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OSSEOINTEGRATION OF IMPLANT PLACED IN EXTRACTION SOCKET AND AUGMENTED WITH ALLOPLASTIC BONE SUBSTITUTES AND SUBEPITHELIAL CONNECTIVE TISSUE GRAFT IN COMPARISON TO THOSE AUGMENTED WITH ALLOPLASTIC BONE SUBSTITUTES ONLY (A RANDOMIZED CONTROLLED CLINICAL TRIAL)

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ABSTRACT

Background: The objective of this study was to assess the osseointegration around endosseous dental implants inserted in fresh extraction sockets using β-Tricalcium phosphate bone graft with and without subepithelial connective tissue graft.

Methods: Twenty patients were enrolled in this study and allocated randomly to control group (Ten fresh extraction sockets were implanted by immediate dental implants and grafted by ß-tricalcium phosphate) or test group (Ten fresh extraction sockets were implanted by immediate dental implants and grafted by ß- tricalcium phosphate with a subepithelial connective tissue graft). The clinical parameters were monitored at 6,9 and 12 months post-implantation while the radiographic evaluation was conducted immediately after implant insertion(baseline),6 and 12 months postoperative. The implant stability was monitored using periotest at baseline,6 and 12 months after implantation.

Results: All implants in both groups were well osseointegrated resulting in a 100% cumulative success rate after one year follow up. There were no significant differences between the studied groups regarding clinical and radiographically parameters throughout the study period. However, the patients in test groups displayed better assessments regarding pocket depth, periotest value, keratinized mucosa and marginal bone level than patients within the control group.

Conclusion: The using of subepithelial connective tissue graft as a membrane with β-Tricalcium phosphate bone graft could improve osseointegration around dental implants in fresh extraction sockets.

Key words: Subepithelial connective tissue graft, extraction sockets. periotest, dental implants, osseointegration, alloplast graft.

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INTRODUCTION

Dental implants considered as a successful treatment plan for missing teeth restoration regarding esthetic and function (Gotfredsen 2012). Immediate implantation offers several advantages over delayed dental implantation: overall treatment time reduction, soft tissue profile maintenance, inhibition of the vertical and horizontal bone loss, decreased surgeries number thus decreasing total cost and morbidity (Khurram et al.2008). Sufficient amount of bone around the dental implant is a critical factor for enhancement of osseointegration, the long-term survival, and success of implant-supported reconstructions (Benic & Heammerle 2014). The difference between diameters of endosseous dental implants and fresh extraction sockets generates a gap between the implant surface and socket walls (Huys 2001). Epithelial cells can be rapidly colonized into large void causing fibrointegration then implant failure (Paolantonio et al. 2001). Many methods have been used to fill this bony defects around endosseous dental implants. With these techniques, bone substitute materials with or without membrane are often used (Jones et al. 2006). Regarding the origin, bone grafts can be classified into autografts, allografts, xenografts, and alloplasts (Benic & Heammerle 2014). Porous calcium phosphate is a member of alloplastic bone substitutes that have been investigated intensely for more than 20 years (Barrere et al. 2006) and can be considered as one of the most frequent alloplastic bone substitutes used in implant dentistry (Szabo et al. 2001). Tricalcium phosphate has the following characters: biocompatible, osteoconductive, rapid resorption and replaced by host tissue (Jensen et al. 2006). In addition, tricalcium phosphate allows the space for bone ingrowth (Jensen et al. 2009). There are a big variety of barrier membranes that can be used for guided bone regeneration. Appropriate selection of this barrier membranes depends on the following inclusions criteria: biocompatibility, adequate clinical manageability, integration by the host tissue, space-making ability and cell occlusiveness (Hardwick et al. 1994). Depending on their resorption the barrier membranes can be classified into non-resorbable and resorbable, according to their origin resorbable type can be divided into natural and synthetic. Regarding the clinical data and long-term effectiveness, documentation needs to be available on the procedures and materials to recommend their clinical use (Benic & Heammerle 2014). Therefore, the aim of this study was to assess the integration around endosseous dental implants inserted in fresh extraction sockets using β-Tricalcium phosphate bone graft with and without subepithelial connective tissue graft.

