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RESEARCH ARTICLE

EVALUATION OF MARGINAL BONE LOSS AROUND IMMEDIATE DENTAL IMPLANTS WITH SYNTHETIC HYDROXYAPATITE GRAFT : A PROSPECTIVE CONTROLLED STUDY

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ABSTRACT

Purpose: The purpose of this study was to evaluate the marginal bone loss around immediate dental implants with synthetic Hydroxyapatite graft.

Materials and Methods: Twenty- four implants in the premolar area of maxilla in 15 patients were included in this study. 12 implants placed immediately after extraction with synthetic hydroxyapatite graft (group I) and 12 without using hydroxyapatite graft served as control (group II). Implant success, plaque index PI, and bleeding index BI, and marginal bone loss MBL were evaluated.

Results: Complete soft tissue healing had occurred in all patients and all the implants were successfully osseointegrated over 18 months. The results of the present study showed that at 18 months the mean values of MBL were 1.30±0.21mm at control site and 0.68±0.13mm at the test site, there were no statistical differences between the test and control group regarding, BI, PI, while there was statistical differences between the test and control regarding MBL through follow- up periods.

Conclusions: Using synthetic hydroxyapatite graft with immediate placement of dental implants into Fresh Extraction sockets significantly reduces marginal bone loss around the implants.

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INTRODUCTION

Immediate implant placement in postextraction sites, without waiting for the site to heal is a treatment modality that has received much attention, and has shown favorable results (Lazzara, 1989; Anneroth *et al*., 1985; Gelb *et al*., 1993; Paolantonio *et al*., 2001; Becker and Becker, 1990; Becker *et al*., 1992; De Bruyn and Collaert, 2002). It is a well-accepted protocol due to the preservation of aesthetics, shorter total treatment time, better actual implant placement and maintenance of socket walls (Lazzara, 1989). However, in animal (Araujo *et al*., 2005; Araujo *et al*., 2006) and human (Botticelli *et al*., 2004) studies, it was shown that immediate postextraction implant placement failed to prevent the natural bone resorption that occurred in the socket walls and especially in the buccal wall. It was also shown that this bone remodeling resulted in a marked reduction of the residual ridge dimension and occurred in the first months after tooth extraction (Araujo *et al*., 2006; Botticelli *et al*., 2006). Hydroxyapatite HA is the most studied calcium phosphate material with clinical experience of its use going back to the 1970s (Meffert *et al*., 1985) HA has been used clinically in dental, craniofacial and orthopedic surgery (Meffert *et al*., 1985; Salyer and Hall, 1989; Rosen and McFarland, 1990; Kamegaya *et al*., 1994). The aim of this study was to evaluate the marginal bone loss around immediate dental implants with synthetic hydroxyapatite graft.

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MATERIALS AND METHODS

This study was designed and performed as a prospective controlled study. All patients were asked to sign surgical consent forms. The study protocol was approved by an ethical committee of Al-Andalus University of Medical Sciences. Fifteen patients (9 females and 6 males) ranging in age 43-56 years with an endodontic failure, tooth fracture, or unrestorable carious tooth in premolar area of maxilla were included in this study. The patients received twenty- four implants, 12 implants placed immediately after extraction with synthetic Hydroxyapatite graft (group I) and 12 without using hydroxyapatite graft served as control (group II). All patients in this study were at physically able to tolerate the procedure, had to be in good health, with no chronic disease or smoking habits. Patients were excluded if any of the following were evident: periodontal disease; any disease, condition, or medication that might compromise healing or osseointegration; or inability or unwillingness to return for follow-up visits and.

All implants in this study were Euroteknika implants (Euroteknika, Sal-lanches, France), which are compatible with the Astra system (Dentsply International, Waltham, MA, USA). The dimensions ranged from 10 to 12 mm in length and 4.1 mm in diameter. Primary stability (torque 25 N/cm) of the implants was achieved during the surgical procedure.

