	4	8
11	7	9
5	3	5
9	8	7
10	5	4
6	4	2
8	9	6
10	11	9
12	5	5
14	8	3

ZOE: Zinc oxide eugenol

Table 3: Statistics for bubble calculation

Subject	Group 1	Group 2	Group 3	Total
N	10	10	10	30
∑X	93	64	58	215
Mean	9.3	6.4	5.8	7.1667
$\sum X^2$	931	470	390	1791
SD	2.7101	2.5906	2.4404	2.9371

SD: Standard deviation

Table 4: Statistics for bubble calculation

Source	SS	Df	MS	F
Between treatments	70.0667	2	35.0333	
Within treatments	180.1	27	6.6704	
Total	250.1667	29		5.25208

P<0.05

Table 5: Observational values of cracks in three groups

ZOE	Light body	Polyether
3	0	2
5	4	5
2	2	3
7	1	2
1	1	5
3	2	2
6	0	1
9	3	0
4	4	1
1	1	2

ZOE: Zinc oxide eugenol

DISCUSSION

An accurate impression is the backbone of prosthodontics. The impression basically is a negative replica of border sealing area, denture bearing area, and denture stabilizing area of the oral tissues of the mouth.[3] Three different philosophies for impression making, namely, mucocompressive, mucostatic, and selective pressure are there in market. With time and various studies, only selective pressure is the philosophy mainly applied. The philosophy states to have a primary impression with mucocompressive material, followed by relieving of selective areas and performing the peripheral tracing, followed by secondary impression or wash impression with a mucostatic material.[4-6] The mucostaic materials used include ZOE, addition silicone in light body consistency, or polyether medium body.[7-12] The purpose of the present study is to find the better material out of the three materials tested in the study. Null hypothesis that no difference exists in the three materials tested in the study stands rejected as a positive association is found between all the three materials at $P < 0.05$ for cracks as well as bubbles (Graphs 2 and 3). The study was designed taking in care the inclusion criteria and other influencing factors. All the dentures were fabricated by dental graduates under the guidance of senior prosthodontist. All the other steps in fabrication were carried out in a similar fashion to avoid any chances of error in the study. Polyether recorded lowest number of bubbles followed by addition silicone and highest in ZOE. Furthermore, addition silicone recorded the lowest number of cracks followed by polyether and maximum in ZOE. Himkat[13] conducted a similar study and found both ZOE and elastomers ideal materials for achieving secondary impressions. Qanungo *et al.*[14] also conducted a study to evaluate border molding with ZOE and addition silicone and found addition silicone

Table 6: Statistics for cracks calculation

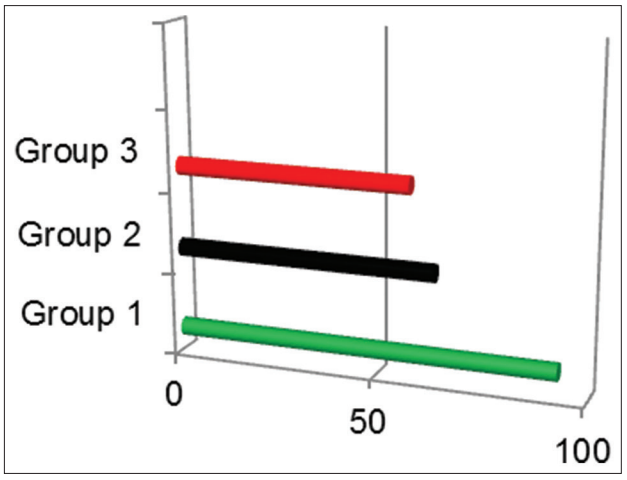
Subject	Group 1	Group 2	Group 3	Total
N	10	10	10	30
∑X	41	18	23	82
Mean	4.1	1.8	2.3	2.7333
$\sum X^2$	231	52	77	360
SD	2.6437	1.4757	1.6364	2.1645

SD: Standard deviation

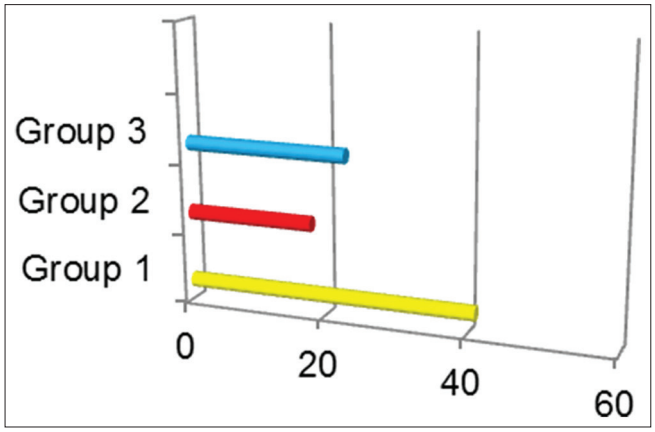
Table 7: Statistics for cracks calculation

Source	SS	Df	MS	F
Between treatments	29.2667	2	14.6333	
Within treatments	106.6	27	3.9481	
Total	135.1667	29		3.70638

P<0.005



Graph 2: Mean values of amount of bubbles in three groups



Graph 3: Mean values of amount of cracks in three groups

to be better. A study[15] compared ZOE and type 1 gypsum and found it better than ZOE. An interesting point noticed in the study was that all the dentures constructed by all the three groups were found to be satisfactory in patient questionnaire. Furthermore, since the detail reproduction of addition silicones and polyether is better than ZOE paste, fewer bubbles and fewer cracks were found in the study which further strengthens the present study. Eight out of 10 patients of group 1 complained of soreness after impression making due to the presence of eugenol in the ZOE paste. The limitations of the study include fewer study subjects and non-inclusion of patient satisfaction score. Further studies are directed to study monophase materials, exploration of any new materials to practice. The use of ZOE paste should be avoided in patients with eugenol sensitivity.

CONCLUSION

1. All the three materials tested can be used satisfactorily for secondary impression purpose.
2. Impression made of polyether material developed least bubbles, and maximum were developed by ZOE.
3. Impression made of addition silicone material developed least cracks and maximum were developed by ZOE.
4. Complete dentures made by all the three materials tested had no significant difference in patient satisfaction level.

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Original Article

Evaluation of Functional Outcome of Anterior Cruciate Ligament Reconstruction using Bone-patellar Tendon-bone Graft

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Abstract

Introduction: Anterior cruciate ligament (ACL) reconstruction nowadays is probably the most common arthroscopic procedure of the knee and the choice of graft to be used for it is probably the most important decision to be made during the surgery. Various options are available and patellar tendon graft is one of them.

Purpose: The purpose of this study was to evaluate the midterm functional outcome of ACL reconstruction done by arthroscopic method using the bone-patellar tendon-bone graft fixed with interference screws.

Materials and Methods: The study was conducted in the Department of Orthopaedics, Government Madurai Medical College. A total of 36 cases were operated out of whom only 32 were available for a follow-up period of 18 months. The outcome was measured using lysholm scoring.

Results: At the end of 24-month follow-up period, almost 80% of the patients had good to excellent results with no major graft-related complications.

Conclusion: Bone-patellar tendon graft is a good option for ACL reconstruction with early rigid fixation permitting earlier rehabilitation and good functional outcome.

Key words: Anterior cruciate ligament, Arthroscopy, Lysholm score, Patellar tendon, Reconstruction

INTRODUCTION

Anterior cruciate ligament (ACL) reconstruction is nowadays one of the most common procedures in the knee. Initially, most of the ACL tears were treated conservatively, but the increased incidence of late meniscal tears and subsequent degenerative arthritis has resulted in many ACL tears being managed now by arthroscopic reconstruction. The procedure which routinely is done as an arthroscopic procedure has many factors to be considered for a good functional outcome. The selection of graft is one such issue.

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Patellar tendon graft was once considered the gold standard, but now, variety of other types of grafts are also used common ones being hamstring tendon graft and quadriceps tendon graft. The advantage of the patellar tendon graft is the strong initial fixation, easy graft harvest, and good bone-to-bone healing it achieves. The problems of iatrogenic patellar injury and quadriceps weakness can be minimized by a good surgical technique. Lysholm scoring is the one of the most common scoring system used to evaluate the functional outcome after any ligamentous reconstruction of the knee. The purpose of this study was to evaluate the midterm functional outcome of ACL reconstruction done by arthroscopic method using the bone-patellar tendon-bone graft fixed with interference screws.

MATERIALS AND METHODS

The study was conducted in the Department of Orthopaedics, Madurai Medical College. A total of 36 cases

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Table 1: Lysholm knee scoring

Post-operative duration (months)	<68 poor	69-76 fair	77-90 good	>90 excellent
6	6	17	10	5
9	2	11	13	12
12	2	6	12	15
18	2	4	9	17

Table 2: Frequency

score	Frequency (%)	Valid percentage	Cumulative percentage
Post-operative duration - 6 months			
Valid			
Poor	6 (15.8)	15.8	15.8
Fair	17 (44.7)	44.7	60.5
Good	10 (26.3)	26.3	86.8
Excellent	5 (13.2)	13.2	100.0
Total	38 (100.0)	100.0	
Post-operative duration 9 months			
Valid			
Poor	2 (5.3)	5.3	5.3
Fair	11 (28.9)	28.9	34.2
Good	13 (34.2)	34.2	68.4
Excellent	12 (31.6)	31.6	100.0
Total	38 (100.0)	100.0	
Post-operative duration 12 months			
Valid			
Poor	2 (5.3)	5.6	5.6
Fair	6 (15.8)	16.7	22.2
Good	12 (31.6)	33.3	55.6
Excellent	16 (42.1)	44.4	100.0
Total	36 (94.7)	100.0	
Missing			
System	2 (5.3)		
Total	38 (100.0)		
Post-operative duration 18 months			
Valid			
Poor	2 (5.3)	6.3	6.3
Fair	4 (10.5)	12.5	18.8
Good	9 (23.7)	28.1	46.9
Excellent	17 (44.7)	53.1	100.0
Total	32 (84.2)	100.0	
Missing			
System	6 (15.8)		
Total	38 (100.0)		

of complete ACL tear who underwent arthroscopic ACL reconstruction using bone-patellar tendon graft were followed up for 2 years. The period of study was between January 2013 and January 2017 was included in the study. All the patients who were having chief complaints of instability were diagnosed clinically by anterior drawer test, Lachman test, and pivot shift test and were confirmed by MRI. ACL tears that were more than 3 weeks old were included in this study. All patients had pre-operative quadriceps strengthening and range of movement exercises. All patients underwent standard arthroscopic ACL reconstruction using bone-patellar tendon-bone graft which was fixed on either side with stainless steel interference screws. All patients underwent a standard post-operative rehabilitation program. They were evaluated at the end of 6, 12, 18, and 24 months using lysholm scoring system.

RESULTS

Among 36 patients, in this study, 32 were male and 4 were females. Right knee was involved in 21 and left knee was involved in 15 cases. 28 patients had sustained due to road traffic accident (RTA) and 8 had accidental fall. The average age of the patients was 30 years. All patients were operated at an average of 7-10 weeks since injury. Most of the patients had sustained injury due to RTA (70%), next common was sports activities (20%) such as kabaddi, football, cricket, and athletics, and few had injuries due to accidental fall. Four patients were lost to follow-up during the course of the study. The mean age of our study was 27 years. The youngest patient was 18 years and the eldest one 42 years. Skeletally immature patients were not included in this study as bone-patellar tendon graft ideally should not be harvested in skeletally immature patient for chances of growth disturbance. A maximum number of patients were in the age group of 26-30 years (60%), next large group was 20-25 years (25%). There were many associated injuries found during arthroscopy. Nine patients had lateral meniscal tear, 15 had medial meniscal tear, and 5 had both. Table 1 shows lysholm knee scoring recorded during subsequent postoperative visits at 6,9,12 and 18 months. Table 2 shows the detailed statistics which classify the results and gives us the frequency of poor to excellent results in the 6 to 18 months follow up period

At the end of 24 months, around 80% of patients had good to excellent results. The average range of knee motion was 127-135°. Loss of knee extension was noticed in three patients. Two patients developed superficial infection which subsided with oral antibiotics anterior knee pain was reported in six patients. The limitation of the study is its small sample size.

DISCUSSION

After ACL reconstruction most patients expect an early return to function and atheletes especially want to return to sports earlier. patellar tendon graft with its strong bone to bone fixation achieved after fixation favours early aggressive rehabilitation protocols which are the key to a good long term functional outcome. Many new graft options have evolved over a period of time with pros and cons like hamstring tendon and quadriceps tendon. inspite

of many options availabe bone patellar tendon bone graft and hamstring tendon graft have been most popular ones because of their consistent good results. though initially considered to be gold standard patellar tendon graft had some donor site morbidity because of which hamstring tendon graft has been increasingly used nowadays. but studies have shown that with a proper surgical technique these problems can be avoided and still remains to be the gold standard graft option for ACL reconstruction. Dai et al found six strand hamstring graft superior to PTB graft in a study. Yao and kratler in 2015 showed PTB graft to be a good choice. Barber described good results even with BPTB autograft similar to allograft. Niu showed better results with double layered BPTB graft. Riff showed around 3 % revision rates after ACL reconstruction with PTB graft in there 30 year follow up. Hardy studied complications following graft harvest and concluded that effective means of prevention exist to reduce the risl of these complications. Samuelson in their meta analysis showed there was no significant difference in failure rates of ACL reconstrucion using PTB and hamstring grafts. Ali described patellar bone tendon bone graft was a reliable method of reconstruction of ACL. Hence these studies show results similar to our study showing good functional outcome following ACL reconstruction using Bone patellar tendon Bone autograft

CONCLUSION

The patellar bone tendon-bone graft is a very reliable graft for reconstruction of ACL. Although it has an increased incidence of anterior knee pain and quadriceps weakness initially, but the midterm results are good.

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Original Article

Study and Evaluation of Fine-needle Aspiration Cytology Features of Metastatic Deposits in Peripheral Lymph Nodes in the Body in SVS Hospital Mahabubnagar

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Abstract

Introduction: Metastatic malignancy is a more common etiology of peripheral lymphadenopathy than lymphoma, especially in patients over 50 years of age. Fine-needle aspiration cytology (FNAC) is a well-established method for initial diagnosis of metastatic malignancies.

Aim: To study the different cytomorphology of metastatic deposits in lymph nodes aspirates by FNAC. Age and site of the lymph node are correlated.

Materials and Methods: All the patients presenting with enlarged lymph nodes clinically, at SVS Medical College and Hospital, Mahabubnagar, cases from July 2016 to July 2017 were included in the study. Fnac was done and the standard method for the procedure was adopted. All the slides were reviewed and diagnosis given for malignancy.

Results: Metastatic malignancy proved to be the most common diagnosis in our study the highest incidence of metastatic malignancy was seen in 6-7 decades of life and with a male predominance. 30 cases were found to have metastatic tumor cells.

Conclusion: This study highlights different cytomorphology of secondary deposits in lymph nodes FNAC, correlated with age and site of the lymph node.

Key words: Adenocarcinoma, Cervical lymph nodes, Fine-needle aspiration cytology, Lymphadenopathy, Metastatic deposits, Squamous cell carcinoma

INTRODUCTION

The key to the diagnosis of lymph node metastasis is the presence of abnormal nonlymphoid cells forming aggregates and clusters, among the normal lymphoid cells and the absence of lymphoglandular bodies.

In patients with enlarged lymph nodes and previously documented malignancy, fine-needle aspiration cytology (FNAC) can obviate further surgery performed merely to confirm the presence of metastases.

The cytological patterns seen in the aspirated smears of metastatic lymph node are often clues to the site of primary malignancy.

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MATERIALS AND METHODS

All the patients presenting with enlarged lymph node clinically, at SVS Medical College and Hospital, Mahabubnagar, cases from July 2015 to December 2016 were included in the study. Fnac was done, and the standard method for the procedure was adopted. All the slides were reviewed and diagnosis given for malignancy.

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RESULTS

Metastatic malignancy proved to be the most common diagnosis in our study the highest incidence of metastatic malignancy was seen in 6-7 decades of life and with a male predominance.

30 cases were found to have metastatic tumor cells. 13 cases were diagnosed as metastatic squamous cell carcinoma. 10 cases were diagnosed as adenocarcinoma secondary deposits. 2 cases were malignant melanoma secondaries and another was papillary carcinoma thyroid. 3 were duct cell carcinoma breast to axillary lymph nodes. 2 cases were diagnosed as poorly differentiated carcinoma.

DISCUSSION

Metastatic squamous cell carcinoma was the most common entity in our study.

Tumor cells are seen mostly in sheets and singly scattered the cells have dense cytoplasm with hyperchromatic nuclei with abundant cytoplasm.[1]

In well-differentiated squamous cell carcinoma the tumor cells show individual cell keratinization.

In the study, the adenocarcinoma was the common metastatic tumor.

Well-differentiated adenocarcinoma cells with acinar and occasionally papillary arrangement and also singly scattered. The individual cells are usually cuboidal to columnar with moderate amount of cytoplasm and nuclei with prominent nucleoli. Cells even show vacuolated cytoplasm indicating intracellular mucin secretion.[2-5]

In the study of papillary thyroid carcinoma shows metastatic deposit in lymph nodes where the cell clusters wherein papillary pattern with central fibrovascular core along with the characteristics vesicular nuclei with nuclear grooving and intranuclear inclusions.

Metastatic ductal carcinoma was seen in 3 cases where all the female patient presented with the breast lumps. Smear yields high cellularity with several loose clusters of tumor cells. Malignant ductal cells have moderate to abundant cytoplasm with pleomorphic nuclei and prominent single to multiple nucleoli.

Melanoma can be seen anywhere in the body.

For example:

- Eyeball, head, neck and great toe and it is can heavy metastasis to any specifically cervical or inguinal nodes. 2 cases of metastatic melanoma both in inguinal lymph nodes.
- These smear show discohesive pleomorphic cells with binucleate or multinucleated forms. The nuclei are large with characteristic prominent 1-2 micronucleoli. Intra- and extra-cellular melanin pigment was seen only in 1 case.
- Primary was known only in 2 case of squamous cell carcinoma that is larynx and gastrointestinal tract and in one case of malignant melanoma that is great toe.
- Ductal carcinoma FNAC of breast and axillary nodes was done simultaneously the most common group for lymph node involvement is cervical lymph node.

Age-wise distribution of FNAC on metastatic lesion of lymph node (Table 1)

Site-wise distribution of FNAC of metastatic lesion of lymph node (Table 2).

Incidence of FNAC on metastatic lesion of lymph node (Table 3).

CONCLUSION

This study was undertaken to know differences.

Table 1: Age-wise distribution

Age group	Number of cases (%)
0-15	0 (0)
16-30	0 (0)
31-45	6 (20)
46-60	10 (30)
61-90	14 (50)
Total	30 (100)

Table 2: Site-wise distribution

Site of involvement	Number of cases (%)
Cervical	15 (50)
Submandibular	2 (10)
Submental	1 (5)
Axillary	3 (15)
Inguinal	2 (10)
Supraclavicular	7 (10)
Total cases	30 (100)

Table 3: Sex wise distribution in 100 cases

Metastases	Number of cases (%)	Male	Female
Total	30 (100)	17	13

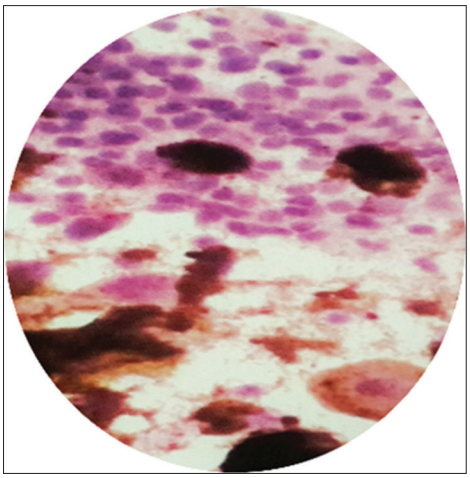

Figure 1: Melanoma deposits

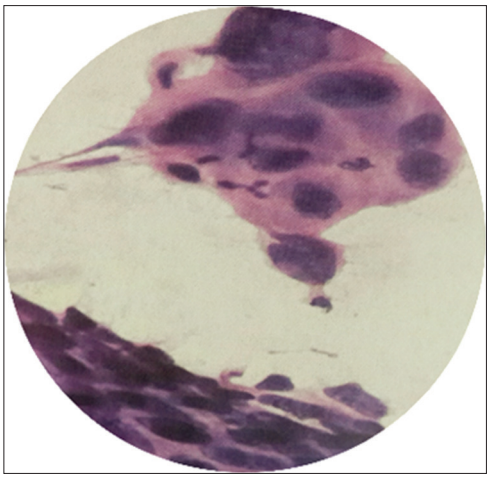

Figure 3: Adenocarcinoma deposits

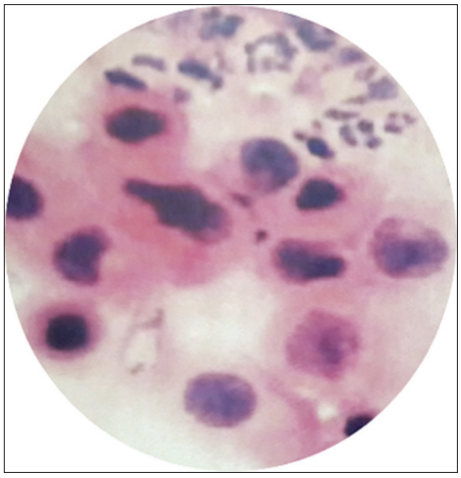

Figure 2: uamous cell carcinoma deposits

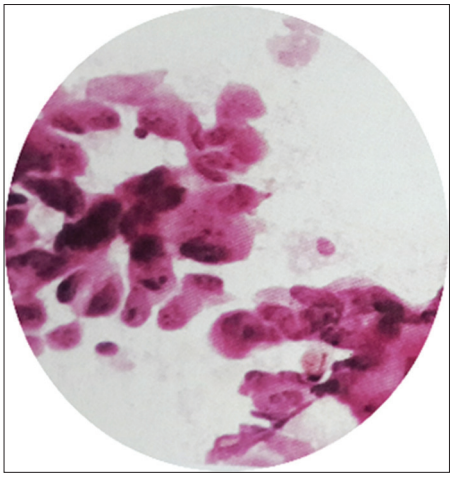

Figure 4: Papillary carcinoma of thyroid deposits

FNAC smear showing metastatic deposits of malignant melanoma (Figure 1).

FNAC smear showing squamous type tumor cell (Figure 2).

FNAC smear showing poorly differentiated carcinoma (Figure 3).

FNAC smear showing adenocarcinoma secondary deposits (Figure 4).

In cytomorphology of secondary deposits from the lymph nodes, correlation with age and site of lymph node involved. In this study, cervical nodes were common groups involved. Male patients are slightly more than females.[6-8] No case of metastasis was sent for histopathological confirmation thus proving that FNAC diagnosis can help surgeon in making a decision regarding the need for excision.

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Original Article

Role of Viruses in Periodontal Diseases - A Research Study

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Abstract

Background: Periodontitis is an inflammatory disease affecting supporting tissues of the teeth. However, questions in understanding of this disease remain unanswered as to what initiates change of gingivitis to periodontitis, biologic basis for disease remission, and relapse and what causes site specificity. Viruses are well known to cause disease in oral cavity, but its role as a causative agent in periodontal diseases remains unclear. A deep understanding regarding the etiopathogenesis of these diseases is important for the development of suitable preventive and therapeutic measures. The diverse opinion about the role of viruses in etiology of periodontal diseases has led to various clinical studies. The review focuses on the studies of viral cause for periodontal diseases marking a turning point in periodontal research, which until recently was centered almost exclusively on bacterial etiology.

Aim: The aim of this study was to compare levels of herpes viruses in gingival crevicular fluid (GCF) of periodontitis and healthy periodontium subjects.

Materials and Methods: A total of 30 patients with periodontitis, 30 patients with gingivitis, and 30 with healthy gingival tissues were selected. GCF samples were analyzed using quantitative real-time polymerase chain reaction to detect and quantify herpes simplex virus (HSV). Levels of HSV were compared between healthy and diseased subjects.

Results: The prevalance of HSV 1 was slightly higher in periodontitis subjects in comparison to the control group with a significant correlation ship with clinical parameters of the periodontitis.

Conclusion: The prevalance of the HSV viruses in the GCF and its correlation between the clinical parameters of periodontitis may represent an association with the host responses in periodontitis.

Key words: Gingiva, Herpes simplex virus, Periodontitis

INTRODUCTION

Periodontitis is a multifactorial, chronic disease that progresses by the destruction of supporting structures of teeth such as cementum, alveolar bone, and periodontal ligament. The main cause of periodontitis is the oral biofilm, with multiple microorganisms present such as bacteria and viruses. The uncertainty about the infection and clinical events of periodontal breakdown has given rise to a number of hypotheses regarding the etiopathogenesis of the disease. The understanding of etiopathogenesis has come a long way from doctrine of calculus to non-specific and specific plaque hypothesis, host-bacterial interaction model, and now, recently to keystone pathogen concept which entails the conversion or a symbiotic relationship of normal flora and host to a dysbiotic state.

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The microbes are essential but not sufficient to cause periodontal disease. These have to interact with the host to elicit disease. The transformation of commensals from a symbiosis to dysbiosis can be attributed by immunosuppression caused by keystone pathogen.[1] Much focus has been eyed on *Porphyromonas gingivalis* as a keystone pathogen, but the balance is tipping in favor

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of non-cultivable and new pathogens; viruses being the prime suspects.

Viruses are known to infect inflammatory cells of the periodontium, and they are present more frequently in diseased sites than in healthy sites. Most human viruses known to cause oral diseases are DNA viruses that are contracted in childhood or early adulthood through contact with blood, saliva, or genital secretions.[2]

Recently, it was suggested that certain viruses might also influence the development and severity of periodontal diseases though the cause of gingivitis and periodontitis is credited to bacteria and initiating the major mechanisms of periodontal destruction.[3] It is obvious that other factors beyond biofilm are important in the pathogenesis of periodontitis, such as tobacco smoking and genetically determined variations in inflammatory response patterns. However, viruses can also interfere on immune responses through immune modulators encoded within viral genomes, which include proteins that regulate antigen presentation, function as cytokines or cytokine antagonists, inhibit apoptosis, and interrupt the complement cascade.[4] Thus, a situation of viral-bacterial interaction could occur in the oral cavity without a denial of the argument for a major etiological role of bacteria in human periodontal disease.

The viruses are one of the smallest forms of microorganisms, which can only multiply inside living cells. These are epitome of instability and uncertainty when it comes to structure, function, and site of inoculation.[5]

Among all the groups of viruses known, Herpesviridae family is the most studied one and has shown potential link with periodontal diseases. The species of this family are divided into three subfamilies according to pathogenicity and type of cell, which they were infected with and their properties of growth (Table 1).[6]

Another virus which has gained attention in relation to periodontal disease is human immunodeficiency virus in acquired immunodeficiency syndrome patients, who have shown typical patterns of periodontal disease in the form of linear gingival erythema, necrotizing ulcerative gingivitis, and periodontitis.

Table 1: Clinical parameters of control group and periodontitis group

	Mean±SD		
Parameter	**Control group**	**Periodontitis group**	***P***
PI	0.71±0.73	1.23±0.76	0.016
Gingival index	1.19±0.72	2.09±0.67	0.000
Bleeding on probing	1.23±0.79	2.37±1.19	0.000
Pocket depth	1.98±0.02	4.13±2.67	0.000
Clinical attachment loss	0.00±0.00	5.58±2.40	0.000

SD: Standard deviation

Evidence Suggesting Viral Association in Etiopathogenesis

The criteria to ascertain various microbes as putative periodontal pathogens were postulated. Dilemma still exists whether viruses are active or prime periodontal pathogens or mere passive inhabitants of periodontal pockets.[7] A pathogen is said to be associated with a disease if it is prevalent in higher numbers in diseased sites as compared to the healthy sites, a number of studies have confirmed a high prevalence of viruses detected in dental plaque and periodontally compromised sites. It has been seen that as many as 1 million herpes virus genome copies can be present in a single site of chronic periodontitis patients.[8]

Herpes simplex virus (HSV), CMV, and EBV have been detected in higher numbers in chronic and aggressive periodontitis patients. Nuclear body type structures, virus-like inclusions, and raised immunoglobulin G titer are indicative of herpes virus infection and were detected in periodontitis patients.[9-11]

Table 2 summarizes the various types of viruses and their prevalence with periodontal disease.[12-16]

Although abovementioned studies indicated an association between viruses and periodontal diseases, certain facts need to be pondered over before reaching to any conclusion. The mere presence of viruses in periodontitis sites does not justify their role in the disease as viruses have also been detected in the healthy sites. The periodontal health was found to be associated with a median genomic detection rate of 8% for EBV and cytomegalovirus. There are certain studies, which have not detected viruses in periodontitis patients. Nibali *et al.*[17] concluded that prevalence of herpes viruses in plaque sample of periodontitis subjects is not universal. Viruses have been detected in latent stages in various periodontal patients indicating their role as mere innocent bystander. Saygun *et al.*[18] concluded that periodontal pockets might act as a main source of viruses in the saliva of periodontitis patients where viruses grow owing to immunosuppression caused by bacteria.

Viruses were not detected at all sites and in all studies. This might be explained by various factors. Scientific evidence states "Association is not causation." Thus, the second

Table 2: Herpes viruses in peridontitis group of patients according to the pocket depth and CAL

Periodontitis group	**Pocket depth >6 mm**	**CAL 3-6 mm**	***P***
HSV-1	6	10	0.009

criterion of "elimination" further substantiates criteria of association.

If the removal of an organism leads to resolution of the disease/lesion, causality may be surfaced. The synergistic pathogen concept reveals that microbes show great interdependence in periodontitis. The effect of the removal of one organism on the other microbes should not be overlooked. Modulation of viral prevalence by therapeutic intervention leads to the improvement in periodontal conditions and might confirm their role as putative pathogens.[19]

Various studies have pointed out considerable improvement in periodontal parameters along with combined bacterial and viral load reduction after mechanical periodontal therapy.[18,20-23] This authenticates a synergistic role played by both pathogens or this might assign primary role to bacteria, whose removal led to decrease of the viral load simultaneously and vice versa. A cause-and-effect relationship between viruses and periodontal disease can be pointed out by proving the efficacy of antiviral therapy alone in achieving periodontal health.[21]

Host Response to Organism and Specific Pathogen Mechanisms

A microorganism is said to be pathogenic if it elicits immune response in host and possesses certain virulence factors, which can be implicated in tissue damage cascade. Herpes virus pathogenicity in periodontal scenario is complex and is executed through direct virus infection and replication or through a virally induced alteration of the host immune defense.

Cytopathic Effects on Host Cells

Herpes viruses can exert direct cytopathic effects on fibroblasts, keratinocytes, endothelia cells, and various inflammatory cells. It may induce abnormalities in the adherence, chemotaxis, and phagocytic and bactericidal activities of PMNs. Epstein–Barr virus active infection can also generate anti-neutrophilic antibodies and neutropenia and polyclonally stimulate the proliferation and differentiation of B-lymphocytes. They can upregulate the interleukin-lβ and tumor necrosis factor-α gene expression of monocytes and macrophages. Increased levels of pro-inflammatory cytokines in periodontal sites can cause enhanced risk of periodontal tissue destruction by disrupting homeostasis.[8]

Increased Bacterial Colonization

Herpes virus proteins expressed on eukaryotic cell membranes may act as new bacterial binding sites. Cytomegalovirus can enhance the adherence of *Aggregatibacter actinomycetemcomitans* to pocket epithelial cells and to HeLa cells.[24]

Activation of Autoimmune Cascade

Periodontitis tends to be of greater severity in carriers of the HLA-DR4 alloantigen,[22] perhaps because cytomegalovirus-specific CD8+T cells can cross-recognize HLA-DR4 molecules and potentially induce autoimmune reactions.[25]

Disruption of Epithelial Barrier

Herpes viruses can disrupt oral epithelial cells. The disruption of epithelial barrier may facilitate the access of bacteria to deeper tissues and create additional sites for bacterial binding and action.[24]

Defective Development of Periodontium

Ting *et al.*[10] hypothesized that a primary cytomegalovirus infection at the time of root formation of permanent incisors and first molars can give rise to a defective periodontium and can affect morphology of teeth. Cytomegalovirus infection early in life can lead to cemental hypoplasia.[26]

Latent Membrane Proteins (LMPs)

LMP-1 mimics receptors of the TNF receptor superfamily and activates numerous signaling pathways.[8]

Alteration of Microbiological Ecology

Oral virobiota may alter microbial ecology and hence can predispose the host to periodontal destruction. A periodontal herpes virus infection may increase the pathogenicity of the periodontal microbiota.[27]

Integrated Pathogenicity

The integration of bacterial, viral, and fungal metatomes (interactome) together with medically compromised host as a co-factor might explain the occurrence of severe, recurrent, and refractory periodontal cases.[28]

Clinical Implications

Implicating viruses in the initiation and progression of periodontal disease has therapeutic implications. HMV, EBV, and CMV have been shown to persist in saliva, gingival tissues, and cells of lymphoid series in latent or active stage of affected individuals. The elimination of these viruses can be done by following methods:

- Periodontal therapy
- Chemical and plaque measures
- Specific antiviral drugs such as acyclovir and valacyclovir can lead to resolution of periodontal disease.[21]

Prophylactic and Therapeutic Vaccination

Periodontal disease being a ubiquitous disease poses a great social and financial burden. Recent understanding of herpes virus-bacterial host interaction holds great promise in developing vaccines to prevent and cure periodontal disease.