MATERIALS AND METHODS

Patient selection

The study population consisted of twenty patients with age range from 23 to 45 years; who were referred to Periodontology Department, Tanta University, between February 2015 and April 2016. Each patient was scheduled for one immediately placed dental implant. Indications for tooth extraction included non-restorable tooth fracture and endodontic treatment failure, all patients were signed informed consent. Random allocation of the patients into one of the two implant groups was done utilizing closed envelopes that identify to which group the subjects were enrolled, with 1:1 allocation ratio. All patients met the following criteria:

- 4- wall sockets at the immediate implant sites
- A minimum of 4 mm of bone present beyond the root apex for primary implant stability
- At least 4 mm of bone width and 10 mm of bone height
- Single-rooted tooth
- An absence of fenestrations or dehiscences in sockets wall
- An absence of any acute local pathology at an immediate implant site

- An absence of any systemic disorders that can affect healing response
- Good oral hygiene and non-smokers
- An absence of any parafunctional habits and traumatic occlusion

Study groups

Control group: Ten fresh extraction sockets were implanted by immediate dental implants and grafted by ß- tricalcium phosphate (Cerasorb- Curasan, Germany)

Test group: Ten fresh extraction sockets were implanted by immediate dental implants and grafted by ß- tricalcium phosphate with a subepithelial connective tissue graft.

Preoperative intraoral therapy:

1) Each patient was evaluated through examination of panoramic, periapical radiographs and diagnostic casts to evaluate the anatomic conditions.

2) In order to create a favorable oral environment to wound healing, proper oral hygiene instructions, periodontal treatment if needed, scaling and root planing were performed for each case.

3) For each patient preoperative premedication was given including amoxicillin 2.0 g, orally (Amoxil 500mg, GlaxoSmithKline, United Kingdom) two hours before implantation procedure (none of the study population were sensitive to the Penicillin), and 0.12% chlorhexidine rinses (Peridex oral rinse, 3M ESPE Dental Products, U.S.A) for 1 minute immediately prior to surgical procedure.

Surgical procedure

All steps of the surgical procedures were done under local anesthesia with strict aseptic measures. Following anesthesia, a sulcular and vertical incisions were made. Then the full thickness mucoperiosteal flap was reflected and teeth were extracted a traumatically using dental forceps in order to preserve the surrounding alveolar bone (Fig .1). The extraction sockets were curetted and irrigated using saline to remove remaining granulation tissue. Socket walls were examined for the presence of dehiscence defects or fenestrations. Then the implant sites were prepared according to the guidelines given by the manufacturers. In this study Dio implant system (66, Centum Seo-ro, Haeundae, Busan, Korea) was used, the implant fixtures were made of pure commercial titanium and have the following body designs: upper taper threads which dissipates stress applied on top of implant, 15 degree taper apical portion which allows easier penetration and round apex to reduce the risk of tissue damage during implant insertion. The implant diameters used in this study were 3.8mm and 4mm with a length of 11.5 mm and 13mm. Preparation of fixture site was started firstly with guide drill (2mm in diameter) which locate the insertion pathway of fixture with 1200-1500 rpm speed and 15 N cm torque. Initial drill (2.1mm in diameter) was used to create osteotomy site with 1200-1500 rpm speed and 15 N cm torque, then a pilot drill (2.7mm in diameter) was applied to expand osteotomy site for easy insertion of a tapered drill. Taper drill with stopper was used with pumping motion to avoid the frictional heat. Tap drill was used with 30 rpm speed and 35-45 N cm torque to make female threads for easier fixture insertion, implant fixture and fixture driver were connected to hand piece which rotated with 30 rpm speed and 35-45 N cm torque, finally torque wrench was used with 55 N cm torque to insert fixture completely, to achieve primary stability the fixture was placed 3-5mm apical to socket apex (Fig .2). The cover screw was placed using hex driver on the top of the implant. The peri-implant defect was augmented with ß-tricalcium phosphate bone graft. In the palate, a horizontal incision was performed 3 mm away from the gingival margin within the area of the first molar

to the first premolar and two vertical incisions were made at two ends of a horizontal incision. After the epithelial tissue layer reflection, a 1-mm thickness, 4 mm in width and 7 mm in length of connective tissue was excised by sharp incision to cover the grafted peri-implant area and fixed by Horizontal cross mattress suture. Releasing incision was made and the mucoperiosteal flap was repositioned with simple interrupted suture (Fig .3).

