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Impact of timing of soft tissue augmentation to increase width of keratinized mucosa around dental implant.

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Abstract
Objective:*to assess the influence of timing of soft tissue augmentation on soft tissue health around the implants.*

Material andmethods*: Twenty patients with missing teeth and deficient width of the keratinized mucosa (KM)were selected for the current study. The patients were divided into 2 groups. 1st group (G1) received the free gingival graft (FGG) two months prior to implant placement, 2nd group (G2) received the FGG at time of second stage surgery. Thesoft tissue health around the implants was evaluatedafter soft tissue augmentation.*

Result*: Both groups have shown significant improvement in the soft tissue health around the implants. However, there was no statistically significant difference between the two studied groups regarding soft tissue health.*

Conclusion*: Both procedures showed a significantsoft tissue augmentation. G1: was an easier technique, facilitate subsequent steps of implant, yet it was time consuming as it requires another surgery, more visits and patient dissatisfaction. FGG in G2: wastime-saving as it requires fewer surgeries, causes less stress, and provides greater patient satisfaction.*
Keywords: *Dental implant; free gingival graft, augmentation.*

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I. Introduction

The need for keratinized tissue around dental implants to maintain health and tissue stability is increasingly recognized as a fundamental to implant success, so soft tissue management is a crucial factor to consider in esthetic implant restoration. It is essential not only to achieve well-anchored implants but also sufficient soft and hard tissue to obtain favorable results[1]. The peri-implant keratinized mucosa is firmly bound to the underlying bone and constitutes a functional barrier between the oral environment and underlying dental implants[2]. Deficient KMW (< 2 mm) was significantly associated with the severity of peri-implant mucositis and was considered to have a significant influence on marginal bone stability[3]. Clinicians have adopted techniques to augment this band of attached tissue to increase the volume of soft tissue and sculpt the emergence profile of the peri-implant soft tissue with a provisional implant-supported crown[4]. Aside from the material of the graft, soft tissue augmentation surgeries can also be performed at different time points during implant treatment[5].

II. Methods

Study Population

The present study was conducted following the seventh revision of the Helsinki Declaration in 2013. Twenty patients with missing teeth and deficient width of the keratinized mucosa seeking dental implant placement were selected for this study from patients attending the department of Oral Medicine and Periodontology, Mansoura University.

Several implants were placed according to the following inclusion criteria: patients with a healthy systemic condition of age ≥ 21 years, patients with narrow width of keratinized mucosa ≤2mm at the proposed implant site, while exclusion criteria; uncooperative patients, known pregnancy, patients with systemic or local disease or condition that would compromise healing.Written informed consent was taken from all patients.

Study design

The study's sample size was determined based on the null hypothesis, which stated that the first and second groups' outcomes were not equal. With a confidence level of 95%, the desired study power was 95%. The G power software (version 3.1.9) was used, and the required sample size of 18 patients was determined. A randomized clinical trial was used in this study. The patient's randomization was performed by one of the department's senior residents, who was not involved in the study and was unaware of any related treatment protocol.

At baseline, periodontal and gingival condition were evaluated for each patient including the following parameters;plaque index (PI), gingival index (GI), probing depth (PD) and clinical attachment level (CAL).

The surgical protocol:

All patients were treated by a submerged dental implant protocol and FGG was harvested from the palate. Group 1 (G1) received the FGG two months prior to implant placement, and group 2 (G2) received the FGG at the time of second stage surgery.

1- implant placement

First stage surgery

Preoperative Cone Beam Computed Tomography (CBCT) was used to evaluate the residual bone at the intended implant insertion site[6]. Accordingly, the most ideal implant size was selected. The patient was instructed to rinse with 0.12% Chlorhexidine mouthwash (Hexitol, Arab Drug Company, Egypt) as antimicrobial prophylaxis three times daily starting two days before surgery. The patient was given a 1gm antibiotic (875 mg Amoxicillin/ 125 mg Clavulanic acid) (Megamox, Julphar, Egypt) one hour before surgery.

Infiltration anesthesia was done using Articaine HCL 4% with 1:100.000 adrenaline (Artinibsa 4%, Inibsa, Spain). Implant fixtures were placed into their planned surgical sites according to the standard drilling protocol[7]. The flap was approximated and sutured using a 5\0 monofilament suture (Proline, Ethicon, USA). A digital peri-apical radiograph was done to assess implant position, relation to vital structures, and relation of implant's collar to bone crest[8]. Patients were instructed to continue on 1gm antibiotic (875 mg Amoxicillin/ 125

mg Clavulanic acid) for 7 days after surgery. Analgesic sodium diclofenac 50mg (Cataflam, Novartis, Egypt) was described 3 times a day for 2 days, then as required. Patients were re-called and sutures were removed 7-10 days after implant placement.

