

Comparative Study Between Different Techniques For Coverage Of Submerged Immediate Dental Implants

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Abstract: Introduction: The submerged immediate implant procedure was more effective than the non-submerged procedure in improving implant anchorage (osseointegration) in the early phase after implant placement. **Aim:** Evaluation of the best technique for Immediate Dental Implant coverage to fulfill the submerged concept for proper osseointegration. **Material and Methods:** This study involved 61 implants in 44 Patients aged 26-43 years old; 34 males and 10 females, all of them underwent immediate submerged dental implantation of different implant systems. 18 implants were covered with labial or buccal advancement flap (BAF) in 14 patients. 15 implants were covered by sub-epithelial connective tissue graft (SCTG) in 15 patients. 14 implants were covered by titanium membrane (TM) in 7 patients. 14 implants were covered by poly-tetra-fluoro-ethylene (PTFE) membrane in 8 patients. All Patients were followed up clinically for undisturbed continuous coverage of submerged implants at time intervals of 1W, 2W, 4W, 2M and 3M post-surgically. **Results:** It was found that the PTFE membrane showed the highest percentage of undisturbed healing of supra-implant soft tissue coverage (92.9%) followed by labial or buccal advancement flap (83.3%), then the sub-epithelial C.T graft (73.3%) and lastly came the titanium membrane that was (57.1%). **Conclusions:** The PTFE membrane was the best used due to: It's a non-reactive material, not affected by oral fluids or thermal changes. So, it can remain exposed to the oral cavity, no need for primary wound closure. It can be stretched and molded in two directions due to its plastic elasticity and tear-proof, it doesn't obliterate the vestibules, it is atraumatic procedure and the membrane removal is easy and uncomplicated. [Khaled A. Elhayes. **Comparative Study Between Different Techniques For Coverage Of Submerged Immediate Dental Implants.** Journal of American Science 2012; 8(1):14-22]. (ISSN: 1545-1003). <http://www.americanscience.org>.

Keywords: Immediate dental implant, PTFE, titanium membrane, buccal advancement flap, SCTG

1. Introduction:

The rehabilitation of the oral cavity with dental implants became a predictable treatment modality, *Fiorellini et al.*, (1999).

The placement of implants immediately after tooth extraction has become a relatively common event; this approach has gained popularity because it reduces the time between tooth extraction and placement of the final prosthetic restoration, *Goldstein et al.*, (2002). It offers considerable advantages over other treatment modalities for both practitioners and patients, *Lang et al.*, (1994). However, lack of primary full flap closure can jeopardize final results, *Nemcovsky et al.*, (1999). So, immediate dental implant represents a successful treatment modality when associated with primary flap closure which is important for satisfactory final results in these procedures, *Nemcovsky et al.*, (2000). Furthermore, one-stage implant placement might be at a slightly higher risk for early failures, *Tallarico et al.*, (2011).

Fiorellini et al (1999) revealed that, when the mean peri-implant bone levels for submerged and non-submerged implants were compared from baseline to week 12, non-submerged implants had a significantly

greater amount and rate of bone resorption than submerged ones.

Astrand et al., (2002) concluded that although there was no significant difference in survival rate or in marginal bone change could be demonstrated between the two systems, at non-submerged procedure (ITI) Implants, 18% crater-form bone loss was observed in comparison with submerged procedure (Brånemark) implants.

Choi et al., (2008) in their study to compare submerged and non-submerged implants in mongrel dogs demonstrated that the submerged procedure was more effective than the non-submerged one in improving implant anchorage (osseointegration) in the early phase after implant placement.

Kahnberg (2009) revealed that the submerged surgical technique demonstrated acceptable clinical and radiographic outcomes over a 2-year period in 26 patients with 40 implants.

Usually the immediate implants are placed and subsequently covered by mucosa allowing a submerged healing mode, *Lang et al.*, (1994). It was concluded that the palatal advanced flap procedure is useful, fast, and easy to perform in cases of immediate implant placement after tooth extraction, *Goldstein et*

al., (2002). The rotated pedicle palatal connective tissue flap is a relatively simple technique for soft tissue coverage of grafted sockets without excessive tension, *El Chaar (2010)*.