Post-operative care:

Patients were instructed to take Amoxicillin 500 mg orally every 8 hours for 6 days, 0.12% chlorehexidine mouthwash every 12 hours for 2 weeks and Ibuprofen 400 mg orally (Brufen 400mg, Mylan Products Ltd, United Kingdom) every 4 hours when needed (Huynh et al.2016). Patients were asked to avoid mechanical means of plaque control at the surgical area for 2 weeks. Sutures were removed after 10 days postoperative and patients were examined on weekly basis during the first month following surgery then the evaluation continued monthly until the end of the study. After six months abutment screw was used to remove the cover screw and mount final abutment on the implant (Fig .4). Using transfer technique, the final restorations were fabricated and then cemented on the implant (Fig .5).

Clinical follow up:

The clinical parameters were recorded at 6, 9 and 12 months postoperative visits. The probing pocket depth (PPD), modified sulcus bleeding index (mSBI) and modified plaque index (mPI) were recorded at four sites (mesio-buccal, disto- buccal, mid-buccal, and mid-palatal/lingual) around each dental implant using a UNC-15 probe (XP23/UNC 15; Hu-Friedy). The mPI and the mSBI indices were assessed according to rules of Mombelli et al. (1987). For statistical analysis, the highest index scores of mPI and mSBI for each implant were used. The PPD was recorded in millimeters from the gingival margin to the base of the probable pocket, the mean PPD was calculated for each implant. In addition, the periodontal probe was used to measure the width of keratinized mucosa (WKM) at the mid-buccal aspects in millimeters (Antonio et al.2006). The implants were considered failures when the following manifestations were found; infection, pain, implant mobility or was removed within the studied period. All individual implants showing less than 1.5 mm bone loss after the first year were considered a success.

Implant mobility was monitored using an electronic instrument (Periotest; Siemens, Bensheim, Germany), which has been recommended to measure horizontal displacement or initial degrees of implant mobility (Giovanni & Niklaus 2004). The measurements were done immediately postoperative, 6 and at 12 months after the implant insertion.

Radiographic evaluation:

Standard periapical radiographs were taken using a custom- fabricated bite block mounted on Rinn system (Dentsply, Friadent Schweiz, Nidau, Switzerland.) immediately postoperatively, 6 and12 months after implant insertion. The marginal bone-level were recorded as a distance from the implant shoulder that was used as reference point to the first observed bone to implant contact (DIB) (Fig .6). This distance was measured on the distal and mesial sites then the average value was used in every implant. Fixture diameter was used as an internal reference for adjustment of distortion in calibration.

Statistical Analysis:

Data were collected coded and analyzed using SPSS software version 22. Descriptive analysis was done followed by inferential statistics using; t-test, repeated measures ANOVA and Chi-Square test. The P value of 0.05% was considered as a cut off point for controlling of alpha error.

