

# Comparative Evaluation of Pre-operative Thickness of Keratinized Soft Tissue with the Changes in the Level of Hard Tissue in Relation to Implant Platform within 6 Months after the Implant Placement

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## Abstract

**Context:** The primary goal of the implant placement is maintenance of stable connection between the bone and the implant. There is controversy in literature whether thickness of soft tissue around dental implants has any role in stabilization of the hard tissue around implant.

**Aims:** The study aims to evaluate and compare pre-operative thickness of keratinized soft tissue with the changes in the level of hard tissue in relation to implant platform within 6 months after the implant placement.

**Materials and Methods:** About 15 patients were selected with missing single tooth. Transgingival probing was done to evaluate pre-operative thickness of keratinized soft tissue. Using cone beam computed tomography (CBCT) implant was planned and placed. CBCT was taken immediately after implant placement and hard tissue levels around implant were measured. After 6 months, thickness of keratinized soft tissue was measured on implanted tooth and CBCT was taken to measure the hard tissue levels around implant.

**Statistical Analysis Used:** IBM Statistical Package for the Social Sciences statistical software 20.0 was used for the analysis.

**Results:** Significant reduction in the keratinized soft tissue thickness and highly significant reduction in level of hard tissue 6 months postoperatively. No significant correlation was found between pre-operative thicknesses of keratinized soft tissue with changes in level of hard tissue in relation to implant platform 6 months after implant placement.

**Conclusions:** There was reduction in level of keratinized soft tissue and in level of hard tissue around implant within 6 months after placement of the implant. However, there was no correlation found between soft and hard tissue changes.

**Key words:** Cone beam computed tomography, Dental implants, Hard tissue levels, Soft tissue thickness, Transgingival probing

## INTRODUCTION

Primary goal of implant installation is osseointegration.<sup>[1]</sup> It has been suggested that good amount of keratinized

soft tissue is the pre-requisite for stable hard tissue around implant. One among all influencing factors for initial crestal bone loss is the biotype of soft tissue. To cover the interdental bone, soft tissue surgery can be done. Although, there is still controversy in literature if soft tissue augmentation around implants is needed to be performed to obtain added band of keratinized tissue. Few studies have attempted to evaluate direct co-relation of thickness of keratinized soft tissue with crestal bone loss, so the aim is to evaluate changes and co-relation in thickness of keratinized soft tissue and hard tissue following implant placement during the initial healing period of 6 months.

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## MATERIALS AND METHODS

All the individuals visiting outpatient department (OPD) of Periodontology department were subjected to clinical examination by following all the personal protective protocol. Subjects volunteering in this study were checked for all the criterion.

The inclusion criterion are presence of healed bone sites (at least 4 months after tooth extraction), no bone augmentation procedures before or during implant placement, Subjects with healthy periodontal status, Age group: 20–40 years, Subjects with minimum alveolar bone height of 11 mm above inferior alveolar canal as estimated by cone beam computed tomography (CBCT), Subjects with minimum crestal bone width of 5.5 mm as estimated by CBCT, Subjects with 5 mm of minimum interocclusal space were considered, Subjects with mesio distal edentulous space >6.5 mm were considered. The exclusion criterion were subjects with history of systemic diseases, Subjects with oral habit of smoking and smokeless tobacco, Subjects with periodontal diseases, Subjects who had undergone surgical intervention 6 months before the start of study, subjects who are on systemic or topical medication or had taken medications in the past 6 months, poorly motivated or subject unable to come for follow-up, Irradiation in implant area, subjects with poor oral hygiene maintenance.

A total of 15 subjects were selected from the OPD in Postgraduate clinic of Department of Periodontology. Written informed consent was provided for participation and permission was taken to use data for research. Placement of implant was planned after the clinical and CBCT evaluation. Proper measurements were taken from the CBCT for evaluation of placement of the implant in given space. Bone quantity was measured to ensure that an implant at least 9 mm in length could be placed without bone augmentation. Transgingival probing was done to measure the pre-operative thickness of keratinized soft tissue on the mid-buccal region of edentulous area. Measurements were carried out with calibrated University of North Carolina (UNC) 15 periodontal probe. After local anesthesia was secured, the thickness of keratinized soft tissue was calculated with the help of periodontal probe (UNC-15) in millimetres till osseous tissue was felt. The tooth adjacent to the operative site was used as a reference point to measure the buccal keratinized soft tissue thickness. The point 3 mm apical to the gingival margin of the adjacent tooth was marked. From this point, a reference line to the midbuccal side of the operative site was marked using a second probe. UNC-15 probe was then used to measure the keratinized soft tissue thickness on mid- buccal side of the operative site and was advanced until osseous tissue was felt. This was considered the pre-operative thickness of keratinized soft