Furthermore, it was concluded that soft tissue flap from the palate was also used for coverage of immediate dental implants; it offers a predictable valuable treatment approach to achieve and maintain primary coverage and crestal bone regeneration over implants without use of barrier membranes, *Nemcovsky et al.*, (2000).

It was revealed that the buccal advancement flap appears to be suitable for closure of large Oro-antral fistulae where implants are subsequently desired, and so suitable for coverage of immediate implant placement, *Ahmed and Askar (2011)*.

Another soft tissue coverage of immediate dental implant is the subepithelial connective tissue graft (SCTG), *Bittencourt et al.*, (2009) concluded that subepithelial connective tissue graft (SCTG) or semilunar coronally positioned flap (SCPF) can be successfully used to treat class I gingival recession, presenting outcomes with long-term stability. However, patient-oriented outcomes, such as esthetics and root sensitivity, favor SCTG therapy. The connective tissue grafts taken from the hard palate can be also used to manage mucosal fenestration of root apices that were treated by a combination with nonsurgical root canal treatment. Furthermore, *Ahathya et al (2008)* concluded that the subepithelial connective tissue graft (SCTG) is a safe and effective method for the coverage of denuded roots. It is associated with a lesser incidence of donor site pain compared to free gingival graft (FGG) at the early postoperative period with different oral surgical procedures requiring soft tissue graft, *Wessel and Tatakis (2008)*. It was also concluded that "It is effective and predictable to preserve and reconstruct peri-implant soft tissue topography with palatal free connective tissue grafts in maxillary esthetic area" *Lin. et al (2008)*. In the area between maxillary first premolar and second molar, it appeared possible to harvest a connective tissue graft measuring at least 5 mm in height, *Klosek and Rungruang (2008)*. On computerized tomography study for the palatal masticatory mucosa, it was found that the palatal masticatory mucosa thickness increased from the canine to premolar region but decreased at the first molar region and increased again in the second molar region, with the thinnest area at the first molar region and the thickest at the second premolar region, so, the canine to premolar region seems to be the most appropriate donor site that contains a uniformly thick mucosa, *Song et al (2008)*.

However, *Buff et al (2009)* mentioned that "the use of connective tissue grafts is a proven, effective treatment modality, but, some sensory changes can occur after graft harvesting from the palate".

Expanded poly-tetra-fluoro-ethylene (e-PTFE) membranes were used to cover immediate dental implants by *Gelb (1993)*. Guided bone regeneration (GBR) with a non-resorbable membrane and no bone graft substitute could help to preserve buccal bone thickness on the immediate implant site without defects, *Park et al.*, (2011). The membrane exposures did not seem to affect outcomes, *Lindfors et al.*, (2010).

An expanded poly-tetra-fluoro-ethylene barrier membrane (Gore-Tex GTAM) was used by *Lang et al.*, (1994) and was tightly adapted around the immediately placed dental implant post and over the bony margins of the alveolus. Within the limits of *Celletti et al.*, (1994) study, clinical and histological evidence demonstrated that; when primary coverage is maintained, the use of e-PTFE membranes can significantly enhance bone regeneration around implants. *Lekholm et al.*, (1993) had used expanded poly-tetra-fluoro-ethylene (e-PTFE) membranes to cover immediate dental implants for different lengths of postoperative periods with successful results. With immediately placed implants, adding an ePTFE membrane to graft material resulted in a greater replacement of woven bone by lamellated bone, *Tehemar et al.*, (2003).

Therefore we aimed for evaluation of the best technique for Immediate Dental Implant Coverage to fulfill the submerged concept for proper osseointegration.

2. Material & Methods:

2.1. Material:

2.1.1. Study sample

This study involved 61 submerged immediate dental implants placed in 44 patients who had badly decayed teeth or remaining roots beyond conservative treatment and seeking for restorative solution for their problems. The surgical and restorative procedures of immediate dental implants were explained to all patients in details. Patients were of both sex, 34 males and 10 females, aged 26-43 years old, they were divided into four groups according to the type of implant coverage:

Group I: Contained 18 implants in 14 patients in whom the dental implants were covered with labial or buccal advancement flap (BAF).

