

Analysis of Soft and Hard Tissue Changes Following Immediate Implant Placement in the Esthetic Zone using Bone and Connective tissue grafting (A Comparative randomized clinical study)

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Abstract

Objectives: The aim of this prospective study were to evaluate esthetic outcome after immediate implant placement with simultaneous grafting of the buccal gap and soft tissue grafting to determine whether soft tissue grafting can enhance the soft tissue outcome.

Material and methods: This prospective study included patients who required an extraction and a subsequent immediate implant placement at maxillary anterior and premolar region. Pink esthetic score is recorded after six months post augmentation taking the adjacent teeth as the reference teeth.

Results: Sixteen patients were included in this study, eight of which belonged to the test group. Altogether, the differences after 6 months in median scores of mesial papilla, distal papilla, soft tissue margin, soft tissue contour, alveolar process deficiency, soft tissue color as well as soft tissue texture in the two groups (P-value = 0.105, Effect size = 0.926), (P-value = 0.442, Effect size = 0.430), (P-value = 0.442, Effect size = 0.430), (P-value = 1.000, Effect size = 0.000), (P-value = 0.442, Effect size = 0.430), (P-value = 1.000, Effect size = 0.000) and (P-value = 0.442, Effect size = 0.430), respectively. As regards total PES score; study group showed statistically significantly higher median score than control group (P-value = 0.038, Effect size = 1.234).

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Conclusions: As regards total PES score; study group showed statistically significantly higher median score than control group (P-value = 0.038, Effect size = 1.234) concluding that soft tissue augmentation can be a viable option to prevent long term esthetic complications.

Keywords: soft tissue augmentation; Immediate implant; PES.

Introduction

One of the most frustrating problems to the patient is the loss of one of his teeth especially in the anterior zone. This is not only frustrating for the patient but also it is one of the most aesthetically challenging cases to restore teeth in aesthetically sensitive zone. After tooth extraction changes in the bone occurs. Bone continues to resorb and remodel meaning that two thirds of this reduction occurs with the first three months after extraction and within one year approximately 50% of the ridge width is decreased.

The average vertical tissues loss that takes place at single extracted sites ranges from 1-4 mm varying according to the site. That's to say the rate of resorption is not the same in all cases being more pronounced in some cases more than others which is a physiological phenomenon that occurs at different rates and degrees.¹

Petrokovski et al² made a study on 123 human edentulous dry bone specimens and found that bone resorption pattern differs in maxilla than in mandible. In maxilla, bone resorption occurs in centripetal and apical way meaning that bone resorption was overwhelmingly from the buccal surface of the extraction socket with significantly reduced resorption from the palatal aspect of the socket.

On the other hand, resorption in the mandible was in a centrifugal and apical pattern leading to the formation of an edentulous crest central to the former tooth sockets. This difference in the pattern of the resorption producing a reverse horizontal overlap of the residual crests leading to changing in the maxilla/mandible

relationship.² This physiological hard and soft tissue changes that occur after extraction often makes deformities in the alveolar ridge making ideal restoration with proper function and aesthetics is not an easy case.³

Therefore, the idea of immediate implant placement was created to decrease the time period between extraction and implant placement. In addition to having the ability to place the implant in more ideal position, lesser number of surgical procedures, enhancing hard and soft tissue maintenance and better psychological impact on the patient. What supported the idea of immediate implant placement is that several studies showed successful osseointegration when implants are immediately placed after tooth extraction, with similar survival rates when compared to implants inserted in healed sites, with or without the help of guided bone regeneration procedures.⁴

Therefore, Careful planning is the key for the success for immediate implant placement with low risk of complications. These include initial primary stability, osseointegration and proper aesthetics.⁵ Immediate implant placement in the maxillary anterior region demands the most rigorous preoperative assessment and planning as this will have a direct impact on the aesthetic outcome and stability of the implant.⁶ To provide the optimal aesthetic and functional rehabilitation of the immediate implant, the following requirements are considered essential: sufficient bone volume (vertical, horizontal and contour), optimal implant position in mesiodistal, pico-coronal, buccolingual and in angulation, stable and healthy per implant soft tissue and aesthetically acceptable soft tissue contours.¹

Unfortunately, Implant treatment does not go without complications. When placing implants in the aesthetic zone, complications will have a great negative impact on aesthetics. One of the common complications associated with immediate implant placement is the gingival recession and deficiencies of the preimplant soft tissues. Prevention of these complications is far way preferred than

trying to fix them after they occur.⁷ This is why researchers recommended soft tissue augmentation to be done simultaneously with implant placement.²⁰ Nisapakultorn et al.⁸ found that thickness of soft tissue has a great impact on facial marginal mucosal level and the seal formed around implant abutment interface.