Surgical procedure

One hour before surgical procedure, patients began a prophylactic regimen of 600 mg clindamycin. All procedures were performed after the administration 3.6-5.4 ml of combination consisting of a local anesthesia (MepevacaineHcl 2%) and a vasoconstrictor (Levonordefrin) at ratio of 1:20,000. Full-thickness mucosal flaps were raised, and then the teeth were gently extracted by extraction forceps, with minimum surgical trauma and without any damage to the adjacent hard tissues. The bony sockets were then carefully debrided with a sharp curette to remove any granulation or fibrous tissue present and irrigated with sterile saline. Integrity of the socket walls and socket depth from the alveolar crest of bone to the socket apex were checked with the osteotomy probe. Depth of the socket was measured to determine the drilling needed after the root apex.

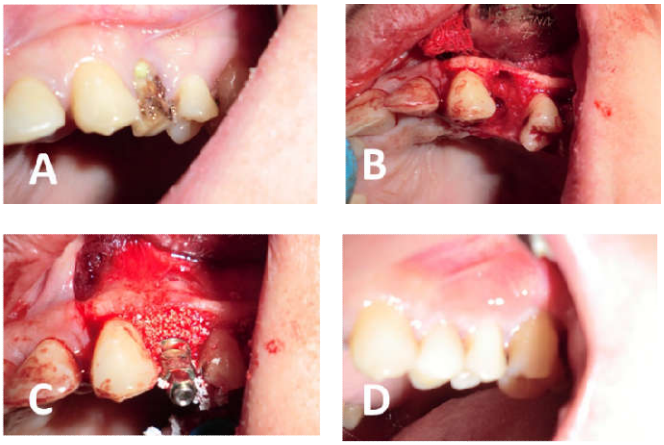

Fig. 1. (A) Before extraction. (B) After extraction. (C) implant placement with HA graft. (D) after final restoration (Test group)

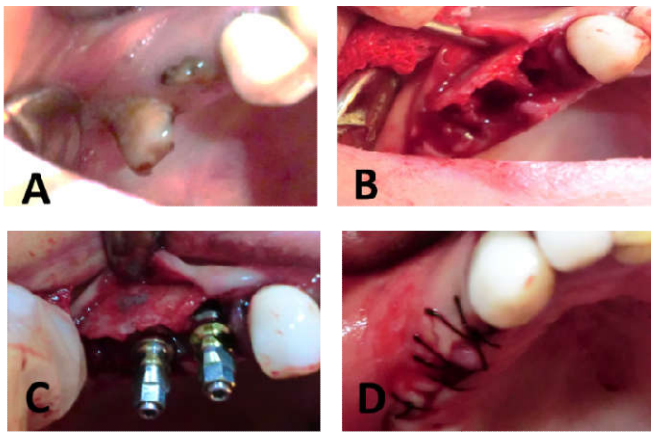

Fig. 1. (A) Before extraction. (B) After extraction. (C) implants placement. (D) after suturing (control group)

Osteotomies were performed via standard protocols in all cases, including, slow-speed sequential drills, and copious irrigation. Drilling extended at least 3-5 mm beyond the root apex. Implants were manually screwed into the prepared osteotomies at the crestal ridge. Implant stability was monitored and noted upon placement. After the implants were placed the space between the alveolar bone and the tested implants filled with hydroxyapatite graft, Closure of the wound was obtained by coronal repositioning of the flap. Fig 1,2.

Postoperative Phase

Post-operative instructions were given to the patients, which included extra-oral ice packs application for 2 hours on the first day to minimize oedema, oral hygiene instructions including warm 0.2% Chlorhexidine Hcl as an antiseptic mouthwash twice daily for 7 days, to continue the use of 300 mg clindamycin orally every 6 hours postoperatively for five days and to take ibuprofen 600 mg twice daily for 7-10 days. A direct digital panoramic radiograph was taken immediately after implants placement to evaluate the implants position. Patients were recalled after 1 week for the removal of sutures and to assess the presence of any pain, swelling, or infection. After a healing period of 6 months, the second-stage surgical procedure was performed with the placement of a healing abutment on the implant. Prosthetic rehabilitation started 2 weeks after the second stage surgical procedure, in which the prosthesis were cemented with temporary cement.

