

Evaluation of the Changes in Attached Gingival width after Simultaneous Dental Implantation with Calcium Sulfate Bone Grafting and Survival Rate of The Implants (Pre-Post Interventional Clinical Trial)

Research Article

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Abstract

Objectives: This study was carried out to evaluate the changes occurring in the width of the attached gingiva after the simultaneous grafting with calcium sulfate around dental implants and to determine the survival rate of implants after the end of the healing period.

Materials and Methods: 24 implantation sites in the anterior area of the maxilla were included in this study of 12 patients referred to the department of oraland maxillofacial surgery indicating for dental implantation with the insufficient width of the alveolar edge and a minimum of 2 mm attached gingiva before implantation (T0 time). Dental implants were performed ,bone grafting was done simultaneously and post evaluation of the attached gingiva width 4 months after the grafting process (T2 time) was done to study the changes in its width and assess the survival rate of dental implants.

Results: The results of this study revealed that the attached gingiva width changes after 4 months (T2 time) of the application of the bone graft was $+ 0.775 \pm 0.511$ mm, with the survival rate of dental implants in the second surgical stage 100% of them.

Conclusion: We conclude within the limits of this study that an adequate amount of attached gingiva was found 4 months after the bone grafting process and the survival rate of implants was 100%, which indicates the positive effect of the material used in bone grafting on the width of the attached gingiva and the survival rate of dental implants.

Keywords: Attached Gingiva Width; Dental Implants; Simultaneous Grafting; Survival Rate Of Dental Implants.

Introduction

Currently, the choice of a dental implant therapy has become a popular way to compensate for tooth loss and it is extremely important to evaluate the factors that affect its health and success. In the past decade, there have been some studies that have reviewed the necessity of keratinized tissue to maintain the health of the surrounding tissues around implants, but this topic has long been the subject of controversy in the medical literature. Some studies emphasize the importance of the keratinized tissue around dental implants by reporting more accumulation of dental plaque, gingival recession, and loss of the healthy tissue around implants without keratinized tissue more as compared to implants surrounded by a sufficient amount of keratinized tissue [1, 2].

Studies indicated that implants surrounded by less than 2 mm of keratinized gingiva suffer from soft tissue recession associated with a high rate of dental plaque index, secondary inflammation, and bleeding on probing around compensation with a recession of the crestal bone [3].

The presence of keratinized gingiva around dental implants may have greater benefits than those resulting from their presence around natural teeth, as some reports indicate that a lack of keratinized gingiva may contribute to the failure of dental implants [4]. It has been observed that the presence of keratinized gingiva enhances the integrity of the soft tissues around the natural teeth. On the other hand, the presence of keratinized gingiva around dental implants may be considered necessary to maintain the crestal part of the alveolar bone. There is also a strong correlation

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between the failure of dental implants and the insufficient width of the keratinized gingiva around them, this relation is due to the ability of it to resist bacterial insertion that can lead to inflammation around the implants [5].

In a comparative study of two groups of implants, one group with keratinized gingiva less than 2 mm and the second group greater than 2 mm, it was observed that the width of the keratinized gingiva affected the marginal bone resorption around the implants, the rate of germinal plaque accumulation and tissue inflammation around the implants and that with the presence of sufficient keratinized gingiva more than 2 mm has a protective effect from tissue inflammation around implants [6].

This is also confirmed by Bouri and his colleagues' study in their study of 200 implants, with the result that increased keratinized gingiva width is associated with a decrease in the marginal bone resorption around the implants and an improvement in soft tissue indexes [7].

Also, the study conducted by Gharpure and his colleagues, which confirmed the importance of keratinized gingiva around implants, indicated that studies assessing soft tissues around implants after various grafting procedures are few and that most studies focus on hard tissue changes [8].

So that we found that it would be useful to study the changes in attached gingival width after bone grafting to assess the amount of it and to determine the survival rate of the implants.

Materials and Methods

Study Design

This study was designed as a pre-post interventional clinical trial. This research was registered as a clinical trial with an ID: 41619166 in the ISRCTN database which is recognized by the World Health Organization (WHO).