Group II: Contained 15 implants in 15 patients in whom the dental implants were covered with

subepithelial connective tissue graft (SCTG) from the palate.

Group III: Contained 14 implants in 7 patients in whom the dental implants were covered with titanium membrane (TM).

Group IV: Contained 14 implants in 8 patients in whom the dental implants were covered with polytetra-fluoro-ethylene (PTFE) membrane.

Pre-operative digital radiographs were performed for entire patients prior to surgical procedure for determination of implant size (length and diameter) suitable for the socket of the tooth to be extracted.

2.2. Methods:

2.2.1. Surgical Technique with group I:

A labial or buccal 3-incisional line pyramidal flap was performed just at the area of the tooth/teeth or

root/roots to be removed. The flap was reflected to the level of the mucolabial or mucobuccal fold, the tooth or the remaining root to be replaced by immediate implant was then extracted atraumatically. The empty socket was prepared by the surgical drillers of the used implant kit to the radiographically predetermined length and width, a synthetic bone graft was placed around the implant if there was a gap between the finally placed implant and the wall of the socket. The reflected pyramidal flap was relaxed by ventral horizontal incision just to release the periosteum and keeping the mucosa intact; the relaxed flap was then pulled to cover the immediate implant completely and sutured tightly to the palatal or lingual gingiva using 3-0 black silk suture and horizontal mattress technique to bring the margins of labial flap under that of palatal/lingual gingiva. (Figure 1)

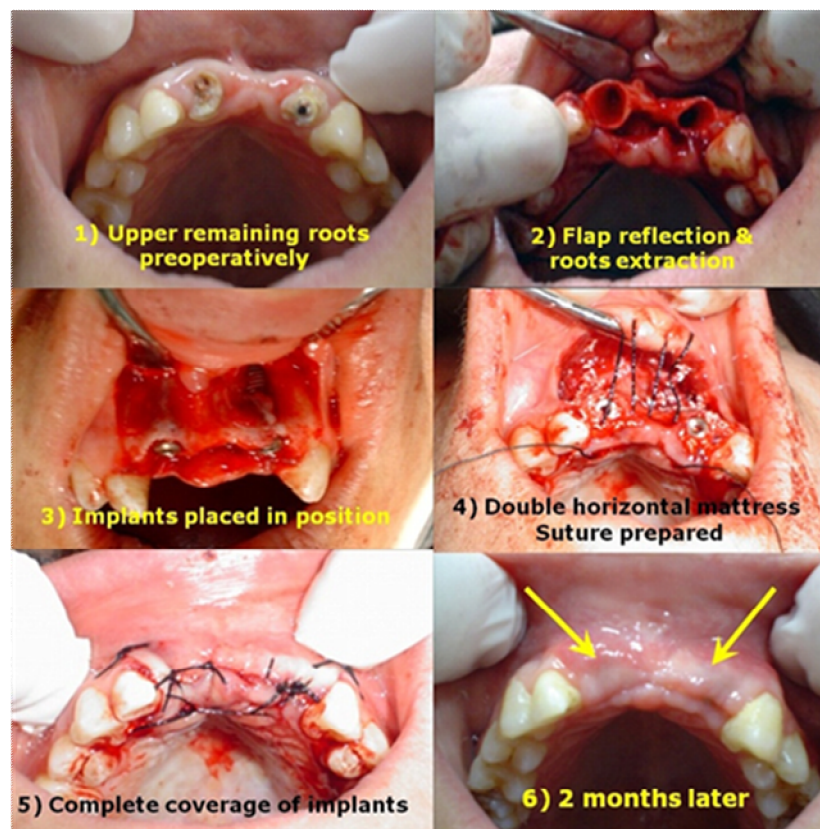


Figure 1: Surgical technique with Group I

2.2.2. Surgical Technique with group II:

After placement of the immediate implant by flapless technique (Figure 2), a gingival incision was performed palatally contralateral to the maxillary implant site. The palatal gingiva was then reflected and a subepithelial connective tissue graft was harvested from the area between maxillary first

premolar and second molar (Figure 3). The graft was placed over the immediate implant and sutured labially/buccally and palatally/lingually with the mucoperiosteum around the socket margins using 3-0 black silk suture to completely cover the implant (Figure 4).