Prophylactic vaccines harness the immune system of healthy subjects to prevent infection by viruses. Therapeutic vaccines stimulate the immune system into combating existing viruses and disease. Labeling of viruses as potential pathogen might also explain the missing authentic link of periodontitis-systemic disease syndrome. Therefore, these vaccines might start a new era of disease-free world.

Sunde *et al.*[21] treated a patient, who exhibited refractory periodontitis and high Epstein–Barr virus subgingival copy counts, with the anti-herpesvirus drug, valacyclovir HCl, 500 mg twice a day for 10 days. The treatment suppressed subgingival Epstein–Barr virus to undetectable levels for at least 1 year and resulted in clinical improvement.

Anti-herpesvirus chemotherapy can also decrease the salivary viral load. A short course of valacyclovir, 2 g twice on the day of treatment and 1 g twice the following day, resulted in a significant decrease in the salivary occurrence of Epstein–Barr virus compared with controls.[29] Valacyclovir, 500 mg orally twice daily for 1 month, given to elite male distance runners, reduced the salivary load of Epstein–Barr virus by 82% compared with placebo.[30] Valacyclovir therapy, 3 g per day for 14 days, resulted in a reduction, of more than 100-fold, of Epstein–Barr virus genome-copies in oral wash fluid of patients with acute infectious mononucleosis.[31] The orally administered acyclovir prodrug and valacyclovir can reach serum concentrations similar to those of intravenously administered acyclovir and are prescribed for a variety of herpes viral diseases.[32] The US Institute of Medicine has assigned high priority to the development of vaccines against HSV, Epstein–Barr virus, and cytomegalovirus, to be given to 12-year-old children.[33]

MATERIALS AND METHODS

A total of 30 patients with periodontitis, 30 patients with gingivitis, and 30 with healthy gingival tissues were selected from the OPD of the Department of Periodontics, IGGDC, Jammu. Gingival crevicular fluid (GCF) samples were analyzed using quantitative real-time polymerase chain reaction (PCR) to detect and quantify HSV virus. Levels of HSV were compared between healthy and diseased subjects.

Exclusion Criteria

- The patients with known systemic diseases
- <20 teeth present
- Any therapy of periodontitis 1 year before the study. A full mouth periodontal examination was done in all patients by a single clinician trained for the specific study recording the following clinical parameters at six sites using a periodontal probe graded in mm*:
- Clinical pocket depth in mm,
- Bleeding on probing recorded as present (1) or absent (0),
- Plaque index (PI) measured along the mucosal margin and recorded as present (1) or absent (0),
- Radiographs were taken from all the diseased sites using a standardized technique.

Microbiological Sample Collection

Sterile cotton pellets removed the supragingival plaque, and micropipette is inserted in gingival sulcus/periodontal pocket. GCF was collected in small plastic tubes samples.

Quantitative Real-time PCR Assays for HSV

The PCR procedure was carried out at the Microbiology and Pathology Laboratory of Government Medical College, Jammu. Quantitative real-time PCR was performed to detect the presence/absence and quantify the HSV-1. The real-time quantitative PCR was performed with oligonucleotide primer pairs and probe specific for the type - common region of HSV-1. The primers used were HSV-FP (5′- TCC CGG TAC GAA GAC CAG-3′) and HSV-RP (5′- AGC AGG CCG CTG TCC TTG-3′), and the probe was HSV-TCP (5′-FAM-TGG TCC TCC AGC ATG GTG ATG TTG/C AGG TCG-TAMRA-3′). Amplification was carried out in an Applied Biosystem Sequence Detector 7500 ma- chine, programed for a four-step protocol: 2 min of incubation at 50°C for Amp Erase activation, 10 min at 95°C for polymerase activation and for 45 cycles: 15 s at 94°C for denaturation, and 60 s at 58°C for annealing, extension, and data collection. Each 50 μL-PCR mixture contained 10 μL of puried DNA, 840 nM concentrations of each primer, and 100 nM probe in 1x TaqMan universal PCR master mix (Applied Biosystems, Branchburg, New Jersey, USA). Negative controls were included in the extraction process between every clinical sample. All negative samples were tested twice.

Statistical Analysis

Statistical analyses were performed using Statistical Package for the Social Sciences for Windows, version 15. Statistical differences between frequencies were tested with Chi-square test.

RESULTS

Within the periodontitis group, several clinical parameters showed a significant difference with different levels of virus in the GCF. Table 1 probing pocket depth and clinical attachment loss revealed higher values in the patients with HSV, while PI was lower. In addition, HSV occurred more often in deeper pockets with more clinical attachment loss (Table 2).

DISCUSSION

Grenier *et al.*[22] reported a higher prevalence of HSV-1 in subjects with periodontitis than in healthy subjects. Similar results were found by Parra and Slots[34] in patients with chronic periodontitis than in patients with mild gingivitis. The same results were concluded by Contreras *et al.*[24] in gingival tissue specimens. Surprisingly, Bilichodmath *et al.*[16] found a higher prevalence of HSV-1 in patients with chronic periodontitis than in patients with the aggressive form of the disease, but they explained the results as the influence of their patients' age, which is also a limiting factor of our study. However, Nibali *et al.*[17] found a low prevalence of all investigated herpes viruses in both patients with periodontitis and controls.

The most important result in our study is the relationship between the presence of HSV-1 and pocket depth with the higher prevalence of HSV-1 with an increase in pocket depth. Other authors did not find correlation between the depth of periodontal pockets and HSV-1.[22] Our results also showed lower values for the PI in periodontitis group subjects, which indicates the influence of HSV-1 on periodontal tissue destruction. Kamma and Slots[35] detected significantly higher frequencies of HSV and other viruses in active and progressive periodontitis sites.

Sabeti *et al.* presumed that viral infections contribute to immune impairment, which in turn creates a fertile ground for bacterial infections and causes shifting of gingivitis toward periodontitis. Furthermore, reactivation of viruses such as HSV coincide phases of remission and reactivation of periodontitis.[35]

CONCLUSION

Long-term studies with adequate sample size, well-designed randomized controlled trials, more sensitive and specific technological advancements to detect latent and activated viruses may provide sufficient evidence to implicate viruses as prime pathogens. Importance of the present literature cannot be undermined as it is rightly said that "absence of evidence is not the evidence of absence." At the same time, a cause-and-effect relationship remains to be established. The possible involvement of human herpesviruses in the pathogenesis of chronic periodontitis merits further investigation.

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Original Article

Clinical Study of Intact Canal Wall Technique in the Management of Chronic Suppurative Otitis Media

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Abstract

Background: Chronic suppurative otitis media (CSOM) is a common inflammatory disorder of middle ear cleft accounting for the majority of conductive hearing losses in the population worldwide. CSOM is managed by intact canal wall (ICW) or canal wall down procedures (CWD) depending on the keratin formation in the middle ear cleft. Auditory gain is better in ICW procedures when compared to CWD procedures.

Aim of the Study: This study aims to evaluate the long-term effects on auditory gain following ICW technique of mastoidectomy with tympanoplasty in the treatment of CSOM (tubotympanic).

Materials and Methods: A total of 60 patients with CSOM were randomly selected and subjected to ICW mastoidectomy and tympanoplasty after necessary investigations. The auditory gain was calculated after 8 weeks of surgery and follow-up of 2 years.

Observations and Results: Among the 60 patients, 53% were males and 47% were females. 75% of the study group belonged to the age group between 20 and 40 years. About 67% of the individuals were of the low socioeconomic group. About 55% of the mastoids were pneumatized. Mucosal edema was observed in 53% and mucosal hypertrophy in 38%. The auditory gain was 15-35 dB in 80% of the individuals.

Conclusions: The overall incidence of CSOM in the study was 5% in the study. The most common pathology was middle ear mucosal edema followed by hypertrophied mucosa. Auditory gain was 15-30 dB in 80% of the patients.

Keywords: Auditory gain, CSOM, Mastoid pneumatization, Intact canal wall mastoidectomy, Pure tone audiometry

INTRODUCTION

Chronic suppurative otitis media (CSOM) is typically a persistent disease of middle ear cleft, insidious in its onset.[1] This disease often causes severe destruction and irreversible sequelae, involving the tympanic membrane, ossicles, and the temporal bone.[2] It manifests clinically as discharge and deafness of variable severity.[3] It can be subdivided into active or inactive depending on whether or not there is an infection. Chronic otitis media develops after long-standing inflammation in the middle ear and mastoid. Even though conservative treatment makes the ear temporarily dry, the susceptibility for future reinfection persists as long as the perforation is present, especially in children.[4] The Foci of sepsis lies in the adenoids, tonsils, sinuses, and teeth.[5] The principal aim of surgery for CSOM is first to clear the disease and only then, if possible, to reconstruct the hearing mechanism in the middle ear.[6] Randomized clinical trials comparing medical and surgical intervention are not available. Hence, the treatment of CSOM is almost exclusively based on empirical experience.[7] Duration and time frame of medical treatment for patients who remain asymptomatic still remains unclear.[8] However, case series describing the intraoperative findings of medically intractable cases have been published.[9] The indications for abandoning medical therapy are currently unclear; thus, no justification in making definite recommendations for the performance of either procedure.[10] The surgery of mastoid and the middle ear has evolved in the present time with the use of operating microscope and endoscopes to its pinnacle.[11] The post-operative complications are minimal. The post-operative end results are convincingly encouraging. The incidence of chronic middle ear infection is about 5% in Indian population.[12] The present

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study is to assess the auditory gain in the intact canal wall (ICW) technique mastoidectomy in patients with CSOM (tubotympanic).

Aim of the Study

This study aims to evaluate the long-term effects on auditory gain following ICW technique of mastoidectomy with tympanoplasty in the treatment of CSOM (tubotympanic). Final success rate, FS (dry ears for 2 years) and the optimal final success rate, OFS (dry ears for 2 years without reoperations and without retractions/perforations) were estimated.

Study Period

February 2009-January 2013.

Institute of Study

General Hospital Attached to Santhiram Medical College, Nandyal, Kurnool, Andhra Pradesh.

MATERIALS AND METHODS

A total of 60 patients attending the OPD of the Department of ENT with CSOM were selected randomly for this study. After obtaining detailed history thorough ENT examination including endoscopy of the ear was done.

Inclusion Criteria

1. Patients aged between 18 and 50 were included,
2. Patients with central perforation only were included,
3. Patients with only conductive deafness were included,
4. Patients undergoing primary surgery were alone included.

Exclusion Criteria

1. Patients aged below 18 and above 50 years were excluded,
2. Patients with sensorineural hearing loss were excluded,
3. Patients undergoing revision surgery were excluded,
4. Patients with diabetes mellitus were excluded,
5. Patients with intracranial complications were excluded.

All the patients were subjected to surgical profile and auditory assessment. Auditory assessment was done with pure tone audiometry (PTA) taking the pure tone average (500-2000 KHZ), PTA as the index of measurement. Auditory assessment was done postoperatively after 8 weeks to calculate the auditory gain. All the patients were subjected to ICW mastoidectomy and tympanoplasty procedure either under local anesthesia or general anesthesia. Mucosal disease and hypertrophied mucosa in the middle ear cleft were removed. Water test was done to see that auditus became patent in every patients. Underlay graft with temporalis fascia was done. Kerr's technique of anterior tucking was done in all the patents. Wherever necessary a 30° sinus endoscope was used to visualize critical areas of the middle ear and sinus tympani. All the patients were followed up for 2 years to assess the auditory gain and observe the graft healing and symptomatic relief of tinnitus and loss of hearing.

OBSERVATIONS AND RESULTS

Among the 60 patients, there were 32 (53%) males and 28 females (47%) (Figure 1).

There were 10 patients (17%) aged between 11 and 20 years, 35 (58%) belonging to the age group of 21-30, 10 (17%) belonging to 31-40 years, and 5 (8%) belonging to the age group of 41-50 years (Figure 2).

Among the 60 patients, 40 (67%) belonged to the low socioeconomic group, 15 to the mid-income group (25%), and 5 (8%) to the upper-income group (Figure 3).

The most common symptom in the study group was discharged from the ear in all the patients (100%), followed by loss of hearing in 50 (83%) patients. Other symptoms were pain in the ear in 14 (23%), tinnitus in 8 (135), and vertigo in 2 (3%) (Figure 4).

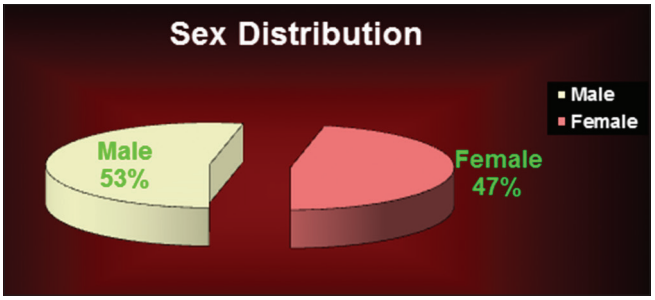

Figure 1: The gender incidence (*n* = 60)

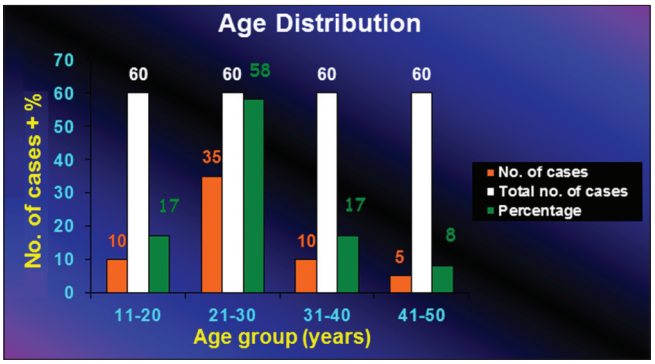

Figure 2: The age incidence of the study group (*n* = 60)

Observation of the duration of symptoms in the study group revealed that 1-6 months duration was found in 21 (35%), 6 months to 1 year in 31 (52%), 1-5 years in 5 (8%), and 5-10 years in 3 (5%) patients (Figure 5).

The type of perforation was observed in the study and found that central perforation was seen in 37 (62%) patients, posterior quadrant perforation in 15 (255), sub-total in 6 (10%), and anterior marginal in 2 (3%) of the patient (Figure 6).

X-ray mastoids of the patients revealed that well-pneumatized air cells were found in 55%, mixed type in 20%, and acellular in 25% of the patients (Figure 7).

Peroperative observation revealed that the type of middle ear mucosa was edematous in 32 (53%), polyp formation in 7 (9%), hypertrophied mucosa in 18 (30%), adhesion in 3 (5%) and ossicular erosion in 12 (20%), and tympanosclerosis in 20 (33%) of the patients (Figure 8).

In the study group, pre-operative audiograms showed 0-20 dB loss in 10 (17%), 21-40 dB loss in 36 (60%), 41-55 dB loss in 12 (20%), and 56-70 dB loss in 2 (3%) patients (Figure 9).

The post-operative PTA showed an auditory gain of 15-30 dB in 80% of the patients. 10-15 dB gain in 3.33% and 30-35 dB in 16.66% of the patients (Table 1).

Final success rate, FS (dry ears for 2 years) was 100% in the present study and the optimal final success rate, OFS (dry ears for 2 years without reoperations and without retractions/perforations) was also 100% in the present study.

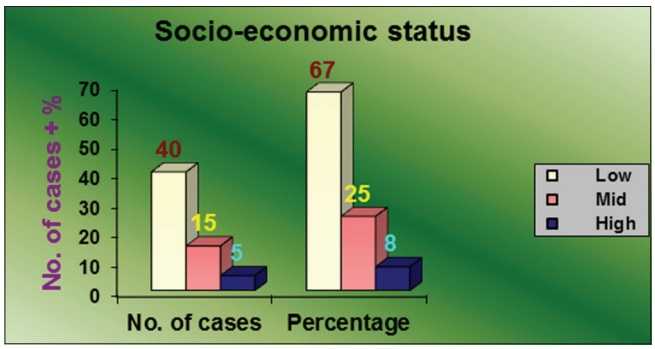

Figure 3: The incidence among economic groups (*n* = 60)

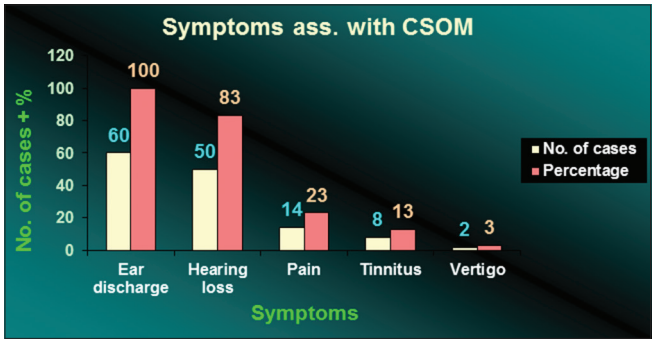

Figure 4: The incidence of symptoms (*n* = 60)

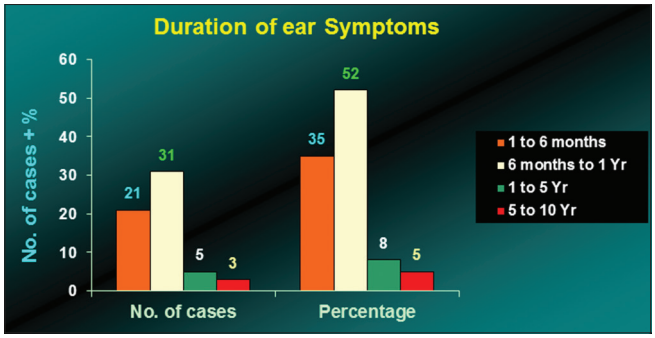

Figure 5: The duration of the disease in the study group (*n* = 60)

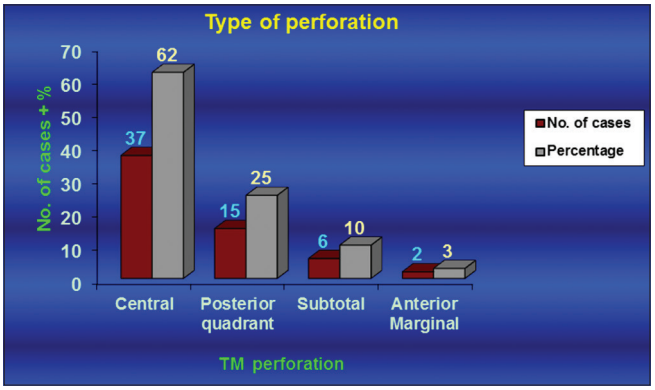

Figure 6: The type of perforation (*n* = 60)

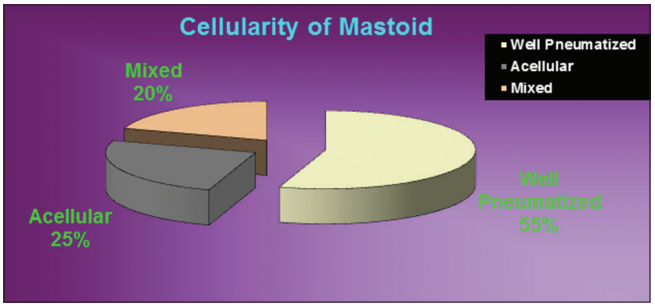

Figure 7: The cellularity of the mastoid X-ray (*n* = 60)

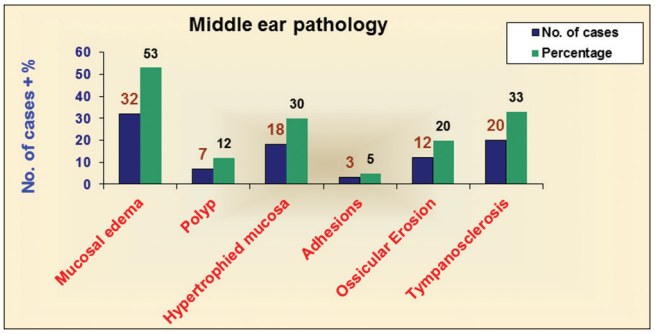

Figure 8: The pathology peroperatively (*n* = 60)

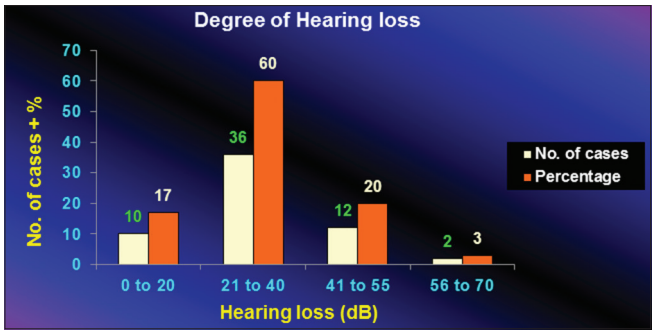

Figure 9: The loss of hearing in the study group (*n* = 60)

Table 1: The auditory gain following 8 weeks post-operative audiometry (*n*=60)

Auditory gain in dB	Number of patients (%)
10-15	02 (3.33)
15-20	13 (21.66)
20-25	14 (23.33)
25-30	21 (35)
30-35	10 (16.66)

DISCUSSION

CSOM and its complications are among the most common conditions seen by the otologist, pediatrician, and the general practitioner. It is a persistent disease with irreversible complications. Early otoscopic, bacteriological, and radiological diagnosis with surgical intervention will assume accurate and appropriate effective therapy. It is observed in the present study that the incidence in the general population is about 5% which was also observed by Vijayendra *et al.*[13] The number of consults (pediatric) with diagnosis of CSOM in the Nigerian epidemiological study was 325 (5.6%) in 2008.[14] It is observed in the present series that majority of the patients belonged to the age group of 21-30 years, i.e., 58%, followed by the age groups of 11-20 and 31-40 years both 17%. Poorie and Iyer[15,16] found the incidence more common in the age group of 0-10 years. This may be because this study includes those patients who underwent surgery of mastoid, unlike their study which is a bacteriological study. CSOM is found to be more common in males; the ratio of M:F is 1.1:1 in the present study. It was 1.4:1 in the study by Poorie and Iyer.[15,16] A similar study by Verma *et al.* showed incidence in M:F as 1.4:1; the prevalence in India was 0.9% of children and 0.5% of adults having CSOM with no difference between the sexes. The incidence of CSOM appears to depend on race and socioeconomic factors. In the present series, the incidence in the low socioeconomic group is 67%, 25% in mid, and 8% in high group. Poor socioeconomic status, overcrowding, poor nutrition, poor hygiene, and infectious diseases (e.g., measles) have been found to contribute to the development of CSOM. In the present series, ear discharge is present in all the patients (100%), loss of hearing in 83%, pain in 23%, tinnitus in 13%, and vertigo in 3% of patients. The duration of symptoms before reporting for treatment range from 6 months to 10 years among the patients studied. About 52% of the patients reported between 6 months and 1 year (51%). It shows the awareness among the general population in regards to the discharge and other symptoms of the ear. Central perforation is noted in 62%, posterior quadrant perforation in 25%, sub-total perforation in 12%, and anterior marginal in 3% of cases.

The assessment began with a thorough history of the frequency, duration, and characteristics of the discharge. Physical examination of the affected ear requires cleansing of the external auditory canal before the tympanic membrane can be accurately assessed. The eardrum was adequately visualized for accurate diagnosis. All the patients were subjected to PTA and found to have purely conductive deafness in 100%. The loss of hearing was found to be more in patients with sub-total and posterior quadrant perforations. The PTA was 21-40 dB loss in 60%, 41-55 dB loss in 20%, and 0-10 dB loss in 17% of patients. This shows the ossicular involvement, apart from simple perforation of the tympanic membrane, in the diseases process of CSOM. It varied from mucosal edema, hypertrophy, fibrosis, ossicular necrosis, and IS joint dislocation to tympanosclerosis on surgical exploration. It gives baseline data regarding the pre-operative hearing status that is important for surgical planning and for evaluating the effectiveness of tympanoplasty and ossiculoplasty. It must be emphasized that PTA should be done only after thoroughly cleaning the ear and in the absence of acute suppurative symptoms. Mucosal edema was seen in (53%), hypertrophied mucosa (30%), polyp (12%), ossicular erosion (20%), and adhesions in (5%) of cases. A hearing loss of 30 dB or more may represent ossicular disruption. Progressive loss with no obvious middle ear pathology on examination may represent tympanosclerosis or otosclerosis; Sunderman and Dyer.[17] All the patients are subjected to plain X-ray of the mastoid law's lateral oblique view, and it is found that (55%) of cases showed cellular mastoid, 25% showed acellular and 20% of cases mixed variety of pneumatization. The primary surgical treatment in all the patients is cortical mastoidectomy "ICW technique" (CWU) with tympanoplasty through a postaural route. Pre-operative broad-spectrum systemic antibiotic like ceftriaxone sodium 1 g is administered to all cases just before the surgery. In all the patients, standard tympanomeatal flaps are raised and that includes posterior meatal skin flap, superior tympanomeatal flap, inferior tympanomeatal flap, and posterior tympanomeatal flap, which help to preserve the vascularity and thus helps in rapid epithelialization of the tympanic membrane. In 100% of patients, the anterior window is made to tuck the

anterior end of the graft to stabilize it as described by Kerr. This helps in preventing retraction of the graft and in such cases, leading to remnant perforation in the anterior part. In the present study, this technique was observed to help in preventing blunting also. It helps the flaps to improve blood supply which will bring down the rate of canal skin break down, chronic myringitis and chronic external otitis. Handle of malleus is skeletonized. In 15 patients, 45° endoscope is used to determine the patency of auditus and condition of the ossicles. Canaloplasty was done in 20 patients (33%). It helps in visualization of the tympanic ring in its entirety so that the graft can be placed accurately. This has helped in rapid epithelialization of the tympanic membrane as there is good aeration of external canal. In all the patients, underlay grafting is done. In 45% of cases, the handle of malleus is exteriorized, and in remaining 55% of cases, it was medialized. In all the cases, the patency of the auditus is judged by the water test, i.e., water flushed through the auditus flows easily through the middle ear and external ear. This precludes good ventilation of the middle ear postoperatively and also helps in keeping the graft *in situ* which is a prerequisite for rapid epithelialization. In all the possible cases, (40%) primary ossiculoplasty is done depending on the ossicular status. Septal cartilage and homograft ossicles are used as prostheses for partial ossicular replacement. In 62% of cases, in the present study, the ossicular chain was intact; hence, Type I tympanoplasty is done. In cases, where malleus is found eroded Type II tympanoplasty (20%), in cases of incus erosion, Type III tympanoplasty is done (12%) in this series. Where incus, malleus, and stapes supra structure are eroded with mobile foot plate, Type IV tympanoplasty (6%) is done. Single-stage procedure is adopted in the present study. Vijayendra *et al*.,[13] in their series performed single-stage procedure in 95% of cases. All the patients are followed postoperatively for 2 years, with the patient reporting to the outpatient department. Suture removal is done after 1st week. External canal pack removed after 3 weeks. Ear drops are allowed after 3 weeks. Where the purulent discharge is noticed microscopic examination is done to find out the cause and cleaning. This will help in drying the canal which helps in rapid epithelialization. Among the patients, 80% of them turned up regularly for follow up. About 15% of them came irregularly and 5% did not turn up for follow up. About 98% of the cases showed final success rate and 88% showed optimal final success rate in this study. About 2% of patients presented with small remnant perforation anteriorly, persistent inflammation on the surface of tympanic membrane with intact TM and mild retraction pocket. Vijayendra *et al*.[13] showed similar result of final success rate of 98% in their series. In a study by Habib *et al*.[18] successful closure of the tympanic membrane was in 78% of tympanoplasty initially but only 52% had a healed graft with good post-operative middle ear function. Albu *et al*. had a 92% rate of successful graft healing but when using the strictest reporting criteria at 2 years of follow-up only had a 38% success rate. They also found that patients with previous adenoidectomy and more impressively adenotonsillectomy had statistically higher success rates of tympanoplasty. Combining mastoidectomy with tympanoplasty is an appropriate option in reducing the need for future surgery. In the present study, 90% of the patients showed well healed dry ear within a period of 8 weeks, 2-3 months in 20% of patients. These patients presented with fungal infection, otitis externa, and myringitits. The post-operative follow-up included an audiometric examination after a gap of 6 months to 2 years showed an auditory gain of 15-35 dB in 80% of the patients. The closure of air-bone gap in the present series was also good with 10-15 dB residual hearing loss. Final success rate, FS (dry ears for 2 years) was 100% in the present study and the optimal final success rate, OFS (dry ears for 2 years without reoperations and without retractions/perforations) was also 100% in the present study.[19]

CONCLUSIONS

The overall incidence of CSOM in the study was 5% in the study. The most common pathology was middle ear mucosa followed by hypertrophied mucosa. Auditory gain was 15-35 dB in 80% of the patients.

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Original Article

Prevalence of Complete and Partial Edentulism in the Patients Visiting District Hospital of Kathua, Jammu, Jammu and Kashmir

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Abstract

Aim: The aim of the study was to evaluate the prevalence of complete and partial edentulism in the population of Kathua District, Jammu, Jammu and Kashmir visiting the OPD of District Hospital, Kathua.

Materials and Methods: Six hundred subjects aged between 15 and 85 years (300 males and 300 females) were included in the study. The intraoral examination was done visually by a single examiner trained for the specific study purpose.

Results: There was no statistically significant relationship between age and gender of the patient with edentulousness. However, with an increase in age, there was greater trend toward partial edentulousness followed by complete edentulousness of the patients in the groups of above 45 years of age.

Conclusion: From the findings of the present study, it can be concluded that the prevalence of edentulousness increases with age which results in various long-term effects of tooth removal on patient's facial structure and general well-being, thereby increasing the need for prosthodontics rehabilitation. More awareness and proper dental education regarding proper dental hygiene and timely replacement of the missing teeth need to be taken care of.

Key words: Complete edentulism, Edentulism, Extraction, Partial edentulism

INTRODUCTION

Tooth loss has an impact on an individual's oral health-related quality of life at biologic, psychological, and social levels. The prevalence and extent of tooth loss have decreased significantly in many countries during the recent decades.[1-3]

Tooth loss is identified by an edentulous space, which is a gap in the dental arch normally occupied by one tooth or more. It could be partial or complete. A person may lack a few teeth (partially edentulous) or all the teeth in one or both upper and lower jaws (completely edentulous) for various reasons.[4]

Partial edentulousness is a dental arch in which one or more but not all natural teeth are missing. In general, it occurs by caries, periodontal problems, traumatic injuries, impactions, supernumerary teeth, and neoplastic and cystic lesions.[5-8]

Partial edentulism leads to clinical challenges and lifestyle compromises. Clinically, it results in drifting and tilting of adjacent teeth, supra-eruption of opposing teeth, altered speech, changes in facial appearance, and temporomandibular disorders.[5,6] Furthermore, the loss and continuing degradation of the alveolar bone, the adjacent teeth, and also the supporting structures will influence the difficulty to achieve an adequate restoration in a partially edentulous patient.[9-13] Pattern of tooth loss is a clear indicator of levels of oral hygiene, dental health awareness, the magnitude of dental problems, and the management.[4]

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Mundt *et al.* 2011 reported that perceived need and attitudes toward dental care had an important influence on the use of care. The older people prompted to have a fatalistic attitude and were least likely to attend the dentist.[14] In Jammu and Kashmir, very limited data are available regarding the complete and partial Edentulism, and thus, the present study is conducted to evaluate its prevalence.

MATERIALS AND METHODS

Six hundred subjects aged between 15 and 85 years (300 males and 300 females) who visited the District Hospital Kathua were included in the study. The intraoral examination was done visually by a single examiner trained for the specific study purpose and was choosen only on the basis of clinical examination. The questionnaire was prepared including the duration and various reasons for edentulism. The questionnaire was filled up by the patient and subjected to evaluation and correlation with the clinical examination.

Inclusion Criteria

- The subjects with permanent dentition were included in the study
- The subjects with age range between 15 and 85 years were also included.

Exclusion Criteria

- Third molar was excluded from the study.

The written informed consent was obtained before the clinical examination and filling up of questionnaire by the patient.

RESULTS

Of 600 subjects, 300 (50%) were males and 300 (50%) females, and 19% of males and 17.6% of females were in the age group of the 15-25 years. 15.6% of males and 16.3% of females were in the age group of 26-35 years. 16% of males and 15.6% of females were in the age group of 36-45 years. 16.3% of males and 17% of females were in the age group of 46-65 years. 17.6% of males and 17.3% of females were in the age group of 56-65 years. 15.3% of males and 16% of females were above 65 years of age (Table 1).

In the age group of 15-25 years, 29.8% of males and 26.4% of females were completely dentulous. In the age group of 26-35 years, 29.8% of males and 24.5% of females were completely dentulous. In the age group of 36-45 years, 18.7% of males and 14.9% of females were dentulous. In the age group of 46-55 years, 12.2% of males and 7.8% of females were dentulous. In the age group of 56-65 years, 5.6% of males and 3.8% of females were dentulous. There was no completely dentulous patient above 65 years of age (Table 2).

There was no edentulous patient in the age group of 15-25 years. In the age group of 26-35 years, 14.8% of males and 18.4% of females were partially edentulous. In the age group of 36-45 years, 47.9% of males and 55.3% of females were partially edentulous. In the age group of 46-55 years, 32.6% of males and 33.3% of females were partially edentulous. In the age group of 56-65 years, 58.5% of males and 63.5% of females were partially edentulous. Above 65 years of age, 34.8% of males and 35.4% of females were partially edentulous (Table 3).

