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Original Article

Dental Caries and its Correlation with Dermatoglyphics, Cheiloscopy, Blood Grouping, and Diet – An *In Vivo* Study

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Abstract

Introduction: Dental caries is a convoluted, chronic, and multifactorial disease and has high prevalence worldwide. The correlative roles of heredity and environment in the development of dental caries have intrigued scientific researchers. Early detection of susceptibility of dental caries by studying its genetic basis by effectively utilizing non-invasive, less expensive, and effective tools is gaining popularity.

Aim: The main aim of this study is to assess the relationship between dermatoglyphic patterns, lip prints, blood group typing, diet, and dental caries.

Methodology: Five hundred participants of age 18–60 years were included in the study. The demographic data were obtained. Caries experience was assessed by Decayed, Missing, and Filled teeth (index), finger prints were recorded and analyzed by Cummins method. Lip prints were recorded and analyzed by tsuchihashi's method, blood grouping was done using slide agglutination method and 24 h diet chart was recorded and sweet score was calculated. The data obtained were subjected to statistical analysis.

Results: The incidence of dental caries was high in individuals with whorl pattern, intersecting lip patterns, O blood group, and with good sweet score.

Conclusion: Dermatoglyphics, Cheiloscopy, and blood group typing diet are non-invasive, inexpensive, and effective tools for predicting dental caries. This early detection can help in anticipation of oral health diseases and help to adopt preventive methods at a younger age.

Key words: Blood grouping, Cheiloscopy, Dental caries, Dermatoglyphic patterns, Diet

INTRODUCTION

Dental caries is a highly prevalent disease worldwide. Its etiology is multi-factorial and occurs due to the interaction of certain dependent factors, such as host, agent, and environment.[1] Demineralization of tooth structures is predominant in individuals with high caries risk and is strongly influenced by saliva's pH. Despite many factors, the correlation between true genetic predisposition and dental caries has piqued the minds of investigators for decades.[1-3]

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Dermatoglyphics is one such genetic parameter used to estimate the caries of an individual subjectively. It refers to unique patterns of epidermal ridges on the palmar of hands and the plantar surfaces of feet.[4,5] The role of dermatoglyphics in preventing and identifying diseases such as intrauterine anomalies, breast carcinoma, and Type I diabetes mellitus has been extensively studied. The unique correlation between dental caries and dermatoglyphics can be attributed to the fact that both the development of epidermal ridges and tooth development occur at the same

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time. As the genetic data are interrelated, this is a possibility to reflect the disturbances of each other.[5-7]

The characteristic patterns and grooves on the labial mucosa, termed lip prints, are unique to every individual. Cheiloscopy, which is the study of lip prints, has the potential to be used as a valuable tool in forensic individual identification.[1] Studies have emphasized that lip prints even recover after trauma, infections like herpes, and they are not dependent on environmental factors.[8]

The ABO blood-typing system is a commonly employed method and also has a role in detecting many genetic and immunological characteristics of the body.[9] Rolla *et al*. have reported that acquired pellicle-containing glycoproteins correlate with blood group activity. An acquired pellicle is a precursor of plaque formation and dental caries. This has piqued the minds of several investigators to determine the correlation between dental caries and blood group. The secretion of ABO antigens into saliva interacts with salivary IgA and prevents dental caries by inhibiting the adherence of bacteria to the tooth structure.[10]

Sugar consumption is a critical risk factor for dental caries, despite the advances in fluorides. Free sugars in the form of sucrose, glucose, fructose, lactose, maltose, and starch are considered potent etiological factors for caries occurrence. The World Health Organization (WHO) recommends that children and adults should restrict their intake of free sugars to <5% to reduce the risk of dental caries.[11,12]

Aim

The purpose of the present study was to assess the correlation between dermatoglyphics, cheiloscopy, blood grouping, diet, and dental caries.