Second-stage surgery:

Second-stage surgery was done after a healing period. After local anesthesia was infiltrated, for G1, mid- crestal incision was done to expose and remove the cover screw, and connection of the healing abutment to allow the emergence of the abutment through the soft tissues was done[9]. A periapical x-ray was taken to confirm the complete seating of the healing abutment to the implant fixture[10]. The suture was taken around the healing abutment using a 5/0 non-resorbable suture (Proline, Ethicon, USA). For G2 the FGG was made at this stage (discussed later)

2- Free gingival graft technique

(a)- Recipient site preparation

Group 1, Two months before implant placement, a horizontal incision was made at the level of mucogingival junction[11]. The partial-thickness flap was then raised and apically displaced. With great care, the flap was sutured to fix its margins and base by a simple interrupted periosteal sutureusing a 6/0 non-resorbable suture (Proline, Ethicon, USA)[12].

Group 2, at the time of the second stage surgery, a horizontal incision was made at the level of mucogingival junction along the length of the recipient area and subsequent steps of the graft were done like that of G1. A sharp blade was used to dissect all tissues coronal to the cover screw and the head of the implant was thoroughly cleaned[13].

(b)- Donner site/ Free gingival graft harvesting

The free gingival graft of an appropriate size using a tin foil template was harvested from the palate with a surgical blade (number 15c)[14]. The template was placed (2 to 3 mm) away from free gingival margin of palatal aspect of teeth in the first molar – canine area[15]. The palatal donor site was then covered with surgical gel foam sponge and a prefabricated acrylic palatal stent was applied over the donor site to protect the area during healing period[16].Removal of fatty tissues from the graft and thinned to a uniform thickness (1.5mm) using sharp small scissor[17].

(C)- Suturing of the graft:

The graft was then sutured to the corresponding periosteum in the recipient area with interrupted sutures and sling sutures to stabilize the FGG using 6/0 non-resorbable proline suture[18].