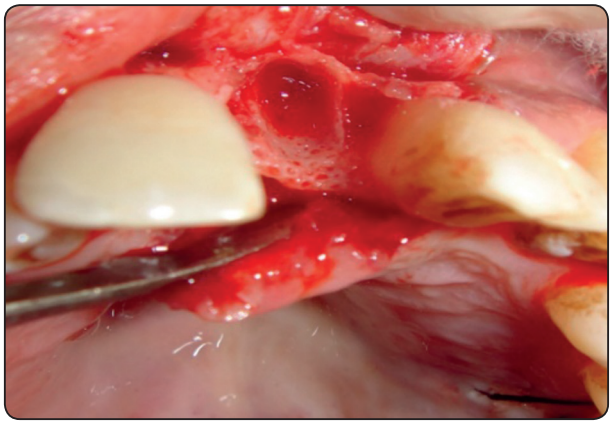
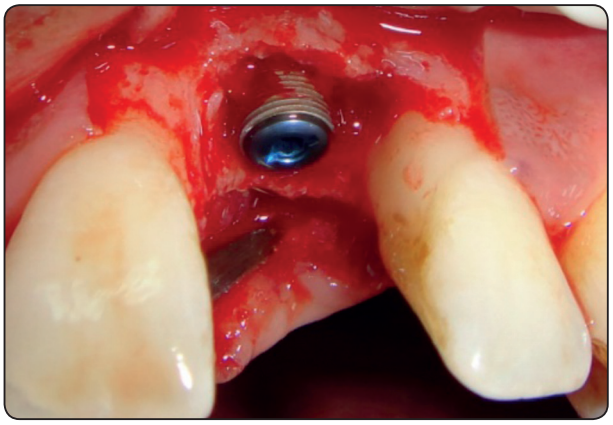


Fig. (1)



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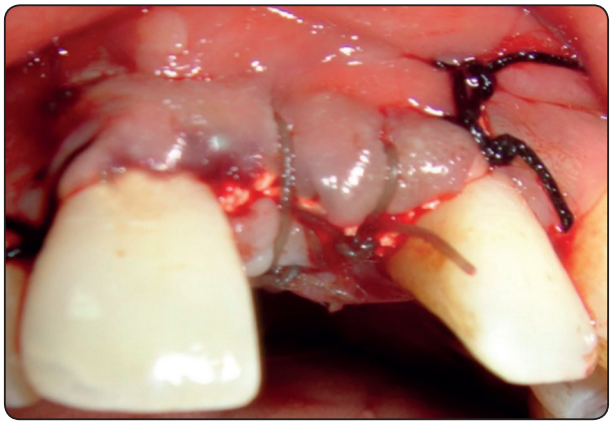

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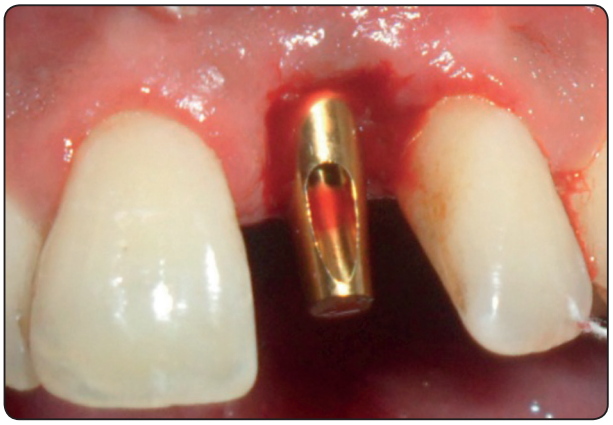

Fig. (4)

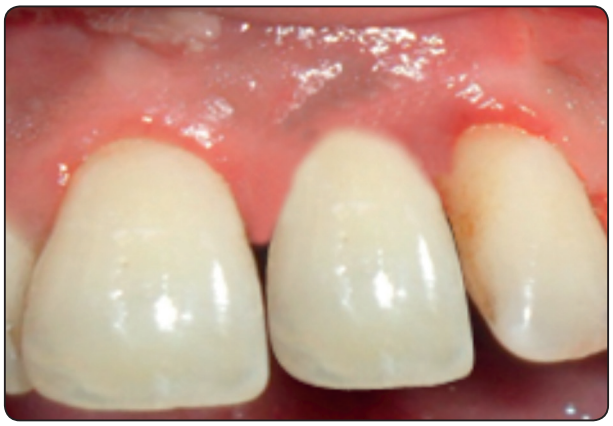

Fig. (5)