METHODOLOGY

Study Design

Five hundred patients who reported to the Department of Conservative Dentistry and Endodontics at Mamata Dental College, Khammam, were screened; 235 were female and 65 were male. The study was conducted after obtaining ethical clearance from the institutional ethical committee with reference number MDC_R_088436, and informed consent was obtained from every participant.

Individuals under the age group of 18–60 years and with systemic diseases such as diabetes mellitus, cardiovascular diseases, and respiratory diseases were included in the study, and individuals with developmental anomalies, trauma, and any pathology on lips and fingers who are not willing to give their consent and are allergic to ink and lipstick were excluded from this study.

A data form with demographic data, systemic diseases, decayed missing filled teeth (DMFT) index, thumbprint, blood group, lip prints, and informed consent was designed.

Evaluation of the Caries Experience

Caries experience (DMFT index) was recorded under light using a mouth mirror, Shepherd crook probe (No. 23), and probe No.17. The caries risk assessment was evaluated according to the WHO Oral Health Survey.

The average DMFT was calculated using the total DMFT of the total number of subjects examined. The mean caries risk assessment was done using the WHO Ginebra 1986 classification.

Recording of Thumbprints

The subject thumbs were thoroughly cleaned using spirit and allowed to dry. The fingers were firmly pressed against the ink pad and then against the data form [Figure 1]. The dermatoglyphic pattern was determined through evaluation of the thumbprints by the Cummins method of Fingerprint identification [Figure 1] using a magnified glass.

Recording of Lip Prints

The lips of the subjects were cleaned, and lipstick was applied evenly over the vermillion border of the lips using a cotton swab. The glued portion of the cellophane tape was placed to record the lip prints in the normal rest position by dabbing the cellophane tape in the center first, followed by the corners of the lips. The cellophane strip was then placed onto the data form [Figure 2] and analyzed by Tsuchihashi's classification [Figure 2] using a magnifying glass.

Evaluation of Blood Grouping

For determining ABO grouping, the capillary blood from the subjects was drawn by a prick on the ring finger. A drop of blood was immediately placed on each slide, respectively, followed by the addition of antisera A and antisera B to each slide, agitated, and evaluated for agglutination. The blood group determination was done using the slide agglutination method [Figure 3].

Recording the Diet Chart

A 24-h diet chart was recorded from the subjects, which included type of food intake, frequency, and time of food intake (during or in between meals), and the sweet score was calculated using the Nizel R. Papas 24-h diet record method.

Statistical Analysis

The data obtained were tabulated and statistically analyzed using SPSS software version 20.0 (Version 20.0; SPSS Inc.),