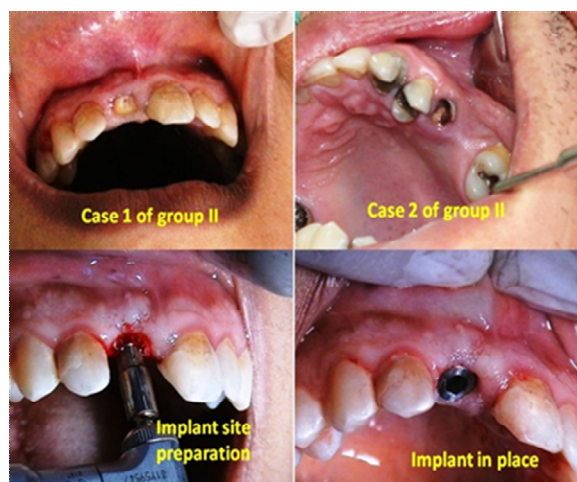


Figure 2: placement of the immediate implant by flapless technique

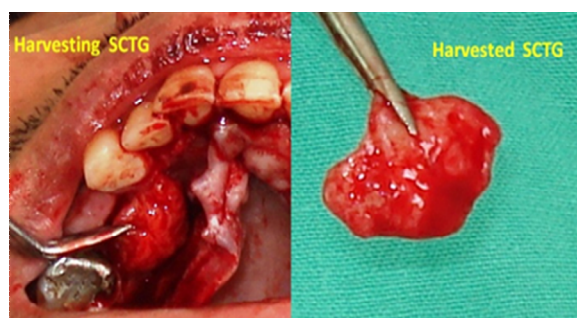


Figure 3: Technique of harvesting Subepithelial Connective Tissue Graft

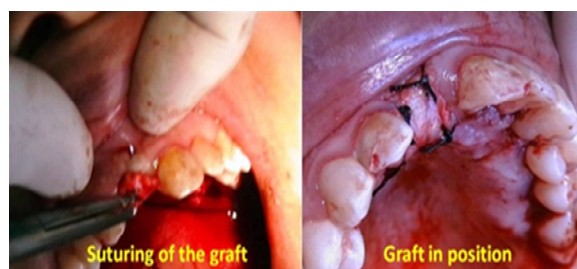


Figure 4: Covering of the immediate implant completely with SCTG

2.2.3. Surgical Technique with group III:

Flap was reflected and the immediate implant was inserted in position after socket preparation. Bone substitute graft was added specially when there was a loss of cortical plates of bone of the socket as in some cases of trauma. The titanium membrane was then molded and placed to cover the bone substitute material and the implant completely with its margins extended subgingivally both labially/buccally and palatally/lingually. It was secured in position with

small pins supplied by the manufacturer to fix it to the bone, suturing of the flap was then done using 3-0 black silk suture leaving the membrane exposed to the oral cavity. (Figure5)