Study Population

The research sample consisted of 24 dental implants (SGS Dental Implant System - Switzerland) were inserted to replace missing teeth in horizontally resorbed alveolar ridges in 12 patients (8 males and 4 females), sample size was calculated by G power

v3.1.9.2 (Franz Faul, University of Kiel, Germany), with the accordance of this criteria:

- Width of attached gingiva at the site of dental implantation (T0 time) ≥ 2 mm.
- Bucco-palatal bone width at the implant site ranges from 3.5 to 5.5 mm according to CBCT images in the anterior region of the upper jaw.
- Good oral hygiene, no smoking patients.
- No contraindication for surgeries under local anesthesia.

We excluded patients with systemic conditions, smoking, precedent irradiation therapy, vertical bone loss, tooth extracted less than 6 months at the implantation site.

All Patients have signed written informed consent before starting the study.

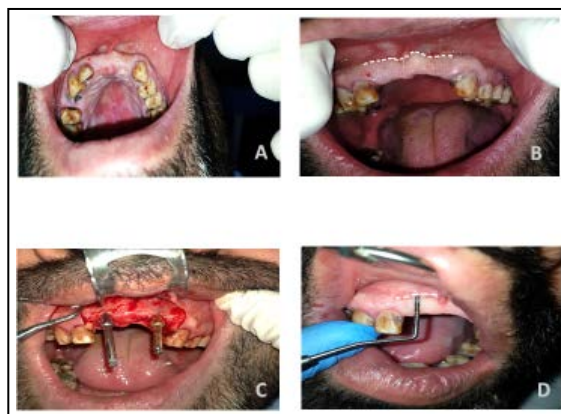
Study outcomes

As a Primary outcome, we measured the width of the attached gingiva 4 months after dental implantation with simultaneous bone grafting, as a secondary outcome we measured the survival rate of the implants at the reentry after 4 months of implantation.

The procedure was done as the following: (FIGURE 1)

- At (T0) time diagnostic CBCT images were taken before surgery to determine the width of the bone by using (Vatech PAX-i3D GREEN, Korea).
- Oral cleansing was used before the surgery, anesthesia was performed locally.
- Pre-operative gingival width at (T0 Time) measurement was performed, it was measured from the muco-gingival junction to the top of the alveolar using a gingival probe, measurements were recorded in mm.
- A full-thickness gingival mucosa flap has been elevated that allows adequate access to bone at the site of work.
- The implant place was prepared in proportion to the remaining less than 1 mm of bone on the buccal surface of the implant which was determined depending on the radiographical study.
- After inserting the implant in its place, a bony defect formed on the buccal surface, where this bone defect was repaired simultaneously to the implantation using Calcium Sulfate bone graft from DentoGen[®] to completely cover this defect.
- After applying the bone graft in place, 2-4 minutes were waited

Figure 1. Clinical photos shows: A) initial situation of the case, B) initial width of attached gingiva equal 5 mm, C) final drills translucency under the bone, D) attached gingiva width 5.7 mm 4 months after surgery at T2 time.



to ensure its rigidity, then the flap was replaced in its place with sutures using 4/0 Nylon, with achieving tension-free closure.

- Patients were provided with postoperative instructions and appropriate prescription, reviewed after 7 days for suture removal.
- Follow up were done after the end of the bone healing process 4 months postoperatively (T2 Time) and at the start of the second surgical stage for gingival healing, where the second measurement was taken to display the width of attached gingiva in the implant site using a periodontal probe and record the measurements in mm.

Measurements were compared at T0 and T2 times to determine the changes in the attached gingival width following implantation and bone grafting.

The survival rate of the implants was determined at this stage during gingiva former insertion.

Results

The research sample consisted of 24 dental implantation sites in a resorbed alveolar ridge in 12 patients referred for dental implantation where the mean radiographical measurement of the resorbed ridge width before the operation (T0 Time) according to the 3D diagnostic images was 4.133 ± 0.543 mm.

The mean width of the attached gingiva before surgery was $4.06 \text{ mm} \pm 1.122$ and the difference in measurement between the averages between T0 and T2 times was $+ 0.775 \pm 0.511$ mm, which expresses an increase in attached gingival width after the end of the 4-months healing period. Table 1 and Figure 2.