Therefore, the aim of this prospective study was to evaluate esthetic outcome after immediate implant placement with simultaneous grafting of the buccal gap and soft tissue grafting to determine whether soft tissue grafting can enhance the soft tissue outcome.

Patients & Methods:

Patient selection:

The study was conducted on patients selected from the outpatient clinic of the Oral and Maxillofacial Surgery Department, Faculty of Dentistry, Ain Shams University. Patients included in this study were selected from those seeking immediate implant placement in the aesthetic zone after tooth extraction. Total of 16 implants were inserted.

The study was conducted in accordance with ethical principles, including the approval from REC, FD, ASU. The study protocol was explained to all prospective candidates, and a written informed consent was received from each patient before *participation*. *The inclusion criteria* was Males and females ≥ 18 years of age, ASA I and ASA II, Patients with single tooth replacements in bounded area in the maxillary anterior and premolar segments that are non-restorable, thin gingiva biotype & Intact labial bone.

The exclusion criteria were Patients who have a loss of more than 50% of the labial plate of bone at time of extraction, Patients with active acute infection related to the extraction site, Patients that lack a stable occlusion as deep bite and/or a healthy periodontium as chronic gingivitis or chronic periodontitis, Patients who have parafunctional habits as bruxism, Patients with poor oral hygiene that are not responsive

to motivation and improvement, Patients suffering from diseases affecting the bone healing & Patients who smoke more than 10 cigarettes a day.

Surgical procedure:

After atraumatic tooth extraction, the presence of all bony walls was guaranteed then patients were randomly distributed into one of two treatment groups, A and B:

- Group A (Study Group): Extraction and placement of 8 immediate implants were carried out. The horizontal gap distance between the immediately placed implant and the socket bony was filled with an organic bovine bone (ABB) and a free subepithelial connective tissue graft (CTG) harvested from the palate was inserted in the labial mucosa.

- Group B (Control Group) Extraction and placement of 8 immediate implants were carried out. The horizontal gap distance between the immediately placed implant and the socket bony was filled with an organic bovine bone (ABB).

After reaching the required asepsis, local anesthesia articaine 4% and adrenaline 1:100,000 was administered and once the tooth had been anaesthetized, atraumatic tooth extraction was done by the following manner: intrasulcular incision was done around the tooth to be extracted and periostomes were used. Once the tooth has been delivered out of the socket, the socket was then thoroughly checked for the integrity of its 4 walls, and then debrided carefully to eliminate any granulation tissue that might exist and irrigated with sterile saline solution. The implant bed was then prepared by sequential drilling, according to the implant system protocol.

In Group (A) sockets: the gap between the implant and the socket wall was grafted with inorganic bovine bone (ABB) (fig.1,2,3) and a free subepithelial connective tissue graft (SCTG) harvested from the palate was inserted in the labial mucosa after creating a partial thickness envelope or pouch (fig.4).

In Group (B) sockets: the gap between the implant and the socket wall was grafted with inorganic bovine bone. After placement of the implant, non-submerged healing abutment was connected to the implant fixture.



Fig1. Preoperative view.



Fig2.extraction of the tooth



Fig 3. Buccal gap

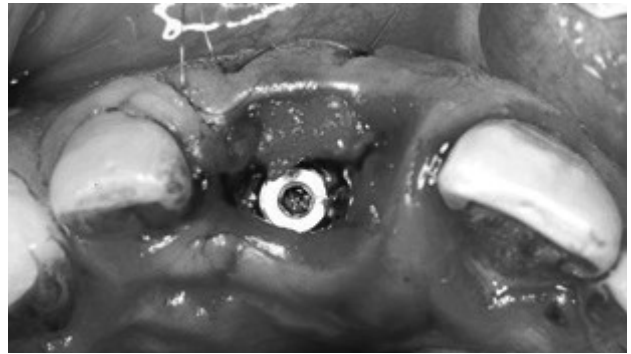


Fig 4. Grafting the buccal gap and soft tissue grafting.