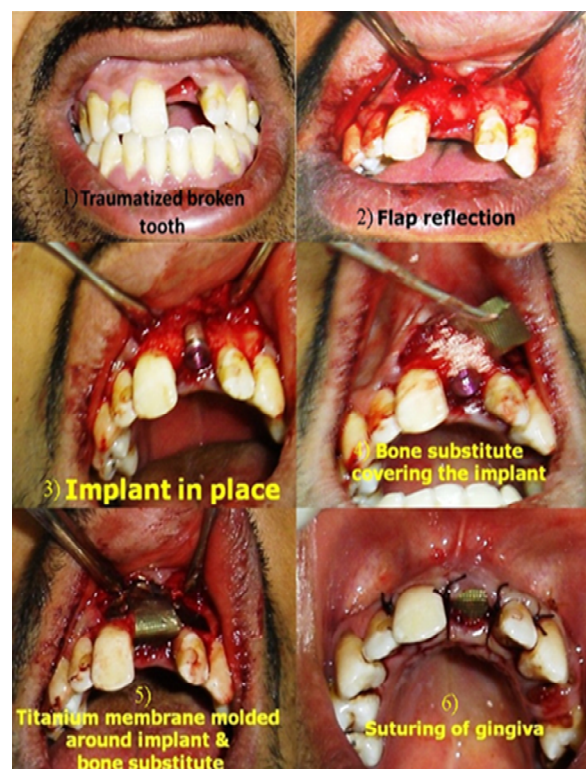


Figure 5: Surgical technique of immediate implant in Group III

2.2.4. Surgical Technique with group IV:

The same technique as with group III but here, the PTFE membrane was used instead of titanium membrane, it was expanded and molded to extend deeply beneath labial/buccal and palatal/lingual gingivae to be secured in position as the small pins were not used with PTFE membrane. It was also left exposed to the oral cavity and the flap was then sutured using 3-0 black silk suture. (Figure 6)

Co-amoxiclav antibiotic 1gm/12H was prescribed to all the patients for 1 week postoperatively and ibuprofen 600mg /12H for only 3 days, routine postsurgical instructions were also explained and emphasized to all patients and all sutures were removed 7 days postoperatively.

All Patients were followed up clinically for undisturbed continuous coverage of submerged implants at time intervals of 1W, 2W, 4W, 2M and 3M post-surgically.

Z-Score test was used to compare the clinical results between all groups at $p \leq 0.05$.

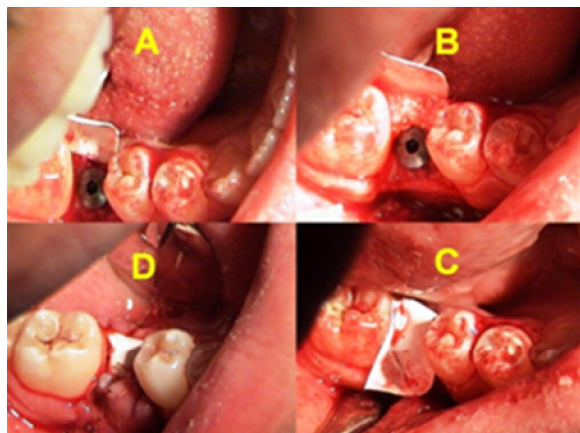


Figure 6: Surgical technique of immediate implant in Group IV

3. Results:

3.1. In BAF group:

At 1 month postoperative, 14 implants were still covered with the advancement flap successfully, while 4 implants showed flap dehiscence. The dehiscence 4 flaps were refreshed and resutured, but re-dehiscence occurred to 3 of them again at 2 weeks post-surgically and the other one was closed successfully.

From the 4th week to 3rd month post-surgically, 15 implants (83.3%) were completely covered with healthy gingiva (Figure 7).



Figure 7: Healing of gingiva over immediate implant 2 months postoperatively in group I

3.2. In SCTG group:

The graft was seen to be whitish in color at 1 week post-surgically for all the cases, and started to change to normal color and texture at 3 weeks post-surgically with only 11 cases, and continued like that till the implants became completely covered by normal gingiva at 3 months post-surgically (Figure 8).

Necrosis of the graft was seen in 4 cases with whom the implants continued as non submerged ones till the end of the study.



Figure 8: Healing progress of SCTG in group II

3.3. In both TM group and PTFE membrane group:

The procedure passed undisturbed and the surrounding mucosa was normal in color and texture till the time of membrane removal at the 4th week post-surgically (Figure 9 a).

On membrane removal, 13 implants of PTFE group were found to be covered by a healthy

granulation tissue while only 8 implants of TM group did the same (Figure 9 b).