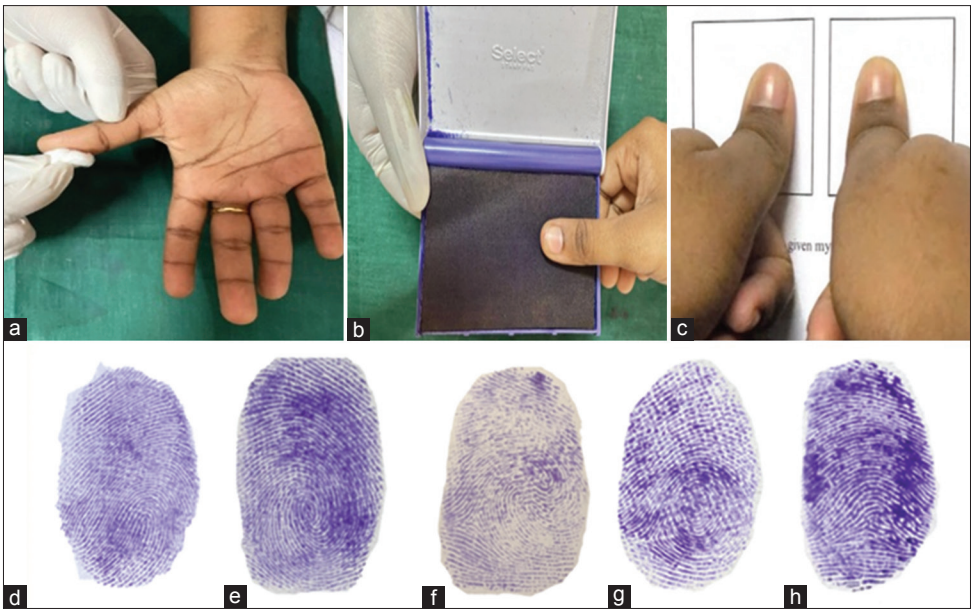


Figure 1: (a-c) Method of thumbprint recording. Thumb patterns - (d) Loop (e) Whorl (f) Twinned loop (g) Central pocket (h) Arch type

Figure 2: Method of lip prints recording Tsuchihashi's classification of lip prints

Comparisons between age, gender, and other parameters (DMFT index, fingerprints, lip prints, blood groups, diet) were done using the Mann–Whitney U test. Comparison between the parameters was done using Kruskal–Wallis analysis of variance (ANOVA) and two-way ANOVA tests. $P < 0.05$ was considered statistically significant.

RESULTS

The results revealed that among all the participants the loop pattern has the highest frequency, followed by the whorl pattern and the arch pattern. The highest mean of dental caries is in a whorl pattern, followed by a loop, an arch, a

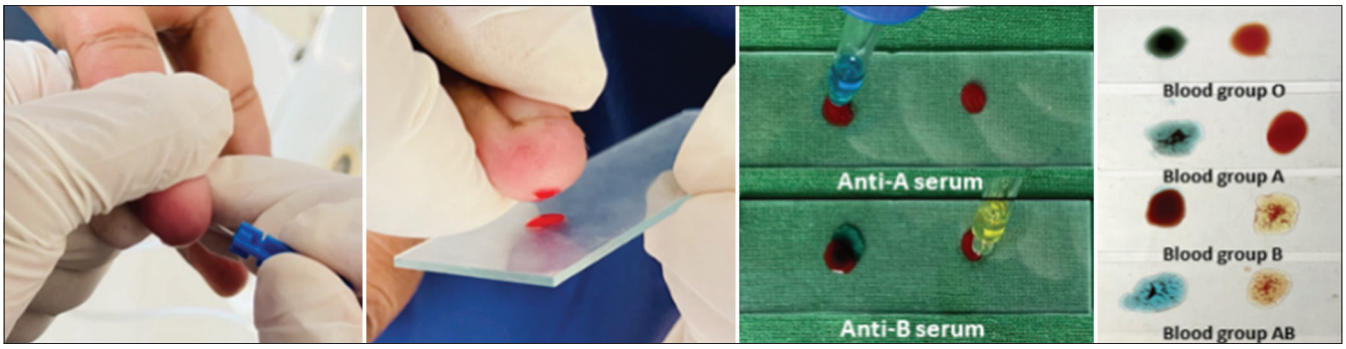


Figure 3: Method of blood typing by slide agglutination method

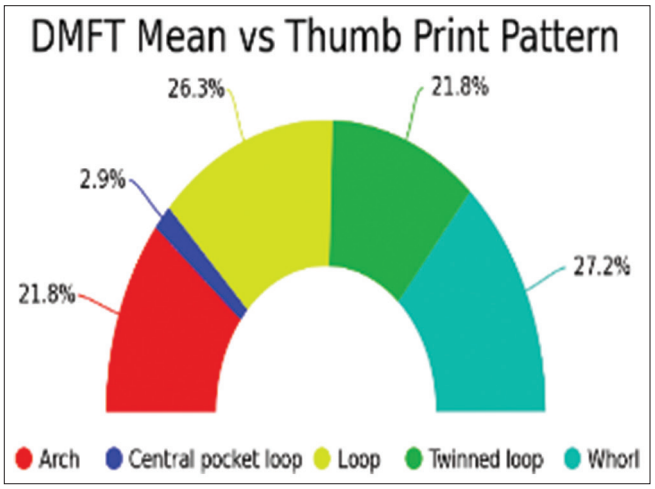
twinned loop, and a central pocket loop, respectively. There is no statistical significance between the arch and twinned loop patterns [Graph 1].