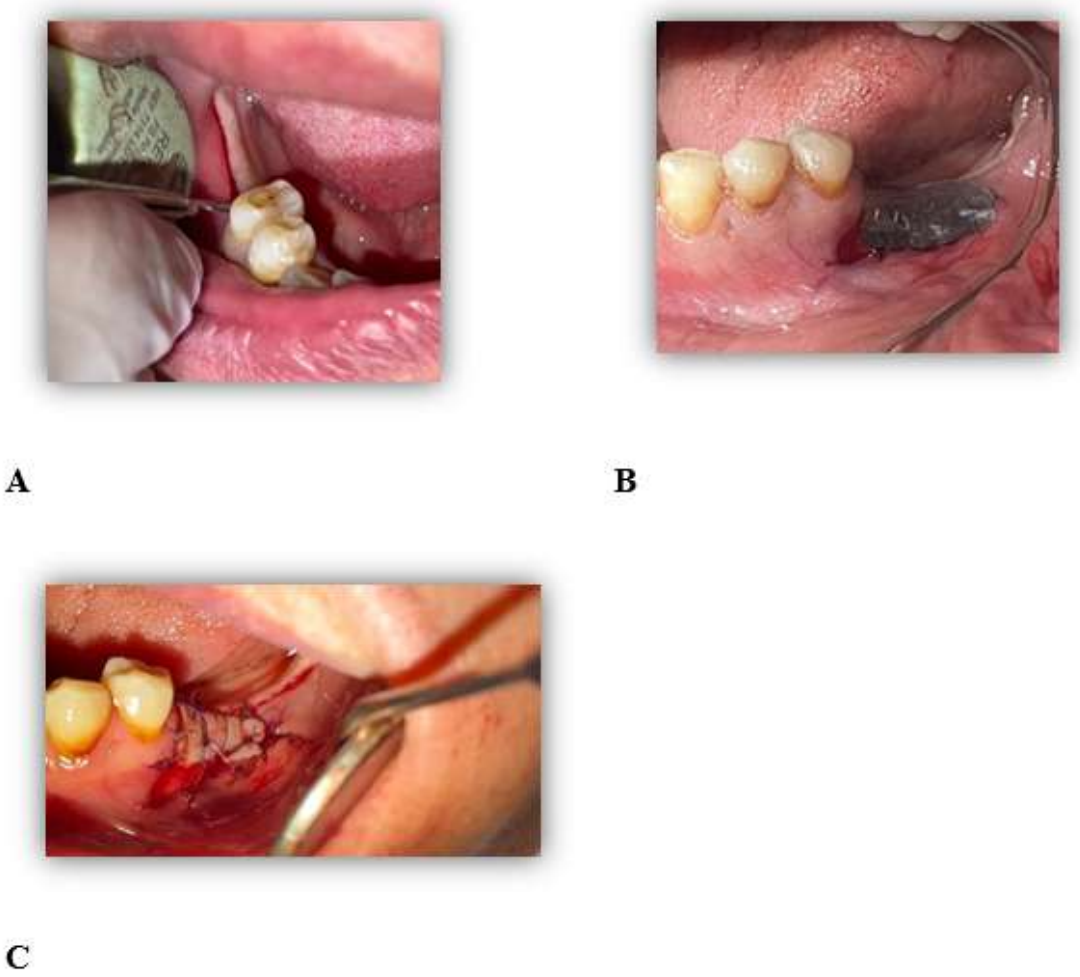

Fig 1 shows FGG augmentation for G1. (A) horizontal incision along MGJ (B) shows tin foil adjustment on the recipient site (C) the graft was sutured in recipient site.

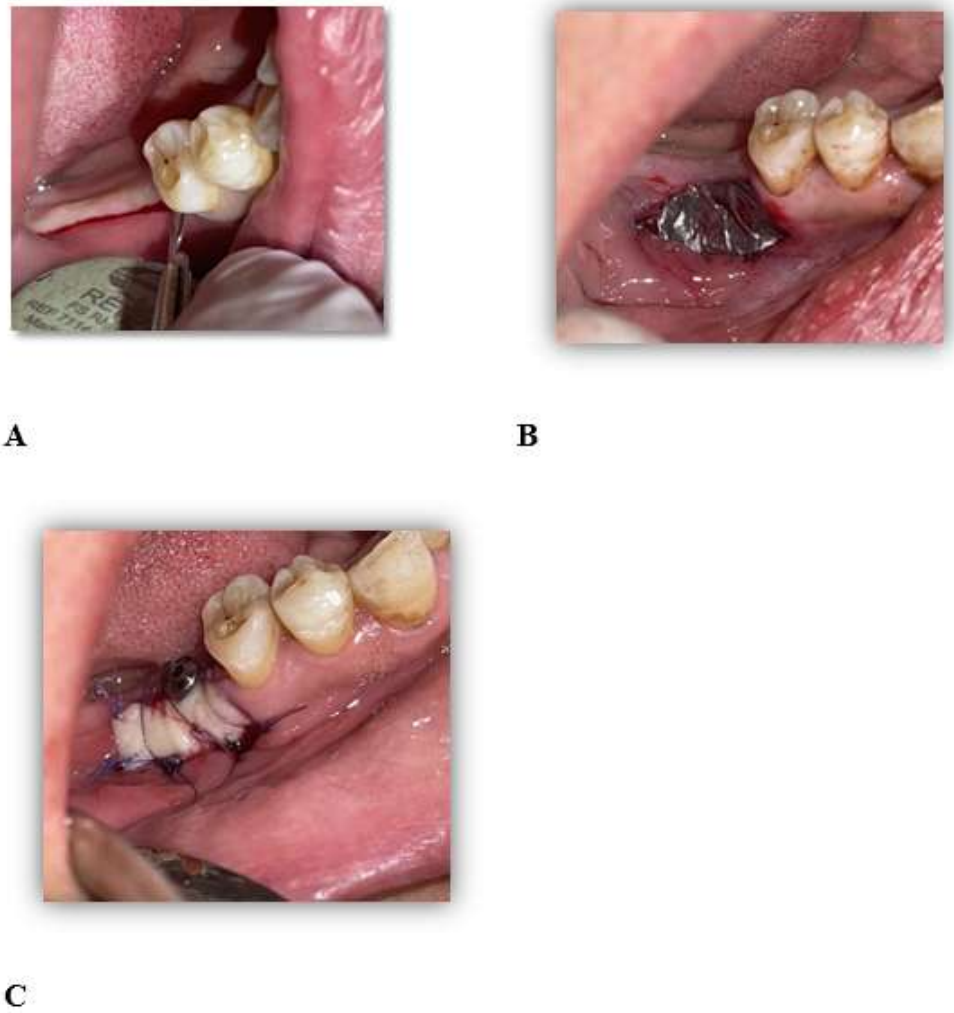

Fig 2: shows FGG augmentation for G2. (A) horizontal incision along MGJ (B) tin foil adjustment on the recipient site (C) the graft was sutured in recipient site.