There was no completely edentulous patient in the age group of 15-25 years and so as in the age group of 26-35 years. In the age group of 36-45 years, 33.3% of males and 29.8% of females were completely edentulous. In the age group of 46-55 years, 55.1% of males and 58.8% of females were completely edentulous. In the age group of 56-65 years, 54.7% of males and 32.6% of females were completely edentulous. Above 65 years of age, 65.2% of

Table 1: Age and gender distribution

Age group (years)	Males (%)	Females (%)	Total
15-25	57 (19)	53 (17.6)	110
26-35	47 (15.6)	49 (16.3)	96
36-45	48 (16)	47 (15.6)	95
46-55	49 (16.3)	51 (17)	100
56-65	53 (17.6)	52 (17.3)	105
>65	46 (15.3)	48 (16)	94
Total	300 (99.8)	300 (99.8)	600

df=10, P=1.0000

Table 2: Distribution of dentulous subjects

Age group (years)	Males (%)	Females (%)	Total
15-25	17 (29.8)	14 (26.4)	31
26-35	14 (29.8)	12 (24.5)	26
36-45	9 (18.7)	7 (14.9)	16
46-55	6 (12.2)	4 (7.8)	10
56-65	3 (5.6)	2 (3.8)	5
>65	0 (0)	0 (0)	0
Total	49 (55.7)	39 (44.3)	88

df=8, P=1.0000

Table 3: Distribution of partially edentulous subjects

Age group (years)	Males (%)	Females (%)	Total
15-25	0 (0)	0 (0)	0
26-35	7 (14.8)	9 (18.4)	16
36-45	23 (47.9)	26 (55.3)	49
46-55	16 (32.6)	17 (33.3)	33
56-65	31 (58.5)	33 (63.5)	64
>65	16 (34.8)	17 (35.4)	33
Total	93 (47.7)	102 (52.3)	195

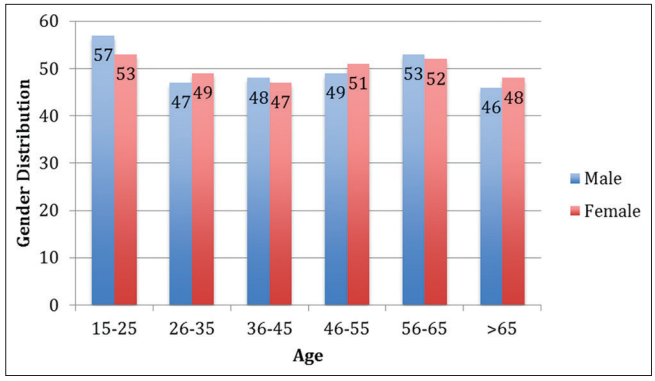
P<0.005

males and 64.5% of females were completely edentulous (Table 4).

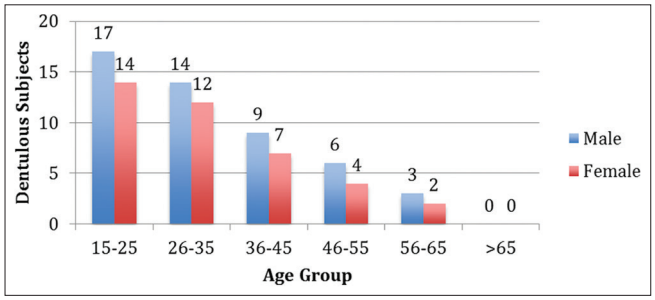
There was no statistically significant relationship between different genders of the patient and edentulousness. However, with the increase in age, there was greater trend toward partial edentulousness followed by complete edentulousness of the patients in the groups of above 45 years of age (Graphs 1-4).

DISCUSSION

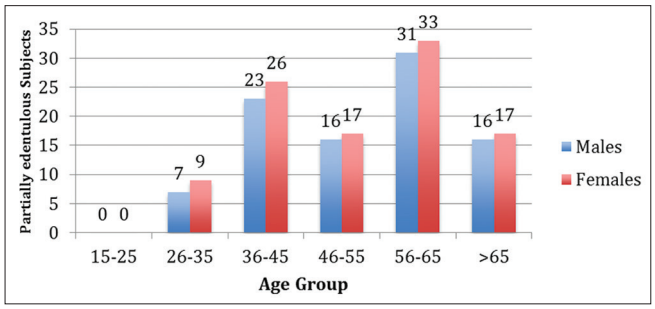
The loss of the teeth instills a major public health problem in many of the countries.[15] Edentulism has a significant impact on health and also affects the overall quality of life.[16] Numerous studies on self-perception have shown that tooth loss is significantly associated with esthetical, functional, psychological, and social impacts on individuals.[17-20]



Graph 1: Age and gender distribution



Graph 2: Distribution of dentulous subjects



Graph 3: Distribution of partially edentulous subjects

Periodontal disease and dental caries proved to be the main determinants for the high occurrence of tooth loss and for the high percentage of edentulism.[21,22] The failure to visit the dentist regularly was also found to be a major reason.[23] Several studies also concluded that age was strongly associated with edentulism.[12,22]

The combined effects of dental caries and periodontal diseases as well as the treatment decisions associated with dental caries and periodontal disease were found to increase with the age.[10-12]

The results of our study showed that there is no significant relationship between gender distribution and edentulism which is not in agreement with the studies done by Suominen-Taipale *et al.*;[21] however; in 1997 the gender differences were not found to be statistically significant in the future studies which is also in agreement with the findings of our study. The findings of our study related to age predisposition affecting partial and complete edentulousness is in agreement with the studies done by Sonkesariya *et al.*[24]

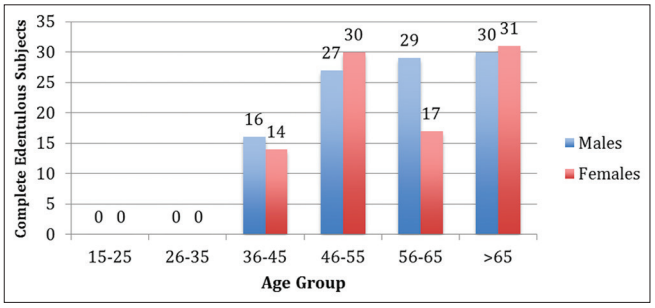
CONCLUSION

From the findings of the present study, it can be concluded that the prevalence of edentulousness increases with age which results in various long-term effects of tooth removal on patient's facial structure and general well-being, thereby increasing the need for prosthodontics rehabilitation. More awareness and proper dental education regarding proper

Table 4: Distribution of complete edentulous subjects

Age group (years)	Males (%)	Females (%)	Total
15-25	0 (0)	0 (0)	0
26-35	0 (0)	0 (0)	0
36-45	16 (33.3)	14 (29.8)	30
46-55	27 (55.1)	30 (58.8)	57
56-65	29 (54.7)	17 (32.6)	46
>65	30 (65.2)	31 (64.5)	61
Total	102 (52.6)	92 (47.4)	194

P<0.005



Graph 4: Distribution of complete edentulous subjects

dental hygiene and timely replacement of the missing teeth need to be taken care of.

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Original Article

Challenges in the Diagnosis of Extrapulmonary Tuberculosis: Role of Gene Xpert Mycobacterium Tuberculosis/Rifampicin Assay

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Abstract

Introduction: Extrapulmonary tuberculosis (EPTB) accounts for about 25% of all cases of active TB. Difficulty in sampling from the extrapulmonary sites and the paucibacillary nature of the specimens make EPTB a diagnostic challenge. Xpert mycobacterium TB (MTB) /rifampicin (RIF) is a fully automated diagnostic test which simultaneously detects TB and RIF drug resistance within few hours.

Aim: The aim is to study the diagnostic role of gene Xpert MTB/RIF in cases of EPTB.

Materials and Methods: All the specimens from patients diagnosed to have EPTB with a composite reference standard (CRS) were subjected to Xpert MTB/RIF. The CRS included parameters such as smear, culture, histology, and cytology reports (for biopsy samples and aspirates, respectively), biochemical tests such as adenosine deaminase levels (for pleural fluid, ascitic fluid, and cerebrospinal fluid [CSF]), and response to treatment during follow-up visits.

Results: Of 108 EPTB cases, maximum 51 (47.2%) were cases of lymph node TB, followed by TB pleural effusion 38 (35.1%), abdominal Koch's 12 (11.1%), and TB meningitis 7 (6.4%). The sensitivity of Xpert MTB/RIF for lymph node specimens was observed to be 62.7%, for pleural fluid 31.5%, and for ascitic fluid 41.6%. None of the CSF samples was reported MTB positive, of 7 by Xpert MTB/RIF.

Conclusion: Xpert MTB/RIF results may not be fully satisfactory from the clinical point of view. However, test should still be done because of its simplicity, reliability, and rapid results. Not only MTB detection but also rapidly determining the patient's multidrug-resistant tuberculosis status in such cases is of prime importance. However, the result should be adjunct to the results of other prevalent techniques of diagnosis of EPTB.

Key words: Extrapulmonary tuberculosis, Multidrug-resistant tuberculosis, Xpert mycobacterium tuberculosis/rifampicin

INTRODUCTION

Tuberculosis (TB) affects one-third of the global population in developing countries, with annual estimates of 9.0 million new cases and 1.5 million deaths. While pulmonary TB (PTB) is the most common presentation, extra PTB (EPTB) is also an important clinical condition.[1]

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Worldwide, EPTB accounts for approximately 25% of all TB cases and even higher percentages in HIV-infected individuals and children.[2]

In Indian scenario, the most common extrapulmonary manifestation of TB is peripheral lymphatic TB, always an accurate clinical diagnosis if the clinician has experience and retains a high index of clinical suspicion. The next common manifestation is TB pleural effusion diagnosis of which remains as difficult as it has always been. For the lethal forms of EPTB like meningeal and disseminated, unfortunately, the same goes true, and the clinician remains pretty much left to his or her own devices of making a clinical diagnosis on not much more than clinical presentation and careful history taking.

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In all these manifestations of EPTB other than clinical judgement, the diagnosis relies on additional laboratory support with histopathology, chemical and cell analysis of fluid, and response to empirical anti-TB therapy.[3] However, the collection of extrapulmonary material often requires invasive procedures, expertise, and it is not easy to obtain additional samples.[4] The culture on Lowenstein- Jensen medium takes up to 8 weeks and 6 weeks on liquid medium to get the final result. Given the limitations of procedures for confirming a diagnosis of EPTB, patients are often started on anti-TB therapy and its response then noted.[5]

In recent times, attention has been devoted to nucleic acid amplification diagnostic technologies with ease of use and promising results.[3] One of the latest systems Xpert mycobacterium TB (MTB)/Rifampicin (RIF) (Xpert) (Cepheid, Sunnyvale, CA, USA), a fully automated real-time heminested PCR system implementing molecular beacon technology for the diagnosis of PTB infection,[6] has been recently endorsed by the Scientific and Technical Advisory Board of the WHO as the most sensitive fast test for TB diagnosis in paucibacillary respiratory samples.[7] The characteristic also makes it a potentially attractive tool for extrapulmonary specimens. A series of meta-analyses has shown that nucleic acid amplification tests (NAATs) have high specificity and positive predictive value with highly variable sensitivity, especially in cases of EPTB.[8]

In various studies, Xpert has usually been compared to culture, which is known to be a very suboptimal reference standard for EPTB. In this study, we have evaluated the performance of the Xpert system on number of different extrapulmonary specimens and evaluated its diagnostic potential by performing Xpert tests in cases diagnosed with a smear microscopy, (Lowenstein-Jensen) LJ culture, clinical findings, histology/cytology, site-specific computerized tomography scan/ultrasonography, and response to anti-TB therapy which formed a composite reference standard (CRS).[8]

MATERIALS AND METHODS

This study was conducted in the Department of Respiratory Medicine, where extrapulmonary samples obtained during the clinical routine between May 2016 and March 2017 were investigated. All the patients were treated for TB on the basis of diagnostic criteria that included smear, (Lowenstein-Jensen) LJ culture, histology, biochemical testing results, clinical presentation of signs, symptoms, site-specific computerized tomography scan/ ultrasonography, and response to treatment with anti-TB therapy which formed a CRS. The final diagnosis of EPTB for the patients was established by the clinician.[9] Follow-up after every 2 weeks from the date of enrolment for anti-TB therapy was done to adjudge the response in intensive phase of treatment. Patients who had received anti-TB treatment within the past 2 years were not included in the study.[9]

TB Pleural/Ascitic/Cerebrospinal Fluid (CSF)

A diagnosis of TB was established when any of the following criteria was met:

1. Identification of bacilli in fluid, sputum, or pleural biopsy specimen by ZN staining or (Lowenstein-Jensen) LJ culture.
2. Presence of granuloma in pleural biopsy tissue; or
3. Lymphocytic exudates with adenosine deaminase (ADA) levels >40 U/l in the absence of any other obvious cause of pleural and ascitic fluid.
4. Lymphocytic exudates with ADA levels >10 U/l in CSF in absence of any other obvious cause of meningitis.
5. Clinical response to anti-TB therapy.

Other causes of pleural effusions were defined using well-established clinical criteria.[10]

Xpert MTB/RIF Assay

TB detection was done by Xpert MTB/RIF assay, made by Cepheid-Sunnyvale-USA. Extrapulmonary specimens were processed according to the GeneXpert system operator manual given by Central TB division, Government of India, Guidance document for the use of cartridge-based nucleic acid amplification test (CB-NAAT) under RNTCP. Our machine contains 4 cartridges, so 4 samples were processed for each run. According to standard operating procedure, the sampling reagent (containing NAOH and isopropanol) was added at 2:1 ratio to the sample and kept for 15 min at room temperature with intermittent shaking. 3 ml of this treated sample was transferred to the cartridge, and the cartridge was inserted in the module of CB-NAAT machine. An automatic process completed the remaining assay steps, and the results were displayed on the monitor of Gene Xpert after 1 h and 50 min. Xpert MTB/RIF cartridge is a disposable, single self-enclosed test unit in which all steps of NAAT, i.e., Sample processing, PCR amplification, and detection are automated and integrated. The manual steps involved in the assay are adding reagent and sample loading. The test procedure is made biosafe by tuberculocidal property of the assay's sample reagent.[11,12]

TB Lymphadenitis

Fine-needle aspiration cytology (FNAC) specimens were collected from consenting patients by aspirating two passes of a 23- or 25-gauge needle attached to a 10 ml syringe. Two smears were prepared from each aspirate, for histocytology and ZN staining. Smears were evaluated for adequacy and a morphological diagnosis, and cases were excluded from

the analysis if either one or both the passes had inadequate cellular materials on smear.

A diagnosis of TB lymphadenitis was established if any of the criteria was met; direct detection of mycobacteria by ZN staining or (Lowenstein-Jensen) LJ culture, cytomorphological features of TB were seen, clinical response to anti-TB therapy was seen.[13]

Xpert MTB/RIF Assay

The residual material from the remaining aspirate was rinsed into 0.7 ml sterile phosphate-buffered saline homogenized sample preparation buffer, was then added to the vial in a 2:1 ratio, incubated at room temperature, and subsequently processed for Xpert MTB/RIF testing as previously described.[11,12]

Statistical Analysis

All the data required for this study were collected and analyzed statistically to determine the sensitivity and positive predictive value of different parameters using the commercially available statistical software MedCalc version 14.8.1 and Microsoft Office 10.

RESULTS

A total of 108 extrapulmonary specimens were obtained from 108 EPTB patients (median age 47.5 ± 22.2 years; 78 males and 30 females) and were included in the study. 22 (20.3%) of the 108 patients were culture positive. The remaining 86 (79.6%) EPTB patients were culture negative, but their clinical history and other investigation evidence were sufficiently indicative of TB (CRS criteria).

According to the results for 108 EPTB patients, the sensitivity of the MTB/RIF assay was 45.3% (49/108). With positive culture results, the sensitivity of MTB/RIF assay was 72.7% (16/22) (Table 1).

Of 108 EPTB cases, maximum 51 (47.2%) were cases of lymph node TB (LNTB), followed by TB pleural effusion 38 (35.1%), abdominal Koch's 12 (11.1%), and TB meningitis 7 (6.4%). Sensitivity of Xpert MTB/RIF for lymph node specimens was observed to be 62.7%, for pleural fluid 31.5%, and for ascitic fluid 41.6%. None of the CSF samples was reported MTB positive, of 7 by Xpert MTB/RIF (Table 2).

Xpert detected 5 (4.6%) rifampicin-resistant and 103 (95.3%) RIF susceptible specimens in EPTB patients.

Xpert test also provided a semi-quantitative report of the number of DNA copies detected in the sample; it was "very low" or "low" in the (70.5%) of the samples reported MTB positive.

DISCUSSION

The conventional methods of culture on solid and liquid media are gold standard for diagnosis of EPTB. However, in pleural TB which is the second most common site in EPTB after peripheral lymphatic TB, the sensitivities of pleural fluid microscopy and culture are about 10% and 20%, respectively.[13-15] In this study, the performance of the Xpert MTB/RIF assay with pleural fluid samples diagnosed with a CRS was investigated. The previous studies have reported much lower sensitivities between 15% and 48%.[1,5,10] In this study also, pleural fluid sensitivity was found to be low at 31.5% comparable to that of other studies. Rufai *et al.* showed that the Xpert MTB/RIF assay test has very low diagnostic sensitivity of 14.2% in pleural fluid, even in culture proven cases.[1] Results of meta-analysis suggest that Xpert MTB/RIF can detect TB pleural effusion in 22.7% of patients using a CRS and also concluded poor sensitivity of Xpert for the diagnosis of TB pleural effusion.[1,16] Porcel *et al.* concluded that the Xpert MTB/RIF assay has a limited diagnostic capacity for pleural fluid samples of TB origin.[10] This study found the sensitivity of Xpert MTB/RIF in pleural fluid specimens to be low, with more than half of all pleural TB patients being missed by this test. Guidelines on EPTB for India recommend that Xpert MTB/RIF should not be used to diagnose pleural TB exclusively.[17]

This study found the Xpert detection in lymph node samples to be higher than that in the any other specimen type (pleural fluid, ascetic fluid, and CSF) as reported by other studies[1,2,4,8] and the sensitivity to be 62.7%. Similar studies that assessed Xpert in lymph node samples against a CRS showed a sensitivity range of 72-87%.[8,9,13,18] We

Table 1: Xpert MTB/RIF assay in culture-positive and culture-negative specimens

Diagnosis of EPTB	*n*	Xpert assay		Sensitivity (%)	Positive predictive value (%)
		Positive	Negative		
Culture positive	22	16	6	72.7	100
Culture negative	86	27	59	31.3	100
CRS*	108	49	59	45.3	100

*CRS: Composite reference standard. MTB: Mycobacterium tuberculosis, RIF: Rifampicin, EPTB: Extrapulmonary tuberculosis

Table 2: Xpert MTB/RIF assay in EPTB Specimens diagnosed with CRS

Specimen type	*n*	Xpert assay		Sensitivity (%)	RIF resistance
		Positive	Negative		
Lymph node	51	32	19	62.7	3
Pleural fluid	38	12	26	31.5	1
Ascitic fluid	12	5	7	41.6	1
CSF	7	0	7	0	0
Total	108	49	59	45.3	5

CSF: Cerebrospinal fluid, MTB: Mycobacterium tuberculosis, RIF: Rifampicin, EPTB: Extrapulmonary tuberculosis

found that Xpert MTB/RIF can be useful in confirming a diagnosis in patients suspected of LNTB when considered alongside the results of FNAC, but a negative Xpert MTB/RIF test does not rule out lymph node TB. Guidelines on EPTB for India also recommend that Xpert MTB/RIF should be used as an additional test to conventional smear microscopy, culture, and cytology in FNAC specimens.[17]

Stakes are particularly high in the diagnosis of TB meningitis due to the high mortality associated with this disease, especially when the diagnosis is delayed.[17] Studies that assessed Xpert in CSF samples against a CRS found a variable sensitivity of 20-86%.[2,6,19,20] Xpert did not detect MTB in any of the seven samples in this study, suggesting that a negative Xpert result does not rule out TB meningitis. Guidelines on EPTB for India recommend that Xpert may be used as an adjunctive test for TB meningitis, and decision to give ATT should be based on clinical features and CSF profile.[17] For ascitic fluid, we found a sensitivity of 41.6% similar to the range of 8-50% reported by Sharma *et al.*[21]

The overall low sensitivity of the Xpert test in this study (45.3%) probably reflects the low mycobacterial loads, and consequently, DNA in EPTB samples. Furthermore, number of DNA copies detected were in the "very low" or "low" range in the large majority (70.5%) of the samples that scored positive. As expected, the higher the bacterial load the greater the likelihood of obtaining positive Xpert result.[10] False positivity due to contamination is less likely because the technology uses closed reaction chamber and surfaces where specimens are processed and were extensively cleaned.[4]

Not only MTB detection but also rapidly determining the patient's multidrug-resistant tuberculosis (MDR-TB) status in such cases is of prime importance in bringing to an end the spread of MDR-TB and decreasing mortality. Treatment under guidelines on programmatic management of drug-resistant TB (PMDT) could be started in five (4.6%) patients with RIF resistance detected by Xpert RIF/MTB in the present study.

Thus, Xpert results may not be fully satisfactory from the clinical point of view, but the Xpert MTB/RIF for the identification of MTB in EPTB samples should still be done because of its simplicity, reliability, and rapid results. However, the result should be adjunct to the results of other prevalent techniques of the diagnosis of EPTB.[10,13] Xpert must be regularly used in resource-limited settings or decentralized laboratory settings. The high cost of this sophisticated technology is offset to an extent by the rapid turnaround time, similar to that of smear microscopy (2 h), with less biohazard risk and only minimal training needed.[8]

Limitation

The limitation of this study is the small sample size for each of the different specimen types. Definitive interpretation of the results for each category of specimens should be done with great care.

CONCLUSION

The Gene Xpert MTB/RIF performance varies with the EPTB sample type. Although it has limited sensitivity, it detects RIF resistance and can be used in Indian health-care setting only as an additional tool for the diagnosis of EPTB.

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Reconstruction of Lower One-third Leg Soft Tissue Defects

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Abstract

Introduction: Major limb injuries involve many or all components of the limb architecture, namely, skin and soft tissue, osseous, vascular, and neural elements which makes for prompt and precise evaluation and management for optimizing functional outcome.

Aim: The aim of this is to evaluate various reconstructive options for the management of lower one-third leg soft tissue defect.

Methods: All patients with post-traumatic soft tissue defects of the lower one-third leg who required a soft tissue cover were included in the study. Detailed history was taken on the mechanism of injury, the time since injury and history of neurological deficits. Then, all the patients were subjected to a full general and local clinical examination to rule out other coexisting injuries and to assess the site and size of the defect, the presence or absence of exposed bone, tendons or neurovascular structures, the degree of wound contamination, and the condition of surrounding skin.

Results: The indication for flap cover was exposed tibia (71%), followed by exposed tendon 21% and exposed implant 8%. The most commonly performed procedure is the inferiorly based fasciocutaneous flaps (45%) followed by reverse fasciocutaneous flaps (32%). Edema and infection were the common complications encountered 23 and 18%, respectively. 70% of patients graded the reconstruction as good, 23% as fair, and 7% as poor.

Conclusion: Fasciocutaneous flaps may represent a good alternative to the free flaps in the areas were other local reconstructive procedures are not possible.

Key words: Leg injuries/surgery, Lower extremity, Reconstructive surgical procedures, Surgical flaps

INTRODUCTION

Increasingly, urban trauma is becoming a major health-care issue. Large emergency departments are inundated with patients with multiple injuries, requiring state-of-the-art care. Most of these complex injuries involve trauma to the extremities, often due to motor vehicle accidents. In a study by MacKenzie *et al.*, it was shown that lower extremity injuries accounted for about 40% of the charges for motor vehicle trauma treatment in a given year. Hospital-based studies reveal that disabilities persist for a long time with a mean time taken to return to work ranges from 42 to 120 months.[1] Coverage of soft tissue defect of the leg presents unique defects requiring the ingenuity of the surgeon in planning flaps for stable coverage. Although well-established norms are in place regarding the time and nature of cover, it requires a team effort, practising it with the involvement of the orthopedic surgeon and allied specialities such as vascular surgeons and general surgeons. The relatively unprotected anteromedial portion of tibia results in exposed bone after trauma, which requires specialized soft tissue cover.[2,3] Most muscles become tendons at this level, and hence, flap cover becomes mandatory in case of soft tissue loss.[4,5] Treatment of lower extremity trauma has evolved over the past two decades to the point that many that would require amputation are now routinely salvaged.[6] Plastic surgeons role becomes not only important in covering a raw area but also in providing a functional lower limb with an acceptable esthetic result. Although we live in an era of zero delay

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work, microvascular transfer, and a single stage workup, due to circumstances beyond our control, it is still necessary to revisit the older methods which are reliable, comparable, and easily reproduced.[7-9] The study was done to reflect our work and thus to enhance our quality of work to produce good results with a few complications as possible. There is need to challenge the concept that distally based flaps are inferior to proximally based flaps just as the dogma that skin flap survival depends on rigid length to width ratios has been refuted. Adjusting all other factors, the true critical factor of flap viability is the nature of their intrinsic blood supply rather than any arbitrary orientation or configuration in either case.[10] The patient expectations, an understanding of quality of existing source vessels in the given region, and local anatomical constraints should be considered. One should go for other alternatives if any of the above prerequisites cannot be met.[8]

Aim

The aim of this study is to evaluate various reconstructive options for the management of lower one-third leg soft tissue defect.

MATERIALS AND METHODS

This study was conducted in the Department of Plastic Surgery, Government Rajaji Hospital, Madurai. Cases with soft tissue defect of lower one-third leg requiring flap cover, i.e., defects with tendon, bone or implant exposed, or in patients undergoing staged procedures were included in this study. A total of 73 patients were included in the study. Timing of coverage was classified into acute - within 72 h, subacute - 3 days to 6 weeks, and chronic - >6 weeks. Defects were classified according to their site as per the usual norms of upper-, mid-, and lower-third. Inclusion criteria: All patients with post-traumatic soft tissue defects of the lower one-third leg who required a soft tissue cover were included in the study. Exclusion criteria: Patients with degloving injuries, arterial injury, head injury, abdominal injury, thoracic injury, bony injuries elsewhere, and brachial plexus injuries and patients who were not willing to participate in the study and for whom skin graft was planned were excluded from the study. All the patients included in the study were admitted to the trauma ward under the care of the attending orthopedician and received first aid. They were then resuscitated to minimize bleeding, restore airway, and correct shock. Detailed history was taken on the mechanism of injury, the time since injury and history of neurological deficits. Then, all the patients were subjected to a full general and local clinical examination to rule out other coexisting injuries and to assess the site and size of the defect, the presence or absence of exposed bone, tendons or neurovascular structures, the degree of wound contamination, and the condition of surrounding skin. A complete vascular and neurological examination with the comparison to the other healthy limb was performed. Laboratory investigations necessary for surgical fitness were done. X-rays and hand-held Doppler studies were done to identify and classify the fracture and assess vascular status. All patients were taken up for wound toilet and debridement on the day of admission. Skeletal stability was achieved if necessary with external fixators, Ilizarov ring fixators, plates, or K-wires as deemed appropriate by the orthopedic surgeon. To control the infection, the wound pus culture and sensitivity done and the systemic antibiotics used accordingly. Wounds were dressed daily with a saline dressing. Once the wounds were free of infection, the soft tissue cover was planned. The appropriate reconstructive technique was selected for every patient according to the reconstructive ladder putting into consideration the site, size and type of the defect, the condition of local tissues, previous surgical procedures in the injured limb, future planned surgical procedures and the patient's general condition. All the patients received post-operative care including proper antibiotic therapy, analgesics in the post-operative period, elevation of the limb to prevent edema and monitoring of the flap color, temperature, and capillary refill. First look dressing of the skin graft was done on the 5th post-operative day. Assisted ambulation was allowed for the patients whenever possible at the end of the 5th post-operative day. Dependable weight bearing was allowed at the end of the 7th post-operative day depending on the presence of bone fractures and the method of bone fixation. Sutures were removed on the 10th post-operative day, and the patients were transferred back to the orthopedic surgeon for further treatment. Patients were evaluated on their 1st, 5th, 10th, 15th, 30th, and 60th post-operative day. Evaluation parameters included viability and stability of the flap, take of the skin graft for secondary defect, presence of pain, ulceration, functional deficit, hospital stay, and patient satisfaction with the reconstruction. On the 30th day, patients were asked to subjectively grade the reconstruction in terms of functionality, return to work, and esthetic appeal. Follow-up periods varied from 6 months to 2 years depending on the patient's compliance. Data were collected in the form of a pro forma which included epidemiological data, clinical data, wound area measurements, and operative surgical information. The data so obtained were subjected to simple statistical analysis to determine and analyze the various reconstructive options used.

RESULTS

The age of patients ranged from 10 to 70 years in this study. Common age group affected is between 21 and 30

years and 41-50 years, 19% each, n = 14. Male-to-female ratio is 7: 1 (M = 64, F = 9) (Table 1). The most common indication for flap cover was exposed tibia (71%), followed by exposed tendon 21% and exposed implant 8%. The most common size of defect was small, i.e., <30 cm^2 (51%), followed by medium-sized defects 30-90 cm^2 (40%) and large defects >90 cm^2 (9%).

The most commonly performed procedure is the inferiorly based fasciocutaneous flaps (45%), followed by reverse fasciocutaneous flaps (32%).

Table 1: Age and gender distribution

Age in range (years)	Male	Female
10-20	9	0
21-30	14	0
31-40	12	5
41-50	14	1
51-60	12	1
61-70	3	2

Table 2: Flap distribution

Name of flap	Number of cases (%)
IBFTL	33 (45)
IBFTM	3 (4)
IBFST	6 (8)
RSNFP	24 (33)
RSNFI	2 (3)
PBM	1 (1)
PF	1 (1)
ALTFF	2 (3)
LDFF	1 (1)

IBFTL: Inferiorly based fasciocutaneous transposition flap - lateral side, IBFTM: Inferiorly based fasciocutaneous transpostion flap - medial side, IBFST: Inferiorly based fasciocutaneous sliding transpostion flap, RSNFP: Reverse sural neurofasciocutaneous island flap, RSNFI: Reverse sural neurofasciocutaneous island flap, PBM: Peroneus brevis muscle flap, PF: Propellar flap, ALTFF: Anterolateral thigh-free flap, LDFF: Latissimus dorsi-free flap

Table 3: Distribution of fasciocutaneous flap

Variety of fasciocutaneous flap	Number of cases
IBFTL	33
IBFTM	3
IBFST	6

IBFTL: Inferiorly based fasciocutaneous transposition flap - lateral side, IBFTM: Inferiorly based fasciocutaneous transpostion flap - medial side, IBFST: Inferiorly based fasciocutaneous sliding transpostion flap

Inferiorly based fasciocutaneous flap from lateral side (79%) was the most commonly performed fasciocutaneous flap because of the presence of reliable and constant perforator.

Inferiorly based fasciocutaneous flaps are the most common procedure performed for small-to-medium sized defect. Neuro fasciocutaneous flaps are excellent choice for medium-to-large size defect. We have done a muscle flap for a smaller defect. Propeller flap was done in one patient with a small defect. Free flaps were done in three patients with large-sized defects (Tables 2 and 3).

The average duration of hospitalization was least for fasciocutaneous flaps - (57% of patients were discharged within 10 days) and longest for pedicled neuro fasciocutaneous flaps and free flaps (2-5 weeks) (Table 4).

Edema and infection were the common complications encountered 23 and 18%, respectively (Table 5).

Of the 46 patients who rated the reconstruction as good, 26 (57%) had underwent distally based fasciocutaneous flap from lateral side, 12 (26%) had underwent distally based reverse neuro fasciocutaneous flap of them rated the reconstruction as good, 2 islanded RSA, 1 muscle flap, 1 propeller flap, 1 ALT, and 1 LD. Of the 5 patients who had rated the reconstruction as poor, 3 (60%) had underwent distally based reverse neuro fasciocutaneous flap, and 2 (40%) distally based fasciocutaneous flap (Table 6).

70% of patients graded the reconstruction as good, 23% as fair, and 7% as poor (Table 7).

Of the 73 patients, 64 were operated in the subacute phase (88%), 7 (9%) were operated in the chronic phase, and 2 (3%) in the acute phase.

DISCUSSION

The wound coverage of lower one-third of leg is a challenging problem because of its anatomical features. The tibia and fibula are vulnerable to injury, open fractures being more common due to the paucity of soft tissues

Table 4: Falp versus duration of stay in hospital

Days in hospital	IBFLT	IBFTM	IBFST	RSNFP	RFNFI	PB	PF	ALTFF	LDFF
0-10	16	2	3	5	1	1			
10-20	7	1	2	12	1		1	1	1
20-30	7		1	6				1	
30-40	3			1					

IBFTL: Inferiorly based fasciocutaneous transposition flap - lateral side, IBFTM: Inferiorly based fasciocutaneous transpostion flap - medial side, IBFST: Inferiorly based fasciocutaneous sliding transpostion flap, RSNFP: Reverse sural neurofasciocutaneous island flap, RSNFI: ???, PBM: Peroneus brevis muscle flap, PF: Propellar flap, ALTFF: Anterolateral thigh-free flap, LDFF: Latissimus dorsi-free flap

around them. Moreover, as most muscles become tendons at this level, flap cover becomes mandatory in the event of trauma. Early return to work and restoration of near normal functionality should be the aim of reconstruction of the lower extremity.