tissue. After the transgingival probing was done and once the bone volume was assessed and the implant surgical option was identified, the implant procedure was commenced. CBCT of the specific region was taken after the implant was placed immediately and measurements were taken. After 3 months, the hard and soft tissues were adequately healed and the prosthetic restoration was commenced. Thickness of keratinized soft tissue was again measured 6 months after implant placement on the mid-buccal side of the implanted tooth. Same reference point was used to measure the mid-buccal keratinized soft tissue thickness after 6 months of implant placement. This was considered the post-operative measurement of thickness of mid-buccal keratinized soft tissue. Both measurements were later used for comparison. CBCT measurements were also calculated immediately after implant placement and after 6 months to check any changes in surrounding bone of the implant. The pre- and post-operative measurements of the levels of hard tissue were used for comparison.

### Statistical Analysis

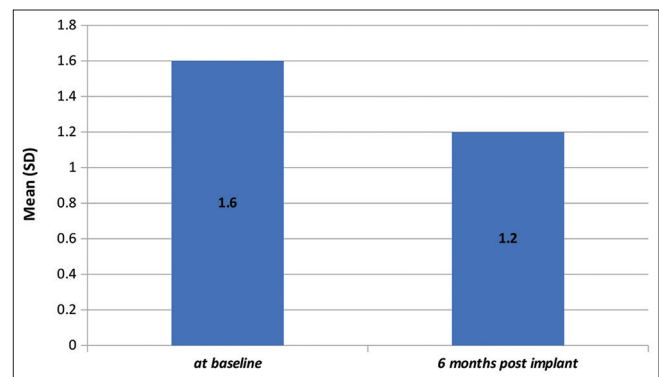
Student *t*-tests (two tailed, paired) and Spearman’s rank Correlation coefficient along with the statistical software was used for the analysis. *P* = 0.05 was set as level of significance and value less or equal to this was said to be statistically significant.

## RESULTS

About 15 individuals with age group ranging from 20 to 40 years were included in this study. Table 1 and Graph 1

**Table 1: Comparison of the soft tissue thicker at baseline and 6 months after implant placement**

Soft tissue thickness	<i>n</i>	Mean	Std. Deviation	<i>t</i> -value	<i>P</i> -value
At baseline	15	1.60	0.507	3.055	0.009*
6 months after implant	15	1.20	0.414		



**Graph 1: Comparison of the keratinised soft tissue thickness at baseline and 6 months after implant placement**

represent the mean value at baseline of soft tissue thickness before implant placement was  $1.60 \pm 0.507$  and the mean value after 6 months of implant placement was  $1.20 \pm 0.414$ . After applying student paired *t*-test, the *t*-value obtained was 3.055. Thus, statistically there was significant reduction in the soft tissue thickness ( $P = 0.009$ ).

Table 2 and Graph 2 represent the mesial, distal, buccal and lingual sites:

**Mesial Site**

The mean value of the hard tissue levels immediately after implant placement was  $-0.1393 \pm 1.06014$  from the implant platform and the mean value of the hard tissue thickness after 6 months of implant placement was  $0.7720 \pm 0.93843$  from the implant platform. The value of Student paired *t*-test for this comparison was 2.696. Thus, there was statistically significant reduction in the bone level ( $P = 0.003$ ).

**Distal Site**

The mean value of the hard tissue levels immediately after implant placement was  $0.4047 \pm 1.69374$  from the

implant platform and the mean value of the hard tissue thickness after 6 months of implant placement was  $1.0867 \pm 0.75355$  from the implant platform. The value of Student paired *t*-test for this comparison was 2.402. Thus, there was statistically significant reduction in the bone level ( $P = 0.016$ ).

**Lingual Site**

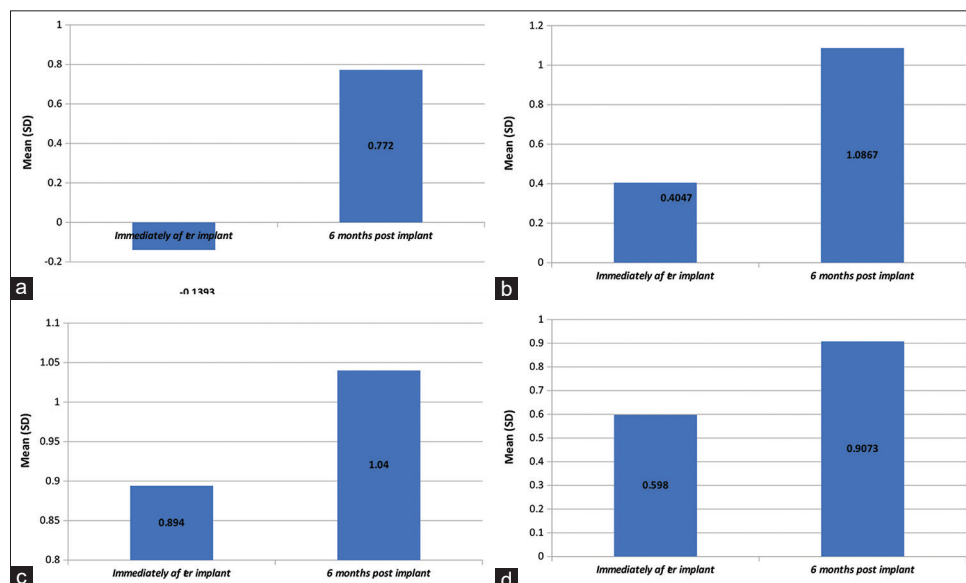
The mean value of the hard tissue levels immediately after implant placement was  $0.8940 \pm 1.00782$  from the implant platform and the mean value of the hard tissue thickness after 6 months of implant placement was  $1.0400 \pm 1.15931$  from the implant platform. The value of student paired *t*-test for this comparison was 1.387. Thus, there was statistically no significant reduction in the bone level ( $P = 0.165$ ).