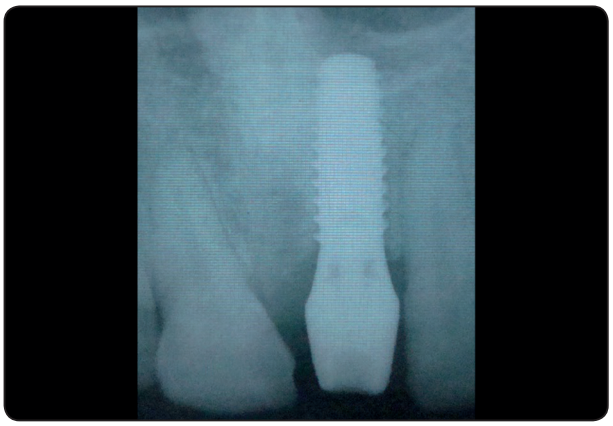

Fig. (6)

RESULTS

A total of 20 implants were inserted for 20 patients (14 females and 6 males). All patients in both groups attended the follow-up postoperative visits till the end of the study period (12 months). All patients recovered well from the surgeries, no intraoperative or postoperative inconveniences have been observed. All subjects showed uneventful healing with no significant periodontal complications during the course of the study. All of the implant retained prostheses were still in function with no prosthetic complications and recorded to be subjectively satisfying. All implants osseointegrated successfully with no signs of implant failure (looseness of the implant, soft tissue dehiscence, infection). The demographic characteristics of the studied subjects were presented in table (1). The majority of the studied patients were female 70%, among the test group the percentage of females was 80% while within the control group females represented 60%. The mean age of the subjects in the test and a control groups was 29.2 and 28.8, respectively. However, there were no statistically significant differences between studied groups in relation to both sex and age. Table (2) showed the comparison of modified plaque index between studied groups at different postoperative visits, in the test group the mean value of mPI at 6, 9 and 12 months postoperatively was 0.3±0.483, 0.4 ±0.516 and 0.5±0.527, respectively. While within the control group it was 0.2±0.422, 0.3 ±0.483 and 0.4±0.516 at 6, 9 and 12 months, respectively. These differences between studied groups at different follow-up periods were not found statistically significant. Clinical assessment of modified sulcus bleeding index in both studied groups was displayed in a table (3). In the test group, the mean value of mSBI was 0.2±0.422, 0.3±0.483 and 0.3±0.483 at 6, 9 and 12 months, respectively. Compared with 0.1±0.316, 0.2±0.422 and 0.3±0.483 of a control group, with no significant differences were found between the two groups at different periods of assessment. Table (4) demonstrated the measurement of pocket depth in test and control groups at different periods of evaluation. Within test group the mean value of PPD was increased from 1.3±0.3496 mm at 6months to1.4±0.3944 mm and1.5±0.4714 mm at 9 and 12 months respectively, the same observation was found within a control group where the mean value of PPD was 1.35±0.4116 mm at 6months and increase to1.5±0.3333 mm and1.65±0.3375 mm at 9 and 12 months respectively, however differences between both groups at different postoperative visits were not found significant. The distribution of the studied groups in relation to the width of keratinized mucosa at different periods of follow-up was presented in a table (5). In the test group the mean value of WKM was 4.7±0.483 mm, 4.5±0.527 mm and 4.4±0.516 mm at 6, 9 and12 months, respectively. Compared with 4.5±0.527 mm, 4.4±0.483 mm and 4.2±0.422 mm at 6, 9 and 12 months, respectively in a control group. Differences in the mean value of WKM among two groups were not found statistically significant. Within the test group, the mean value of periotest value (PTV) was changed with time of measurement where it was -3.1± 0.738 immediately after implant insertion and change to -2.9±0.568 and -2.6±0.516 at 6 and 12 months, respectively. These differences were statistically significant. The same observation was recorded in a control group where it was -3.2±0.632 and changed to -2.7±0.675 at six months and -2.3±0.675 at 12 months, with statistically significant differences. However, differences between studied groups at different recall visits were not significant (table 6). The mean value of a distance from the implant shoulder to first bone to implant contact (DIB) among the studied groups was illustrated in a table (7). Within the test group, the mean value of DIB showed a statistically significant increase from 0.43±0.1636 mm immediately after implantation to 0.5±0.17 mm and 0.61±0.1595mm at six and 12 months, respectively. The same observation was noted among the control group where it was 0.42±0.1549

mm and increased to 0.57±0.1252 mm at six months and 0.72±0.0919 mm at 12 months with significant differences. However, differences between two groups at different visits of measurements were not found significant. In these study, all implants in both groups were well osseointegrated resulting in a 100% implant survival.