The etiological indications for lower one-third leg soft tissue defect in this study showed road traffic accidents to be the most common cause at 94%.

In concordance with Santanelli,[11] road traffic accidents continue to be the major cause of soft tissue defect in a developing country like ours just as in the developed nations.

In this study, the age of the patients varied from 10 to 70 years with the mean age of 30 years, which not comparable with Gururaj *et al.*, 25 to 35 years.[2]

Common age group affected is between 21 and 30 years and 41-50 years, 19% (n = 14) each.

Almost 88% (n = 64) of patients in this study were stabilized with external fixator despite conclusive studies by Trabulsy *et al.* Fixators *et al.* proving nonreamed locked nails were more effective than external fixators.[12]

Again this may reflect availability rather than personal preference. In this series, the maximum number of flaps was done in the subacute phase - 88% and the least in the acute phase 3%, chronic phase being 10%.

This is in total contrast to literature elsewhere where an early cover is recommended (Godina and Byrd *et al.*).[9,13]

Table 5: Distribution of complications

Complications	Number of cases (%)
Nil	43 (46)
Partial necrosis	3 (3)
Dehiscense	2 (2)
Complete necrosis	2 (2)
Graft loss	1 (1)
Superficial necrosis	5 (5)
Edema	21 (23)
Minor infection	17 (18)

The results from other studies showed that immediate wound reconstruction is preferred to delayed wound reconstruction in that it shortens the period of hospital stay significantly, few dressing changes, fewer operations, decreased infection rate, and secondary necrosis of exposed tissues. Thus, early consultation for soft tissue reconstruction is advised, and all attempts should be done to perform immediate reconstruction.

We emphasize the importance of cooperation at the time of primary surgery between orthopedic and plastic surgeon to preserve access to potential flaps. The technique of bony fixation of the tibia may prevent the use of this flap, especially in the presence of external fixation pins, which may injure perforating vessels or tether the flap, restricting its range of transposition.

The most commonly performed procedure is the inferiorly based fasciocutaneous flap (57%), followed by reverse fasciocutaneous flaps (36%). Inferiorly based fasciocutaneous flap from lateral side is the most common procedure (45%) performed for small-to-medium sized defect as the perforator is constant and reliable in the lower lateral aspect of the leg. Neuro fasciocutaneous flaps are excellent choice for medium-to-large size defect. Peroneus muscle flap was done for smaller defect. Propeller flap was executed in one patient with small defect. Three patients with large defects underwent free flaps. The use of microsurgical techniques for the difficult problems revolutionized the field with literally limitless tissue available for transfer, and defects deemed to be unsalvageable were suddenly salvageable, but with the advent of newer techniques like perforator flaps and neurocutaneous flaps, there is a resurgence of interest in non-microsurgical reconstructive options. This is of special significance in a resource-challenged center like ours. In this study, we have attempted to explore the abovementioned reconstructive strategies for lower 3rd leg reconstruction. However, the indications and the criterion of selection of a particular technique for a particular defect are not well established and is rather a matter of personal judgment. 51% (n = 37) of patients had small-sized defects, 40% (n = 29) had medium-sized defects, and only 6% (n = 7) presented with large defects. The size of the defect and the experience of the center in

Table 6: Flap versus Patient's satisfaction

Patient satisfaction	IBFTL	IBFTM	IBFST	RSNFP	RSNFI	PBM	PF	ALTFF	LDFF
Good	26	2	5	12	2	1	1	1	1
Fair	5	1	1	9	0	0	0	1	0
Poor	2	0	0	3	0	0	0	0	0

IBFTL: Inferiorly based fasciocutaneous transposition flap - lateral side, IBFTM: Inferiorly based fasciocutaneous transpostion flap - medial side, IBFST: Inferiorly based fasciocutaneous sliding transpostion flap, RSNFP: Reverse sural neurofasciocutaneous Island flap, RSNFI: ???, PBM: Peroneus brevis muscle flap, PF: Propellar flap, ALTFF: Anterolateral thigh-free flap, LDFF: Latissimus dorsi-free flap

microvascular surgery was a significant factor in deciding reconstructive options.

Perforator Plus Technique

While raising the local fasciocutaneous flap, we always tried to include the perforator at the base of the flap, which was identified pre-operatively with hand-held Doppler.[14]

The average duration of hospitalization was least for fasciocutaneous flaps (57% of patients who underwent fasciocutaneous flaps were discharged or transferred to ortho ward before 10th day). and longest for pedicled neuro fasciocutaneous flaps and free flaps.

Edema ($n = 21$) and infection ($n = 17$) was the most common complication in this series, and it was managed by conservative measures - Anti-edema measures appropriate antibiotics/irrigation, but one case necessitated a sequestrectomy in the operation theater. Partial flap loss in three patients (2 reverse sural artery neuro fasciocutaneous flaps and 1 distally based fasciocutaneous flap) was managed in 2 ways. (1) Where bone was not exposed, wound was allowed to granulate after removing the necrosed part and later covered with split skin graft. (2) Where bone was exposed, the patient was taken to the operation theater and the flaps were adjusted after shifting the pedicle further distally as needed.

Total flap loss in 2 cases (1 reverse sural artery neuro fasciocutaneous flap and 1 distally based fasciocutaneous flap) was covered with a skin graft after allowing it to granulate after making drill holes in the exposed bone and the other reconstructed with alternate flap cover - reverse sural artery flap. Resuturing or strapping was done for two patients with minimal dehiscence. Complications were greatest in the subacute phase, the chronic cases surprisingly mirrored the early phase, perhaps owing to adequate preparation with repeat debridements, sequestrectomy, antibiotic cover, and wound homeostasis in the interim period with adequate skeletal stabilization (Table 8).

Complication rate was least in those cases given early cover and highest in the subacute phase, and in chronic cases, the complication rate was comparable to acute phase. The complication rates for the acute and subacute phases were correlating with Byds's series where he had complication rates of 18% and 50%, respectively.[9] This once again emphasizes the need for early cover (Table 9).[15]

93% of the patients in this study were satisfied with the surgery and the outcome. As expected, local flaps had a high satisfaction rates while distant flaps had fair or poor satisfaction rates, but we have to take into consideration that these patients had significantly more severe injuries than those who underwent local and regional flaps, and hence, identification of these patients and early education regarding the possible functional outcomes will mentally prepare the patient for the long road ahead and significantly improve the long-term functional outcome after such difficult reconstruction. With the knowledge of perforators supplying the lower-third leg, perforator flaps are now being done. They are to be done with equal care as though performing a microvascular procedure. Although free tissue transfer has revolutionized coverage of lower one-third leg defects, it may not be feasible to have the personnel with the necessary skill and facilities at that time. Fasciocutaneous flaps and reverse neuro fasciocutaneous flaps still have well-established roles to play in lower extremity reconstruction. Limb reconstructive is a long and complicated process in which unlike other surgical emergencies protocols are still evolving and evidenced-based guidelines are not available.

Table 7: Overall satisfaction of patients

Patient satisfaction	Number of case
Good	51
Fair	17
Poor	5

CONCLUSION

Although free flaps are the gold standard for coverage of lower one-third leg soft tissue defects, distally based

Table 8: Flap versus complications

Complication	IBFTL	IBFTM	IBFST	RSNFP	RSNFI	PBM	PF	ALTFF	LDFF
Nil	24	1	1	11	1	1	1	1	1
Partial necrosis	2	0	0	1	0	0	0	0	0
Complete necrosis	1	0	0	1	0	0	0	0	0
Dehiscence	2	0	0	0	0	0	0	0	0
Graft loss	0	0	0	0	1	0	0	0	0
Superficial necrosis	3	0	0	2	1	0	0	0	0
Edema	7	0	2	11	0	0	0	1	0
Minor infection	6	0	1	9	0	1	0	1	0

IBFTL: Inferiorly based fasciocutaneous transposition flap - lateral side, IBFTM: Inferiorly based fasciocutaneous transpostion flap - medial side, IBFST: Inferiorly based fasciocutaneous sliding transpostion flap, RSNFP: Reverse sural neurofasciocutaneous island flap, RSNFI: ???, PBM: Peroneus brevis muscle flap, PF: Propellar flap, ALTFF: Anterolateral thigh-free flap, LDFF: Latissimus dorsi-free flap

Table 9: Complications versus phase of cover

Complications	0-3	4-42	>42
Nil	1	42	0
Partial necrosis	0	2	1
Dehiscence	0	1	1
Complete necrosis	0	2	0
Graft loss	0	1	0
Superficial necrosis	0	4	1
Edema	1	20	0
Minor infection	0	16	1

fasciocutaneous flaps and distally based reverse neuro fasciocutaneous flaps are still very useful in a set up like ours where sophisticated instruments, prolonged theater time, back-up anesthesia team for reexploration is not available all the time, and also because of the long wait list of trauma patients for surgery. Fasciocutaneous flaps are reliable, safe, and fast to learn.

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Original Article

Clinico-etiological Profile of First-time Stroke Patients Presenting to a Tertiary Care Hospital in Navi Mumbai

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Abstract

Introduction: To initiate preventive and curative measures in stroke patients, it is critical that we understand the risk factors and etiological agents involved in stroke. In this study, we aimed to study the clinical profile of the first-time stroke patients presenting to our hospital, analyze possible etiological agents and identify the risk factors of stroke in these patients.

Materials and Methods: We designed a cross-sectional study of stroke patients who presented to the Department of Medicine, D Y Patil Hospital and Research Centre, Navi Mumbai, from May 2010 to December 2012. After obtaining the Approval of the Ethics Committee, we obtained history, clinical examination findings and sent blood and imaging investigations for all patients. Standard clinical definitions were used to assess the presence of clinical risk factors.

Results: During the study period, we included 30 patients in our study. About 47% of the patients were aged more than 35 years, and male predominance was observed in our study population. About 43% of the population was diabetic and 33% were hypertension; the two most important risk factors for stroke. Majority of the population had a normal body mass index (BMI) (37%), with 13% being morbidly obese. Dyslipidemia was found in 60% of the patients. About 30% and 20% of the patients gave a history of smoking and alcohol intake, respectively. The numerical values of various anthropometric and physiological parameters such as height, weight, BMI, pulse, blood pressure, fasting sugar, and homocysteine levels have been expressed as mean and standard deviations.

Conclusions: This study gives us the clinic-etiological profile and risk factors present in stroke patients in our patient population. Large-scale studies surveying stroke patients at multiple centers are needed to support our findings.

Key words: Diabetes, Etiology, Risk factors, Stroke

INTRODUCTION

Stroke is a rising problem in the developing world. With the advancing life expectancy of people in developing countries, the importance of ischemic stroke will grow as a worldwide problem.[1] Worldwide about 20 million people suffer from stroke each year. 5 million will die as a consequence and 15 million will survive, of those who survive 5 million will be disabled by their stroke.[2] In India, the first population-based study in rural area was conducted in 1990, in Vellore, and the prevalence rate of stroke was reported to be 51/100,000 in rural population. A number of community survey have shown a crude prevalence rate for hemiplegia in the range of 200 per 100,000 persons, nearly, 1.5% of all urban hospital admission, 4.5% of all medical, and around 20% of all neurological cases.[3]

The symptoms of brain ischemia may be transient, lasting only a few seconds to minutes, or may persist for longer periods of time. If the brain becomes irreversibly damaged and infarction ensues, symptoms may become permanent in nature. A stroke often precludes patients' abilities to return to work or to regain their role in a family. Thus, by affecting both patients and loved ones, stroke is a family

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illness and family relationships and dynamics are changed irrevocably. Unfortunately, it has been explained that the neurologic symptoms do not accurately reflect the presence or absence of infarction, and the severity of symptoms does not indicate the cause of the ischemia.[4] Therefore, it is critical that we understand the etiology causing the stroke so that appropriate treatment can be initiated in a timely fashion. Furthermore, understanding the risk factors associated with stroke is important before primary and secondary preventive measures can be prescribed to the patient. In this study, we aimed to study the clinical profile of the first-time stroke patients presenting to our hospital, analyze possible etiological agents and identify the risk factors of stroke in these patients.

MATERIALS AND METHODS

Study Design and Setting

We designed a cross-sectional study of stroke patients who presented to the Department of Medicine, D Y Patil Hospital and Research Centre, Navi Mumbai, from May 2010 to December 2012. D Y Patil Hospital and Research Centre is a tertiary level teaching hospital which caters to the healthcare needs of people in Mumbai and adjoining cities as well.

Sample Population

For this study, we approached all consecutive patients admitted with a diagnosis of stroke for eligibility and consent. All consecutive 30 patients admitted during the study period and with confirmed diagnosis of stroke were included, studied, analyzed, and followed up until discharge or death of patients. Hospital stay of patients was ranging from 1 day to 1 month. We included patients with stroke which was diagnosed if the symptoms and signs were suggestive of acute loss of focal or global cerebral function or evidence of ischemia/infarction/hemorrhage on computerized tomography (CT) head scan or magnetic resonance imaging (MRI) brain. We excluded patients with focal epilepsy, migraine, and structural brain lesions (such as tumors), stroke secondary to infection, and connective tissue disorders and those who refused consent.

Clinical Definitions

For this study, hypertension was defined as blood pressure recording of more than 140/90 mmHg on three separate occasions on 3 different days. Patients who are already on antihypertensive medications were also taken as hypertensive. Dyslipidemia was defined as serum triglycerides higher than 150 mg/dl, low-density lipoprotein cholesterol more than 100 mg/dl and high-density lipoprotein cholesterol <50 mg/dl in females and <40 mg/dl in males. Patients were classified as suffering from heart diseases if they had a history of ischemic heart disease, congenital heart disease, rheumatic heart disease, atrial fibrillation, or evidence of left ventricular hypertrophy on electrocardiogram (ECG) or echocardiography. In addition, history of smoking, tobacco chewing, and alcohol intake was enquired and noted. Diabetic patients were diagnosed as per the American Diabetic Association guidelines. Patients on antidiabetic medications were also classified as diabetics. A family history of stroke was considered if the first-degree relatives of the patients suffered from stroke. Patients were considered as obese if their body mass index (BMI) was equal to or more than 30.

Data Collection and Data Analysis

After obtaining the Approval of the Institutional Ethics Committee, the patients were consented before being included in the study. We collected clinical and history of the patient from patient himself. Close attendant/family members were interviewed to obtain history if the patient was unconscious or in altered sensorium, in which the consent was obtained from the legal guardian of the patient. We obtained the demographic profile of the patients. History was noted regarding chief complaints, temporal profile of each complaint, history of stroke and ischemic heart disease, personal history, family history of stroke in first-degree relative, and history of drug intake (anticoagulants and contraceptive pills). General examination of the patient was carried out in each patient that included blood pressure, pulse, pallor, icterus, JVP, cyanosis, edema, and the findings were noted. Detailed nervous system examination was performed and noted, which included handedness, level of consciousness, higher functions, cranial nerve examination, pupils, fundoscopy, motor and sensory examination, reflexes, meningeal signs of irritation, involuntary movement, and severity of stroke on admission was assessed according to the National Institute of Health Stroke Scale. Other body systems were examined particularly cardiovascular system to rule cardiac cause of stroke (like valvular/congenital heart disease, atrial fibrillation).

All patients received routine laboratory investigations including fasting and postprandial blood sugar, fasting lipid profile, 12-lead ECG, chest X-ray posterior-anterior view, two-dimensional echocardiogram (if needed). Plain/contrast CT or MRI brain, with/without angiogram was done in the patients. Serum homocysteine level and carotid Doppler study were done as well. Furthermore, we assessed the risk factor profile of each patient. Known risk factors of stroke were evaluated in the patients using the clinical definitions described above.

Based on the history, examination and investigations, patients were broadly classified according to its mechanism

of stroke: Ischemic stroke, hemorrhagic stroke, and subarachnoid hemorrhage. All patients were treated conservatively as neurointensive care is not available in our hospital. Patients were followed until discharge or death, and the prognosis was studied with regard to the fatality during the hospital stay. All data were entered in excel sheets to create a master chart. Using statistical program SPSS version 24, different variables were described as mean (standard deviation) or median (interquartile range). Variables frequencies were calculated as percentages.

RESULTS

During the study period, we included 30 patients in our study. Majority of the patients were aged more than 35 years (Table 1) and male predominance was observed in our study population. About 43% of the population was diabetic and 33% were hypertension; the two most important risk factors for stroke. Majority of the population had a normal BMI (37%), with 13% being morbidly obese. Dyslipidemia was found in 60% of the patients. About 30% and 20% of the patients gave a history of smoking and alcohol intake, respectively. Table 2 described the anthropometric and physiological parameters of the patients included in the study. The numerical values are expressed as mean and standard deviations.

Table 1: Clinico-demographic profile of patients included in the study

Variable	*n* (%)
Total patients	30
Age distribution	
<30 years	4 (13)
31-35 years	12 (40)
More than 35 years	14 (47)
Gender distribution	
Males	23 (77)
Females	7 (23)
Medical history	
Diabetic	13 (43)
Hypertensive	10 (33)
BMI	
<25	11 (37)
25-30	10 (33)
30-35	5 (17)
More than 35	4 (13)
Dyslipidemia	
Yes	18 (60)
Increased serum creatinine	
Yes	3 (10)
Serum homocysteine levels	
Normal	22 (73)
Moderate	3 (10)
Severe	5 (17)
Lifestyle factors	
Smokers	9 (30)
Tobacco chewing	4 (13)
Alcoholics	6 (20)

BMI: Body mass index

DISCUSSION

In our study, 47% of the patients were between the age of 35 and 40 years. The incidence of stroke increases with age. This may be direct consequence of prolonged exposure to previously recognized or unrecognized risk factors or development of new risk factors which can arise due to the aging process. Dalal *et al.* in a population-based survey in Mumbai, found the gender distribution similar to ours.[5] The authors further noted that age and sex distribution pattern of Asian population are remarkably different and not at all comparable to Japanese, European, and American population. Pardiwalla *et al.* reported the incidence of stroke in young to be 10%.[6] In the present study, 88% of the patients had hemiplegia/hemiparesis, and this was accompanied by cranial nerve involvement in majority of the cases (79%). Unconsciousness at the onset was present in 16% patients and 18% patients experienced headache. Speech disturbance was noted in 61% cases. In the present study, only 5 cases had seizures. As reported by different authors, seizure is not a common finding in stroke patients.[7]

Hypertension is the dominant predisposing factor for stroke and is strongly related to atherothrombotic brain infarction as well as intracranial hemorrhage. Epidemiologic studies have reported that hypertension

Table 2: Quantitative parameters of patients included in the study

Variable	Mean±SD
Anthropometric measurements	
Height (mts)	1.6±0.1
Weight (kgs)	73.6±9.6
BMI (kg/m^2)	28.0±5.8
Waist circumference (cm)	94.9±4.3
Hip circumference (cm)	105.4±3.0
Waist-hip ratio	0.9±0.0
Physiological parameters	
Pulse (per min)	88.7±9.7
Systolic blood pressure (mm Hg)	140.7±29.0
Diastolic blood pressure (mm Hg)	84.5±14.6
Respiratory rate (per min)	19.0±2.2
Hemoglobin (g %)	11.7±1.7
Fasting blood sugar (g %)	129.5±30.9
Postprandial blood sugar (g %)	159.8±36.8
Serum homocysteine	24.4±32.0
Total cholesterol (mg %)	221.9±51.7
Low-density lipoprotein (mg %)	188.0±49.6
High-density lipoprotein (mg %)	29.7±10.5
Triglyceride (mg %)	146.3±23.0
Serum creatinine (mg/dL)	0.9±0.3

SD: Standard deviation, BMI: Body mass index

is associated with an increased likelihood of subclinical or silent stroke, which in turn has been linked with increased risk of recurrent stroke.[8] However, these observations alone do not conclusively prove a causality, as increasing blood pressure could be a marker for other risk factors such as increased body weight, dyslipidemia, glucose intolerance, and the metabolic syndrome. Studies have shown that patients with diabetes mellitus have approximately twice the risk of ischemic stroke compared with those without diabetes.[9] It has been proposed that dyslipidemia, endothelial dysfunction, and platelet and coagulation abnormalities are among the risk factors that may promote the development of carotid atherosclerosis in diabetics. Numerous studies have shown that dyslipidemia is a major risk factor for stroke. In our patient, population 60% had dyslipidemia. However, the relationship between the serum cholesterol concentration and stroke incidence appears to be more complex, because the level of risk varies with the stroke subtype.[10]

Although there have been no randomized controlled trials of smoking cessation for stroke prevention, observational studies have demonstrated that the risk of stroke due to smoking declines after quitting and is eliminated by 5 years later.[11] Alcohol may increase or decrease the risk of stroke, depending on the level of consumption, and the type of stroke. A meta-analysis of 19 cohort and 16 case-control studies found that heavy alcohol use of greater than 60 g/day increased the risk for all strokes (relative risk (RR) 1.64, 95% confidence interval (CI) 1.39-1.93), ischemic strokes (RR 1.69, CI 1.34-2.15), and hemorrhagic strokes (RR 2.18, CI 1.48-3.20).[12] Therefore, it is not the type of alcohol that is important but the amount and the pattern of intake. Literature shows that increased serum homocysteine concentrations are associated with an increased risk of cerebrovascular disease, as it results in increased risk of the large artery subtype of ischemic stroke.[13]

Our study has some limitations. Our study, because of time and resource constraints, had a small sample size. Furthermore, the sociodemographic profile of these patients might be different from other geographical locations in India; therefore, the generalizability of the results of our study is a concern.

CONCLUSION

In the present study, we have described the various demographical and clinical characteristics of the first-time stroke patients who presented to our hospital. In addition, we looked at the various risk factors which were present in these patients. Future studies surveying larger number of stroke patients in multiple centers are recommended.

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Original Article

Functional Outcome Analysis of Long Bone Fractures and Dislocation with Vascular Injury

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Abstract

Introduction: Fractures with an arterial injury requiring vascular repair are severe injuries. This type of fracture is often associated with severe soft tissue compromise and damage of neurological structures.

Aim: To study the pattern of fractures and dislocations associated with vascular injury of extremities and outcomes of fracture union, function of the limb and complications in relation to fracture pattern and modality of treatment.

Materials and Methods: A total of 31 patients admitted in the emergency ward with fractures and associated with vascular injury was taken into this study. All patients have been taken up for surgical intervention both for vascular repair by vascular surgeons and skeletal fixation by us.

Results: Mode of injury was road traffic accidents in 27 patients (87%) of which fall from riding a two-wheeler predominated. Lower limb was most commonly involved (26 cases) and most common bone fractured was tibia. Closed fractures with vascular injury occurred in 10 cases and open injury in 21 cases. Most common artery to be involved was popliteal artery (21 cases). Patients with less Ganga Hospital scoring had improved outcome in the form of early soft tissue healing and early rehabilitation. One patient with mangled extremity severity score of 8 and Ganga Hospital score of 15 expired because of crush syndrome.

Conclusion: Initial management with external fixation allows time to assess the viability of limb, edema to subside and soft tissue to recover. Delay in surgery and extensive soft tissue injury are associated with increased amputation rate.

Key words: Arterial injury, Bone fracture, Thrombolysis

INTRODUCTION

Trauma frequently involves the bones of the extremities. This can also involve the vessels of the extremities either directly from the initial injury or secondarily from the fragments of the fractured bone.[1] The successful management of patients with lower extremity arterial injuries has two goals. The first is to save the patient's life and the second is to save the extremity and the function of the limb. With advanced improvement of arterial repair and regaining the vascularity of the limb, issues to be noted are methods of fracture management and complications associated with it. Furthermore, adequate vascularity of the limb is needed for the fracture union. As a result, there can be delay in union or non-union of the fracture fragments.[2-4] Furthermore, decreased vascularity alters the local immunity leading to the development of infection. Peripheral arterial injuries occur 90% in the extremity associated with fractures and dislocation.[5] Early mobilization of the limb prevents the development of disuse atrophy and makes the patient return to his daily activities. Popliteal artery injuries are among the most challenging of all extremity vascular injuries. The outcome depends predominantly on the force of injury. The popliteal vein and popliteal nerve are frequently involved associated injuries with popliteal artery. Popliteal artery (20-60%) is at risk during traumatic dislocation of the knee owing to the bowstring effect across the popliteal fossa secondary to proximal and distal tethering.[6-8]

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Aim

To study the pattern of fractures and dislocations associated with vascular injury of extremities and outcomes of fracture union, function of the limb and complications in relation to fracture pattern and modality of treatment.

MATERIALS AND METHODS

This prospective study was conducted in a tertiary care hospital. 31 Patients admitted to emergency ward with fractures and associated with vascular injury was taken into this study. The study was Approved by the Ethical Committee of the Hospital, and informed consent has been obtained from the patient. All patients have been taken up for surgical intervention both for vascular repair by vascular surgeons and skeletal fixation by us. Wounds were classified into open and closed. For Grade III A and III B wounds plastic surgeon opinion and if needed intervention has been done.

Inclusion Criteria

Age >18 years, fracture of femur, tibia, humerus, radius and ulna with vascular injury, knee and elbow dislocation with vascular injury, Class I and II ischemia, mangled extremity severity score (MESS) ≤8.

Exclusion Criteria

Crush injury, train traffic accident, polytrauma patient (associated with abdomen and chest injury), Class III ischemia, MESS score >8.

RESULTS

Mean age of the patients at the time of presentation was 30.9 years (range: 17-50 years). Majority of them were male (29 patients), with road traffic accidents (RTA) were the predominant mode of injury (27 cases). In upper limb fractures of 5 cases, 3 cases of dominant right side, and 2 of the left side (Table 1). In lower limb fractures equal distribution of right and left side was present. Average delay between injury and repair was 10.25 h range between 4 h and 24 h in 28 patients. Closed fractures with vascular injury occurred in 10 cases and open injury in 21 cases. Most common artery to be involved was popliteal artery (21 cases) (Table 2). In 4 patients with closed fractures with immediate primary fixation, there was one delayed union in shaft of femur, and superficial infection in one case of shaft of femur. One patient developed graft failure and AK amputation done. In 12 cases of open injuries with fractures with viable limb all developed knee stiffness. In 8 closed fractures with viable limb 5 knee stiffness. Knee stiffness developed in patients treated with external fixation primarily. Malunion developed in 3 cases treated with external fixation alone (Table 3). Infection was present in 6 cases of open injuries and 4 closed injuries. 4 were superficial and 6 required debridement. Infection occurs in about 10 cases of lower limb fractures 8 were open and 2 were closed injuries, requiring repeated debridement in 5 cases. Patients with less Ganga Hospital scoring had improved outcome in the form of early soft tissue healing and early rehabilitation. One patient with MESS score of 8 and Ganga Hospital score of 15 expired because of crush syndrome. In 4 cases of brachial artery injuries, 3 patients had associated median nerve injury. 5 patients had above-knee amputation after vascular repair. It was done in 4 patients with open injuries and 1 with closed injuries, 4 due to graft failure, and 1 due to infection. Amputation rate was 16%. There was 1 death due to crush syndrome, reverse saphenous vein graft was the vascular repair done in 27 cases. There was a mean hospital stay of 4 months with open Grade III injuries.

DISCUSSION

In patients with fractures or dislocation associated vascular injury may be due to the effect of direct trauma, or fracture fragments may tent on the vessel causing occlusion.

Table 1: Distribution of fractures

Fractures	Number of cases (%)
BB leg or proximal tibia	13 (42)
Distal femur and tibia	3 (10)
Supra condylar femur	3 (10)
Shaft of femur	6 (19)
Shaft of humerus	3 (10)
Distal radius	1 (3)
Knee dislocation	1 (3)
Elbow dislocation	1 (3)

Table 2: Distribution of artery injured

Artery injured	Number of cases
Femoral artery	4
Femoral vein	1
Popliteal artery	21
Brachial artery	4
Radial artery	1

Table 3: Distribution of mode of treatment

Mode of treatment	Number of cases (%)
External fixation alone	19 (61)
External fixation with minimal internal fixation	3 (10)
Minimal internal fixation alone	1 (3)
Primary external fixation/secondary ORIF and plating	4 (13)
Primary ORIF and plating	4 (13)

ORIF: Open reduction and internal fixation

Immediate decision has to be taken to avoid the serious catastrophe of limb amputation in such patients.[9] The time of pre-operative evaluation should be as short as possible to minimize ischemia time and thus prevent potential necrotic changes. The severity of ischemia depends not only on its duration but also on the level of arterial injury, extent of soft tissue damage, and efficiency of collateral circulation. The average age in a series by Mirdad[6] 29.6 years and male to female ratio of 9.8-1 which suggests that these serious injuries occur in people engaged with active and probably dangerous activities in the most productive stages of life. In our study, mean age was 30.9 years with a male to female ratio of 9.3-0.7. In Mirdad[6] study, RTA were primarily responsible for this type of injury (67.4%). In our study also RTA predominate in 87% of patients. Early application of systemic anticoagulation therapy[4] (heparin 100 U/kg i.v) reduces amputation rate. It also prevents thrombosis in microcirculation. In our cases, the anticoagulant treatment was initiated in the emergency if systemic anticoagulation was not contra-indicated (active hemorrhage, coagulopathy, and craniocerebral injury) in the dose of 5000 IU i.v stat (100 U kg/i.v). Then, the decision is to be taken whether to fix the fragment first or to vascular repair and also to do definitive or temporary fixation. Starr *et al*.[2] in his study on 19 patients with femoral fractures in 10 patients he performed primary internal fixation followed by vascular repair and in 9 patients initial vascular repair followed by internal fixation he found no difference. In their study, he used temporary shunts in patients with prolonged ischemia time. Al-Salman[4] in his study preferred primary vascular repair in cases involving stable fractures. Then, after fixation checked for damage to the vascular structures. With unstable fractures, they performed bone fixation before vascular repair. In our study, we performed vascular repair primarily in all cases before bone fixation and checked for vascular damage after fixation (Table 4). Graft failure was in 4 cases. Iannacone *et al*.[1] in his study in patients with associated injury and for time constraints he temporarily stabilized the fragments with external fixator in femoral shaft fractures then converted into exchange nailing or plating. DiChristina *et al*.[3] in 8 open femoral fractures 3 patients had persistent discharge and 2 patients had AK amputation. None of the patients had more than 90° of knee flexion whereas there is a full range of knee motion in patients with closed fractures. In our study, all patients with open injuries had decreased range of knee motion. In our study, 7 patients with open femur fracture had knee stiffness and range of motion was <90°. Topal *et al*.[8] in his study performed prophylactic fasciotomy in patients with ischemia duration longer <6 h or major soft tissue disruption. Major soft tissue defect renders vascular repair impossible. Even if repair is possible, it may cause the development of compartmental hypertension by interrupting collateral blood supply to distal arteriolar bed. In his study, he also concluded prophylactic fasciotomy prevents the development of compartmental hypertension in those with two bone fractures below knee multiple arterial injuries and gross soft tissue disruption. Al-Salman *et al*.[4] also showed doing fasciotomy in vascular injuries associated with orthopedic trauma decrease the risk of compartment syndrome. Cakir[10] in a series of 192 cases between 1982 and 2005 preferred external fixation in the majority of cases of about 76 cases. The advantage includes less tissue destruction, less operative time for immobilization and less potential for infection in contaminated wounds. Furthermore, daily debridement and irrigation of the wound in case of severe soft tissue injury. Repair of concomitant venous injuries[11] is recommended this prevents post-operative edema and keeps the arterial repair open. Proximal vein injuries such as axillary vein, brachial vein in the arm and femoral vein has to be repaired primarily to improve outcome. Treatment of vascular trauma also includes appropriate management of soft tissue injury. Multiple debridements were needed in several of our patients to control the infection.

Table 4: Distribution of vascular procedure

Vascular procedure	Number of cases (%)
RSV graft	27 (87)
Thrombectomy	2 (6.5)
Topical papaverine application	1 (3.25)
Observation	1 (3.25)

RSV: Reverse saphenous vein

CONCLUSION

Assessment of vascular injuries in fractures and dislocation based on clinical examination and hand Doppler reduces the assessment time than on imaging. Patients with Grade I, II, and III A injuries with vascular injury internal fixation are the ideal method to fix the fracture. Initial management with external fixation allows time to assess the viability of limb, edema to subside and soft tissue to recover. Delay in surgery and extensive soft tissue injury are associated with increased amputation rate. In closed injuries with stable fracture can be stabilized through the same approach undertaken for vascular repair. Earlier rehabilitation reduces joint stiffness and improves muscle power. Early intervention prevents myonecrosis and its complication.

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Original Article

Epidemiological Analysis of Trauma Patients with Renal Injuries

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Abstract

Introduction: The evolution in the management of renal trauma has been made possible by advances in both imaging and minimally invasive techniques. Nowadays, computed tomography (CT) plays a major role in investigation of renal trauma and is currently the imaging modality of choice.

Aim: To study the epidemiology of renal injuries, complications, early and late, associated with renal trauma, and to study the morbidity and mortality pattern in renal trauma victims.

Materials and Methods: All patients who sustained renal trauma confirmed by investigations were included in the study. This included renal trauma due to road traffic accidents, train traffic accidents, fall from height, assault, and stab injuries.

Results: In the present study, out of total 521 patients admitted with abdominal trauma, 99 had some form of urological injuries (19%). No significant renal injury was missed after CT imaging and the sensitivity of contrast-enhanced CT approached 100% in our series. In the present study, 74% of cases were managed conservatively without any surgical intervention and all these patients recovered well.

Conclusion: Contrary to the findings of most other studies, posterior ureteral disruption injuries seem to predominate among genitourinary trauma in our study. CT scan is the most comprehensive imaging tool to identify and characterize the renal injuries.