The correlation of dental caries and lip print revealed that among all the participants, the highest frequency was reported with branched patterns, followed by intersecting, vertical, reticular, and undetermined patterns. The highest mean of dental caries was in the intersecting pattern, followed by branched, vertical, reticular, and undetermined patterns, respectively. There is no statistical significance between the intersecting and branched patterns [Graph 2].

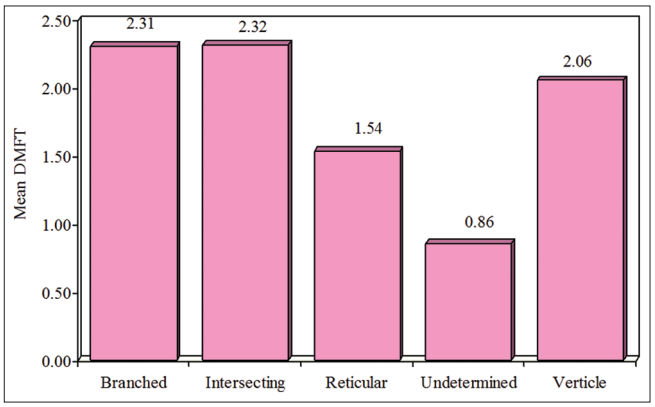
The correlation of dental caries and blood grouping revealed that among all the participants, the highest frequency was reported with the O blood group, followed by the B blood group. The highest mean dental caries was found in individuals with O blood group, followed by A, B and AB respectively. There was no statistical significance between the A and AB blood groups [Graph 3].

The correlation of dental caries and diet revealed that among all the participants, the highest frequency was reported with the excellent, good, and watch-out zones. The highest mean of dental caries was in the good zone, followed by the watch-out and excellent zones, respectively. There is no statistical significance between the good and watch-out zones [Graph 4].

By correlating dental caries with dermatoglyphics, cheiloscopy, blood grouping, and diet, it can be inferred that individuals with whorl thumb patterns, intersecting lip patterns, with an O blood group, and under a good and watch-out zone of diet are at high risk of genetic susceptibility to caries.