**Buccal Site**

The mean value of the hard tissue levels immediately after implant placement was  $0.5980 \pm 0.73742$  from the implant platform and the mean value of the hard tissue thickness after 6 months of implant placement was

**Table 2: comparison of the hard tissue levels immediately and 6 months after implant placement At different sites**

Hard tissue level	Time intervals	n	Mean	Std. Deviation	Z-value	P-value
Mesial	Immediately after implant placement	15	-0.1393	1.06014	2.696	0.003*
	6 months post implant	15	0.7720	0.93843		
Distal	Immediately after implant placement	15	0.4047	1.69374	2.402	0.016*
	6 months post implant	15	1.0867	0.75355		
Palatal	Immediately after implant placement	15	0.8940	1.00782	1.387	0.165
	6 months post implant	15	1.0400	1.15931		
Buccal	Immediately after implant placement	15	0.5980	0.73742	2.428	0.015*
	6 months post implant	15	0.9073	1.03865		



**Graph 2: Comparison of the hard tissue levels immediately and 6 months after implant placement at different sites. (a) Mesial, (b) Distal, (c) Palatal, (d) Buccal**

0.9073 ± 1.03865 from the implant platform. The value of Student paired t-test for this comparison was 2.428. Thus, there was statistically significant reduction in the bone level ( $P = 0.015$ ).

Table 3 and Graph 3 represents the mean value of the hard tissue levels immediately after implant placement was 0.4393 ± 0.98877 from the implant platform and the mean value of hard tissue thickness after 6 months of implant placement was 0.9515 ± 0.94389 from the implant platform. The value of Student paired t-test for this comparison was 3.431. Thus, there was statistically highly significant reduction in the bone level ( $P < 0.001$ ).

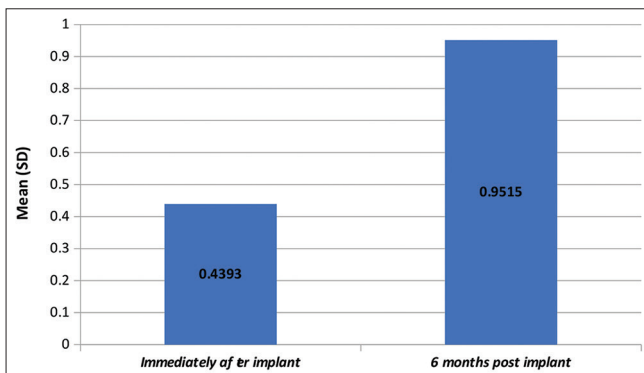
Table 4 and Graph 4 represent the mean value of the Spearman's rank coefficient correlation of difference between thickness of soft tissue and levels of hard tissue with respect to implant platform was 0.260. Thus, there was no statistically significant correlation between the two ( $P = 0.349$ ).

**Table 3: Comparison of the hard tissue levels immediately and 6 months after implant placement**

Hard tissue level (Total)	n	Mean	Std. Deviation	Z-value	P-value
Immediately after implant placement	15	0.4393	0.98877	3.431	<0.001**
6 months post implant	15	0.9515	0.94389		

**Table 4: Correlation of the soft tissue thickness changes (at baseline-6 months after implant placement) with the hard tissue levels (immediately after implants- 6 months after implant placement)**

Correlation between soft tissue thickness and hard tissue levels	Soft tissue thickness	
	Spearman's rho (correlation coefficient)	P-value
Hard tissue level	0.260	0.349