Key words: American association for the surgery of trauma classification, Injury, Kidney, Management, Trauma

INTRODUCTION

Trauma is nondiscriminatory and affects in all age group. Despite advances in the technology of motor vehicle collision remains the most common cause of abdominal trauma in this country. Other less frequent causes being blunt trauma to the abdomen includes fall from a height, assaults, bicycle accidents, and horseback riding injuries. Of all the genitourinary organs, the kidney is the most likely to be injured in cases of external trauma and injuries to at least one kidney occur in as many as 10% of abdominal trauma cases. Up to 80% of renal injuries are caused by blunt trauma, due to motor vehicle accident and most significant renal injuries are associated with other major organ injuries.[1-3] The epidemiologic data for renal trauma are highly variable. The variability can be partly attributed to the different etiologies of renal injury. The mechanism of visceral damage in blunt force injuries can be explained by three mechanisms. The first is when rapid deceleration causes differential movement among adjacent structures. As a result, shear forces are created and cause hollow, solid, visceral organs, and vascular pedicles to tear, especially at relatively fixed points of attachment. For instance, the distal aorta is attached to the thoracic spine and decelerates much more quickly than the relatively mobile aortic arch. As a result, shear forces in the aorta may cause it to rupture.[4-6] Similar situation can occur at the renal pedicles, leading to vascular thrombosis and renal infarction. The second is when introabdominal contents are crushed between the anterior abdominal wall and the vertebral column or posterior thoracic cage. This produces a crushing effect, to which solid viscera (e.g. spleen, liver,

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and kidneys) is especially vulnerable. The third is external compression forces that result in a sudden dramatic rise in the intraabdominal pressure and culminate in the rupture of a hollow visceral organ (in accordance with the principles of Boyle's law).[7,8]

Aims

To study the epidemiology, morbidity, mortality, and its complications in renal trauma victims.

MATERIALS AND METHODS

This prospective study was conducted in the Department of Urology at Tirunelveli Medical College. All patients who sustained renal trauma confirmed by investigations were included in the study. This included renal trauma due to road traffic accidents, train traffic accidents, fall from height, assault, and stab injuries. Exclusion criteria: Critically injured patients who expired within 30 min of admission, patients with incomplete evaluation of their traumatic injuries due to any reason, patients who were lost even to the first follow-up, iatrogenic renal trauma as in procedures such as percutaneous nephrolithotomy and unintentional injuries caused during surgical procedures.

We collected data related to age, gender, time and mechanism of injury, degree of found injury (stratified by organ injury scaling for kidney trauma), diagnostic methods, associated injuries, therapeutic approach, clinical outcome, and length of hospital stay.

RESULTS

In the present study, out of total 521 patients admitted with abdominal trauma, 99 had some form of urological injuries (19%) (Table 1). Of all the genitourinary organs, contrary to the findings of most other studies, we had an overwhelming number of posterior urethral injuries associated with pelvic fracture.

Kidney was the second most common genitourinary organ to sustain injury in abdominal trauma in our study. Of the total of 38 patients who sustained renal injuries, 84% (32 out of 38) were males. Only 6 females (16%) sustained renal injuries in our series. Young adults in the age group of 16–30 years were the most frequent to sustain renal trauma. Road traffic accidents were responsible for the vast majority of renal trauma in our series. In the present series, hematuria, either microscopic or gross was present in 76% of all patients who sustained renal trauma. Of the two patients who had pedicle injury, only 1 had evidence of hematuria (Figure 1). Four out of six patients with Grade V renal injuries and two out of five patients with Grade IV renal injuries presented with shock at admission. The information obtained from contrast-enhanced computed tomography (CECT) was used to grade the degree of renal trauma as per the recommendations of American association of the surgery of trauma (AAST) organ injury severity scale for the kidney. Most of the victims in the series had either Grade I or Grade II injuries (Figures 2 and 3).

No significant renal injury was missed after CT imaging and the sensitivity of CECT approached 100% in our series. Splenectomy was required in three patients and repair of the liver lacerations was required in two patients, while the rest of the injuries was managed conservatively

Table 1: Distribution of injuries

Type of injuries	Number of patients
Renal injuries	38
Adrenal injuries	0
Ureteral injuries	2
Bladder injuries	15
Urethral injuries	44

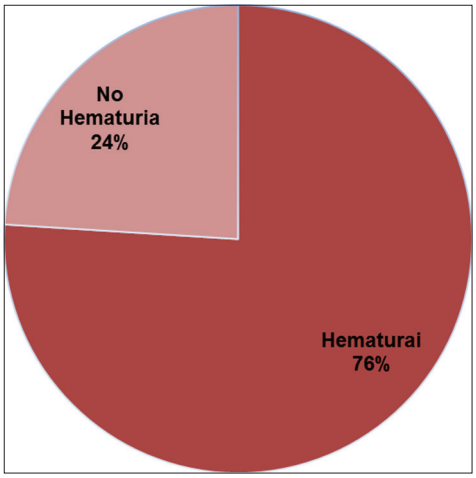

Figure 1: Incidence of hematuria

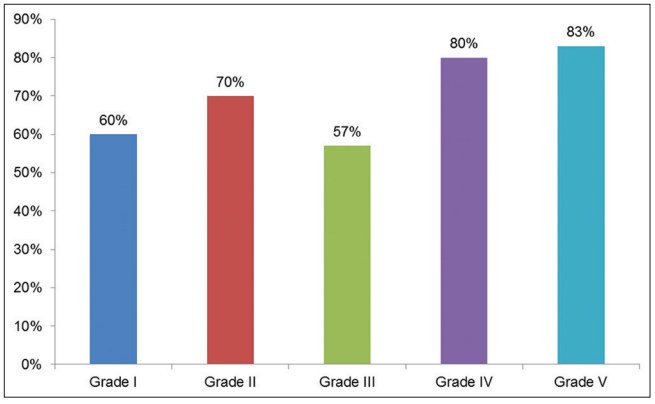

Figure 2: Sensitivity of ultrasonogram in terms of grades of renal injuries

without intervention (Figure 4). Up to 6% of renal units sustaining traumatic injuries may have coexisting congenital anomalies such as congenital ureteropelvic junction obstruction, double moiety, and polycystic kidney disease. One of our patients, an 18-year-old male had bilateral pelvi-ureteric junction obstruction with hydronephrosis and sustained bilateral pelvic injuries following a fall from tree. Percutaneous drainage and DJ stent placement followed by late repair in the form of pyeloplasty were done in that patient. Another patient aged 28 years had autosomal dominant polycystic kidney disease and sustained Grade 2 injury to his right kidney following a road traffic accident. Conservative management was successful in that patient. Hence, the incidence of congenital renal anomalies in this renal trauma series is around 5.2%. In the present study, 74% of cases were managed conservatively without any surgical intervention and all these patients recovered well. Two patients who had Grade IV renal injuries with urinary extravasation required percutaneous drain placement and DJ stent insertion. Two patients who had extensive Grade IV renal injuries with hemodynamic instability required surgical explanation, debridement of devitalized renal tissue, and repair. The nephrectomy rate in this study was around 18% (Figure 5).

Both the patients who presented with secondary hemorrhage had to undergo emergency nephrectomy because of hemodynamic instability. One patient who developed perinephric abscess required an open drainage (Table 2). Of the total of 38 patients who sustained renal injuries, two patients expired. One of these patients had associated duodenal injury and the patient's death was attributed to the complications of the bowel injury. Other patient who expired in the series had concomitant major vessel injury involving inferior vena cava, which was the likely cause of his death. Hence, no death can be directly attributed to the renal trauma alone, irrespective of the grade of the injury.

DISCUSSION

The epidemiology of trauma to the genitourinary system is unfamiliar to those in emergency services. Most of the road traffic accidents involved young people driving two wheelers.[9] Hematuria is the best indicator of trauma to genitourinary system. The presence of microscopic (>5 red blood cells/high power field) or gross hematuria is characteristic. However, the degree of hematuria and the severity of renal injury do not correlate consistently. In up to 36% of renal vascular injuries from blunt trauma, hematuria is absent. Furthermore, gross hematuria has been observed with renal contusions, although it is more likely to be associated with a significant parenchymal injury. In

Table 2: Distribution of complications

Complications	Number of patients
Urinary extravasation	4
Urinoma requiring drainage	2
Perinephric abscess	1
Wound infection (surgical)	2
Secondary hemorrhage	2
Hypertension	4

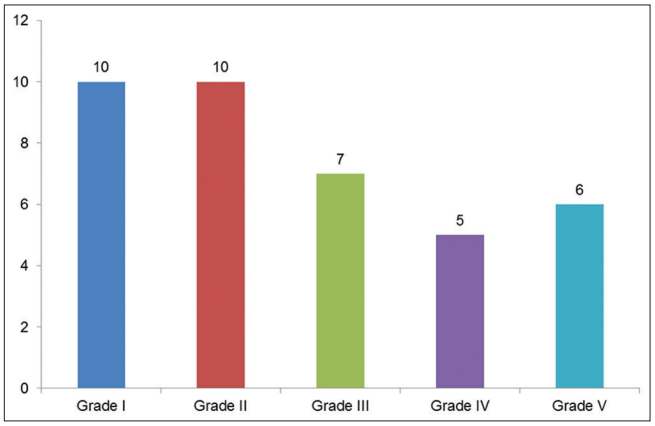

Figure 3: Degree of renal trauma

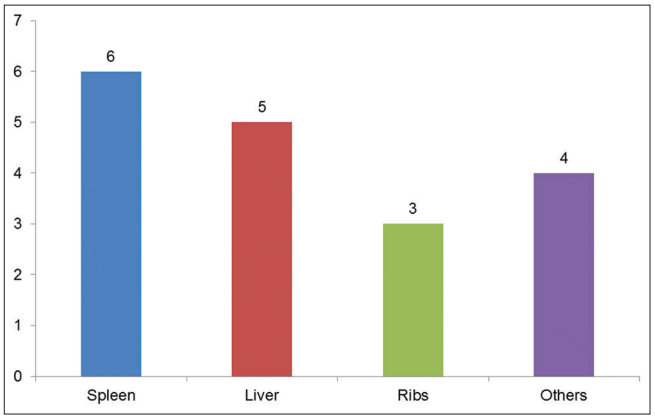

Figure 4: Concomitant organ injury

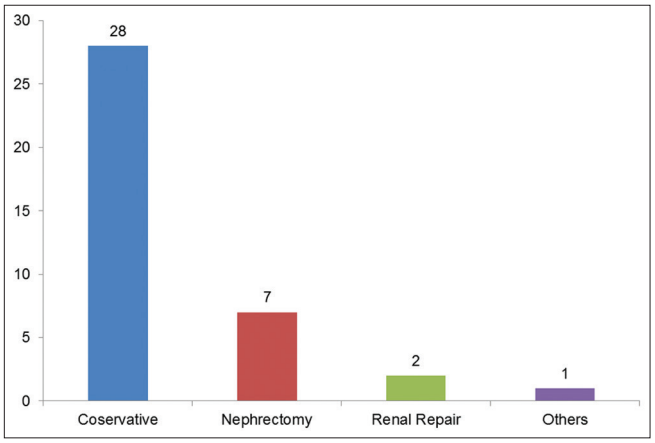

Figure 5: Type of management

patients with blunt trauma, if shock (systolic blood pressure <90 mmHg) is noted with microscopic hematuria, the incidence of significant renal injury increases. All blunt trauma patients with gross hematuria and patients with microscopic hematuria and shock (systolic blood presence <90 mmHg any time during evaluation and resuscitation) underwent renal imaging with CT with intravenous contrast, as per protocol. Patients with penetrating injuries with any degree of hematuria also underwent renal imaging with contrast CT.[10] The information obtained from CECT was used to grade the degree of renal trauma as per the recommendations of AAST organ injury severity scale for the kidney. Most of the victims in the series had either Grade I or Grade II injuries.[11] Approximately 70–80% of renal injuries have major associated organ injury that can affect the choice of management of renal injuries. In the present series, spleen was the organ most commonly traumatized along with the kidneys. Spleen was the organ which was most commonly injured concomitantly with renal injury in the present series.[12] Significant renal injuries requiring intervention are found in only 5.4% of renal trauma cases. A hemodynamically stable patient with an injury well staged by CT can usually be managed without renal exploration. Indeed, 98% of all blunt renal injuries can be managed nonoperatively, Grade IV and V injuries more often requiring surgical exploration. However, even these high-grade injuries can be managed without intervention, if carefully staged and selected.[13]

Penetrating trauma from gunshot or stab wounds to the kidney can be managed nonoperatively if carefully staged with CT. McAninch and Carroll have managed 55% of renal stab wounds and 24% of gunshot wounds in their series without operative interventions.[14]

CONCLUSION

Urological injuries are present in up to 20% of patients admitted with abdominal trauma; hence, urologist has a key role in the management of trauma victims. Contrary to the findings of most other studies, posterior urethral disruption injuries seem to predominate among genitourinary trauma in our study. CT scan is the most comprehensive imaging tool to identify and characterize the renal injuries. Nonoperative management has proven to be successful in majority of the patients sustaining renal trauma. The need for surgical intervention seems to increase with increasing grade of renal injuries. Even penetrating renal trauma, when properly staged can be managed successfully with conservative approach. In this series, two out of three patients with penetrating renal trauma were managed nonoperatively. The nephrectomy rates are high when a patient with polytrauma is explored for other concomitant organ injuries.

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Original Article

Morphometric Analysis of Tentorial Incisura and its Clinical Implications

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Abstract

Introduction: Tentorial incisura is important due to transtentorial herniation, a terminal pathophysiological event in various neurosurgical conditions. With advent of modern neuroradiological methods lacuna in understanding of herniation syndromes is being gradually filled.

Aim: To analyze anatomical variation, classy types and their clinical relevance and interpretation on neuroradiological imaging.

Materials and Methods: Total 100 magnetic resonance images (MRI) of brain were analyzed using RadiAnt DiCom viewer. Statistical methods used descriptive analysis, Pearson correlation, significant two-tailed test, student *t*-test, and analysis of variance.

Results: Notch length is typed into three, maximum notch width into three. By combination, the tentorial incisura is typed into nine types. Correlation between parameters and statistical significance is interpreted.

Conclusion: Morphometry classification and relative smaller dimensions of anatomical structures and relationships in Indian population have been elucidated. Various manifestations of herniation syndromes explained. Pre-operative MRI morphometric analysis has been highlighted.

Key words: Magnetic resonance images, Morphometric analysis, Tentorial incisura

INTRODUCTION

The tentorial incisura is an anatomical structure that carries with it tremendous clinical and pathological importance in the field of neurosurgery. The incisura is surrounded by a myriad of vital structures that mandates exercising utmost caution during the course of the performance of various complicated neurosurgical procedures in that region.

The phenomenon of transtentorial herniation that was first described by Meyer[1] in the year 1920 is a terminal pathophysiological occurrence in various neurosurgical conditions ranging from traumatic brain injury to brain tumor progression.[2] However, for want of advancement in modern neuroradiological imaging techniques, there remained a lacuna in our understanding of Herniation syndromes.[3]

With the advent of modern imaging methods, this void is being gradually filled by our ever-growing understanding of the neuroanatomical aspects of the tentorial incisura.[4] The tentorial incisura has numerous anatomical variations which contribute to and influence the rapidity of onset and progression of herniation irrespective of the underlying cause. Numerous morphometric studies have been conducted on various aspects of the brain, however, studies regarding the anatomical variations of the tentorial incisura are very limited, and the available studies have been conducted in cadavers in the sixties.[5,6]

In this study, normal anatomical variations in the dimensions of the tentorial notch and position of the brainstem in relation to the tentorial hiatus are measured and analyzed using currently available magnetic resonance imaging (MRI) techniques. These factors are likely to have immense bearing on the progression and outcome of traumatic brain injury and other neurosurgical causes of herniation syndromes. These also carry implications during

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micro neurosurgical approaches while attempting to deal with lesions in the vicinity of the hiatus.

The tentorial hiatus is a complex void that varies greatly in size and shape among individuals. Although it can be simply described as the free edge of the tentorium cerebelli, it is much more complex than what meets the eye. The reason behind this complexity is primarily its three-dimensional anatomy with lack of blood vessels in its edges and occurrence of occasional calcification. Hence, visualization and quantification of this structure remained a challenge for neurosurgeons and neuroanatomists for decades.

With the advent of modern imaging modalities, this elusive process has become more within reach and thus enhancing our knowledge of this structure. In-depth understanding and characterization of the hiatus and induction of a practical and simple classification of it may help explain patterns of herniations, susceptibility of the oculomotor nerve to compression and pathomechanics of concussion and inertial injuries of the brain.

With the entry of powerful operating microscopes into the field of neurosurgery, a new era has been ushered into this field which has made earlier impossible and untouchable lesions of the brain within the reach of the neurosurgeon with minimal retraction of the normal brain and at times with negation of the very need for touching the normal brain parenchyma. By doing so, the risk and complications associated with cranial surgery can be greatly minimized and altogether avoided at times.

Morphometric data allows for precise and foolproof pre-operative planning of location of the lesion and trajectory toward the lesion which provides the least transgression of normal tissue. This is of paramount importance in reducing operative morbidity and much dreaded but fraught mortality associated with neurosurgery since time immemorial.

Aim of the Study

1. To analyze the anatomical variations of the tentorial incisura[7]
2. To classify the various types of tentorial incisura
3. To elucidate the clinical relevance of these variations
4. To establish an anatomical basis for interpretation of the tentorial hiatus on radiological imaging.

MATERIALS AND METHODS

Study Group

Our study group consisted of 100 patients aged between 18 and 60 years undergoing MRI of the brain *per se* in the absence of organic lesions of the brain or as part of the screening of the brain in cases of spinal pathology or non-central nervous system pathology, either as an in-patient or as an out-patient. Hence, any patient who during the process of imaging was found to harbor an intracranial pathology such as an intracranial space-occupying lesion was excluded from the study.

Method Used

MRI in axial, sagittal and coronal sections were selected and analyzed using RadiAnt DiCom Viewer which is versatile open source software available for common usage. Parameters measurement (Figures 1-4) in millimeters.

1. Anterior notch width (ANW): The width of the tentorial hiatus in the axial plane measured through the posterior aspect of dorsum sellae
2. Maximum notch width (MNW): Maximum width of the notch in the axial plane
3. Notch length (NL): Distance between superoposterior edge of Dorsum Sellae in a median plane to the apex of the notch
4. Posterior tentorial length (PTL): Shortest distance between the apex of the notch and the confluence of sinuses
5. Apico tectal distance (AT): Distance from the tectum in the median plane to a perpendicular line dropped from the apex of the notch to the cerebellum
6. Inter-pedunculoclival distance (IC): Distance between

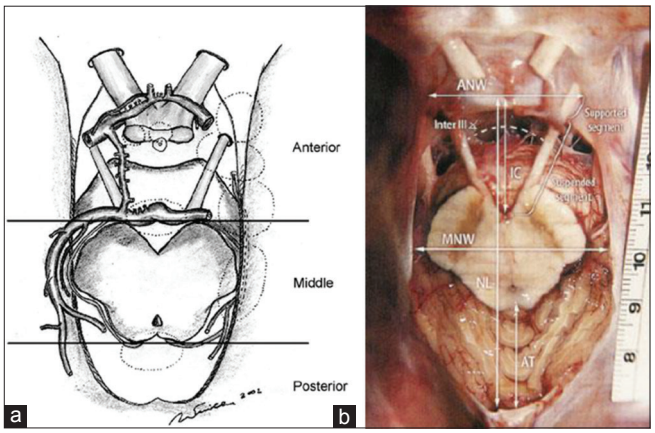

Figure 1: (a and b) Tentorial incisura

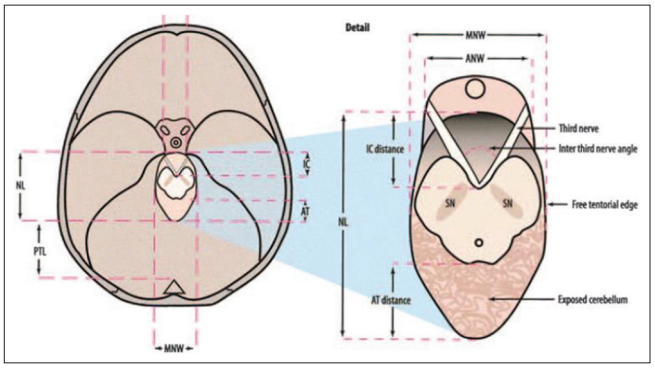

Figure 2: Tentorial incisura measurements

the interpeduncular fossa to the superoposterior edge of the Dorsum Sellae

7. Cephalic index (CI): (Calvarial breadth/anteroposterior calvarial length) ×100.

Statistical Methods

In this study, the following statistical methods were utilized. They are:

1. Descriptive analysis
2. Pearson correlation
3. Significant two-tailed test
4. Student *t*-test
5. Analysis of variance.

OBSERVATIONS AND RESULTS

In our study, a total of 100 patients were analyzed taking measurements at various pre-defined levels. The raw data were tabulated.

Descriptive Analysis (Table 1)

Correlation (Table 2)

To ascertain the correlation between the various data sets we used the Pearson Correlation technique (*r* value) and obtained the corresponding *P*-value using significant two-tailed test. The following statistically significant correlations were observed.

There was a significant ($P < 0.05$) positive correlation between ANW and MNW, MNW and NL, AT and IC, AT and AP, AT and BR, PTL and BR. There was a significant negative correlation ($P = <0.05$) between ANW and AT. There was a highly significant correlation ($P < 0.01$) between MNW and IC, NL and AT, NL and IC, NL and AP, NL and BR, NL and AT, PTL and Anteroposterior length of skull. Age was not statistically correlated with any of the Dimensions measured.

Student *t*-test (Tables 3 and 4)

ANOVA

Analysis of variance with age as dependent variable showed that ANW ($P = 0.003$) and MNW ($P = 0.002$).

None of the factors had a statistically significant dependence on age.

Taking into consideration all the above statistical methods, the dimensions of the tentorial hiatus are classified as follows.

NL is short <48.7 mm ($n = 24$), midrange 48.7–55.1 mm ($n = 51$), and long >55.1 mm ($n = 25$). MNW is narrow <27.6 mm ($n = 22$), midrange 27.6–31.2 mm ($n = 54$), and wide >31.2 mm ($n = 24$). Matrix distribution was done to classify the Tentorial Hiatus (Table 5 and Figure 5).

Classification of Tentorial Notch (Table 6)

In our study, a total of 100 patients were analyzed taking measurements at various pre-defined levels. The raw data

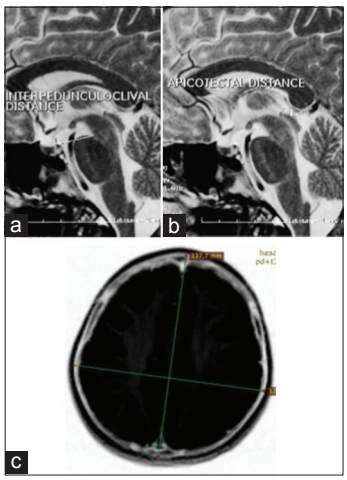

Figure 3: Measurements in MRI

Table 1: Descriptive analysis

Method	Age	ANW	MNW	NL	AT	IC	PTL	AP	BR	CI
Valid	100	100	100	100	100	100	100	100	100	100
Missing	0	0	0	0	0	0	0	0	0	0
Mean	36.99	17.113	29.373	52.248	17.637	16.817	53.391	174.354	144.034	83.2685
Standard error of mean	1.06444	0.40285	0.34878	0.50638	0.38838	0.35326	0.67496	1.60434	1.01762	0.96341
Median	36.5	16.15	29.35	52.8	17.55	16.7	53.9	176.5	143.8	81.3679
Mode	47	14.40[a]	29.10[a]	55	15.6	17.9	49.70[a]	178	146.00[a]	77.44[a]
Standard deviation	10.6443	4.02845	3.48781	5.06376	3.88378	3.53259	6.74959	16.04343	10.17617	9.6347
Variance	113.303	16.228	12.165	25.642	15.084	12.479	45.557	257.392	103.554	92.815
Range	40	19.1	17.2	29.3	21.7	20.2	44.6	88.7	75.6	61.21
Minimum	19	10.9	21	36.7	4.5	7.6	25.7	109.4	111.9	68.59
Maximum	59	30	38.2	66	26.2	27.8	70.3	198.1	187.5	129.8
Percentiles 25	28	14.4	27.625	48.775	15.6	14.1	50.125	171.25	138.4	78.3917
Percentiles 50	36.5	16.15	29.35	52.8	17.55	16.7	53.9	176.5	143.8	81.3679
Percentiles 75	47	18.2	31.2	55.15	20.6	18.675	57.6	183.1	148.15	84.4282

[a]Multiple modes exist. The smallest value is shown, MNW: Maximum notch width, NL: Notch length, PTL: Posterior tentorial length, ANW: Anterior notch width, AT: Apico tectal, CI: Cephalic index

Table 2: Pearson correlation and significant two-tailed test

		ANW								
MNW	PC	0.239*								
	Sig.	0.017	MNW							
NL	PC	−0.03	0.249*							
	Sig.	0.746	0.013	NL						
AT	PC	−0.207*	0.033	0.641**						
	Sig.	0.039	0.743	0	AT					
IC	PC	−0.08	0.268**	0.392**	0.237*					
	Sig.	0.408	0.007	0	0.018	IC				
PTL	PC	−0.04	0.148	0.099	−0.02	−0.063				
	Sig.	0.714	0.142	0.328	0.884	0.533	PTL			
AP	PC	−0.18	0.128	0.353**	0.241*	−0.104	0.296**			
	Sig.	0.07	0.205	0	0.016	0.303	0.003	AP		
BR	PC	−0.15	0.156	0.394**	0.234*	0.064	0.213*	0.299**		
	Sig.	0.135	0.121	0	0.019	0.526	0.033	0.003	BR	
CI	PC	0.042	−0.01	−0.063	−0.07	0.149	−0.11	−0.750**	0.390**	
	Sig.	0.677	0.927	0.53	0.513	0.14	0.266	0	0	CI
AGE	PC	−0.13	−0.01	0.059	0.021	−0.188	0.131	0.149	0.214*	0.012
	Sig.	0.189	0.903	0.561	0.833	0.061	0.194	0.14	0.033	0.908

PC: Pearson correlation, *Correlation is significant at the 0.05 level (two-tailed), **Correlation is significant at the 0.01 level (two-tailed), Sig: Significant two-tailed test, MNW: Maximum notch width, NL: Notch length, PTL: Posterior tentorial length, ANW: Anterior notch width, AT: Apico tectal, CI: Cephalic index

Table 3: 95% confidence interval of the difference

Parameter	Lower	Upper
ANW	16.3137	17.9123
MNW	28.6809	30.0651
NL	51.2432	53.2528
AT	16.8664	18.4076
IC	16.1161	17.5179
PTL	52.0517	54.7303
AP	171.1706	177.5374
BR	142.0148	146.0532
CI	81.3569	85.1801

MNW: Maximum notch width, NL: Notch length, PTL: Posterior tentorial length, ANW: Anterior notch width, AT: Apico tectal, CI: Cephalic index

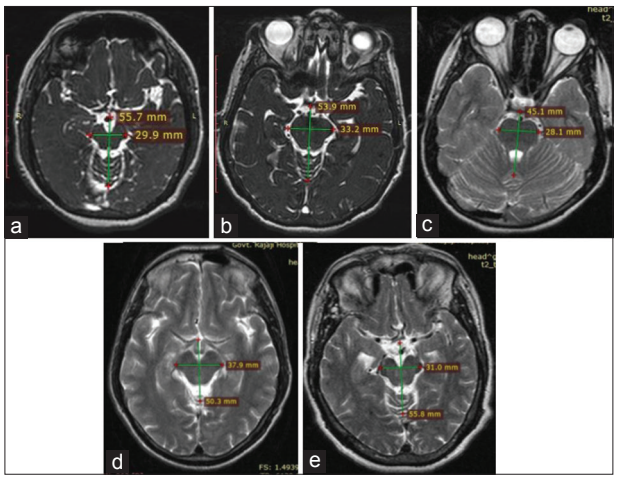

Figure 4: Tentorial incisura. (a) mid maximum notch width (MNW) and long notch length (NL), (b) mid MNW and mid NL, (c) mid MNW and short NL, (d) wide MNW and mid NL, (e) mid MNW and long NL

Table 4: ANOVA

Parameter	Sum of square	df	Mean square	F	Significant
ANW					
B/G	812.331	31	26.204	2.243	0.003
W/G	794.282	68	11.681		
Total	1606.613	99			
MNW					
B/G	624.297	31	20.139	2.361	0.002
W/G	580.02	68	8.53		
Total	1204.317	99			
NL					
B/G	749.066	31	24.163	0.918	0.594
W/G	1789.463	68	26.316		
Total	2538.53	99			
AT					
B/G	521.671	31	16.828	1.178	0.283
W/G	971.622	68	14.289		
Total	1493.293	99			
IC					
B/G	437.723	31	14.12	1.204	0.259
W/G	797.718	68	11.731		
Total	1235.441	99			
PTL					
B/G	1652.368	31	53.302	1.268	0.206
W/G	2857.774	68	42.026		
Total	4510.142	99			
AP					
B/G	6512.598	31	210.08	0.753	0.806
W/G	18969.19	68	278.96		
Total	25481.79	99			
BR					
B/G	3623.846	31	116.9	1.199	0.263
W/G	6628.038	68	97.471		
Total	10251.88	99			
CI					
B/G	4132.831	31	133.32	1.793	0.023
W/G	5055.89	68	74.351		
Total	9188.721	99			

MNW: Maximum notch width, NL: Notch length, PTL: Posterior tentorial length, ANW: Anterior notch width, AT: Apico tectal, CI: Cephalic index

Table 5: Classification of tentorial notch

Classification	NL			
	n=100	Short	Midrange	Long
MNW	Narrow	Small (9)	Narrow (10)	Mixed (3)
	Midrange	Short (11)	Typical (29)	Long (14)
	Wide	Mixed (4)	Wide (12)	Large (8)

MNW: Maximum notch width, NL: Notch length

Table 6: Classification of tentorial notch

Classification		
Wide notch	MNW (wide)	NL (mid)
Narrow notch	MNW (narrow)	NL (mid)
Long notch	MNW (mid)	NL (long)
Short notch	MNW (mid)	NL (short)
Typical notch	MNW (mid)	NL (mid)
Large notch	MNW (wide)	NL (long)
Small notch	MNW (narrow)	NL (short)
Mixed notch 1	MNW (wide)	NL (short)
Mixed notch 2	MNW (narrow)	NL (long)

MNW: Maximum notch width, NL: Notch length

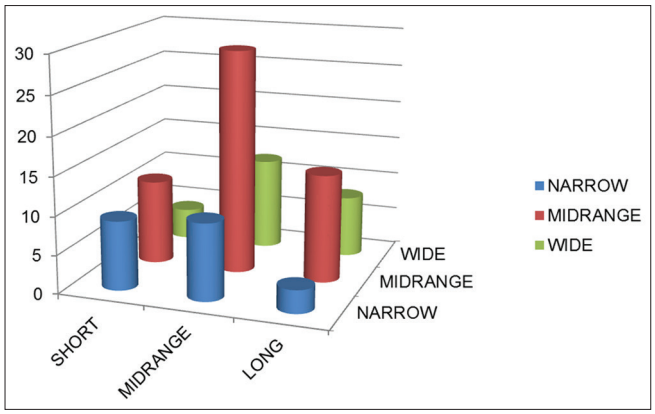

Figure 5: Types of tentorial incisura

were tabulated. Tentorial incisura can be broadly classified into nine anatomical variations.

DISCUSSION

As early as the year 1958, before the advancement of magnetic resonance and other imaging technology, Sunderland and colleagues categorized the tentorial notch into two types - broad and narrow.[6] In the same line, Adler and Milhorat classified it into eight types based on cadaveric studies.[8]

Klintworth *et al.* put forth the concept that the tentorium and its opening are highly variable in respect to their size, shape, dimensions, and orientation in various animal species.[9] There are even a few animals in the world in which such a structure is classically absent. These include fishes, reptiles, and amphibious animals. In another subset, the tent is incomplete in the sense that it does not reach the midline at all, such as morphology is seen in guinea pigs and rodents.

Only in higher mammals such as humans and primates, the tent forms a thick membrane partitioning the superiorly located cerebral hemispheres and the inferiorly located cerebellar hemispheres. The opening of the tentorium, namely, the tentorial Hiatus or notch or incisura, surrounds the midbrain structures.

When studies on the phylogeny and development of the tent were conducted, it was inferred that this is a structure that emerged later during eons of evolution. It was first found as symmetrical dural folds on either side of the midbrain in the cerebro-cerebellar fissure. As time went by, the falx cerebri descended down to meet the tentorium at more and more points, carrying with it the formation of a straight sinus. As species evolved, the length of the straight sinus increased and so did the dimensions of the hiatus.

Similar studies in Indian population are few and far between. Even western studies of the same have been conducted in cadaveric samples. Live *in vivo* studies are limited if not almost non-existent.

It is a generally accepted fact that the morphological features of the population of the west correlate poorly with that of the Asian population. Western individuals have a much larger head with a greater CI with larger structural features compared to people of the East, especially the Indian and other Asian population.

During the process of brain herniation due to various causes, there occurs gross anatomical distortion of tissue as they come down through the tentorial aperture. This produces highly localizing signs and clinical features in the patient. The features found in pathological specimen include.