At 2 months post-surgically, this healthy granulation tissue has differentiated into normal gingival tissue. Finally, at 3 months post-surgically the gingiva overlying the implants had become completely normal in texture, form and color (Figure 10).

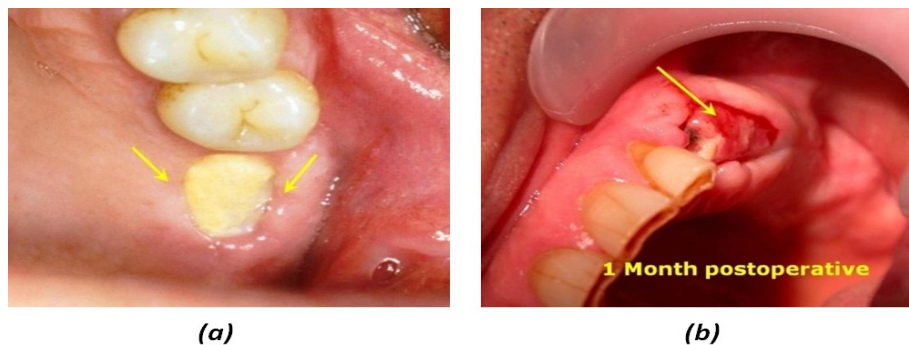


Figure 9: (a) 4 weeks postsurgically showing PTFE in place with no infection
(b) A case of group IV (PTFE Group) just after membrane removal

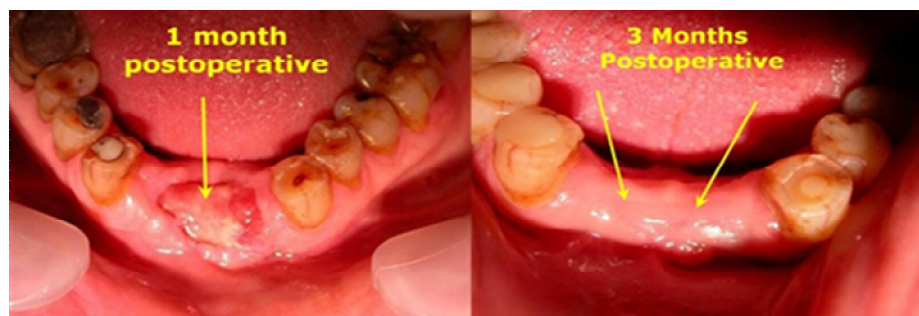


Figure 10: Showing the progress of healing in Group IV

On the other hand, there was no complete formation of granulation tissue over 1 implant in PTFE group and 6 implants of TM group on removal of membrane at 4 weeks post-surgically. So, they continued as non submerged implants till the end of the study.

3.4. Statistically.

It was found that the PTFE membrane showed the highest percentage of undisturbed healing of supra-implant soft tissue coverage (92.9%) followed by BAF (83.3%), then, the SCTG (73.3%) and lastly came the TM that was (57.1%). (Figure 11 & 12)

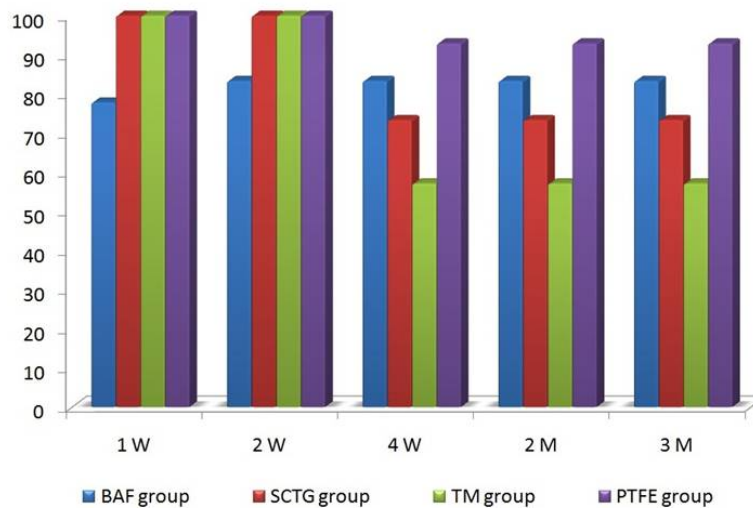


Figure 11: Percentages of covered implants in all groups at different time intervals