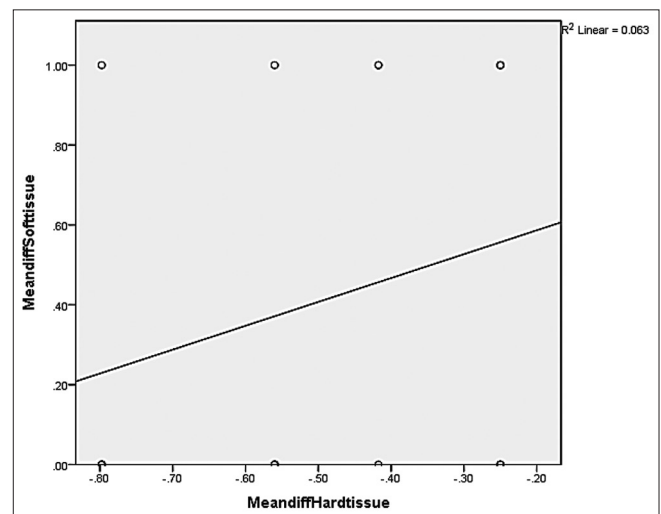


**Graph 3: Comparison of the hard tissue levels immediately and 6 months after implant placement**

## DISCUSSION

The observations of the present study showed statistically significant reduction in the keratinized soft tissue thickness 6 months after implant placement when compared to the pre-operative thickness of the keratinized soft tissue. Similar results were shown by Cardaropoli *et al.* in 2006 they demonstrated that after implant surgery remodelling occurs, they observed that esthetics can be affected by alterations in soft tissue after crown placement.<sup>[2]</sup> Berglundh and Lindhe in 1996 they found that although the tissue thickness at abutment connection was significantly different, the combined dimensions of the junctional epithelium and the supra-alveolar connective tissue (i.e., biologic width) around the implants at test and control sites were similar 6 months later. They suggested that the soft tissue attachments (biologic width), once established, were natural mechanism for protecting the osseointegration zone from the bacterial and mechanical factors of the oral cavity. This study proves the clinical rationale for soft tissue augmentation before abutment attachment or nonsubmerged implant placement when there in presence of thin mucosal tissues.<sup>[3]</sup> Nabil *et al.* in 2015 concluded that the interproximal reduction protocol resulted in acceptable soft tissue and esthetic outcomes.<sup>[4]</sup>

Observation for hard tissue levels showed highly significant reduction in the level of hard tissue 6 months after the implant placement when compared to the pre-operative level of the hard tissue in relation to prosthetic platform. Similar results were shown by Hermann *et al.* in 2000 in a comparison examined histometrically bone dimensional changes crestally around submerged and non-submerged



**Graph 4: Correlation of the soft tissue thickness changes (at baseline-6 months after implant placement) with the hard tissue levels (immediately after implants- 6 months after implant placement)**

implants. Histologically in unloaded conditions, they showed that in early phase of healing bone changes occurs crestally after placement of implants.<sup>[5]</sup> Uppala *et al.* in 2020 compared bone loss crestally around the implants that were placed with platelet concentrates and beta-tricalcium phosphate bone grafts and they concluded that after 9 months of placement of implants average crestal bone loss in both groups was 2.75 mm and 2.23 mm which was statistically significant.<sup>[6]</sup>

Another observation showed that there was no significant correlation found between keratinized thicknesses of soft tissue pre-operatively with changes in hard tissue levels in relation to implant platform at 6 months after implant placement. Similar results were shown by Savita *et al.* in 2016 they assessed and compared gingival thickness in maxillary anterior region using paralleling technique with the help of two techniques that is CBCT and the radiovisiography and correlated them with the underlying thickness of the alveolar bone. This study failed to prove that there is significant correlation in gingival width and underlying bone in anterior maxilla. They concluded that within the limitations of the study, both the radiology techniques are important equipments for assessing the dimensions of soft and hard tissues.<sup>[7]</sup> Himanshu and Saso in 2017 in maxillary anterior region evaluated the correlation between pre-operative cortical bone thickness (buccal) and peri-implant tissue response followed by immediate implant placement. They concluded that no significant correlation was found between both.<sup>[8]</sup>

From above observation, it can be said that although there is reduction in the thickness of soft tissue and also reduction in the hard tissue level; there is no statistical correlation between the two. There are many other factors which influence the hard tissue levels after implant placement that is available bone around implant, status of oral hygiene, elevation of the periosteum while performing surgery, osteonecrosis caused due to instrument overheating, trauma from occlusion due to prosthesis, bone remodelling process, events in the inflammatory and healing process.

Future studies in this regard should be planned with larger sample size and above mentioned factors also should be given a consideration in the study design.

## CONCLUSIONS

After 6 months of implant placement, there was reduction seen in the level of the keratinized soft tissue and in the level of the hard tissue around the implant. Furthermore, no co-relation was seen between the pre-operative levels of keratinized soft tissue with the levels of the hard tissue in relation to the implant platform.

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