1. Medial displacement of the temporal lobe or the part in question
2. Medial displacement of the brainstem structures
3. Grooving of the brainstem
4. Descent of the hippocampal gyrus
5. Compression of the ipsilateral oculomotor nerve
6. Characteristic Duret hemorrhages into the brainstem.

Although the above-enlisted features are a generalization of the incidence occurring during herniation, these are not all found in the same patient or among different patients undergoing this moribund potentially fatal pathological process. The reason for this difference in manifestations of the same process in different individuals is unclear.

This also fails to explain the incidental occurrence of the neurosurgically famed false localizing signs. All the above paradoxes can be explained due to the anatomical variations in the tentorial notch in individuals of the same species, in our case human beings.

It has been proven that longer and wider incisura have a greater amount of cerebellar tissue exposed when compared to those that are narrow and shorter. Small apertures logically expose lesser amount of brain tissue. This exposure variability in relation to the dimensions of the notch has viable implications in regard to the propensity of occurrence of herniation syndromes, be it descending or ascending herniations.

During the postmortem examination of the human brain, it is customary to obtain the specimen by the division of the falx cerebri and the tentorium, so as to enable mobilization and delivery of the brain.[10] This invariably causes unavoidable distortion of the normal anatomy. This compounds the already present changes inherent to a dead brain specimen.

This anatomical distortion can be circumvented by studying the brain in its natural live state in humans using the now freely available MRI techniques. It is much easier to see the anatomical landmarks and to make accurate *in situ* measurements of the various dimensions of interest without causing undue morbidity to the patient. However, the only limiting factor in a country like ours is the availability of MRI equipment, the running costs involved, the time consumption for image acquisition and the patient-borne cost factor.

All the parameters looked for by the authors of various cadaveric studies can be sought and easily quantified. Based on these, the position of the brainstem and type of incisura can be identified. This measurement can also be used to calculate and plan the trajectory during neurosurgical operations in the brain especially in lesions in and around the tentorial hiatus. Such proper planning can avoid unnecessary morbidity and even mortality during performing complicated microneurosurgical procedures.[11,12]

CONCLUSION

The following conclusions can be drawn from this study.

A morphometry based classification of the tentorial hiatus has been formulated. Various dimensions of the region of the tent have been measured in a representative subset of South Indian population. Anatomical make up of our population with that of the population represented in Western studies are compared. Relatively smaller dimensions of anatomic structures and relations in Indian population have been elucidated. The reason for variable manifestations of herniation syndromes can be explained.

In this study, ANW correlates positively with MNW. MNW correlates positively with NL. AT distance, NL and interpeduncular-clival distance are significantly correlated. There is no significant correlation between age, CI and the hiatus dimensions.

The value of radiology based morphometric analysis in pre-operative neurosurgical planning has been highlighted.

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Original Article

Central Corneal Thickness in Myopia: A Cross-sectional Study

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Abstract

Purpose: This study aims to determine the relationship between central corneal thickness (CCT) and myopia.

Meterials and Method: This is a institution-based cross-sectional study. CCT of 45 myopic patients was measured using ultrasound A-scan pachymeter. CCT was correlated with myopia using Karl Pearson's correlation coefficient.

Result: 45 patients were recruited for this study. Age of patients ranged from 18 to 75 years, with a mean of 46.50 years. Myopia ranged from −0.25d to −13.00d with a mean of 6.62D. The mean CCT was 543.54 microns. Pearson correlation coefficient was CCT and myopia: $r = 0.0363$, $P = 0.734$.

Conclusion: There was no correlation between CCT and myopia. The process by which myopia progress does not influence CCT.

Key words: CCT, Myopia, IOP

INTRODUCTION

Central corneal thickness (CCT) is an essential tool in the assessment and management of corneal disease. It is also an important indicator of corneal health status. CCT has an impact on the accuracy of intraocular pressure (IOP) measurement by applanation tonometry.[1]

Myopic changes of the eyes include elongated axial length, deeper anterior chamber, thinner retina with lattice changes and higher prevalence of retinal detachment, decreased choroid circulation, as well as decreased scleral thickness and elasticity.[1]

Changes in the anterior segment associated with myopia are still under debate. The myopic eye is known to be longer than the normal emmetropic eye. If this is the result of general growth, one might expect the cornea to have grown thicker than normal. If instead, the myopic eye is larger due to a mechanism similar to that of a balloon being inflated, one would expect the cornea to be thinner than normal according to a simple stretching theory. An emmetropic eye could then be compared to a sphere and a myopic eye to a prolate spheroid.[2]

Myopia is increasing in prevalence among the populations of East Asian origin. Estimates of the proportion of myopia in the young population of South East Asian countries range from 30% to 60%.[3]

Studies that have attempted to investigate the effect of refractive errors on CCT have reported conflicting results. Some studies have reported no correlation between corneal thickness and level of myopia,[4] whereas some studies have found the cornea to be thinner in more myopic eyes.[5]

CCT indicates corneal physiologic health and affects the measurement of IOP. A thin central cornea is a risk factor for development of glaucoma in patients with ocular hypertension.[6]

Objective

To determine the relationship between CCT and myopia among patients attending ophthalmology OPD.

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METERIALS AND METHODS

Place of Study
The study was conducted at Kannur Medical College, Department of Ophthalmology.

Study Population
45 myopic patients attending ophthalmology OPD.

Methods
CCT of 45 myopes was measured using ultrasound pachymetry (Figure 1a).

Sample Size
45 myopes (90 eyes) (Figure 1b).

Inclusion Criteria
Myopes (age 18–65 years) visiting ophthalmology OPD with power between −0.25 and −15.0 D, cylinder of 3D or less.

Patients attending ophthalmology OPD willing to give written informed consent for the study.

Exclusion Criteria
History of hypertension, glaucoma, uveitis or ocular trauma, keratoconus, eyes with suspected corneal dystrophy, known ocular pathology, or previous ocular surgery.

Type of Study
Institution-based cross-sectional study.

Data Collection Method
The CCT was measured using ultrasound A-scan Pachymeter (pac-man). Furthermore, personal details, age, sex, manifest, and cycloplegic refraction, IOP measurement was taken.

Sample Size
$$n = \frac{(Z1-\alpha)^2 \times 2 \times S^2}{d^2}$$

Sample size = 45.

Statistical Analysis
Data on continuous scale will be presented as mean ± SD. Data on categorical scale will be presented as proportion and percentage. To check for the correlation between CCT and Myopia, Karl Pearson's correlation coefficient was used. $P = 0.05$ was considered statistically significant.

RESULTS

45 patients were recruited for this study. Age of patients ranged from 18 to 75 years, with a mean of 46.50 years Table 1. Myopia ranged from −0.25d to −13.00d with a mean of 6.62D (Figure 1c). The mean CCT was 543.54

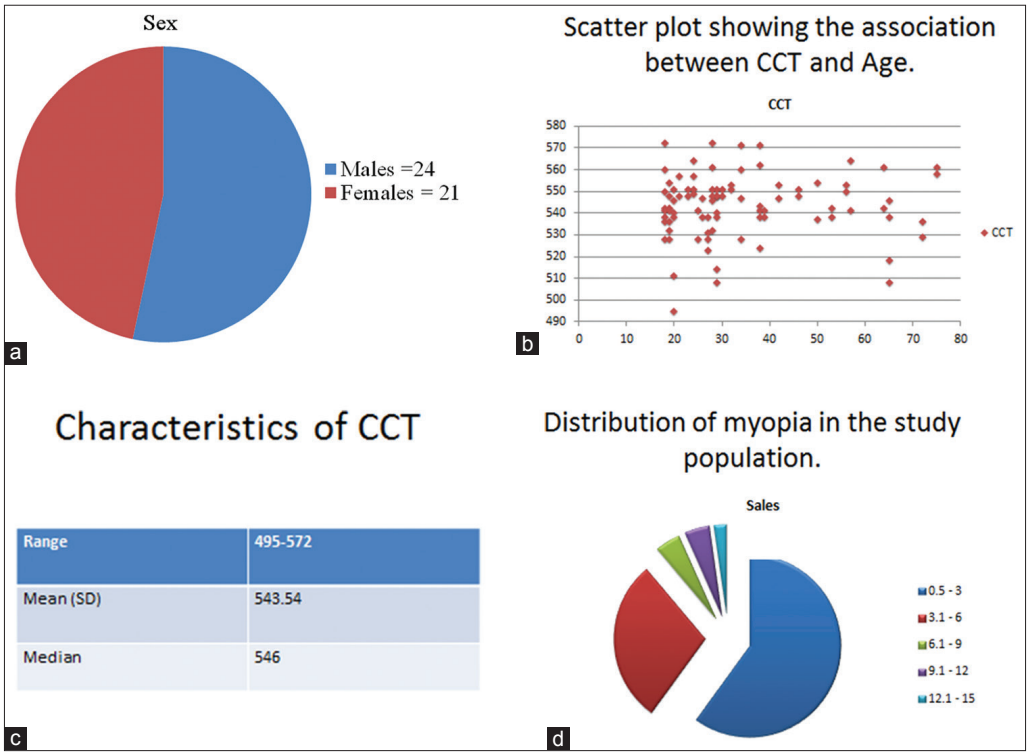

Figure 1: (a) Sex distribution (b) association between CCT and age (c) CCT characteristics (d) distribution of myopia

Table 1: Demographic features of study patients

Number of patients	45
Number of eyes	90
Age	
Range (years)	18–75
Mean±SD	34.4

microns (Figure 1d). Pearson correlation coefficient was, $r = 0.0363$ ($P = 0.734$).

DISCUSSION

This study demonstrates that CCT does not correlate with the degree of myopia. It appears that the cornea is not thinning in the same way as the sclera in myopic eyes. The mean ± SD CCT was 543.54 microns. This is comparable with similar studies. Fam *et al*.[3] in a study on 714 Chinese patients had a mean of 534.5 microns. Chang's[7] series had a mean of 533 microns, whereas Vijaya *et al*.[8] reported the mean ± SD CCT in a normal rural South Indian population to be 505.9 (31.10) microns.

This study showed no statistically significant correlation between CCT and myopia.

CONCLUSION

There was no correlation between CCT and myopia. The process by which myopia progress does not influence CCT.

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Original Article

Critical Thinking in P4C (Philosophy for Children) Educators: An Intervention Study

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Abstract

One of the main issues in determining the place of a nation in the world is to train the personnel in terms of thinking and internalizing the power of knowledge. There are many methods in teachinghow to think among the children enabling them to learn philosophy of thinking process. This could enhance clarification, open-mindedness, logical thinking and the organization of mind among the children at schools. Methods could be used to raise the children as a thinking creative.This method deals with teaching stories, guidebooks, notes, and designs to children in a community of inquiry with Socratic method whichargues the issue to arrive at the critical thinking. In the present study, 30 tuteesused this philosophical method. They were selected to pass a course in which they use philosophy of critical thinking. The purpose of this study was to discover the effect of thephilosophical treatment on the educators teach children. The critical thinking pre and post questionnaires were given to the instructors through the instruments of California critical thinking Questionnaire-Version B. Results showed that the level of the instructors' critical thinking was significantly promoted after the course(p=0.0001). Findings also showed that there was not any significant relationship between educational level, age and the critical thinking of the participants (p=0.64). Findings of the study suggest that the Socratic philosophy method could be used to train the educators who learn critical thinking in the pre-service and in-service courses to teach the preschooleducators, and school teachers.

Key words: Philosophy for Children, Educators, Critical thinking, Socratics questioning

INTRODUCTION

One of human beings' needs of life is to from the happenings and exploration of educational issues at the university and higher education levels. This is a need for any child to shapethis issuethat enables him to be closer to the modern world. Therefore, the society needs smart, innovation and creative members corresponding to these new happenings.Primary schools focus on science and technology based on some cognitive approaches to transfer science and information to the students and ignore the training of creative and thoughtful individuals. However, recently, there is a movement among educational psychologists and other scholars to suggest the educators can train of thinking skills rather than transferring science and knowledge to the students.Thus, the individuals are able to think through theirnatural intelligence abilities (Mango et al., 2010).

It means that all the individuals are able to think; however, this potentialpower should be changed into the actual use. Critical Thinking is one of the dimensions of thoughts. Lipman (2002) makes a difference between ordinary and critical thinking. Ordinary thought is simple and without any criterian but critical thinking is more complex and has objective dimensions. Critical thinking is a dynamic process which helps the individuals analyze the data and reach the conclusion and is able to decide properly. Thus the background of critical thinking goes back to philosophyafter John Dewey, who developed it in some published books. Nowadays, the world witness revolution in the critical of thinking (Daniel et al., 2007). Critical thinking is a branch of Logic which is called practical logic. This kind of logic can remove uncertainty, and make transparency, logical reasoning, criticism, and mind discipline (Ghaedi et al, 2015). The purpose of critical thinking is to understand problems, evaluate theviewpoints and give solutions (Sedaghat et al., 2015).

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Cognitive skills of critical thinking include:

Analysis: finding out the purpose of an issue and their relationships.

Evaluation: discovering the validity of issues and evaluating their relationships

Inference: Ability to conclude the issues

Inductive reasoning: Ability to conclusion based on logical reasoning which helps the individual to relate the relationships between the parts of a whole and discover the main objectives.

Deductive reasoning: Ability to arrive at the conclude issuesbased on a comprehensive basis which helps the individuals thinks and gets the reasons of the happenings and discovers the parts of a whole(Austin et al., 2015).

There is a common sense on the entity of thought that it is genetics which can hot be changed or trained. However, educational training emphasize that the critical thinking could be trained such as other skills and sciences. The training of critical thinking can be done and applicable (Trinckey et al., 2004). Nowadays, the role of critical thinking in education has been exhaled by the philosophers of pedagogical issues. This is so vast that the researchers deal with it from various perspectives around the world. Moreover, the training of critical thinking has been issued as a goal in different countries. Some scholars have been dealing with it as an activity in schools (Daniel et al., 2011). However, there are several problems in training critical thinking since there are some weaknesses. These problems in teaching critical thinking could be:

1. The main weakness may be lack of understanding in teaching critical thinking or teaching about the critical thinking. This problem may impose itself to our educational settings and complicate its process.Lipman notes that the objective of critical thinking training is to train people how to think. This needs teaching critical thinking criteria, rules and principles. However, the educational situations are now out of controlling this. In other words, there is a need to make the learners think critically not to learnabout the critical thinking (Lipman, 2003)
2. According to Lipman, the other weakness is that the university level is too late for learning critical thinking and thinking styles, evaluation and logical reasoning (Lipman, 1993). The reason behind this is that firstly, it needs more than one semester and secondly, the children at the school level could learn it with readiness. Thus in the second period of 20th century, the educators can practice critical thinking in primary schools.
3. Lipman believes that teaching critical thinking can develop all children's thinking capabilities of thinking on sciences and develop theirknowledge of critical thinking. However, children and adolescents may learn some other is issue rather than critical thinking. In other word, they just can learn critical thinking like learning is as the same as critical thinking. Lipman proposed a reformed plan to train the critical thinking. But he noticed later that critical thinking is not enough by itself since there are not the issues like conceptualizing and skills which are available in the formal philosophy and logic. In Lipman'sperspective, critical thinking cannot make children think deeply in the philosophy. He believed that critical thinking makes individuals to think carefully but philosophy can make it deeply (Lipman, 2003).
4. The other criticism with critical thinking is in the Mcpack's (1981) critics on the critical thinking training.It is believed that the tutees should be trained after some other prerequisite courses in various disciplines. However, the reality is that there are not any appropriate correspondence between logical or problem solving techniques and the practice of critical thinking (Meyers, 1995). Thus McPack believe that training critical thinking in each discipline could be specific since basic knowledge in each discipline is a part of that discipline(McPack, 1981).

With regard to the above shortcomings, Lipman tried to plan a philosophical program for teaching critical thinking to children (P4C) which dealt with key and the critical thinking and made it deeply rooted in children's cognition, creative thinking and caring thoughts. He gave true exercises in the children's curriculum regarding the childhood and adolescent activities. These could remove the weaknesses one and two which are mentioned above. The emphasis on the third weakness is to make children ask the questions as the prerequisite issues and evaluate the responses.This can answer the McPack's (1981) problem.

Therefore, philosophy for children and adolescent could be a great step to elevate their inferencing, decision making and discriminating power (Niakan et al., 2015).P4C with the emphasis on children thinking training was used by Lipman (1999) in NewJeresy, the USA center. This was noticed by more them 100 countries around the world. Lipman define philosophy for children as an applied philosophy. This does not mean that it is used for knowing the philosopher's ideas on different issues. It means childrens' knowledge on how to use their thinking process on different issues and arrive at their own results.

P4C is to make historical philosophy with the help of book stories and book guides. In fact, these stories are the tools for thinking philosophically. These tools are used to reach other goals which are beyond the thinking process. The objectives

are put in a story which contains an issue for leaving to think. After finishing the story, that issue or problem will be discussed in the classroom (Gasparatou et al., 2012). Telling the story is going to be done by children in a circle since they could discuss their ideas on the story. In Lipman's ideas, teaching the principles of thinking should be the basic part of pedagogical training like working with scientific issue such as the use of lenses in a microscope. Lipman refers to logical reasoning as the science that cannot be learned just by mathematics. Children need a unique pattern which helps teachers to teach logical reasoning to arrive at the answers. Planning such patterns could not be easy but applicable. Using story telling activates in groups or individuals can help them not only achieve logical reasoning but they learn how to be philosophers. These understanding are needed for living in the new world (Millett et al., 2012). In this case, teachers and trainers have a great role in doing this job. The teachers are facilitators rather than the knowledge givers. Lipman criticized traditional teaching in which the teacher is the expert. In this new perspective, the teacher is a motivator in the children's circle of discussion and interaction on questions and answers raised in the classroom. There are teacher-student and student-student interaction (Murris, 2016).

The teachers who believe in critical thinking should think of the goal, beyond the issues in the classroom and make the class situation ready for critical thinking. The place for critical thinking (i.e., correct, unbiased, cooperative, logical reasoning and self-critics) should valuethe critics' ideas and questions and motivate the learners to evaluate the related issues. The learners need to believe their thoughts and present their beliefs freely (Huang et al., 2016).

The teacher is an educator who asks questions based on fasts and ideas clearly to make a discussion. The teacher should motivate the learners to think on similarities and differences to arrive at the conclusion. The teacher teaches the learners how to learn and think about basic issues this makes the leaders thoughtful. These students can classify different subjects and recognize that daily activities which are the collection of several issuesinterwoven issues. The learners should discover knowledge, evidence, and logical reasoning through meaningful outcomes regarding their life issue outside schools (Madtes et al., 2013).

The teacher who believesin individuals and thinking freedomdoes not give the knowledge as a readymade result to the learners. The trainers should guide them who to think and ask related questions which help the learners to arrive at the response. The trainer should not give the conclusion as a teaching activity. The trainee should get the response in a logical manner. They these trainers should know howto teach and learn how to make appropriate questions in a guided manner (Ku et al., 2014).

One of the methods of teaching critical thinking is classroom questioning that the teachers and educators can use regarding Socrates' questioning. This is a kind of questioning is with a load voice which asks the utterance meaning and correctness. In Socrates' discussion, the learner's thought and feelings are asked and the trainers let them think and evaluate their thoughts. In other words, the trainers help the learnersto arrive at a framework or a planned design. This can make the learners to be serious and disciplined regarding their beliefs. Using Socrates' questioning emphasizes several points: (1) each thought hasits own logical reasons, (2) it is giving a claim which is meaningful, (3) has implicit and included meanings, (4) it foregrounds some issues and backgrounds some others, (5) It has intentions, (6) it has some criteria, (7) it is clear or unclear, (8) It is deep or shallow, (9) it is questionable or simple to be understood, (10) it is mature or immature, (10) it has one logical reasoning or multi-logical reasoning (McLachlan et al., 2016).

Socrates' training may have several methods regarding questioning technique may be done by teachers or students. These questions could be done in a large group, pairs or individuals. They have the main objectives that focus on the questions of raising individuals' motivation and curiosity (Garside et al., 2012).Socrates' discussion needs the question skill which is an art and trainers should be sensitive to various questions in appropriate situations and contexts. Thus the teachers should train philosophy for children and raise their critical thinking level based on cognitive processes which help them to elevate this type of thinking.

In the present study, the teachers knew the Socrates' method and understood the effect of philosophical training on children's critical thinking at the preschool and primary school levels in Abadan Hoda Andisheh Institute.

MATERIALS AND METHODS

Design

The design of the study is quasi-experimental withthe pre and post- test questionnaires research objectives. It is an applied research with pedagogical objectives.

Research Population and Sampling

The research population included the educators of Abadan Hoda Andisheh Institute. They were participated in the course planned for how to train children's philosophical thinking. Thirty trainers were selected through simple random sampling. This research tried to assess the effect of training coursesamong educators who teach philosophy for children. The textbooks included several unitson critical

thinking for trainers at pre-schools and primary schools. In these two courses, they learned P4C as well as how to think critically, questioning and data collecting. In this treatment period, the book "thinking together" developed by Filip Camwas covered in six sessions, each took 90 minutes. The sessions were: first session, " learn together" (i-e., learning how to think deeply, and Vygotsky's ideas on thinking together), second session, " philosophical activity" (i.e., Lipman's ideas on philosophical inquiry, recognizing philosophical questions and processes in thinking deeply), third session, educational materials (i.e., effect and role of story in thinking, recognizing good stories, having discussion plan for better performance), fourth session, philosophical inquiry (i.e., make children familiar with discussion, make questions and motivate then to participate in discussion), fifth session philosophical inquiry (i.e., make familiar them with logic, criterion, reasoning and logical Issues), sixth session, planning a discussion (i.e., knowing the importance and readiness to work with the discussion circle). The second book was the great ideas for youngchildren: specific for "primary school and pre-school teacher" developed by Wartenberg(2014)that was taught in two introductory sessions, each session took 60 minutes. The sessions included: (1) teaching philosophy in primary schools (i.e., instinctive philosophers, I became the teacher of philosophy for children, learner-centered teaching, and philosophical game), and the second session dealt with ready for teaching (i.e., familiarity with philosophy in primary schools and preparing lesson plans). Both sessions dealt with Socrate's questioning approach. After introductory classes, 10 practical sessions were run with the help of trainers who taughtphilosophical questioning based on Socrate's idea in the classrooms. Then they filled in the California critical thinking skills test (CCTST) at the end of the sessions.

Data Collection Instrumentation

Demographic information questionnaire

This questionnaire included several subsections on the participants' age, experiences, and educational level.

a) CCTST
This questionnaire was developed by Facion and Facion (1994) who evaluated the criticalthinking skills in the individuals and standardized it with the help of 46 experts in the domain of critical thinking based on its concepts.This questionnaire evaluates specific skills of critical thinking in five areas including Analysis, Inferencing,Evaluation, Inductive and Deductive reasoning. In this scale, each correct response gets one mark. The minimum is zero and maximum is 34. The marks in each section are between zero and 16.Thus in the analysis section (9marks), Evaluation (14 marks), Inferenc (14 marks), and Deduction (16 marks). Thus each individual can get 5 scores on critical thinking skills which and are totally between zero and 34. Time allocated to this questionnaire was 45 minutes. To measure the learne critical thinking among the students, California Type B was also used regarding its uses in several studies (i.e., Castilino, 2002; Chen, 2011; Goul, 2006;Wheeler, 2003).

b) The books
Two books were used in philosophical training classrooms.*Thinking together* (Cam, 1998) and G*reat Ideas for little children: For pre and primary school teachers* (Wartenberg, 2014)were used as the materials for teaching philosophy for children.

Data Analysis

Data were analyzed through descriptive and inferentialstatistics (i.e., PairedSamples *t*-test and Pearson Correlation Coefficient).

RESULTS

Thirty pre and primary school teachersparticipated in this study. They were females with the age ranging from 18 to 21 years old. The average of experiences was 18 months (i. e., the minimum 6 months and maximum 30 months). 86% of the participants were BA and the rest was MA, Diploma and post diploma. Descriptive statistics showed that the total average score of critical thinking in the pre-test was (0.266) and in theposttest was (0.455). The maximum was evaluation with 0.244 in the pre-test. In the post-test, the maximum was also evaluation with (0.566) and the minimum was inferencing with (0.406). The results are presented in Table 1.

Total score of critical thinking difference between before and after the treatment were compared through Paired Samples*t*-test at the level of (p=0.0001).This shows that there was a significant difference between the scores of the pre and post-tests. In other words, the average score in the post-test were higher than the pre-test. The results are presented in Table 2.

The significant difference before and after training courses was met through Person Correlation Coefficientsand the results showed that the correlation was (0.419) at the level of significace (p= 0.0001). In other words, the correlation between the scores and the teachers' critical thinking was highlysignificant (p<0.0001) (Table 3).

The correlation between the level of critical thinking before and after intervening with the level of education are not significantly correlated (r=0.3).This shows that

Table 1: Average and SD of critical thinking

Procedure	Variable	Average	SD
Pre-test	Totalcritical thinking	0.266	0.07
	Inferencing	0.257	0.09
	Deductive reasoning	0.252	0.08
	Inductive	0.314	0.1
	Analysis	0259	0.1
	Evaluation	0.244	0.2
Post-test	Total critical thinking	0.455	0.09
	Inferencing	0.406	0.1
	Deductive reasoning	0.450	0.1
	Inductive	0.481	0.1
	Analysis	0.485	0.1
	Evaluation	0.566	0.2

Table 2: Difference between total averages of critical thinking scores

Variable	Procedure	N	Mean	SD	t	df	Sig. P-value
Total critical thinking	Pre	30	9.06	2.5	–11.4	29	0.0001
	post	30	15.5	3.07			
Inferencing	Pre	30	2.83	1.01	–8.4	29	0.0001
	Post	30	4.46	1.6			
Deductive reasoning	Pre	30	4.03	1.3	–7.5	29	0.0001
	Post	30	7.20	2.05			
Inductivereasoning	Pre	30	4.40	1.9	–4.8	29	0.0001
	Post	30	6.73	1.9			
Analysis	Pre	30	1.37	0.2	–6.02	29	0.000
	Post	30	1.51	0.2			
Evaluation	Pre	30	2.33	1.3	–4.6	29	0.0001
	Post	30	4.36	1.5			

Table 3: The correlation coefficient between critical thinking level before and after intervention

	Correlation coefficient	P
Critical thinking first stage Critical thinking second stage	0.419	0.0001

the individuals' educational level is not effective in their critical thinking and there should be more than this as an effective variable. Since the participants approximately held the same age and training experiences, determining a significant correlation between the critical thinking and these variables were not possible.

DISCUSSION AND CONCLUSION

Since the 21st century faces technological development and new changes which affect human beings' lives, there is aneed to have human beingslearn cognitive abilities to be innovative and creative in their thinking. Regarding the bases of researching andcuriosity in childhood (i.e., the pre and post primary school periods), teachers need to learn and then teach critical thinking in these years tochildren. The teachers should help the learners toadapt themselves with cultural varieties in the society to overcome the environmental problems and can face different situations to solve their problems in creative manners. One of the educational activities which should be emphasized is the skill of thinking, especially critical thinking (e.g., P4C). The other worlds, Lipman's P4C can be done through Vygotsky's formalist approach, Dewey's practical manner and Socrates' questioning method. This is a gradual and organized plan which has been designed for children between 4 and 18 (Lam, 2012). The objective of this plan is to help the children think rather than store knowledge in their mind. They should decide and judge various issues (De Marrizio et al., 2011).

Nowadays, this idea has been used by many educational institutes in different countries (Letskoka, 2014). In Iran, this approach has been noticed and researched newly.In fact, in the circle of learners' critical thinking, the learners and teachers do the research cooperatively. They talk and discuss the issues and accept the frameworks of logical reasoning proposed by children. Discussion in the circle of critical thinking has some practical consequences including agreement, determining, deciding, concluding and judging. There are not any imposed or biased ideas in this program and they agree on the results of the group's judgment.

Lipman(1993) believes that philosophical thinking does not mean thinking and reasoning but it means thinking about thinking (Benade, 2011). This can be done if the trainers understand cognitive processes and try to elevate them. In fact, the trainers could be the most important factor of critical thinking process. Moreover, training the teachers is very important. If the trainers are not competent in following critical thinking procedures, they could affect children's lack of creativity. Therefore, teacher training in performing philosophical procedures should be emphasized as a priority since the trainers should make the class discussive and guide the class in a cooperative manners (Green et al., 2012).

On the other word, it should be noted that there are a pool of researches which have focused on critical thinking. However, a few researcheshave dealt with the effect of philosophical thinking on children's educational efficacy. Thus, this study has investigated the research questions to discover whether teaching philosophical education to trainers can affect the learners' critical thinking. Results showed the trainers' competence on critical thinking level was elevated after intervention. This shows that the trainers can elevate their critical thinking which affects the children's critical thinking level too.

Since the less experienced teachers face challenges too to work with the students in the research-based classes,

the teachers need pre and in-service training courses at the beginning of their service. Thus it is suggested that in-service training are held to train teachers how to deal with pre-school and primary school children in terms of elevating their level of critical thinking. This may train the thoughtful, creative and critic children. Textbook developers may give appropriate tasks which elevate critical thinking to encourage the learners to think critically rather than store some information. There is a need to focus on future research in this area and investigaterelated issues by means ofconducting more comprehensive studies to promote the level of critical thinking among the students and teachers in edncational settings.

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Original Article

Strengthening the Health Care System to Address the New Challenge of Non-Communicable Diseases in the Kingdom of Saudi Arabia: A Systematic Review

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Abstract

Background: The Kingdom of Saudi Arabia has a three tire health system in the country which includes primary, secondary and tertiary. In the recent years there is a shift from communicable to non-communicable diseases in the kingdom of Saudi Arabia because of the lifestyle changes and behavioral modifications.

Methods: A recently published article from various databases between the year 2005 and 2015 were identified. 21 scholarly peer reviewed literatures and 5 world health organization and ministry of health documents were included in the study.

Results: The study relieved the burden due to non-communicable diseases are high in the country and has an impact on the health care delivery system so this study suggested nine detailed strategies for strengthening the health care delivery system to prevent the non-communicable diseases and also for providing better care for the patients with non-communicable diseases.

Conclusion: The burden of disease pattern has been changed over a period of years in the kingdom of Saudi Arabia so there is a need to strengthen the health care delivery system for facing the new challenges.

Key words: Non-communicable diseases, Health Care system, Saudi Arabia

INTRODUCTION

Globally, non- communicable diseases (NCDs) cause death to 38 million people annually, and 17 million NCDs patients die before they reach 70, with 82% of premature and 75% of all NCDs deaths in low- and middle-income families [1]. Within this global epidemic, Saudi Arabia is experiencing an increased burden on healthcare services largely as a consequence of the changing patterns of disease from communicable to non-communicable diseases [2]. An alarming increase in cardiovascular diseases, diabetes, cancer and chronic respiratory diseases, for which the treatment is costly, accounts for 78% of all mortality [1].

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Cardiovascular diseases are the leading cause of NCDs deaths with 46% of total death, followed by cancer 10%, then diabetes 5%, respiratory diseases 3% and other NCDs 14% [1]. The population proportion of those aged between 30 and 70 is 42.7%, and the probability of this age group dying from the four main NCDs is 17%, while tobacco, alcohol, physical inactivity and unhealthy eating increase the risk of NCDs death[1]. In Saudi Arabia, NCDs are estimated to be the largest contributor to the illness burden for the population and the healthcare system, and their prevalence is expected to continue to rise [1]. NCDs are also an enormous drag on economic development and workplace productivity, while the healthcare system takes the greatest burden in terms of attaining people and takes care of all these things [3]. Most NCDs deaths are premature, but would be preventable if the healthcare system's response was more effective and equitable to the NCDs patients' needs, and more supportive of the public policies related to the use of tobacco and alcohol, unhealthy eating and lack of physical activity [4].

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AIM

The aim is to explore the impacts of NCDs on the healthcare system in Saudi Arabia.

METHODOLOGY

In the literature search conducted on " Non-communicable diseases and the healthcare system" in Saudi Arabia, firstly, a review of the relevant literatures published in English from March 2005 to March 2015 was carried out, by using different databases. Medline, CINAHL, SCOPUS, PubMed, the Saudi Ministry of Health (MOH) database, the World Health Organization (WHO) database and public health websites were searched. The keywords and phrases used were synonyms, i.e. 'burden of chronic non-communicable diseases', 'prevalence of cardiovascular diseases', 'ischemic heart disease', 'cancer', 'chronic respiratory diseases', 'asthma', 'diabetes', 'hypertension', 'males', 'females', 'behavior', 'interventions', 'risk factors', 'Saudi Arabia' and 'healthcare system'. The search involved breaking down the research question into its core concepts and alternative terms, and then constructing an effective search strategy. The search strategy has been saved for further use, if needed. In total, twenty-six publications in peer-reviewed journals were identified.

In this systematic search of literature, the source type was limited to academic and peer-reviewed journals, and publications dated to the last 10 years and to Saudi Arabia.

The inclusion criteria allowed fourteen references to be linked to the issue of NCDs, while seven articles were related to the healthcare system in Saudi Arabia. The remaining five publications were the relevant MOH and WHO documents. Following the systematic search, the literature was reviewed and analyzed to identify the main themes relevant to the topic of "The impacts of non-communicable diseases on the healthcare system". Furthermore, data about the per-capita healthcare expenditure and the total healthcare budget were obtained directly from the MOH databases. This study is based on the, only accessible, MOH database (MOH provides 59.5% of the healthcare services). This study does not account for the private sector (which provides 31.5%) and semi-governmental healthcare services (which provide 9%), as they are not accessible.