The survival rate of implants in the second surgical stage after 4 months of surgery (T2 Time) was 100% of the implants that were

performed. Table 2

Discussion

The aim of this research is to perform single-stage guided bone regeneration (GBR) in a narrow socket (3.5 - 5.5 mm) instead of the two-stage technique. To achieve this, we used a bone graft (CS) alone depending on its properties and with the length of its clinical use that exceeded 110 years [9].

Surgical protocols differed in treating horizontally resorbed alveolar ridges, a systematic review of bone alveolar edges with confined partially edentulous spaces concluded that studies support a single-stage GBR procedure whenever it is possible [10].

The results of this research showed that the change in the width of the attached gingiva between the times T0 and T2 is $+ 0.775 \pm 0.511$ mm. This increase in the width of the attached gingiva accompanying the bone grafting process can be attributed to the type of bone graft used from the type of calcium sulfate, as many previous studies indicated the use of this graft as a barrier membrane in bone grafting operations because of its properties in preventing the migration of epidermal cells towards the covering bone [11] and its ability to stimulate the generation of vascular growth [12]. Strocchi study concluded that the CS graft is remarkably capable after 4 weeks of its application to increase the formation of blood vessels, which may have a role in improving the blood supply of the soft tissues covering it and improving its healing [13].

The results of the study carried out by Lorenz et al., to assess the condition of the tissues around the implants and the stability of these tissues after the implantation in a narrow socket with a direct bone grafting procedure in the implantation session on

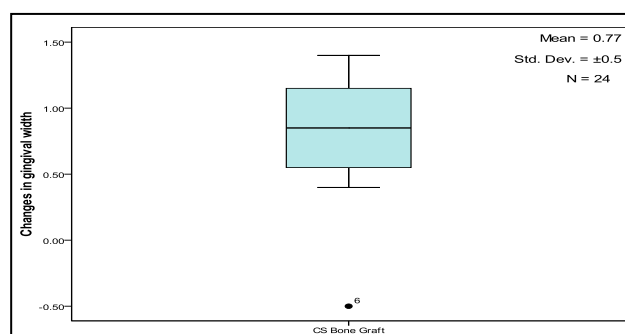
Table 1. Study of changes in gingival width after 4 months of surgery at T2 time.

Number of implants	Mean change	Standard deviation	Range	Min	Max
24	0.775	0.512	1.9	0.5-	1.4

Table 2. Results of implants success rate at T2 time.

	N of implants	percentage	result
Success implants	24	100%	Totally success of implants
Failed implants	0	0%	
Sum	24	100%	

Figure 2. A Diagram shows the changes in gingival width.



47 implants showed that the width of the attached gingiva after the end of the 3-year observation period was 3.2 mm. The minimum is 2 mm and the highest value of the attached gingiva width around the implants was 6 mm. He also indicated that the success rate of the implants that were used in the studied cases was 100% of the implants that were applied, and he indicated that the use of this treatment protocol in implantation and grafting directly has achieved the required results and durable implants with the surrounding soft tissues [14].

The results of this research are in agreement with Meijndert et al study in which bovine grafts with collagen membranes were used and compared with autografts from the chin. The mean width of the attached gingiva after 12 months was 2.79 ± 0.51 mm [15].

Wessing indicated in the study he conducted with his colleagues on 49 dental implants that were implanted in a narrow socket, and direct bone grafting was performed during the implantation using xenograft powder and the comparison between two types of membranes covering them that the survival rates of the implants were 100% and this was evaluated in the second surgical phase session 6 months after surgery [16].

Conclusions

Within the limits of our findings in this research, we conclude the following:

1. Presence of adequate width of attached gingiva buccally to implants that were placed simultaneously with the bone grafting process, after 4 months of surgery.
2. The ability to have a positive effect on the graft used to stimulate the growth of soft tissues.
3. The high survival rate of implants indicates the reliability of the method used for implantation and vaccination.

Recommendations

1. The method used in this research for implantation and direct grafting is recommended as a treatment option that provides results with high reliability in terms of the effect on soft tissues and the survival rates of implants.
2. Long-term observation of soft tissue changes around the implants that have been performed.

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