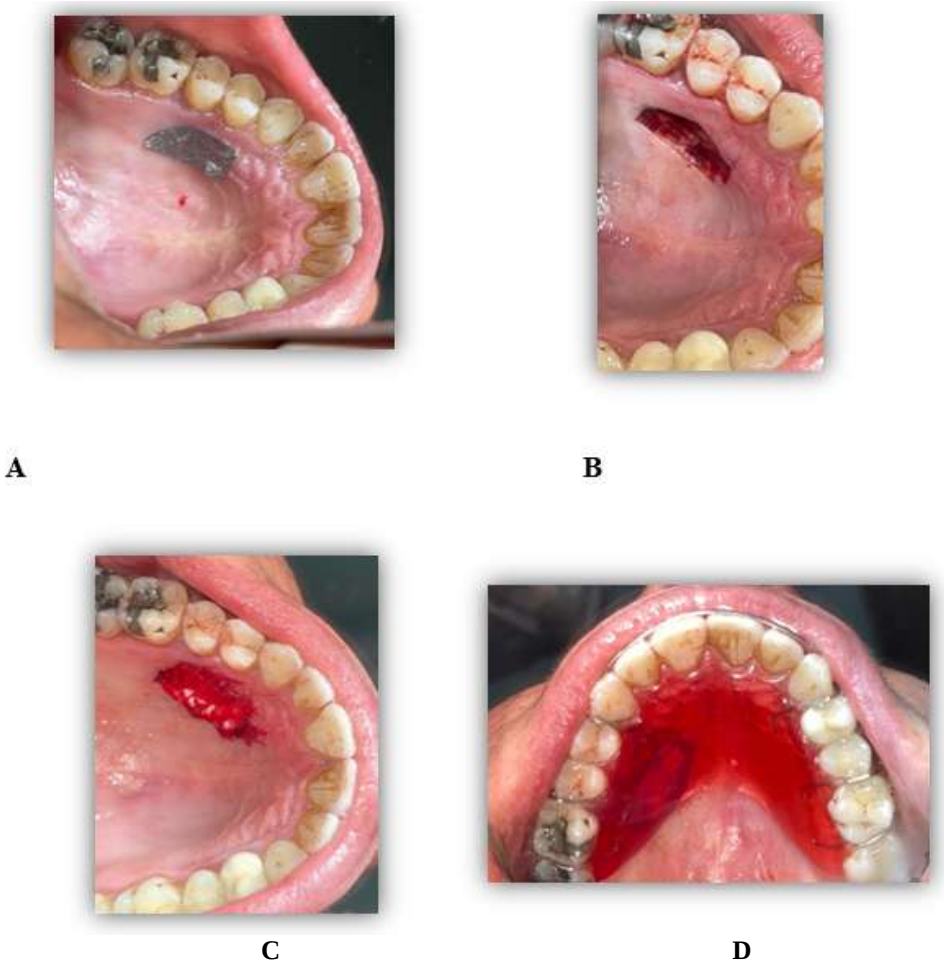

Fig 3: shows steps of graft harvesting (A) the trimmed tin foil paper in its appropriate place in the donner site (B) the graft was harvested (C) gel foam sponge in the donner site (D) the acrylic stent in place.

Fig 4: shows tin foil adjustment in the recipient site.

Clinical evaluation and follow-up:

The subjects were assessed to evaluate the periodontal health around the implant by measuring the clinical periodontal indices used in this study. The reproducibility of the data

was determined by calculating the number of sites examined, where the scores were repeated exactly or to an accuracy of 1 mm for each site.

Clinical examinations for evaluation of peri-implant soft tissue health including plaque index, gingival index, probing depth, clinical attachment level was performed one month and three months after final restoration.

III. Result:

The present study was carried out on 20 patients of age varying from 30 to 55 years suffering from decreased width of keratinized mucosa.Demographic data of the study population were recorded at the baseline (table 1).