RESULTS AND DISCUSSION

The results obtained from the literature search of "the impacts of NCDs on the Saudi healthcare system" reveala need for strengthening the healthcare system towards improving the prevention of NCDs and the care of people with NCDs in Saudi Arabia.

This study groups findings according to the following emerging themes related to these impacts:

- Healthcare financing and leadership for healthcare,
- Healthcare service delivery and human resources for healthcare,
- Healthcare technologies and medical products, healthcare information system, and
- Community education and partnerships for healthcareand research in healthcare.

This study will discuss in detail nine factors to strengthening the Saudi healthcare system, and consequently improve prevention, care and treatment of NCDs.

Healthcare Financing

The Article 31 of the Basic Role of Governance requires that the Saudi government ensure free healthcare for all citizens [5]. The MOH's budget represents 6.8 % of government's expenditure, and the total expenditure on health is 4.9% of the Gross Domestic Product [6].

As the population, its aging group, long-tern NCDs and, consequently, the increased demand for healthcare services are increasing, [7] it has forced the government to increase its budget allocation on healthcare from US$ 6.7 billion in 2008 to US$16 billion in 2014 [6]. The treatment of NCDs is costly; for example, only the economic burden of Diabetes Mellitus is estimated at about $2.4 billion in 2015, which accounts for 13.1% of the public healthcare spending [8]. The rapid increase in healthcare costs in general, and NCDs in particular, is exerting big pressure on the government. There is a need to decrease the government's spending on healthcare due to the increased burden on healthcare services largely as a consequence of the changing patterns of disease from communicable to non-communicable diseases. Thus, alternative sources for financing healthcare, and inter-sectoral cooperation are essential. In 1999, the government started implementing a cooperative health insurance (CHI) over three phases to support financing healthcare [5, 9]. In the first phase, the CHI would be applied to Saudis and non-Saudis working in the private sector, in which employers pay health insurance costs for their employees. In the second phase, the CHI would be applied to citizens and non-citizens working in the government sector, paid by the government. In the third phase, the CHI would be applied to other groups, such as tourists [5]. However, the final decisions on the second and third phase of this programme are yet to be made. The national health insurance programme is seen by researchers and policy-makers as vital for improving accessibility and the finance of the Saudi healthcare

system [10,2]. Approval and implementation of the CHI would be an important source of financing health, and may decrease the government's spending on healthcare.

Healthcare Leadership

The MOH is responsible for managing the Saudi healthcare system through 13 healthcare directorates [11]. The structure of its organization and administration is well-defined and decentralized, and its functions include strategic planning, formulation of healthcare policies, supervision of all healthcare services, and monitoring of all healthcare-related activities [9]. Over the past few decades, the MOH has developed strategies for service delivery, including preventive, rehabilitative curative and promotive programmes [12]. Furthermore, to decrease pressure on the MOH, the regional directorates have been given more autonomy to plan and recruit staff, and limited financial discretion [7]. Insufficient spending authority and individual budgets have badly affected the regional directorates [7], which affects their autonomy, and hinders effective decision-making.

A study suggests more planned action towards creating national healthcare workforce [13]. Improving leadership at national and subnational levels will facilitate effective engagement with the MOH and the healthcare directorates to ensure appropriate coverage.

The primary healthcare (PHC) lacks evidence-based national standards, guidelines and protocols for addressing NCDs [1]. Thus, leadership and strong actions on preventative healthcare is needed for driving and coordinating actions to reduce the prevalence of NCDs. Improving management methods is also necessary for raising the level of performance, efficiency and adequacy of preventive and curative healthcare services [14]. The MOH governance system needs restructuring and reorganizing. The Saudi public healthcare sector is overwhelmingly operated, controlled, financed, managed and supervised by the MOH. This model of administration is less likely able to meet health needs in the future without thoughtful and well-planned actions that separate the multiple roles of the MOH.

Therefore, possible solutions are granting more authority to the regional directorates, and implementing a cooperative health insurance [7].

Healthcare Information System

The MOH is encouraging the use of information technology towards improving the quality of data, and evolving to paperless management [15]. However, the MOH lacks not only coordination between primary and other healthcare institutions, but also the information held by the private and semi-government healthcare sectors [16]. Another challenge that the Saudi healthcare system faces is thus the lack of an established and efficient national healthinformation system [17]. The MOH is adopting e-health systems too slowly, as a number of information systems used in central hospitals and regional directorates are isolated [12]. In 2008, the e-health services began to be centralized, and a 5-year plan was implemented to connect all healthcare providers, assess the performance of the services, and raise them to a standardised level [18].

Slow uptake of e-health systems and disconnected information systems in the MOH institutions, regional directorates and private sectors obviously have implications for efficiency of healthcare delivery. Thus, a high level of coordination is essential toprovide accurate data for coordinating, integrating, planning, monitoring and evaluating.

MOH hospitals are using the International Classification of Diseases – Tenth Revision in order to code the causes of morbidity and mortality, but still 25.6% of total deaths in 2012 were registered under the group of ill-defined symptoms and conditions [6]. However, as morbidity and mortality data are not always accurate [17], a comprehensive surveillance programme is needed for the high burden of NCDs. A national study reports that 57.8% and 43.6% of hypertensive and diabetic Saudis, respectively, are undiagnosed [19]. A surveillance programme will provide data on a scientific basis, and enable the relevant authorities to recommend a comprehensive national plan for improving the healthcare system. Surveillance is a crucial monitoring tool for evidence-based decision making about public healthcare and the success of its interventions for containing the emerging epidemic of NCDs [4] . Thus, measurement should be monitored, evaluated and improved, as availability of information is vital to combat, prevent and improve the management of NCDs.

Healthcare Service Delivery

The MOH provides healthcare services through 259 hospitals distributed around the country, and through a network of 2,259 PHC centres located in both large cities and small towns. Other governmental agencies also provide healthcare services through 39 hospitals, while the private sector provides services in 137 hospitals [6] . The MOH delivery model is organized into five tiers, i.e. PHC centres, district hospitals, general hospitals, central hospitals and medical cities [12]. The PHC centres have a gatekeeping function for referrals to general and specialized hospitals [20]. In general, citizens can only access the PHC centres in their areas of residence [21]. Accessibility to healthcare services, cost-effectiveness and equity form an integral part of early detection and management of NCDs,

and reduction of risk behaviors. The improvement of accessibility to healthcare services requires the equity of healthcare facilities around the country, and equal access to healthcare services, which also includes transport [22].

The current MOH statistics reveal a maldistribution of healthcare services across geographical areas [6].

Healthcare facilities in major urban centres, such as Riyadh and Makkah, attract most of the human resource in 46 and 37 hospitals, respectively [6].Also, availability of hospitals for secondary and tertiary healthcare in these areas tends to bypass PHC centres. Such utilization patterns exert not only an excessive burden on the hospital emergency department and underutilization of PHC services, but also significantly higher costs for healthcare [21]. The PHC centres are effective in managing the risk factors, and coordinating care and medication for NCDs through PHC professionals [23]. For instance, diabetes control in the PHC centres requires monitoring blood glucose regularly, hypertension management requires monitoring blood pressure, chronic obstructive pulmonary disease (COPD) requires smoking cessation, and all these require medication and lifestyle changes, such as adopting healthy diet and increasing physical activities. To increase accessibility to healthcare centres throughout the country, the MOH needs to implement a more holistic strategy for redistributing healthcare services in the hospitals and the PHC centres. Finally, increasing awareness by improving access to healthcare facilities helps the promotion of healthy lifestyles [24].

Human Resources for Healthcare

The increase in population and NCDs requires more doctors, nurses and hospital beds [7]. Saudi Arabia relies heavily on expatriates (61% of all healthcare staff) to provide healthcare services, resulting in large turnover and instability in the healthcare system [25]. Not only does the government continue developing the Saudi healthcare workforce through the establishment of healthcare institutions, but there are also 73 colleges for medicine, healthcare and nursing, as well as 4 healthcare institutes [7]. The purpose of establishing such colleges is to substitute the vast expatriate workforce with highly qualified Saudi nationals in healthcare sectors [26]. Furthermore, the MOH has increased the scholarships and training budget in order to offer opportunities to employees to continue their studies abroad [27]. These strategies will contribute to improving the skills of the current employees, raising the quality of healthcare, and decreasing the rate of turnover amongst healthcare professionals. Yet, these strategies may not be sufficient to cope with the challenges, especially with the increasing trend of NCDs and the group aged 15-64 representing 64.8% of the population [12]. It is still highly likely that the government will continue recruiting expatriate healthcare workers in order to meet the needs of the rapidly increasing population. The number of Saudi healthcare professionals in the MOH will probably decrease due to the expanding of healthcare facilities in the country following the population growth [26]. The ability to formulate and apply effective strategies for retaining and attracting more Saudis into healthcare professions is a priority for an effective improvement of the Saudi healthcare system. The government has been taken numerous efforts for teaching and training Saudis for healthcare professional jobs, which is evidence of problems in communication. The MOH should cooperate with both the government and private sectors in consolidating long-term strategies and more realistic plans; for example, more medical colleges and further training programmes are urgently needed. Also, educating expatriate nurses about the cultural heritage of the Saudi people is necessary for increasing cultural harmony [28].

Healthcare Technologies and Medical Products

The Saudi Food and Drug Authority established in 2011 have improved the governance of healthcare technology, as it autonomously oversees both governmental and non-governmental sectors [12]. However, the treatment of NCDs costs the pharmaceutical industry enormous amounts of money, and may even be ineffective [29]. Healthcare technology is the second biggest cost in the Saudi healthcare system, such as medication, vaccines, biomedical equipment, and the networks of laboratory and blood safety, with an increase of 2.7% in imported pharmaceuticals worth US$ 2.63 billion between 2009 and 2010 [12]. The Saudi industry manufactures generic pharmaceutical products, and can supply only about 15% of the pharmaceutical market [30]. The regulations for pharmacies and medical products are loosely implemented, and intended for Saudi control of this national market [30].

Concerns should be voiced about such increased costs related to the growing rate of NCDs, and an increase in the use of expensive technology to manage and treat NCDs. Pharmacies are largely unregulated and almost all medicinal products can be bought over the counter without a prescription. Better accessibility to medication means more demand from the pharmaceutical industry to supply the population with medication without seeing a medical professional, or accessing the PHC services. Such an unsafe distribution chain requires stricter controls of drug supply by the Saudi Food and Drug Authority, as well as encouraging people to obtain a prescription from the PHC professionals, which will also encourage individuals to monitor their own health, and seek medical care.

Research in Health

MOH is only dealing with few specialized medical research [11].The MOH established and finances only one research centre at the King Faisal Specialist Hospital and Research Centre, only for genetics, environmental health, cancer, and cardiovascular and infectious diseases [2]. Despite ranking second in biomedical publications among Arab countries, the citation of Saudi research publications is poor, which indicates its low impact [31]. Continuation of limited research centres and absence of inter-sectoral collaboration will affect the population's health. Despite almost 6 decades since the MOH was established, the number of research centres is still very limited. There has been some sharp criticism of the MOH's lack of efforts to create more research centres which would increase the management of NCDs, such as cancer. Encouraging and supporting health research would provide the required professionals to studyanalyze and reduce the epidemic of NCDs. The MOH should not only establish more research centres, but also conduct research in collaboration with other research centres i.e. universities. Promoting research in the medical and healthcare sciences to improve health and wellbeing in Saudi Arabia is highly recommendable. It is vital to promote and support high-quality research into the prevention and control of NCDs.

Community Education

Currently, the MOH provides PHC services which promote community education through a network of 2,259 centres. The total number of PHC centres provided by the MOH increased by 17.4%, i.e. from 1,986 centres in 2008 to 2,259 centres in 2012 Studies reveal a low quality of interpersonal care due to language barriers and cultural gaps, as most PHC providers are expatriates, and may not clearly communicate with the majority of their patients [20]. Primary prevention needs to be improved, so that it can increase the population's awareness and community programmes (e.g. anti-smoking, healthy eating and physical activity) promoting healthy behaviours [19]. Studies reveal a decrease in cancer mortality through early detection and advances in treatment [32]. Furthermore, healthcare education programmes carried out in the PHC centres need to be reviewed and evaluated with a special emphasis on activities for people suffering from chronic diseases [33].

Similarly, community education promotes health awareness, and fosters the adoption of healthier lifestyles. Early prevention is the most effective way to reduce the rate of NCDs and difficulties associated with treatment in the later stages of disease [34]. It is vital to support programmes for the prevention and control of NCDs with suitable expertise and resources. Raising community awareness and encouraging action are an important direction for NCDs reduction. Basic general public knowledge about controlling cancer is as valuable as diagnostic tools, screening, new approaches to prevention, early diagnosis and treatment [35]. Moreover, efficient community education gives strong anti-smoking messages, increases adoption of healthy lifestyles and physical activities, and provides ongoing support to individuals and families.

Partnership for Healthcare

The lack of integration and coordination of the public healthcare sector's activities is a major waste contributing to the escalation of costs of Saudi healthcare services [5]. Although few ministerial committees help strengthen inter-sectoral action and promote healthcare policies, inter-sectoral collaboration is better at the subnational level thanks to local government and local stakeholders [12]. Most NCDs deaths are largely preventable, but prevention requires a multi-sectorial approach [4]. Approximately 80% of heart diseases, type II diabetes and stroke can be prevented by elimination of the shared modifiable risk factors, such as unhealthy diet, tobacco use, the harmful use of alcohol and physical inactivity [36]. Saudi Arabia is ranked the fourth in the world in tobacco import, which raises a major concern about the hidden health problems related to its use [37]. The high consumption of tobacco would indirectly project the magnitude of COPD, lung cancer, cardiovascular diseases and other related diseases [38].

Addressing risk factors with a comprehensive andpopulation-wide approach will greatly reduce NCDs [39].

This approach should include reducing commercial availability of tobacco, increasing public awareness about the dangers of tobacco use, reducing salt consumption, increasing fruit and vegetables consumption, and improving the environment for prompting physical activates by all sectors to make the default choice healthy. Mortality and morbidity due to smoking can be reduced by banning tobacco particularly for youth [40]. Therefore, the MOH, the Ministry of Education, other governmental and non-governmental organizations and stakeholders need to collaborate more closely. Integration and coordination of activities of the public healthcare sector providers and other professionals will enable them to use resources jointly, and avoid the duplication of services. Improving partnerships at both national and subnational levels will facilitate collaboration with the private sector, and ensure adequate healthcare services coverage.

CONCLUSION

There is strong evidence of a rapid and alarming change in the burden profile in Saudi Arabia. Diabetes, obesity,

high blood pressure, cancer and cardiovascular diseases are putting an enormous toll on the healthcare system and society, which requires prevention and management through carefully planned interventions.

As NCDs are a threat to the future well-being of the Saudi population, to consider and address the future challenges, the healthcare system should be strengthened to respond appropriately. This study helps identify and tackle major obstacles to the healthcare system to effectively respond to NCDs, which can be overcome by improving leadership and research skills, separating of the MOH's multiple roles, diversifying financing sources, and developing public and private partnerships. Other obstacles can be addressed by strengthening, enhancing and sustaining community educational programmes as well as delivering equitable high-quality healthcare to all population. Among challenges are isolated health information systems in regional directorates and implementation of comprehensive national surveillance programme. To improve the Saudi healthcare system, and address the challenges, the MOH and other relevant sectors need to coordinate their activities, and ensure that new healthcare strategies are successful.

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Original Article

Incidence and Distribution of Pulp Stones Found in Radiographic Dental Examination of Adult Jammu Dental Patients

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Abstract

Aim: The present study is conducted to evaluate the Incidence and Distribution of Pulp Stones Found in Radiographic Dental Examination of Adult Jammu Dental Patients

Materials and Methods: Out of a total sample size of 127 visiting Deptt. of Conservative Dentistry, Indira Gandhi Govt. Dental College, Jammu, a total of 80 subjects were selected based on the inclusion criteria and patients willingness. Radiovisiographs (RVG) of premolars and molars using XCP-DS sensor holders for standarized x-rays were taken. The subjects were divided into 2 groups according to different genders with 40 subjects each.

Results: A significant gender difference with the incidence of pulp stones among female subjects was observed. Majority of the teeth showed the presence of pulp stones. Majority of the pulp stones in maxilla were found in third molars followed by first molars and first premolars in both the genders. Similar findings were observed in the mandible. A statistically significant presence of pulp stones in both the genders among individually selected teeth.

Conclusion: It is concluded that the incidence and distribution of pulp stones were more in females and in maxillary teeth. Th incidence was more among the third molars. The data concluded from the present study could serve as a useful aid for endodontist in root canal treatment procedures.

Key words: Radiographs, Pulp stones, Incidence, Root canal

INTRODUCTION

Pulp stones (PS) are discrete calcified masses found in the dental pulp, in the pulp tissue or become attached to or embedded into the dentine. [1] Structurally, pulp stones can be classified as true or false, the former being made of dentine and lined by odontoblasts, whereas false pulp stones are formed from degenerating cells of the pulp that gets mineralized. [2]

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Their locations are more common in the coronal than in the radicular portions of the pulp and they can be observed as free, attached, and embedded in the dentinal surface of the pulp chamber. Pulp stones are classified done according to their structure as true, false, and diffuse. They range in size from small microscopic parti-cles to large masses that almost obliterate the pulp chamber. [3]

Although the exact cause of pulp calcification is unknown some factors have been implicated in stone formation such as genetic predisposition [4], orthodontic tooth movement, circulatory disturbance in pulp, age [5], interactions between the epithelium and pulp tissue, idiopathic factors [6], and long-standing irritants like caries, deep restorations, and chronic inflammation. [7]

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The frequency of occurrence of pulp stones has been reported to increase with age. [8,9] Some studies did not find any difference in occurrence between genders, [10,11,12,13] whereas other studies have found females to have more pulp stones than males. [13,14,15]

The present study is conducted to evaluate the Incidence and Distribution of Pulp Stones Found in Radiographic Dental Examination of Adult Jammu Dental Patients.

MATERIALS AND METHODS

Out of a total sample size of 127 visiting Deptt. of Conservative Dentistry, Indira Gandhi Govt. Dental College, Jammu, a total of 80 subjects were selected based on the inclusion criteria and patients willingness.

Inclusion criteria was the presence of all 32 permanent teeth.

Radiovisiographs (RVG) of premolars and molars using XCP-DS sensor holders for standarized x-rays were taken. The subjects were divided into 2 groups according to different genders with 40 subjects each.

Age of the subjects ranged from 25-45 years. Intra-pulpal dense radio-opaque structures seen in the RVG were considered as pulp stones. The number of pulp stones, tooth type and jaws were recorded with respect to the gender. Chi-square test was used for statistical analysis using SPSS software version 20.

RESULTS

Table 1 showed a significant gender diffrence with the incidence of pulp stones among female subjects which was 55.7% (p=0.0704). Table 2 showed that majority of the teeth showed the presence of pulp stones. Table 3 showed that majority of the pulp stones in maxilla were found in third molars followed by first molars and first premolars in both the genders. Table 4 showed similar findings in the mandible.

Table 5 showed a statistically significant presence of pulp stones in both the genders among individually selected teeth.

DISCUSSION

The present study was conducted in 80 subjects visiting Deptt. of Conservative Dentistry, Indira Gandhi Govt. Dental College, Jammu. Various previous studies used intra oral periapical radiographs, bite wing radiographs and

Table 1: Gender distribution of subjects with pulp stones

Incidence of pulp stones	Females (%)	Males (%)	Total (%)	*P* value
Present	27 (67.5)	19 (47.5)	46 (57.5)	0.0704**
Absent	13 (32.5)	21 (52.5)	34 (42.5)	
Total	40 (100)	40 (100)	80 (100)	

**Statistically significant

Table 2: Percentage and distribution of number of teeth with pulp stones

Incidence of pulp stones in teeth	Females (%)	Males (%)	Total (%)	*P* value
Teeth with pulp stones	540 (67.5)	380 (47.5)	920 (57.5)	0.0000***
Teeth without pulp stones	260 (32.5)	420 (52.5)	680 (42.5)	
Total	800 (100)	800 (100)	1600 (100)	

***Highly Significant

Table 3: Distribution of frequency of pulp stones in maxilla

Maxilla	Number of teeth	Males (%)	Females (%)	Total (%)
First premolar	160	38 (23.75)	48 (30%)	86 (53.75)
Second premolar	160	25 (15.6)	40 (25%)	65 (40.62)
First molar	160	46 (28.75)	61 (38.12)	107 (66.87)
Second molar	160	37 (23.12)	42 (26.25)	79 (49.37)
Third molar	160	54 (33.75)	79 (49.37)	133 (83.12)
Total	800	200	270	470

Table 4: Distribution of frequency of pulp stones in mandible

Mandible	Number of teeth	Males (%)	Females (%)	Total (%)
First premolar	160	37 (23.12)	53 (33.12)	90 (56.25)
Second premolar	160	30 (18.75)	48 (30)	78 (48.75)
First molar	160	39 (24.37)	57 (35.62)	96 (60)
Second molar	160	28 (17.5)	49 (30.62)	77 (48.12)
Third molar	160	46 (28.75)	63 (39.37)	109 (68.12)
Total	800	180	270	450

Table 5: Level of significance of difference in prevalance of pulp stones in selected teeth

Teeth	No. of pulp stones		*P* value
	Males	Females	
First premolar	75	101	0.0628
Second premolar	55	88	0.0082
First molar	85	118	0.0291
Second molar	65	91	0.0469
Third molar	100	142	0.0118
Total	380	540	0.0000***

panormic radiographs to find the prevalance of pulp stone, however we used RVG to minimize the patient exposure to X Rays. [9,16-21]

The findings of our study showed a significantly higher incidence of pulp stones among the female subjects which is in accordance with the results of Jayam R *et al.*, Sreelakshmi *et al.* and Turkal M etal. [19,20,21] According to their results the higher incidence among females could be related to the presence of the parafunctional habits leading to the degenerative changes in the pulp.

According to the findings of our study 57.5% of the teeth showed presence of pulp stones which were in accordance with the findings of previous studies. [20]

The number of teeth showing pulp stones was more in our study as our sample size was limited in comparison to other studies. Our study found that the pulp stones were more prevalant among the third molars followed by first molars in both the arches which is in agreement with the findings of Jayam R *et al.* [21]

However, Sisman *et al.*[15] found a higher incidence of pulpstones in first molars which can be attributed to their earlier eruption and their ability to bear majority of the occlusal forces.

One of the main limitations would be results from the procedure of radiographic assessment which included only RVG's, which gave a limited clarity of picture of the posterior teeth with pulp stones in comparison to the bitewing projections as they are often selected for determining the presence of pulp stones. They produce more accurate images of the teeth without major distortion or magnification. [22,23]

Also, a larger sample size should be considered and the site of the pulp stones in the root canals would have been located for a clear picture of distribution. Also, various associted factors leading to degenerative changes in the pulp should be included in future studies.

CONCLUSION

It is concluded that the incidence and distribution of pulp stones were more in females and in maxillary teeth. Th incidence was more among the third molars. The data concluded from the present study could serve as a useful aid for endodontist in root canal treatment procedures.

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Original Article

Prevalence of White Spot Lesions during Orthodontic Treatment with Fixed Appliances in Jammu City

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Abstract

Aim: To determine the prevalence of white spot lesions (WSLs) in orthodontic patients at three different points of time during orthodontic treatment using the visual examination method.

Materials and Methods: the prevalence of white spot lesions was found by examining the patients before starting orthodontic treatment, after 6 and 12 months into treatment. Upon clinical evaluation, teeth were given a visual score based on the extent of demineralization.

Results: The results of our study showed that majority of the males and females) did not show any white spot lesions before the start of the orthodontic treatment. There was no statistically significant relationship between the presence of white spot lesions and genders (p = 0.9072). The mean score before the start of orthodontic treatment was 1.20 ± 0.20 and in females it was 1.28 ± 0.18 which gradually increased with the increase in duration of the treatment.

Conclusion: This clinical study showed a sharp increase in the number of WSLs during the first 6 months of treatment and was more in maxillary teeth. WSL showed a significant correlation with oral hygiene status of the patient, which should evaluated during the initial months of treatment so that implementation of various measures can be done to prevent demineralization.

Key words: White spot lesions, Prevalence, Demineralization, Jammu

INTRODUCTION

Apart from it's beneficial effects, orthodontic treatment has certain risks and limitations. White spot lesions (enamel demineralization) is one of the most common and a significant risk associated with orthodontic treatment in patients with poor oral hygiene.

The various components of fixed orthodontic appliance such as brackets, bands and wires act as a site for plaque accumulation. During fixed orthodontic therapy, a rapid shift in the bacterial flora of plaque occurs with increased levels of acidogenic bacteria, mainly Streptococcus mutans and Lactobacilli which results in demineralization and alteration in the appearance of the enamel surface by the production of acid by these bacteria in plaque.[1-6]

Early lesions appear as opaque, white spots that leads to caries if left with any intervention and can be detected clinically as early as 1 to 2 months into treatment and their prevalence ranges from 2 to 96% in patients undergoing fixed orthodontic treatment.[7,8]

White spot lesions are most commonly seen on the buccal surfaces of teeth mostly in the gingival region and around the brackets. Many relevant studies reported the presence of white spot lesions at the completion of orthodontic treatment.

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The prevalence of these lesions varies depending upon the examination method used. Gorelick *et al.*, in their study found that 50% of patients who underwent orthodontic treatment were having WSLs when examined with the visual examination technique. [1,5,9]

Though it was stated in the past that WSLs could develop within 1 month, their formation and prevalence at different points of time during orthodontic treatment have not been investigated. Therefore, the aim of this study is to determine the prevalence of white spot lesions using the visual examination method in orthodontic patients before orthodontic treatment and at 6 and 12 months into treatment in Jammu city.

MATERIALS AND METHODS

The prevalence of white spot lesions was found by visual evaluation of teeth of the patients at three different points of time i.e. before starting orthodontic treatment, after 6 months and after 12 months into treatment were given a visual score based on the extent of demineralization. From a simple size of 343 patients coming to the Department of Orthodontics in Indira Gandhi Government Dental College, Jammu, a total of 240 subjects were taken who were willing to participate in the study and were fulfilling the inclusion criteria.

Inclusion Criteria

No previous history of orthodontic treatment,

Absence of Dental caries and Absence of any systemic condition.

Exclusion Criteria

Presence of any congenital anomaly.

The selected subjects were equally divided into three groups consisting of 80 subjects (40 males and 40 females). The study participants were also separated into 3 groups as; Group I consisted of subjects before the start of treatment, Group II comprised of subjects who had been undergoing orthodontic treatment for 6 months and Group III comprised of subjects who were undergoing treatment for 12 months.

The following scale was used for the visual examination:

Score 0 = No visible white spots or surface disruption (no demineralization)

Score 1 = Visible white spot without surface disruption (mild demineralization)

Score 2 = Visible white spot lesion having a roughened surface but not requiring a restoration (moderate demineralization)

Score 3 = Visible white spot lesion requiring restoration (severe demineralization)

The examination was performed under direct illumination of chair light after drying the teeth with compressed air. All the participants were examined by the same examiner trained for the specific study to avoid intra examiner errors.

Data Analysis

SPSS version 20.0 (SPSS, Chicago, IL, USA) was used for analysis of data. Frequency, Mean and Standard Deviation was calculated. Chi-square test was used to analyze the data and the level of significance was at 0.05.

RESULTS

Table 1 showed that majority of the males and females (87.5% and 82.5% respectively) did not show any white spot lesions before the start of the orthodontic treatment. However the presence of white spot lesions increased more within first six months (52.5% males and 55% females) into treatment with a gradual increase till twelve months (57.5% males and 65% females) into treatment. There was no statistically significant relationship between the presence of white spot lesions and genders. Table 2 showed that in Group 1, the mean score of white spot lesions in males was 1.20 ± 0.20 and in females it was 1.28 ± 0.18. In-group 2 the mean score for males was 1.33 ± 0.10 and in females it was 1.27 ± 0.09. Group 3 showed that the mean score of WSLs was 1.52 ± 0.10 in males and 1.53 ± 0.09 in females.

DISCUSSION

The present study was conducted in Department of Orthodontics in Indira Gandhi Government Dental College, Jammu with a total of 240 subjects. The fixed orthodontic treatment reduces the patients efficiency to maintain oral hygiene which leads to increased plaque retention around the various components of fixed appliance which further leads to the development of white spot lesions and enamel demineralization. The findings of the present study showed that majority of the subjects did not show any white spot lesion before the start of orthodontic treatment however there was an increase in the number of subjects with white spot lesion present after 6 months and 12 months into the treatment which is in agreement with the studies done by Gorelick *et al.*[1] and Tufekci E.[10]

Fewer studies showed that white spot lesions were found to be more frequent on the gingival surfaces of premolar tooth because of gingival bracket placement and also lead to gingival enlargement in some cases. It was recommended

Table 1: Frequency of WSLs in different genders

Group	WSL absent		WSL present	
	Males (%)	Females (%)	Males (%)	Females (%)
Group I (before orthodontic treatment)	35 (87.5)	33 (82.5)	5 (12.5)	7 (17.5)
Group II (6 months into treatment)	19 (47.5)	18 (45)	21 (52.5)	22 (55)
Group III (12 months into treatment)	17 (42.5)	14 (35)	23 (57.5)	26 (65)
	χ^2=0.112, *P*=0.9457		χ^2=0.195, *P*=0.9072	

Table 2: Mean scores of patients with WSLs at different points of time

Group	Number of subjects		Mean score		Standard deviation	
	Males (%)	Females (%)	Males	Females	Males	Females
Group I (before orthodontic treatment)	5 (12.5)	7 (17.5)	1.20±0.20	1.28±0.18	0.447	0.487
Group II (6 months into treatment)	21 (52.5)	22 (55)	1.33±0.10	1.27±0.09	0.483	0.455
Group III (12 months into treatment)	23 (57.5)	26 (65)	1.52±0.10	1.53±0.09	0.510	0.508
Total	104 (43.3%)					

to perform gingivectomy by either means to create adequate space between gingival margin and the bracket. [11]

According to the findings of our study the mean score of WSLs in Group I was 1.20, which gradually increased after 6 months (1.33) and 12 months (1.52) into treatment. The results were in accordance with the study done by Tufekci E *et al.*[10,14]

The findings of our study showed that there was no significant gender difference associated with white spot lesions, which was contradictory to the studies done by various authors in the past.[10,12-14]

In our study oral hygiene index was not considered which is also a limiting factor as some of the studies have stated that maintenance of oral hygiene status had a strong and significant correlation with the prevalence of white spot lesions. It is well known that poor oral hygiene was an important risk factor in the formation of WSLs. Juliena *et al.* found WSLs in only 17% of patients with good oral hygiene index, compared to 24% with fair and 38% with poor oral hygiene status.[15]

CONCLUSION

This clinical study showed a sharp increase in the number of WSLs during the first 6 months of treatment and was more in maxillary teeth. WSL showed a significant correlation with oral hygiene status of the patient, which should evaluated during the initial months of treatment so that implementation of various measures can be done to prevent demineralization.

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Original Article

Prevalence of Different Types of Removable Dentures in Patients Visiting District Hospital, Kathua, Jammu and Kashmir

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Abstract

Aims and Objectives: The aim of this study was to evaluate the prevalence of different types of removable dentures in elderly population of Jammu.

Materials and Methods: The study was carried out in District Hospital, Kathua, J&K from July 2016 to December 2016. The age range of the subjects was 41 to 70 years. A single examiner clinically examined all the selected subjects.

Results: Majority of the subjects were wearing posterior RPD (57.5%) followed by anterior RPD (12.83%) and conventional over dentures (11%). In the present study a statistically significant association was found for both male and female subjects opting for posterior RPD in all the age ranges. Majority of the males (69%) opting for posterior RPD was found in 60-70 years of age group, whereas majority of the females (57%) wearing posterior RPD were in the age range of 50-60 years.

Conclusion: The prevalence of removable dentures was more among the lower socio economic status group of the society and a trend towards the replacement of posterior teeth was common among the sample size with equal consideration by males and females.

Key words: Edentulism, Overdentures, RPD

INTRODUCTION

Denture is an artificial frame used to replace or rehabilitate the missing teeth and adjacent soft tissues in the oral cavity. It is divided into fixed partial and removable dentures, partial or complete.[1-8] Many studies were conducted on the subjects with Partial edentulism with or without RPD to find their satisfaction with RPDs.[9,10]

Numerous investigations in different developed countries showed the gradually decreasing percentage of adults wearing removable dentures. Epidemiological data vary in different countries.[1–8]

In developed countries, the need for removable partial dentures declined whereas in developing countries their need is still increasing. [11] Also in India, patients with lower socio economic status tend to opt for removable dentures rather than fixed partial denture and implants. Edentulousness varies with the availability and accessibility of dental care.

A significant increase in prevalence of edentulousness is correlated with increasing age.[1–8,11-13] Edentulousness is also dependent on gender.

Lack of motivation and limited finances force the lower class of the country to get compromised dental care by quacks and non-qualified posers. Which often leads to various infections and lesions in the oral cavity including

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the periodontal disease and systemic complications also because of compromised sterilization.

The aim of the study was to evaluate the prevalence of different types of removable dentures in elderly population of Jammu.

MATERIALS AND METHODS

The study was conducted in District Hospital, Kathua, J&K from October 2016 to Sept 2017.

