

## An Observational Study Assessing Correlation of Keratinized Tissue Width and Periodontal Indices Around Implant-Supported Fixed Partial Dentures

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### Abstract

**Aim:** The aim of the present study was to assess the correlation of keratinized tissue width with periodontal indices around implant-supported fixed partial dentures (FPDs).

**Material & methods:** A cross-sectional study comprised of patients with implant-supported FPDs one year after their prosthetic delivery. A total of 100 implants were evaluated. All the patients were thoroughly informed of the aims of the study and processes of examination, and written informed consent was obtained from them.

**Results:** Altogether, 100 edentulous patients with a mean age of 63.1 (SD 6 6.9) years and with 66 restored dental implants were included in the study. A total implant (25%) was located in the maxilla and 75 implants (75%) in the mandible. The periodontal indices were compared between the two groups with keratinized mucosa width <2 mm and  $\geq 2$  mm around dental implants. The results showed no significant difference in marginal gingival recession between the two groups ( $P > 0.05$ ). No significant difference was noted in radiographic marginal bone level, PD in different areas or the mean PD between the two groups ( $P > 0.05$ ). The correlation between KM and GI was not statistically significant and also the correlation between PI and KM was not statistically significant. ( $P = 0.75$ ) The correlation between BOP and keratinized mucosa width was not statistically significant too.

**Conclusion:** Although this study did not show a significant correlation between the keratinized tissue width and peri-implant tissue health and consequently the implant success rate, long-term interventional studies are required to make a final judgment in this respect.

**Keywords:** Dental Implants, Keratinized Tissue, Peri-Implant Mucosa.

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### Introduction

Dental implants are a reliable and predictable treatment option for replacement of the lost teeth, which can restore both esthetics and function. [1] At present, dental implant treatment is highly popular due to its biological stability. [2] Apart from survival rates, clinicians and patients should be aware of biological and technical complications that occur to various extents. Dental implants demonstrate high survival rates and thereby expanded treatment options in partially and fully edentulous patients. [3] Due to structural and anatomical differences between teeth and implants, presence of healthy soft tissue around dental implants seems to be more important than around natural teeth. [4-7] The attached mucosa adheres to the surface of the titanium implant by means of hemi-desmosomes. [4]

However, no periodontal membrane or root cement is present. Therefore, a direct anchorage of connective tissue to the surface of the implant is not possible and the mechanical quality of this attachment is low. [4-7] Therefore, the necessity of a zone of keratinized tissue around the dental implants has been suggested. This zone can contribute to a high level of mechanical stability of peri-implant tissue. The significance of keratinized mucosa around dental implants has been a topic of debate in the literature. [8] For many years the presence of an "adequate" zone of gingiva was considered critical for the maintenance of gingival health and prevention of periodontal disease progression. Friedman<sup>8</sup> stated that "inadequate" zone of gingiva would facilitate subgingival plaque formation because of improper pocket closure

resulting from the movability of the marginal tissue. In an observational study, Loe and Lang suggested 2 mm of keratinized tissue width, including 1 mm of attached gingiva around dental implants. [9] Dental implants with attached gingiva <2 mm are more prone to gingival recession and bone loss. In prosthetic treatments with limitations with regard to extension into the gingival sulcus, a minimum of 5 mm of keratinized gingiva width is necessary because such restorations enhance plaque accumulation and gingival inflammation in areas with keratinized tissue width <2 mm. [10] The need for keratinized mucosa around implants is a controversial topic. Comparatively few studies are available examining the relationship between the width of KM and the health of peri-implant tissues.

Hence, the aim of this study was to evaluate whether the width of the keratinized mucosa around implants supporting overdentures has a positive effect on the health of the surrounding soft and hard tissues.

### Material & Methods

A cross-sectional study at Department of Dentistry, Netaji Subhas Medical College and Hospital, Bihta, Patna, Bihar, India comprised of patients with implant-supported FPDs one year after their prosthetic delivery. A total of 100 implants were evaluated. All the patients were thoroughly informed of the aims of the study and processes of examination, and written informed consent was obtained from them.