Follow-up Phase

A-Clinical Evaluation:

All patients were examined immediately after surgery and during the first week to check if there was pain, discomfort, swelling, or infection. The plaque index PI and bleeding index BI were used for clinical evaluation at 12 and 18 months after implant placement. In accordance with Mombelli *et al*. (1987)

B-Radiographic Evaluation:

Radiographic examinations with digital panoramic radiographs were performed directly after surgery (baseline) and at 6, 12 and 18 months. An independent radiologist analyzed the radiographs without knowledge which implants were treated with PRGF. The reference for the measurements was the implant-abutment interface. The saved image was opened in Image J program. The scale was determined in reference to the known implant length. From “Analyze” command, “Set Scale” command was selected to convert pixels dimension to millimeters. A line was drawn from the implant apex to the implant shoulder. The length of the implant was measured and compared to the real implant length to determine the magnification factor in the image. The distance from the implant apex to the first seen point of Bone Implant Contact was measured. The difference between it and the implant length represents vertical marginal bone defect. The measurements were noted mesially and distally and the mean was calculated in mm according to the magnification factor of the image. All the measurements were taken three times then the mean was calculated. In accordance with Buser *et al*.

(1990) an implant was classified as having survived if the following parameters were met: (1) absence of recurring peri-implant infection with suppuration; (2) absence of persistent subjective complaints such as pain, foreign body sensation, and/or dysesthesia; (3) absence of a continuous radiolucency around the implant; and (4) absence of any detectable implant mobility.

Data analyses

The statistical analyses were performed using SPSS version 17 software (SPSS Inc., Chicago, IL, USA). Comparison between quantitative variables were carried out by Student t-test of two independent samples. The results were considered to be significant at P- values less than 0.05.

RESULTS

All patients showed good compliance and the healing period was uneventful for both treatment groups without infection or complications. The survival rate was 100% in two groups and none of the implants lost osseointegration through follow up periods. Baseline analysis of marginal bone loss showed no significant differences between group I and group II, thus allowing post-treatment results to be compared.

Plaque Index (PI):

There were no significant differences between control and test groups at 12 and 18 months, at 5% level (P>0.05), (Table 1), mean plaque index values were 0.72±0.33at control group, 0.53±0.31at test group at 12 months, and they were 0.98±0.23at control group, 0.97±0.25at test site at 18 month.

Bleeding index MBI :

There were no significant differences between control and test groups at 12 and 18 months, at 5% level (P>0.05), (Table 1), mean Bleeding index values were 0.66±0.28at control group, 0.62±0.31at test group at 12 months, and they were 0.67±0.48control group, 0.67±0.48at test site at 18 months

Marginal bone loss MBL:

There were significant differences between control and test groups at 6,12 and 18 months, at 5% level (P<0.05), (Table 2), mean Marginal bone loss were 0.85±0.05 at control group, 0.325±0.57at test group at 6 months, 1.19±0.13 at control site, 0.47±0.09at test group at 12, and they were 1.30±0.21control group, 0.68±0.13at test site at 18 months. (Table 2)