TABLE (1): Demographic characteristics of studied groups

Character	Test		Control		P. Value
	n	%	n	%	
Sex					
Male	2	20	4	40	0.329
Female	8	80	6	60	
Age in years					
Mean	29.20		28.8		0.850
S.D	4.962		4.367		

p > 0.05 (not significant)

TABLE (2): Comparison of modified Plaque Index between studied groups at different periods of follow up

	Control group	Test group	P
At 6 months:			
Range	0-1	0-1	
Mean	0.2	0.3	0.628
SD	0.422	0.483	
At 9 months:			
Range	0-1	0-1	
Mean	0.3	0.4	0.660
SD	0.483	0.516	
At 12 months:			
Range	0-1	0-1	
Mean	0.4	0.5	0.673
SD	0.516	0.527	
p	0.004*	0.001*	

Significant

TABLE (3): Comparison of modified sulcus bleeding Index among studied groups

	Control group	Test group	P
At 6 months:			
Range	0-1	0-1	
Mean	0.1	0.2	0.556
SD	0.316	0.422	
At 9 months:			
Range	0-1	0-1	
Mean	0.2	0.3	0.628
SD	0.422	0.483	
At 12 months:			
Range	0-1	0-1	
Mean	0.3	0.3	1
SD	0.483	0.483	
p	0.051	0.022	

Significant

TABLE (4): Distribution of studied groups in relation to pocket depth

	Control group	Test group	P
At 6 months:			
Range	1-2	1-2	
Mean	1.35	1.3	0.773
SD	0.4116	0.3496	
At 9 months:			
Range	1-2	1-2	
Mean	1.5	1.4	0.548
SD	0.3333	0.3944	
At 12 months:			
Range	1-2	1-2	
Mean	1.65	1.5	0.424
SD	0.3375	0.4714	
p	0.00*	0.00*	

Significant

TABLE (5): Width of keratinized mucosa among studied groups at different postoperative visits

	Control group	**Test group**	**P**
At 6 months:			
Range	**4-5**	**4-5**	
Mean	**4.5**	**4.7**	**0.388**
SD	**0.527**	**0.483**	
At 9 months:			
Range	**4-5**	**4-5**	
Mean	**4.4**	**4.5**	**0.388**
SD	**0.483**	**0.527**	
At 12 months:			
Range	**4-5**	**4-5**	
Mean	**4.2**	**4.4**	**0.388**
SD	**0.422**	**0.516**	
p	**0.00***	**0.00***	

**** Significant***

TABLE (6): Comparison of periotest value between studied groups

	Control group	Test group	P
Immediately:			
Range	-4 to-2	-4 to-2	
Mean	-3.2	-3.1	0.749
SD	0.632	0.738	
At 6 months:			
Range	-4 to-2	-4 to-2	
Mean	-2.7	-2.9	0.482
SD	0.675	0.568	
At 12 months:			
Range	-3 to -1	-3 to -2	
Mean	-2.3	-2.6	0.279
SD	0.657	0.516	
p	0.00*	0.00*	

****Significant***

Table (7): Comparison of the mean value of a distance from the implant shoulder to first bone to implant contact between both groups

	Control group	Test group	P
Immediately:			
Range	0.2 - 0.7	0.2 – 0.7	
Mean	0.42	0.43	0.890
SD	0.1549	0.1636	
At 6 months:			
Range	0.4 – 0.8	0.3- 0.8	
Mean	0.57	0.5	0.308
SD	0.1252	0.1700	
At 12 months:			
Range	0.6- 0.9	0.4 – 0.9	
Mean	0.72	0.61	0.075
SD	0.0919	0.1595	
p	0.00*	0.00*	