Graph 1: Correlation between thumb prints and dental caries

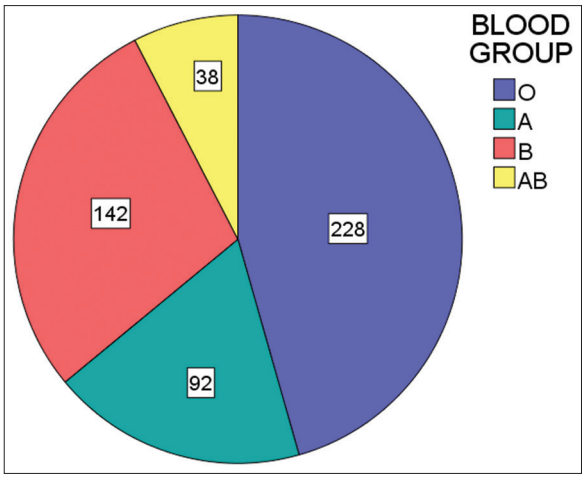


Graph 2: Correlation between lip patterns and dental caries

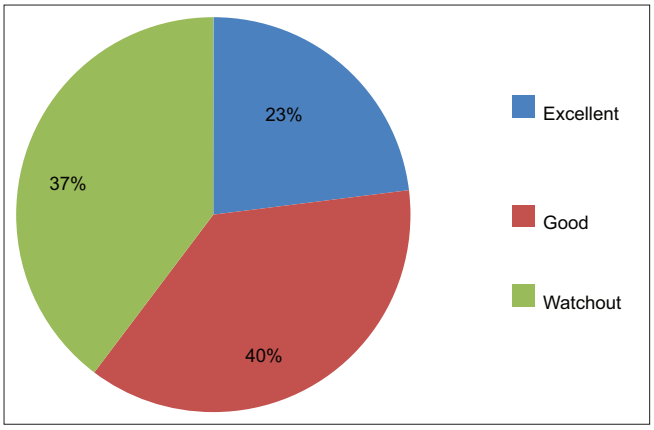
DISCUSSION

Dental caries is a chronic, complex disease of the mineralized tissues of teeth attributed to a multifactorial etiology that includes diet, genetic, host, and environmental factors. Although there is a fascinating approach to the genetic predisposition of dental caries by clinical and fundamental researchers. It is critical to analyze the genetic and environmental correlation of dental caries to anticipate and prevent the occurrence of dental caries.[4,13] Hence, the correlation of dental caries was done with fingerprints, lip-prints, blood grouping, and diet, which dictates the multi-factorial causation.

Fingerprints act as valuable physical markers for identifying deceased individuals. The dermatoglyphic patterns as



Graph 3: Correlation between blood group typing and dental caries



Graph 4: Correlation between diet and dental caries

a factor in the genetic predisposition of dental caries have intrigued various researchers for decades.[14,15] The epidermal ridges of the fingers and palms, as well as the facial structures such as the lip, alveolus, teeth, and palate, are formed from the same embryonic tissues (ectoderm) during the same embryonic period.[1]

Fingerprints in the present study were analyzed using the Cummins method. Data were obtained by the method used by Atasu and Somani, that is, the ink method (black duplicating printing ink). The highest number of respondents was in a loop pattern, and the highest caries incidence was seen in a whorl pattern, which was in accordance with Abhilash *et al.* Among the systemic diseases, the highest number of respondents was in a loop pattern, and a higher caries incidence was seen in a whorl pattern.

The use of lip prints is not so popular but exists as a methodology in forensic science. The grooves present on the human lips are unique to each person and can be used to determine identity. Studying in depth and establishing further facts and truths in lip print will certainly help us as useful evidence in forensic science.[16]

Based on lip print patterns, the highest number of respondents was in the branched pattern, and the higher incidence of caries was seen in the intersecting pattern, which was in accordance with the study done by Tsuchihashi *et al.* Among the systemic diseases, the highest number of respondents and high caries incidence was in an intersecting pattern.

Landsteiner categorized blood groups into four. The ABO gene, which is found on the long arm of the 9th chromosome, regulates blood types.[17] Jan *et al.* have stated that sugars and other fermentable carbohydrates have a role in the start of dental caries. ABO blood-type antigens are copiously produced by the submaxillary-sublingual salivary glands and extensively distributed in human saliva.[18]

Mondal *et al*., and Agrawal *et al*., have found the distribution of ABO blood groups in various populations as O>A>B>AB, with O being the most prevalent blood group, which is in accordance with our study. Mangal and Preetha, Mazumdar *et al*., have found that the O blood group had a higher DMFT score compared to other groups.[19] This result is in accordance with the findings of our study that the O blood group has a higher caries prevalence.

Dental caries were more prevalent in blood group O, followed by B, A, and AB. Females constituted about 47.08% and males 52.91%. The mean DMFT score was lower for males when compared with females in the present study.

Based on diet scores, the highest number of respondents were in the watch-out group, and the high caries incidence was seen in a good zone, which was in accordance to a study done by Feldens *et al*., Danforth *et al*., and Larsen.[20]

CONCLUSION

Dermatoglyphics, cheiloscopy, blood group typing, and diet are non-invasive, inexpensive, and practical tools for predicting dental caries. This early detection can help in anticipation of oral health diseases and help to adopt preventive methods at a younger age. However, it can be used only as an additional tool; still, further large-scale extensive research and studies should be undertaken.

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