DISCUSSION

Al though the Immediate implant placement in post extraction sites has received much attention in the literature and has shown favorable results (Lazzara, 1989; Anneroth *et al*., 1985; Gelb *et al*., 1993; Paolantonio *et al*., 2001; Becker and Becker, 1990; Becker *et al*., 1992; De Bruyn and Collaert, 2002). There are some topics as esthetic outcome, preservation of alveolar process, are still matter of debate (Quirynen *et al*., 2007). The aim of this study was to evaluate the marginal bone loss around immediate dental Implants with synthetic hydroxyapatite graft. In this study, Soft tissue healing was uneventful in all patients included, none of the patients suffered from pain or periimplant infection, all implants were found to be successfully osseointegrated without any signs of peri-implantitis through follow-up periods. Plaque index, bleeding index were evaluated to rule out the effect of peri-implant tissues inflammation on the marginal bone loss, and the results showed that there were no statistically significant differences between means of (BI), (PI) at test and control group at 12 and 18 months follow up periods. There were statistical differences between the test and control groups regarding marginal bone loss through follow- up periods. At 18 months follow-up period, the mean values of marginal bone loss in this study were 1.30±0.21mm at control group and 0.68±0.13mm at the test group. Casap *et al*. (2007) reported the outcome of 30 implants immediately placed after extraction. One implant failed immediately after restoration. No bone loss data were provided. In that study A potential disadvantage with immediate implants could be the mismatch between the implant surface and the socket walls. Some investigators have tried to regenerate the missing bone between the implant surface and the sockets using various bone augmentation techniques such as autogenous bone grafts

Table 1. Mean± SD and t test of plaque index (PI), bleeding index (BI) in the tested groups (I and II) during different observation periods

	PI			BI		
	I	II	P value	I	II	P value
12mo.	0.53±.031	0.72±0.33	.076	0.62±0.31	0.66±0.28	0.737
18mo.	0.97±0.25	0.98±0.23	1.00	0.66±0.47	0.67±0.48	0.881

Table 2. Mean± SD and t test of marginal bone loss (MBL) in the tested groups (I and II) during different observation periods

	MBL		
	I	II	P value
Baseline	0.12±.096	0.12±.096	1.000
6mo.	0.325±0.57	0.85±0.05	.000
12mo.	0.47±0.09	1.19±0.13	.000
18mo.	0.68±0.13	1.30±0.21	.000

(Becker *et al*., 1994; Bilge Gökçen-Röhlig *et al*., 2010), guided bone regeneration with resorbable or nonresorbable barriers, (Brägger *et al*., 1996; Rosenquist and Ahmed, 2000) and various bone promoting molecules, such as enamel matrix derivative (Cangini and Cornelini, 2005), or recombinant bone morphogenetic protein (Fiorellini *et al*., 2005). Marginal bone loss was decreased significantly when the using of PRGFs with immediate dental implants after extraction in our previous studies (Al Nashar and Yakoob, 2015; Al Nashar *et al*., 2016). Cornelini *et al*. (2004) evaluated the use of a porous bone mineral matrix xenograft (Bio-Oss) as an adjunct to a biodegradable barrier membrane (Bio-Gide) to support healing following the immediate placement of transmucosal implants into extraction sockets. Their results revealed that, the radiographic bone level remained unchanged compared to baseline in the test and control groups. In the study performed by Scott and Maurice, (Scott and Maurice, 2002) using a synthetic bioactive restorable bone graft of low-temperature HA material mixed with autogenous bone graft for implant reconstruction. The results were showed that, the underlying implants were found to be covered with a thick layer of mature bone. Paulino Castellon *et al*.(2004) investigated the immediate implant placement in sockets augmented with HTR synthetic bone. They concluded that, immediate implant placement in combination with HTR synthetic bone graft is a predictable procedure and provides a good bone for successful prosthetic reconstruction. Hassan *et al*. (2008) demonstrated a comparative evaluation of immediate dental implant with autogenous versus synthetic guided bone regeneration. The results showed that the autogenous bone graft appeared to be superior and the graft of choice because it maintained bone structure and has activated the osteogenesis process. The marginal bone loss after 12 month in their study was 1.65 ±0.23 in autougenous graft group and 2.55 ± 0.51when the synthetic guided bone regeneration is used.

Conclusion

Within the limits of the present study Using synthetic Hydroxyapatite graft with immediate placement of dental implants into fresh extraction sockets reduces marginal bone resorption around the implants. The results of our study however, need to be confirmed in the long term and with a larger sample of patients.

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