Methods of assessment:

Aesthetic outcome was evaluated according to the PES (Pink aesthetic score). The pink aesthetic score (PES) evaluates the esthetic outcome of soft tissue around implant-supported single crowns in the anterior zone by giving seven points for the mesial and distal papilla, soft-tissue level, soft-tissue contour, soft-tissue color, soft-tissue texture, and alveolar process deficiency.⁹ Scores 0, 1 or 2 were given to each parameter. Regarding mesial and distal papilla, score 2 is given in case of complete presence of papilla, 1 in case of partial presence and 0 in case of total absence of papilla. Soft tissue contour is defined as the visibility of implant restoration margins which is given score 2 in case of complete adaptation, 1 in case of small difference present and finally 0 in case of significant difference. Assessment of soft tissue level is done by comparing with the adjacent tooth. In case of similarity score 2 is given, 1 in case of difference less than 1 mm and 0 in case of difference more than 1 mm. Color and texture of soft tissue is affected by the presence or absence of inflammatory process. The acceptable total score is more than 6.¹⁰

Results:

There was no statistically significant difference between median scores of mesial papilla, distal papilla, soft tissue margin, soft tissue contour, alveolar process deficiency, soft tissue color as well as soft tissue texture in the two groups (P -value = 0.105, Effect size =

0.926), (P -value = 0.442, Effect size = 0.430), (P -value = 0.442, Effect size = 0.430), (P -value = 1.000, Effect size = 0.000), (P -value = 0.442, Effect size = 0.430), (P -value = 1.000, Effect size = 0.000) and (P -value = 0.442, Effect size = 0.430), respectively.

As regards total PES score; study group showed statistically significantly higher median score than control group (P -value = 0.038, Effect size = 1.234).

Table: Descriptive statistics and results of Mann-Whitney U test for comparison between PES in the two groups

PES	Study (n = 8)		Control (n = 8)		P -value	Effect size (d)
	Median	Range	Median	Range		
Mesial papilla	1.5	1 – 2	1	1 – 1	0.105	0.926
Distal papilla	2	1 – 2	2	2 – 2	0.442	0.430
Soft tissue margin	1.5	1 – 2	1	1 – 2	0.442	0.430
Soft tissue contour	1.5	1 – 2	1.5	1 – 2	1.000	0.000
Alveolar process deficiency	2	1 – 2	1.5	1 – 2	0.442	0.430
Soft tissue color	2	1 – 2	2	1 – 2	1.000	0.000
Soft tissue texture	2	1 – 2	1.5	1 – 2	0.442	0.430
Total PES score	12	10 – 12	11	9 -11	0.038*	1.234

*: Significant at $P \leq 0.05$

Discussion:

The popularity of immediately placed implants returned back to decreasing the overall treatment period between extracting the tooth and placing the implant which is more appealing to the patients. This makes immediate implant placement replacing single missing teeth in the anterior maxilla is a viable option.¹¹ Other advantages of immediate implants which are not less important including decreasing bone loss in both vertical and horizontal directions, reducing number of surgeries done and better psychological impact on the patients.¹²

Based on the review of literature, immediate implants have also some disadvantages as presence of gap between the implant and the extraction socket where the ideal modality in dealing with this gap is still a matter of debate. The need for grafting offsets the presumed advantage of lowering the cost. In addition to, this procedure is more technically demanding and more extensive soft tissue manipulation may be needed.¹¹ At the beginning it was thought that immediate implant placement would avoid the dimensional changes that occur after extraction but clinical and experimental studies¹¹ failed to prove especially of the buccal plate leading to midfacial recession which has negative impact on the aesthetic results.¹²

For predictable aesthetic results, immediate implant should be placed in thick gingiva biotype. Decreased gingival thickness results in unfavorable consequences as marginal bone loss and loss of periodontal attachment.¹³ Studies¹³ conducted by Sammartino et al and Belser et al revealed that presence of thin preimplant soft tissue increases the gingival recession risk and consequently the exposure of the metal margin of the implant prosthesis.

Schneider et al. in 2011¹⁴ conducted a study examining the stability of the augmented preimplant tissues after bone and sub-epithelial connective tissue grafting. After one year follow up only minimum changes (0.04 +/- 0.31 mm) were found between the post-surgical and the one year follow up concluding the high degree of stability of this kind of soft tissue grafting.

Kan et al. ¹²in 2009 evaluated the soft tissue changes and biotypes of 20 patients who had undergone immediate single implant with connective tissue grafting. At an average follow-up of 2.15 years, 100% of the sites had 2: 50% papilla fill while 80% of the sites had complete papilla fill proving the efficacy of immediate tooth replacement in preserving the interproximal papilla. Moreover, no significant differences were recorded between the initially thin or thick gingival biotypes.¹²The results of the present study supported the previous studies as study group showed statistically significantly higher median PES score than control group (P -value = 0.038, Effect size = 1.234

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