Table (1): Demographic data of the studied population.

	Study population		
	Group I	**Group II**	**Test of significance**
Age range	30 – 54	30 – 55	
Age mean±SD	38.45±7.15	41.33±4.5	t=0.5352 p=0.9072

Periodontal indices were measured at 1, 3 months after installation of the final restoration. By comparing study groups regarding peri-implant soft tissue health, it was demonstrated that there was no statistically significant difference between studied groups regarding plaque index, gingival index and probing depth (p>0.05) (table 5)

Table 2: Comparison of plaque index, gingival index and probing depth among studied groups one month and three months after installation of the final restoration.

	Group I N=10(%)	**Group II N=10(%)**	**Test of significance between both groups P value**
PI (mean± SD):			
1 month	0.57± 0.69	0.56± 0.66	t= 0.1573 p=0.428
3 months	0.54±0.43	0.41± 0.32	t=0.3459 p=0.34
GI (mean± SD)			
1 month	0.58±0.68	0.56±0.5	t=0.17231 p=0.395
3 months	0.31±0.27	0.37±0.35	t=-0.46787 p=0.33
PD/mm (Mean±SD)			
1 month	2.67±0.41	2.69±0.37	t=-0. 31614 p= 0.373
3 months	2.42±0.38	2.4±0.43	t=0.645 p=0.217

t: Student t test
Statistically significant difference if p value<0.05

IV. Discussion:

Sufficient keratinized mucosa is essential for both the long-term durability of the implant and peri-implantitis[19]. The appropriate preoperative timing for increasing gingival width is a matter of controversy. Soft tissue (ST) management around dental implants can be done at different time points: before implant placement, simultaneous with implant placement, at the time of second-stage surgery, or following the installation of the final restoration[20].

When an ST graft is performed before implant placement, it facilitates subsequent steps as implant surgery was done in already augmented tissues that became mature and easily manipulated, which might ensure better blood supply, allowing tension-free coverage of the flap and improving the stability of tissues[21]. Also, it was considered an easy and less sensitive technique to be performed as each procedure (graft–implant) was done in a separate surgery. Yet this timing technique has the disadvantage of needing another surgery, more visits, more time for treatment, and patient dissatisfaction. Also, multiple surgical interventions increase the risk of soft tissue dehiscence and clinical complications as reported by some researchers[22]. However, no ST dehiscence or other complications occurred in this study.

When an ST graft is performed at the time of 2nd stage surgery, it requires fewer surgeries, resulting in reduced pain and discomfort, less stress, a quicker recovery time, cheaper costs, and higher patient satisfaction[23]. Yet, it is a more sensitive technique that requires more experience and could make patients feel worse due to the longer procedure[21, 24].

The free gingival graft (FGG) was used to facilitate regeneration, due to its denser cell content and remains the ideal level of treatment in terms of keratinized tissue width(KTW), long-term volume stability, and doesn't require pricey biomaterials because the patient's oral cavity can be used to get the graft[25]. However, this method came with significant drawbacks, such as donor site morbidity (pain and discomfort), the limited size of tissue available for grafting, difference in color and texture from adjacent tissues, and a longer healing period[26]. In our study, the donner site was protected by a surgical gel foam sponge and then covered by a prefabricated acrylic stent to decrease post-operative pain, and improve healing outcomes[27].Concerning KTW at the peri-implant area, all relevant articles revealed a significant gain of KTW at different time points of soft tissue augmentation**.**

In our investigation, no statistically significant difference existed between the study groups in terms of the periodontal indices around the dental implant as measured one month and three months after the installation of the final restoration ($p>0.05$). [28]. When soft tissue graft was performed prior to implant placement, it facilitates subsequent steps as implant surgery was done in an already augmented tissues that became mature and easily manipulated, might ensure better blood supply, allowing tension-free coverage of the flap and improves the stability of tissues. Also it was considered as an easy and less sensitive technique to be performed as each procedure (graft – implant) was done in a separate surgery[29]**.**

V. Conclusion

With predictability, soft tissue augmentation can be used during implant therapy at various times[30]. In our study, two different times were chosen to augment soft tissues around the dental implant. In this investigation, a total of 20 patients were involved (10 patients in each group). After evaluation and data collection, statistical analysis was applied to the collected data and the following result was obtained. There was no statistically significant difference in plaque index, gingival index, or probing depth between the groups under study.

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