#### Inclusion Criteria

Patients with implant supported FPDs, in which at least one year had passed since their prosthetic delivery and loading.

#### Exclusion Criteria

- Cigarette smoking, pregnancy,
- Antibiotic use in the past six months, systemic conditions requiring antibiotic prophylaxis, and
- Systemic diseases affecting bone metabolism and soft tissue such as hyperthyroidism, hyperparathyroidism and uncontrolled diabetes mellitus.

### Methodology

Data regarding age, gender and periodontal indices were collected. A parallel periapical radiograph was obtained from implant sites to assess alterations in bone around dental implants. These examinations included plaque index (PI), gingival index (GI), bleeding on probing (BOP), clinical probing depth (PD), marginal gingival recession, width of keratinized mucosa and radiographic marginal bone level.

The PI was assessed using the Silness and Loe plaque index. The amount of plaque covering the surface of crowns in four areas of mesiobuccal, mid-buccal, distobuccal and lingual/palatal was assessed and scored from 0 to 3. The scores of the four areas were added and divided by 4 to obtain the mean score for each implant. According to the Silness and Loe PI, 0 indicated absence of plaque, 1 indicated a low amount of plaque, 2 indicated a moderate amount of plaque and 3 indicated a high amount of plaque. [11]

The GI was determined using the Loe and Silness GI. Gingival tissue was assessed at four points around dental implants (mesiobuccal, mid-buccal, distobuccal and lingual/palatal) in terms of the presence of inflammation and scored from 0 to 3. The scores were summed and divided by four to obtain the mean value for each implant. According to the Loe and Silness GI, 0 indicated natural gingiva, 1 indicated mild inflammation, 3 indicated moderate inflammation and 4 indicated severe inflammation. [11]

For assessment of BOP, the periodontal probe was inserted into the gingival sulcus and was walked around the implant with a certain pressure. Bleeding was assessed after 30 seconds: 0 indicated no bleeding (negative) and 1 indicated bleeding (positive). [11]

For assessment of PD, the distance from the gingival margin to the sulcus depth was measured at four points of mesiobuccal, mid-buccal, distobuccal and lingual/palatal around each implant using a Williams probe and reported in millimeters. The mean of the four values was considered as the mean PD. [11]

For assessment of marginal gingival recession, the finishing line of the crown served as the cemento-enamel junction of natural teeth and as in natural teeth, the distance from this line to gingival margin was considered as the amount of gingival recession and reported in millimeters. [11]

Radiographic marginal bone level was defined as the vertical distance from the implant border to the first implant-bone contact point at the mesial and distal aspects on parallel digital periapical radiographs taken with a photostimulable phosphor plate detector.

Considering the ratio of implant height to its radiographic image, radiographic magnification was determined and accordingly, actual values were calculated. In cases where primary radiographs were not available, implant border was considered bone-level at the time of surgery and bone remodeling within the first year was considered to be 1 mm according to a similar study.

<sup>12</sup> Keratinized mucosa width was defined as the distance between the gingival margin and

mucogingival junction at the mid-buccal area, which was measured by a Williams probe with 1 mm accuracy. [11]

All data were collected and analyzed by t-test and chi-squared test using SPSS 20.

**Statistical Analysis**

**Results**

**Table 1: Descriptive statistics**

Age (years)	62.8 ± 6.4
Arch type Maxilla: Mandible:	
Gender	
Male:	45 (45%)
Female	55 (55%)
Arch type	
Maxilla	25 (25%)
Mandible	75 (75%)
Loading period (months)	26.44 ±12.32

Altogether, 100 edentulous patients with a mean age of 63.1 (SD 6 6.9) years and with 66 restored dental implants were included in the study. A total implant (25%) was located in the maxilla and 75 implants (75%) in the mandible.