****Significant***

DISCUSSION

The immediate dental implants in fresh extraction sockets have insufficient osseous tissue to surround the implant completely at the time of implant insertion. Thus, many techniques were used to stimulate new bone formation include both membrane therapy and bone grafting (Jones et al. 2006). This study was designed as a randomized control clinical trial of 20 subjects aged 23-45 years. To strengthen the clinical results, radiographic examination was conducted. This is consistent with Verhoeven et al. (2000) who stated that the most important source of data for assessment of marginal bone loss around the implants is the radiographic image. In the present clinical trial, guided bone regeneration procedure simultaneously with implant placement was used in order to reduce the number of surgeries. Because of the several clinical drawbacks that associated with the use of nonresorbable membranes and autogenous bone, such as the need for second-stage surgery to

remove the nonresorbable membranes, a high risk of postoperative infection and rapid resorption of the autogenous bone (Donos et al. 2008). In this study, the subepithelial connective tissue graft was used as a biological membrane to assess the results regarding osseointegration around the dental implant augmented with alloplast graft. The role of connective tissue as a biological membrane in guided bone regeneration procedure has been assessed in the management of intrabony defects (Paolantonio et al. 2010). However, there have been no sufficient studies on its use as a guided bone regeneration barrier around an immediate implant. Therefore, the objective of this controlled clinical study was to assess the use of subepithelial connective tissue graft as guided bone regeneration membrane around dental implant inserted in fresh extraction sockets and augmented with β-Tricalcium phosphate bone graft. Ozdemir et al. (2013), report that calcium phosphate ceramics grafting materials such as tricalcium phosphate (TCP), bicalcium phosphate (BCP) and hydroxylapatite (HA), have been reported to induce bone formation in experimental studies with osteogenic properties and superior stability compared to autologous bone grafts. These findings agree with many experimental and clinical studies which reported that the osteoconductive properties of this bone grafting materials used in maxillary sinus floor augmentation and bone defect repairs (Iezzi et al. 2008, Lee et al. 2008 and Jensen et al. 2009). Therefore, in the present study β-Tricalcium phosphate was used to augment the coronal gaps around the immediate implants in both studied groups. In the current study, all prosthetic and surgical steps were done by the same operator, resulting in minimum probable treatment differences. This is in agreement with Burtscher et al. (2015) who also reported that, to achieve maximum decreasing in probable treatment differences, all surgical procedures were done by the same surgeon. Periotest was used in this prospective study to monitor the implant stability in both studied groups because it was non-destructive intraoral testing technique to evaluate implant stability (Atsumi et al.2007). This is in agreement with Brunski, (2006) who showed that the destructive methodologies, such as pushout, removal torque evaluation and pullout methods are of limited value in human studies, owing to the ethical issues because of the invasive nature of this techniques. In this study, preoperative oral hygiene instructions, meticulous scaling, and sockets curettage were carried out in addition to prescribing of antibiotics and chlorhexidine mouth rinse for all studied subjects to decrease the microbial effect on the surgical area. This is in agreement with Gher et al. (1994) and Chung et al. (2011) who recommended this regimen and concluded that an optimal oral hygiene was a critical factor for implant success. The primary stability in the current study was achieved by fixture insertion 3-5 mm apical to socket apex, this is in accordance with Chung et al. (2011) who stressed on close implant to bone contact and extreme degree of primary stability. In the present study, all implants were inserted with high insertion torque 35-45 N cm. This is in agreement with Ottoni et al. (2005) and Irinakis & Wiebe (2009) who concluded that, to achieve a predictable success rates the insertion torque must be above 30 N cm. In agreement with Mish, (1999) who demonstrated that, the full thickness flap protect the soft tissue from infection and laceration. In this study, the rationale for performing full thickness flap was twofold; first, it allows inspection of the socket wall for dehiscencies and fenestrations properly. Second, flap facilitates tooth extraction especially when it is fractured. In this 1-year follow-up clinical study, the results within the both studied groups have showed excellent clinical outcomes at implant-supported restorations. Between the studied groups at every follow-up period, for any of the clinical parameters evaluated, the differences did not reach the significant level. Within the current study, the mPI and mSBI in both groups were increased throughout the postoperative recall visits with no significant impacts on implants survival and stability. However, throughout the

study, scores of 1 and 0 were consistently observed for mPI and mSBI.