The final sample consisted of 927 subjects. Out of 927 subjects, 600 were selected based on the age range and inclusion criteria and were equally divided into 300 males and 300 females. The age range of the subjects was 41 to 70 years. The presence of different types of removable dentures i.e. anterior RPD, posterior RPD and conventional over dentures (COD) were evaluated from the normal oral examination. The evaluation was performed by a single examiner specialized in prosthetic dentistry. The socio economic status was assessed using modified Kuppuswamy scale. [14]

The association factors like age and gender with the type of removable denture were evaluated using a chi-square test.

RESULTS

The results of the present study showed that majority of the subjects were wearing posterior RPD (57.5%) followed by anterior RPD (12.83%) and conventional over dentures (11%). In the present study a statistically significant association was found for both male and female subjects opting for posterior RPD in all the age ranges. Majority of the males (69%) opting for posterior RPD was found in 61-70 years of age group, whereas majority of the females (57%) wearing posterior RPD were in the age range of 51-60 years.

In the present study the male and female subjects opting for conventional over denture were very few with a maximum of 13 % males in the age range of 41-50 years and 15% females in the age range of 51 -60 years. Similarly in the anterior RPD 19 % male and 21% female subjects were in the age group of 41-50 years. Table 2 showed that majority of the patients in upper lower class and lower class chose removable dentures in comparison to patients of upper and middle class and there is a statistically significant relationship between the socio economic status and selection of removable dentures (p=0.0001) (Tables 1 and 2).

DISCUSSION

The present study was conducted in District Hospital, Kathua, J&K from October 2016 to Sept 2017. The results of the present study showed that the majority of the patients who were wearing removable dentures were of lower socio economic status and more patients were wearing posterior RPD in comparison to the anterior RPD and conventional over dentures. The results were similar in findings reported by Kar S *et al.* They also found that the

Table 1: Age and gender distribution for different types of removable dentures

Age group	Gender	Dentate subjects	Type of removable denture		
			Anterior RPD	Posterior RPD	Conventional overdenture
41-50 years	Male (*n*=100)	17	19	51	13
	Female (*n*=100)	18	21	52	9
51-60 years	Male (*n*=100)	17	9	63	11
	Female (*n*=100)	21	7	57	15
61-70 years	Male (*n*=100)	12	12	69	7
	Female (*n*=100)	27	9	53	11
	Total (*n*=600)	112 (18.66%)	77 (12.83%)	345 (57.5%)	66 (11%)

χ^2=27.950, df=15, χ^2/df=1.86 , $P(\chi^2>27.950) = 0.0219$

Table 2: Selection of removable dentures based on socio economic status

Socio economic status	Number of subjects	Dentate subjects	Type of removable denture		
			Anterior RPD	Posterior RPD	Conventional over denture
Upper class	1	1	0	0	0
Upper middle class	3	3	0	0	0
Lower middle class	46	2	13	21	10
Upper lower class	258	41	61	137	19
Lower class	292	37	76	156	23

χ^2=39.442, P=0.0001

prevalence of over dentures was very low among higher socio economic groups of the society. [15] The findings of our study showed that there was no correlation between the age ranges of the subjects and the prevalence of removable denture types which are in accordance with the studies done by Kar S *et al.* however some studies found that there is increased risk of complications related to complete dentures with increase in age of the patients and removable partial dentures were more durable as a dental replacement for elderly patients. [16,17] The findings of study showed that majority of the males and females were wearing posterior RPD's in comparison to anterior RPD's and over dentures, similarly few of the studies showed that the male gender showed a higher prevalence for anterior and posterior RPD stating the reason that the low education and cultural restrictions of females to undergo dental treatment.

Despite the various advances in dental treatment, the selection for the rehabilitative options depends on the patient's attitudes and socioeconomic status.[18,19]

The limitation of the present study is the limited distribution of area, urban and rural population should have been segregated and considered leading to better results of the study. Further evaluations of different socio economic strata over a wide area of distribution are required.

CONCLUSION

The prevalence of removable dentures was more among the lower socio economic status group of the society and a trend towards the replacement of posterior teeth was common among the sample size with equal consideration by males and females. Affordable fixed prosthodontics treatment should be advocated to enhance the oral health of the particular strata of the society. The unethical and substandard treatment provided by the non- qualified so called posers should be strongly dealt with.

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Case Report

Use of Lateral Cephalometric Analysis in Diagnosing Craniofacial Features in Papillon-Lefevre Syndrome

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Abstract

Knowledge of facial structure is important as an oral physician as our goal is to achieve ideal facial profile with esthetic harmony. Therefore, the understanding of the hard and soft tissue structures is necessary in planning proper management of the patients. This clinical case report of Papillon-Lefevre syndrome is an attempt to illustrate the advantage of specific cephalometric findings for assessing the hard and soft tissue variables in this group of patients that could be significant for diagnosis and proper treatment planning in establishing the esthetic and functional oral rehabilitation of patients affected with this syndrome.

Key words: Bone, Cephalometric analysis, Cephalometry, Craniofacial, Dental, Papillon-Lefevre disease, Radiography

INTRODUCTION

Papillon-Lefevre syndrome (PLS) is an autosomal recessive disorder characterized by palmoplantar hyperkeratosis and rapidly progressive periodontitis, leading to premature loss of both deciduous and permanent teeth.[1,2] Literature often covers the etiological aspect, clinical manifestations, and management options in these patients, but little was found describing specific craniofacial findings and their role in the management of such patients. This article reports a clinical case of PLS laying emphasis on the use of specific cephalometric findings, both for skeletal and soft tissue variables, in diagnosing the significant craniofacial features and to justify their role in the evidence-based management of the patient with this syndrome.

CASE REPORT

A 20-year-old male patient had reported to the outpatient department, complaining of esthetic problems and difficulty in eating due to multiple missing teeth since childhood. Clinical history revealed that patient had an early loss of primary teeth followed by sequential loss of permanent teeth due to excessive mobility by the age of 12-13 years. The patient also gave a history of thickening and scaling of the skin of palms and soles since childhood, which aggravates during the monsoon season. Past medical history was noncontributory. Parents were not of consanguineous marriage, and other family members including siblings were apparently normal.

Extraoral examination revealed that patient had an average facial height with competent lips. Lower lip appears to be everted with deep mentolabial sulcus. Upper lip appears to be retruded. Cutaneous manifestation showed well-demarcated, thickened, dry, and scaly keratotic plaques on the dorsal surface of palms, which undergo crustations, cracking, and deep fissuring. Similar keratotic plaques had also been seen on the feet and the ankle. Ocular examination revealed no abnormality. Intraoral examination revealed partially edentulous maxillary and mandibular arches with interarch distance of 1.2 cm. The gingiva around the teeth was inflamed and swollen while the oral mucosa covering the edentulous area appeared normal (Figure 1). Based on history and clinical examination, a provisional diagnosis of PLS was made.

A panoramic radiograph was obtained which revealed generalized loss of alveolar bone and variable loss of

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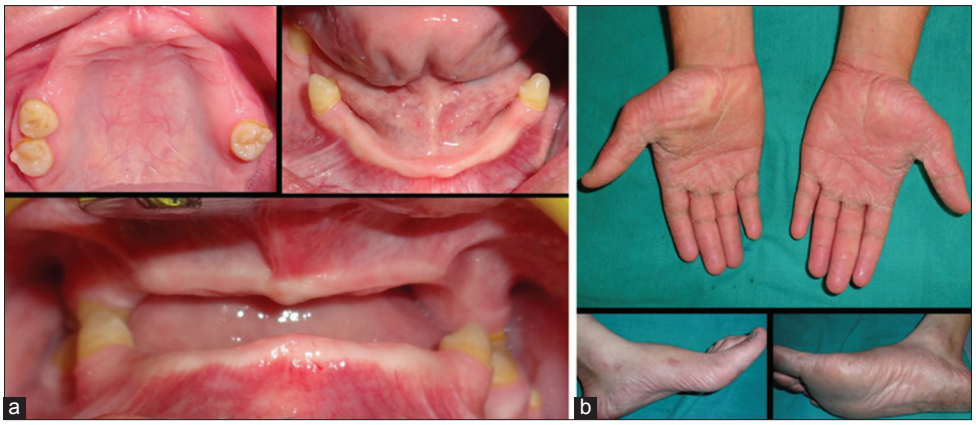

Figure 1: A photograph of the patient diagnosed with Papillon-Lefevre syndrome: (a) Intraoral picture showing partially edentulous maxillary and mandibular arches with decreased interincisal distance; (b) cutaneous features showing hyperkeratotic plaques on the palms and feet

bone support around all the present teeth. To assess the craniofacial features in detail, a lateral cephalometric analysis was advised which showed reduced lower facial height with low Frankfort mandibular plane angle (FMA = 10°). SNA angle and ANB angle appears to be reduced suggestive of the retrognathic maxilla, leading to skeletal Class III profile. NAPog (angle of convexity) measurement showed skeletal concavity reconfirming the Class III skeletal relationship. There was a compensatory increase in the soft tissue thickness noted. Alteration in the soft tissues was evident for upper lip position; it was more retrusive, and nasolabial angle (NLA) was found to be more acute (Figure 2). The lateral skull radiograph showed no evidence of intracranial calcification. Routine laboratory investigations were within normal limits. A microbiologic examination by polymerase chain reaction analysis was normal.

Initially, the patient was kept on amoxicillin (500 mg TDS) and metronidazole (400 mg TDS) for 3 weeks and was advised chlorhexidine mouthwash (0.2%) 2-3 times daily. This was followed by oral prophylaxis and complete oral rehabilitation. Complete oral rehabilitation was planned with implant-supported prosthesis. For implant placement analysis, cone-beam computed tomography was advised which revealed generalized bone loss in the maxilla and variable amount of bone loss in mandible with knife-edge alveolar ridge in the anterior region (Figure 3). Due to inadequate bone height in maxilla and mandible for implant placement and unwilling of patient to undergo for zygomatic implant treatment, prosthetic rehabilitation was planned by giving telescopic crown attached with the denture base (Figure 4). Consultation of a dermatologist was taken for the evaluation of cutaneous manifestations.

On follow-up evaluation, after every 6 months for 3 years, the planned oral rehabilitation treatment was found to be

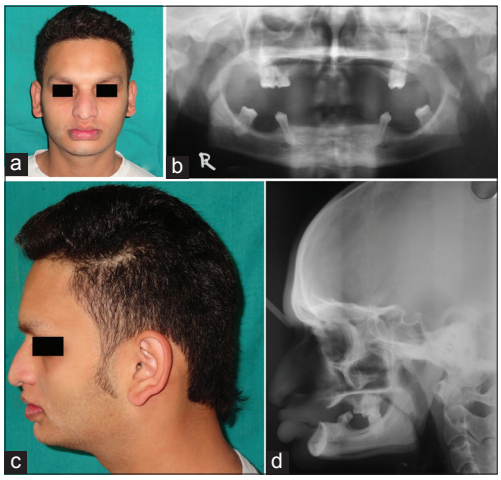

Figure 2: (a) Pre-treatment facial view showing average facial height; (b) pre-treatment panoramic radiograph showing severe loss of alveolar bone; (c) pre-treatment lateral profile view showing retruded upper lip, everted lower lip, and deep mentolabial sulcus; (d) pre-treatment lateral cephalograms showing Class III skeletal relationship, reduced value for upper anterior face height/lower anterior face height, reduced Frankfort mandibular plane angle, SNA and ANB angle, skeletal concavity as evident by NAPog measurement, reduced nasolabial angle, and deep mentolabial sulcus

successful, and the patient facial profile was in good esthetic and functional harmony (Figures 5 and 6).

DISCUSSION

Early diagnosis and management of PLS are quite challenging to the clinicians. The major determinants for the successful rehabilitation of the PLS patients are an early institution of well-planned treatment and compliance with prevention program. A multidisciplinary approach in managing such patient can improve the prognosis and quality of life of the affected individuals.

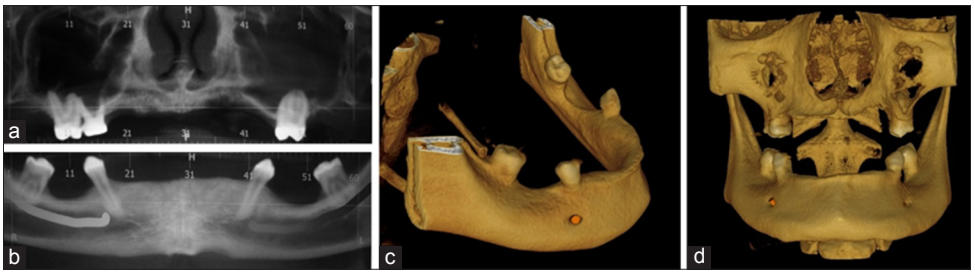

Figure 3 (a) Cone-beam computed tomography image showing generalized bone loss in maxilla; (b) variable amount of bone loss is evident in and around the teeth in mandible; (c) 3D reconstruction image of mandible showing knife-edge alveolar ridge in the anterior region; (d) 3D volumetric reconstruction image of maxilla and mandible

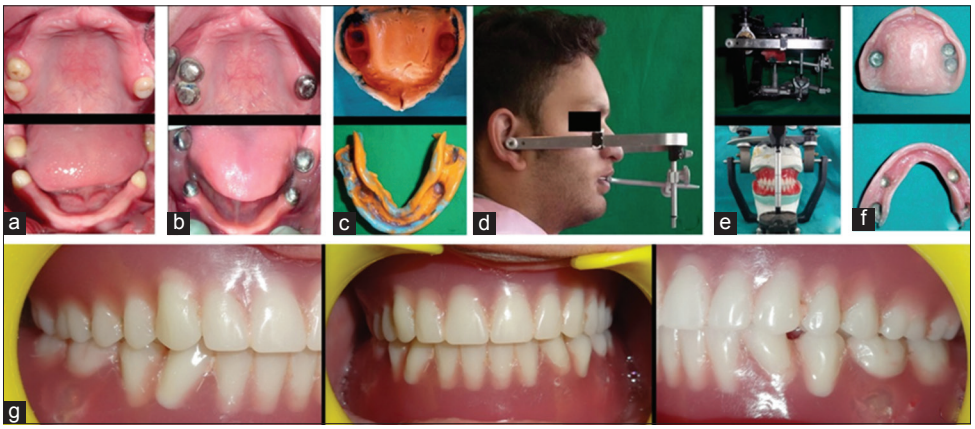

Figure 4: Photograph of the Papillon-Lefevre syndrome patient showing step-by-step complete oral rehabilitation procedure: (a) Preparation of teeth to receive metal copings; (b) primary metal copings; (c) border molding was done with low fusing impression compound in the maxillary arch and with rubber-based putty material in the mandibular arch and final impression was made with the elastomeric impression material; (d) maxillomandibular record was taken using face-bow; (e) transfer of the face-bow record on the articulator; (f) final prosthesis with the secondary copings placed in the denture; (g) intraoral post-operative view after denture placement with the right and left posterior side occlusion

Early loss of the maxillary deciduous dentition is common in patients with PLS.[3] Premature loss of either the deciduous or the permanent teeth will cause loss of alveolar bone in both the vertical and horizontal dimensions.[4] Bindayel *et al.,*[4] in their study analyzed lateral cephalograms of eight PLS patients for both hard- and soft-tissue variables and revealed significantly altered values for FMA, ANB, SNA, NAPog (angle of convexity), and nasolabial (NLA) angle. They suggested that many patients with PLS develop a Class III relationship. This is in agreement with the study by Al-Khenaizan,[5] which also reported that patients with PLS have the characteristics of skeletal Class III malocclusion. In the present case also, the patient has a Class III skeletal profile.

Class III skeletal relationship in PLS patient is mainly attributed to retrognathic and hypoplastic maxilla rather than prognathic mandible. This has been revealed by the measurement of SNA and ANB angle.[4] SNA angle is the angle formed by the intersection of S.N. Plane and a line joining nasion and point A, which indicates the relative anteroposterior positioning of the maxilla in relation to the cranial base. A larger than normal value indicates that the maxilla is prognathic (Class II) while the smaller value is suggestive of the retrognathic maxilla (Class III). ANB angle is formed by the intersection of lines joining nasion to point A and nasion to point B, which denotes the relative position of the maxilla and mandible to each other. An increase in this angle is indicative of Class II skeletal tendency while an angle that is less than normal or a negative angle is suggestive of a skeletal Class III relationship.[6] In our case, SNA and ANB angle is found to be reduced, suggestive of Class III skeletal relationship.

PLS patients also showed decreased lower facial height, mainly because of posterior (clockwise) inclination of the maxilla. This is evident by the ratio of upper anterior face height (UAFH) to the lower anterior face height (LAFH).[4] UAFH is the linear measurement from nasion to anterior nasal spine, while LAFH is the linear measurement from anterior nasal spine to menton.[6] The ratio of UAFH to LAFH is more significant than the individual measurement of UAFH and LAFH because UAFH varies with the superior-inferior dimension of the size of an adult skull while the ratio of UAFH/LAFH indicates the balance of facial proportions. UAFH/LAFH ratio <0.8 indicates

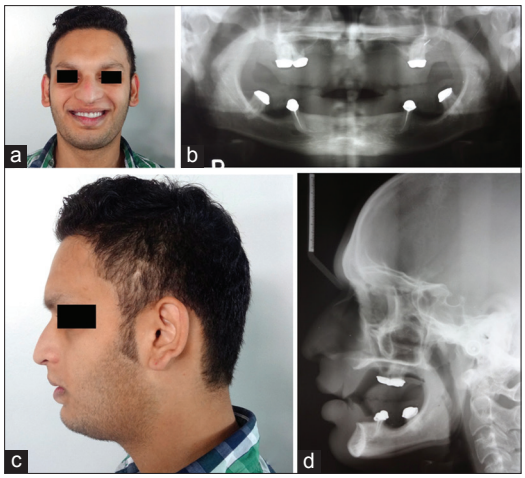

Figure 5: (a) Post-treatment facial view; (b) post-treatment panoramic radiograph; (c) post-treatment lateral profile view; (d) post-treatment lateral cephalograms. All showing improvement in the facial esthetics and functional rehabilitation of patient

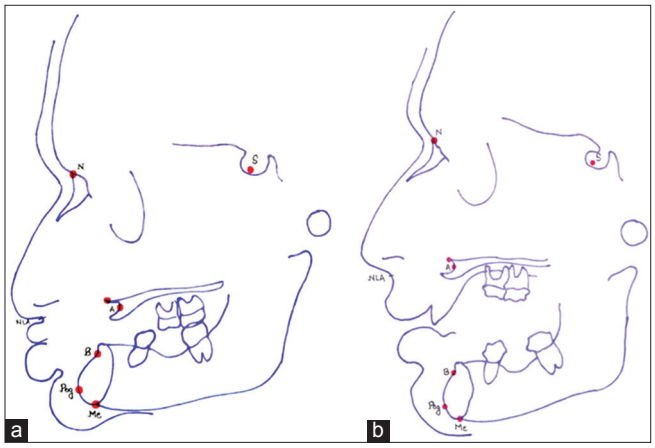

Figure 6: Tracing of relevant cephalometric landmarks: (a) Pre-treatment cephalometric tracing; (b) post-treatment cephalometric tracing. Landmarks depicted on cephalometric tracing – N: Nasion; Point A; Point B; Pog: Pogonion; Me: Menton; NLA: Nasolabial angle; SNA angle: Intersection of S-N plane and a line joining nasion and point A; ANB angle: Intersection of lines joining nasion to point A and nasion to point B; upper anterior face height (UAFH) - linear measurement from nasion to anterior nasal spine (N-ANS); lower anterior face height (LAFH) - linear measurement from anterior nasal spine to menton (ANS-Me); angle of convexity (NAPog) - intersection of a line from nasion to point A and a line from point A to pogonion; nasolabial angle (NLA) - formed between the lower border of the nose and a line connecting the intersection of nose and upper lip with the tip of the lip (labrale superius)

a greater LAFH, or longer LAFH, while UAFH/LAFH ratio >0.8 indicates a smaller LAFH or shorter LAFH. Due to decreased lower facial height, the FMA angle is also reduced.

Another parameter to be assessed is the angle of convexity, which reveals the convexity or concavity of the skeletal profile. It is formed by the intersection of a line from nasion to point A and a line from point A to pogonion (NAPog). A positive angle or an increased angle suggests a prominent maxillary denture base relative to the mandible. A decreased angle of convexity or a negative angle is indicative of a prognathic profile.[7] In our case, NAPog measurement showed skeletal concavity reconfirming the Class III skeletal relationship. Due to this, the mandibular incisors, if present, tend to be retroclined as a dental compensation for maxillary retrognathism.[4]

Soft tissue evaluation should be taken into consideration in such patients during treatment planning.[8,9] A frequently used soft tissue parameter is the NLA.[10] The NLA is representative of soft tissue profile and remains an excellent clinical and cephalometric parameter to reveal the anteroposterior position of the maxilla and skeletal malocclusions.[11] NLA is the angle formed between the lower border of the nose and a line connecting the intersection of the nose and upper lip with the tip of the lip (labrale superius). Increased NLA reflects a maxillary retrusion or retroclined maxillary anterior and decreased NLA reflects a prognathic maxilla or proclined upper anteriors.[12] It has been suggested that a relatively small NLA adds to the Class III characteristics of affected patients.[4] Another soft tissue parameter is the evaluation of mentolabial sulcus, which represents the concavity below the lower lip.[12] In our case, NLA was found to be more acute indicating maxillary retrusion with deep mentolabial sulcus.

Early diagnosis and well-planned treatment protocol of Class III malocclusion is recommended for PLS patients to achieve normal maxillary growth, to prevent traumatic occlusion of the anterior teeth, and to improve the patient's facial profile.[13] Orthodontic correction is a documented approach in the literature for early correction of mild skeletal Class III discrepancy.[14,15] Moreover, this typically requires stable and healthy dental and periodontal tissues. For those with PLS, rapid periodontal breakdown could result in loss of some of the dentition. However, the literature shows that that orthodontic treatment combined with an antibiotic regimen can successfully control the periodontal signs of PLS and result in the maintenance of a healthy dentition.[16-19] In our case also, the patient was initially kept on prophylactic antibiotics followed by complete oral prophylaxis.

Furthermore, implant therapy has proved to be successful in these patients.[20] Dental implants offered better stability and retention of prosthesis, improved comfort and masticatory efficiency, and also the improved esthetics. According to Dhanrajani,[1] the use of implants in patients with severe periodontitis has been reported, and the results indicate that periodontally compromised patients can be

successfully treated with implants. However, in the present case, because of the severity of the skeletal discrepancies and the unavailability of adequate bone height and also, the strict regimen required to maintain a healthy dentition, orthognathic surgery followed by zygomatic implant might be a treatment alternative for this patient. However, as patient was not willing for such surgical intervention, prosthetic oral rehabilitation with telescopic crown attached with the denture base was planned.

Continuous monitoring and frequent recall appointments have shown to minimize the further periodontal deterioration.

CONCLUSION

In summary, it appears reasonable to conclude that a stepwise management protocol should be followed in patient with PLS to prevent further bone loss and to maintain the structural integrity of orofacial musculature. Cephalometric analysis is proven to be a valid diagnostic option with significant clinical benefits in treatment planning of patient with PLS; this not only improves the esthetics but also help in functional oral rehabilitation of the patient. We hope that this clinical case study may serve as a guide for further future case studies with larger representative sample to confirm our findings and to justify an evidence-based management protocol.

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Case Report

Class II Correction using Combined Twin Block and Fixed Orthodontic Appliances: A Case Report

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Abstract

The following case report presents an effective orthodontic treatment for an eleven year old male who reported with mild Skeletal Class II jaw base, Class II division 1 incisors, with an increased overbite and overjet of 10mm along with mild crowding in upper and lower arches. A two phase treatment was planned. Phase 1 comprised growth modification with modified Clark's twin block appliance followed by Phase 2 of fixed orthodontic treatment with MBT appliance. A good static and functional occlusion was achieved with Class I molar relation on both sides along with improved facial profile.

Keywords: Modified Clark's twin block, Class II division 1, Mandibular retrusion, Functional appliance

INTRODUCTION

Class II malocclusion is the most commonly occurring orthodontic problem.[1] It is characterized by a dental antero-posterior discrepancy often combined with a skeletal problem which may be due to mandibular retrognathism, or maxillary protrusion or a combination of both. According to McNamara, retrusion of the mandible is the most commonly occurring factor contributing to Class II malocclusion.[2] Thus treatment approaches in such patients are aimed at altering the amount and direction of mandibular growth. Many functional appliances are available that help in mandibular growth by forward posturing of the mandible to correct the skeletal disharmony.

The twin block appliances are simple, comfortable and esthetically acceptable to the patient. It was developed by Dr. William Clark in 1977. The basic philosophy behind the twin block appliance are the occlusal inclined planes that act as a guiding mechanism causing the mandible to be displaced downward and forward. Twin blocks have the advantage of versatility of design.[3] The design can be adapted to resolve different type of malocclusions in individuals.

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CASE REPORT

An 11 year old medically fit Caucasian male reported with the chiefcomplaint of stuck out upper front teeth and presented a Class II division 1 incisor relationship on a mild skeletal Class II jaw base with reduced vertical proportions, further complicated by overjet of 10mm, increased and incomplete overbite and mild crowding in upper and lower arches. The IOTN classification for the malocclusion was 5.a.

In clinical examination, extra oral assessment revealed that the patient had a mild skeletal II base due to retrognathic mandible with reduced Frankfort-mandibular planes angle and lower anterior face height.

Figure 1: Pre Treatment Extraoral Photographs

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Figure 2: Pre Treatment Intraoral Photographs

Soft tissue assessment revealed lip incompetency and lower lip trap with an incisal display of 3 mm at rest, an obtuse nasiolabial angle and deep labiomental fold (Figure 1). Intra- oral assessment revealed that the patient had mixed dentition with mild gingivitis, mild crowding in upper and lower arches, proclined upper incisors and retroclined lower incisors (Figure 2). The cephalometric analysis supported the clinical finding of mild skeletal class II pattern with proclined upper incisors and retroclined lower incisors.

Treatment Plan

The treatment was aimed at improving the facial profile by managing antero-posterior and vertical discrepancies and achieving Class I incisors,molar and canine relationship. A two phase orthodontic treatment was planned.

Phase 1 included growth modification using a modified Clark's twin block functional appliance. The upper appliance consisted of Adam's clasp (fabricated with 0.7mm SS wire) on first molars and premolars, upper labial bow (0.7mm SS wire) and posterior bite blocks with 70° inclination. The lower appliance included Adam's clasps on first molars and premolars (0.7mm SS), posterior bite blocks (70° inclination) and acrylic capping in the lower labial segment (Figure 3). The appliance was worn full time for 9 months followed by part time wear to allow settling of the occlusion (Figure 4).

Phase 2 comprised of fixed mechanotherapy with upper and lower Pre-adjusted Edgewise appliances (0.022" x 0.028" slot, with a MBT prescription) on a non-extraction basis (Figure 5).

Figure 3: Phase 1 appliance therapy: Modified Clark's twin block appliance

Figure 4: Post functional Intra Oral Photographs

Treatment Result

The results indicated improvement in both dental and skeletal parameters. At the end of the treatment, the overjet was reduced from 10 mm to 3 mm, overbite was improved and good Class I molar relation was achieved on both right

Figure 5: Phase 2 fixed appliance therapy

Figure 6: Post treatment Extraoral Photographs

Figure 7: Post treatment Intraoral Photographs

and left side (Figures 6 and 7). The ANB angle was reduced improving the patient's facial profile. Growth modification with use of functional appliance proclined the lower incisors by 2° to the mandibular plane. The upper incisors inclination reduced to 113°.The lower lip trap was eliminated due to favourable vertical and anteroposteriorgrowth with the lips being competent at the end of treatment.Overall, a good static and functional occlusal result was achieved and no change in root length (Figures 7, 8 and 9).

DISCUSSION

A modified Clark's twin block appliance was chosen for growth modification which had Adam's clasp on both

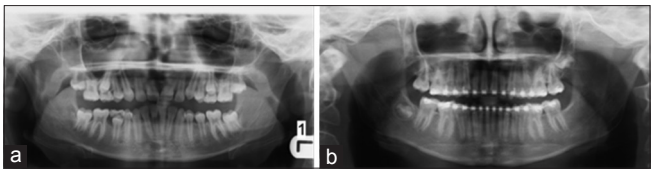

Figure 8: OPG. (a) Pre Treatment, (b) Near End

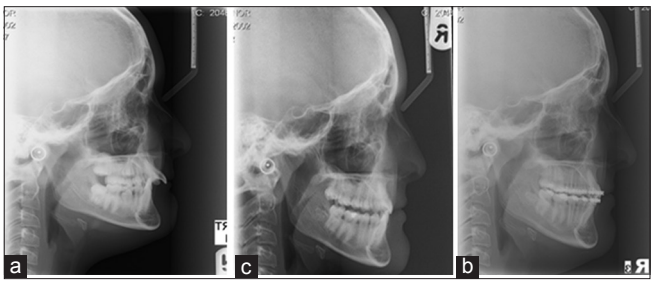

Figure 9: Lateral Cephalogram. (a) Pre Treatment, (b) Post Functional, (c) Near End

Figure 10: Retention: Upper and lower removable vacuum formed retainers to be worn full time for 6 months followed by 6 months of night time wear

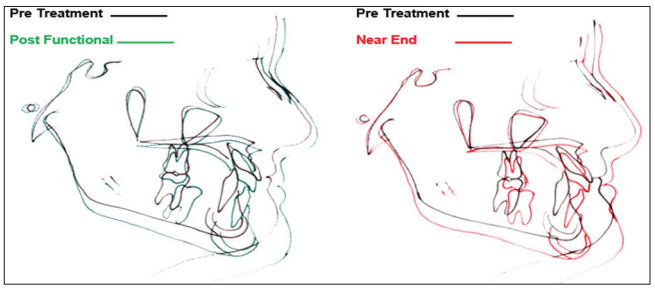

Figure 11: Cephalometric superimpositions. Overall superimposition, registered on De Costers line

upper and lower first premolars and first molars for better retention.A labial bow was placed on the upper incisors to correct the inclination of the upper incisors. It also aided the insertion of the appliance.Followingantero-posterior correction, the appliance was worn on a night time basis to allow buccal settling and close of the lateral open bites.

Growth modification favoured the antero-posterior and vertical skeletal growth thereby improving the skeletal

Class II pattern, and providing dentoalveolar changes to correct the molar relation and reduce the overjet and overbite. A good aesthetic and occlusal result was achieved as reflected by the PAR score (Table 1).

The overall superimposition indicates a normal growth pattern of the craniofacial complex in a downward and forward direction (Figure 11). Cephalometric analysis revealed that sagittal correction was achieved due to an anterior repositioning of B point. Vertical skeletal growth continued throughout treatment which helped reduction in overbite.

The ANB was reduced by 1°, indicating favourable growth of mandible which resulted in reduction of the antero-posterior skeletal discrepancy. This was confirmed by the reduction in the wits analysis to 0mm. The upper incisors were retroclined but the increased palatal root torque in MBT bracket (-17°) helps counteract post functional incisor retroclination. The lower incisors got slightly proclined but still within the normal value (Table 2).

Lund and Sandler[4] in their study of 36 subjects treated with twin block appliance reported an increase in mandibular length, increase in SNB angle and decrease in ANB angle. The skeletal results were in agreement with another study done by Mills and McCulloch on 28 subjects treated by twin block appliance. However, Lund and Sandler reported a mean maxillary incisor retroclination of11.0° as compared with 2.5° of retraction in the later study.[5] This difference may be due to the use of labial bow in upper portion of the twin block appliance by Lund and Sandler. In this case, since an upper labial bow was used, there was a maxillary incisor retroclination of 12° and a lower incisor proclination of 6° as acrylic capping of the lower incisors was done. The Lund and Sandler group experienced slightly more proclination of lower incisors i.e. 8.2° as compared to 5.2° proclination in Mills and McCulloch group.[4,5] This happened because in the later study an acrylic labial bow on lower incisors was used for retention purpose.

A long term retention using vacuum formed Essix retainers was given (Figure 10). The prognosis for stability is good provided that the patient complies with the retention regime.

Table 1: Occlusal indices

Index	Parameter	Value
Index of treatment need (IOTN)		
Dental health component	Start	5.a
	Finish	1
Aesthetic component	Start	10
	Finish	1
Peer assessment rating (PAR)		
	Start	17
	Finish	2
	Change	15
	% Change	88%

Table 2: Cephalometric values

Variable	Pre-treatment	Post-functional	Post-treatment	Change
SNA	80°	80°	80°	0°
SNB	77°	78°	78°	1°
ANB	3°	2°	2°	−1°
Eastman correction ANB	4°	3°	3°	−1°
SN to maxillary plane	7°	8°	8°	1°
Wits appraisal	3 mm	0 mm	0 mm	−3 mm
Upper incisor to maxillary plane angle	127°	113°	115°	−12°
Lower incisor to mandibular plane angle	82°	84°	88°	6°
Interincisal angle	133°	140°	136°	3°
MM angle	19°	23°	23°	4°
Upper anterior face height	45 mm	45 mm	47 mm	2 mm
Lower anterior face height	45 mm	50 mm	51 mm	6 mm
Face height ratio	50%	52%	53%	3.0 %
Edge centroid relationship	−2 mm	2 mm	2 mm	+4 mm
Lower incisor to APo line	−4 mm	−2 mm	−1 mm	3 mm
Lower lip to Ricketts E Plane	−6 mm	−4 mm	−3 mm	3 mm

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