**Table 2: Comparison of PD, radiographic marginal bone level and marginal gingival recession in the two groups with keratinized mucosa width <2 mm and ≥2 mm**

Index	Keratinized mucosa width	Number	Mean	Standard deviation	P-value
Mean radiographic marginal bone level	≥2 mm	70	0.77	0.58	0.75
	<2 mm	30	0.74	0.44	
Mean probing depth of the four areas	≥2 mm	70	3.48	1.22	0.05
	<2 mm	30	2.82	1.45	
Marginal gingival recession	≥2 mm	70	0.64	0.72	0.070
	<2 mm	30	1.07	0.80	

The periodontal indices were compared between the two groups with keratinized mucosa width <2 mm and ≥2 mm around dental implants. The results showed no significant difference in marginal gingival recession between the two groups (P>0.05). No significant difference was noted in radiographic marginal bone level, PD in different areas or the mean PD between the two groups (P>0.05). The correlation between KM and GI was not statistically significant and also the correlation between PI and KM was not statistically significant. (P=0.75) The correlation between BOP and keratinized mucosa width was not statistically significant too.

**Discussion**

In most cases, failure of loaded implants is accompanied with a gradual process of breakdown of supporting soft and hard tissues. [12] This process can be observed clinically at an early stage by decreasing health of the peri-implant mucosa. [13] Especially in the maxilla the possibilities for plaque control in patients having implants supporting overdentures are often limited due to an unfavourable implant position or to limitations of the prosthetic design. This may negatively influence the patient’s capacity to clean the superstructures and the underlying permucosal

portions of the implants. Also, in many cases tooth-brushing is painful for these patients because of the thin buccal mucosa, which is often formed after implant placement procedures. [14]

Altogether, 100 edentulous patients with a mean age of 63.1 (SD 6 6.9) years and with 66 restored dental implants were included in the study. A total implant (25%) was located in the maxilla and 75 implants (75%) in the mandible. The periodontal indices were compared between the two groups with keratinized mucosa width <2 mm and ≥2 mm around dental implants. The results showed no significant difference in marginal gingival recession between the two groups (P>0.05). No significant difference was noted in radiographic marginal bone level, PD in different areas or the mean PD between the two groups (P>0.05). The correlation between KM and GI was not statistically significant and also the correlation between PI and KM was not statistically significant. (P=0.75) The correlation between BOP and keratinized mucosa width was not statistically significant too. Chang et al [15] evaluated 239 implants in 69 patients that had been loaded for 3–4 years. They measured BOP, PD, GI, PI and keratinized mucosa width and evaluated pre- and post-operative radiographs to assess bone

resorption. In their study, PI and GI were significantly higher in patients with keratinized mucosa width of <2 mm.

In a study by Kaptein et al [14] they concluded that implants supporting overdentures had a higher risk for bone loss, based on the worse peri-implant tissue health. They also showed that mean peri-implant probing depth and gingiva index in overdentures is significantly higher than fixed bridges. Esfahanian et al [16] assessed the correlation of keratinized tissue width and periodontal parameters around implant-supported FPDs and showed that increased width of keratinized gingiva and attached gingiva around implants is not necessarily associated with higher level of peri-implant health. Bouri et al [17] assessed the association of keratinized mucosa width and health status of the peri-implant soft tissue and reported that increased width of keratinized gingiva around dental implants is associated with lower mean bone resorption and improved soft tissue indices. Han et al [18] have shown the use of free soft tissue grafts to augment keratinized gingiva before or following the restoration of an implant. The rationale for performing the procedures include making plaque control more effective, facilitating impression taking by the restorative dentist and dissipating muscular and frenal pull, and possibly preventing further recession. [19,20] Epözita et al [21] in a meta-analysis showed that soft tissue health in terms of GI affects the health of posterior implants. They concluded that implant position plays a more effective role than the keratinized mucosa because they reported that annual bone resorption in posterior implants is 3.5 times the rate in anterior implants.

### Conclusion

According to the results of the current study and those of previous studies, presence of adequate keratinized tissue around dental implants can improve gingival health indices. However, absence of adequate keratinized mucosa does not necessarily mean that the health of the surrounding tissue is compromised or the implant success is at risk. Some other factors such as oral hygiene also profoundly affect the gingival health. An ideal oral hygiene in an area with a narrow or no keratinized mucosa might be associated with normal bone and gingival indices. In an area with wide keratinized mucosa and poor oral hygiene, gingiva and bone health might be compromised.

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