This in accordance with Chung et al. (2011) who reported that during study follow up periods the mPI scores were either 1or 0, implying that studied subjects can maintain a good oral hygiene. In this study, the mean values of the PPD within the test group were 1.3 ±0.3496, 1.4±0.3944 and 1.5±0.4714 at 6, 9 and 12 months, respectively. Compared to 1.35±0.4116, 1.5 ±0.3333 and 1.65±0.3375 at 6, 9 and 12 months in a control one, respectively. Without significant effects on implants success.

This in agreement with Giovanni & Niklaus (2004) who reported that the PPD of approximately 3 mm indicated successful dental implants. In the current study, a mean buccal gingival recession of o.3 mm has been observed in both studied groups at 1-year follow up visit. This is consistent with Marco et al. (2015) who observed that in the test group (immediate implant in fresh socket and subepithelial connective tissue graft by tunnel technique) at the 2-year visit, a mean recession of 0.2 mm from the initial width of keratinized mucosa.

This results are in contrast with the data reported by Cornelini et al. (2008) and Kan et al. (2009) where at 1- year after immediate implant insertion and subepithelial connective tissue graft, a mean gain of 0.2 mm was recorded in facial gingival tissue. Periotest instrument has been used to diagnose horizontal displacement or initial implant stability with acceptable level of objectivity (Atsumi et al.2007). In the present study, the mean PTV in test group was -3.10 at baseline (immediately after implant insertion), -2.90 at 6 months and -2.60 at 12 months while in control group, it was -3.20, -2.70 and -2.30 at baseline,6 months and 12 months, respectively. It has been concluded that for proper osseointegration, a periotest value of -5 to 5 is required (Olive & Aparicio,1990). Based on this, the primary stability of all implants in this study were optimal. The aim of the radiographic part in the current study was to assess peri-implant bone loss and implant success in both studied groups at different follow-up visits. Albrektsson et al. (1986) and Roos-Jansaker et al., (2006) proposed criteria for implant survival and success that the marginal bone loss (MBL) should be less than 1.5 mm in the first year. In the present prospective study, the mean marginal bone loss from baseline to 12 months postoperative was 0.18 mm in test group and 0.3 mm in control group. This is in accordance with Chung et al. (2011) who recorded a mean MBL of 0.31 mm from baseline to 12 months following immediate implant with subepithelial connective tissue graft. In this study the cumulative success rate of single implant placed in fresh extraction socket in both groups was 100% after one year follow up. This result is comparable with other clinical studies using the same period of follow up (Kan et al .2003, Norton,2004, Kan et al .2007 and De Rouck et al.2008). The monitored acceptable increase in the clinical and radiographically parameters in both studied groups can be explained by several normally expected factors such as micro-gap between implant and abutment, decreased bone remodeling following implant insertion and surgical trauma.

This is in consistent with Schou et al. (2002) who reported that during the healing phase, the impaired remodeling can cause initial bone loss around the implants in the first year of function. In the current study, the interpretation for better outcome within a test group than a control group regarding to PPD, WKM, PTV and MBL throughout the follow up recall visits could be attributed to placement of a subepithelial connective tissue graft. This is in accordance with Molly et al. (2006) who concluded that the using of a subperiosteal barrier membrane is considered as a reliable and acceptable technique for increasing bone volume. This observation also coincided with Kwan (1998), Gamal and Mailhot, (2008) and Moghaddas et al. (2010) who stated using of Palatal connective tissue graft as autogenous membrane has been associated with successful results.

CONCLUSIONS

The results of the current study demonstrated that the using of subepithelial connective tissue graft as a membrane with β-Tricalcium phosphate bone graft for guided bone regeneration around dental implants in fresh extraction sockets showed promising results. However, future studies with larger sample size and long-term evaluation will be needed for a better judgment on the efficiency of this particular procedure

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