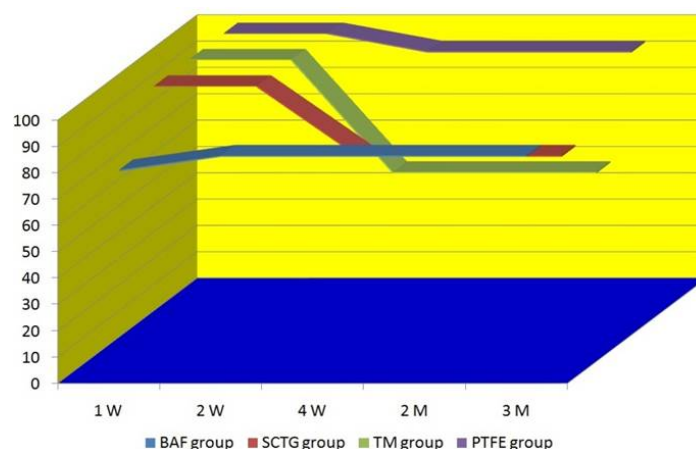


Figure 12: Percentages Implants coverage in all groups throughout time intervals

Comparing each technique with the others at 3 months postoperatively using Z-Score test at significance level where $p \leq 0.05$. It was found that both PTFE and buccal advancement flap (BAF) were significantly successful compared to titanium membrane (TM) for coverage of immediate dental implants.

There was no significant difference between all other comparisons. (Table 1 & Figure 13)

Table 1: Comparison between all groups at 3 months postoperatively at $p \leq 0.05$

	BAF	TM	SCTG
TM	0.05 *		
SCTG	0.242	0.180	
PTFE	0.300	0.014 *	0.082

(* = significant)



Figure 13: Comparison between percentages successes of implants coverage in different groups at 3 M. postsurgically

4. Discussion:

The hypothesis of this research was based on the great importance of complete coverage of immediate dental implants for obtaining higher success rate. This hypothesis was built on many authors opinions as Nemcovsky *et al.*, in (1999) who said that "lack of primary full flap closure can jeopardize final results", Nemcovsky *et al.*, in (2000) who concluded that the immediate dental implants represent a successful treatment modality when associated with primary flap closure which is important for satisfactory final results in these procedures and finally Tallarico *et al.*, in (2011) who revealed that 1-stage implant placement might be at a slightly higher risk for early failures.

On contrary, Lang *et al.*, (1994) concluded that the immediate non-submerged installation of an implant into an extraction socket is a predictable treatment modality with good long-term prognosis. This conclusion might be obtained as the authors used PTFE membrane to cover the immediately placed dental implants completely for 5-7 months; therefore, they fulfilled the concept of submerged technique. This was also agreed with Fiorellini *et al.*, (1998) who said that "it may be recommended that non-submerged implants be placed with a submerged or "semi-submerged" protocol when utilized in conjunction with ePTFE membranes.

The SCTG taken from the palate was harvested from the area of premolar region as this area can provide a graft measuring at least 5 mm in height as concluded by Klosek and Rungruang (2009), so, it can easily cover any implant of large diameter, in addition, the premolar region seems to be the most appropriate donor site that contains a uniformly thick mucosa as concluded by Song *et al* (2008). The SCTG was preferred than free gingival graft (FGG)

as it is associated with a lesser incidence of donor site pain at the early postoperative period. This was in agreement with the conclusions of *Wessel* and *Tatakis* (2008). The gingival incision was performed palatally contra-lateral to the maxillary implant site to allow for proper healing at the implant site without any disturbance in the blood supply.

The highest rate of success that was seen with PTFE membrane group thought to be due to that the PTFE membrane could be easily expanded and molded to properly cover the fixture of immediate dental implant, so, it can be tightly adapted around the immediately placed dental implant as reported by *Goldstein et al.*, (2002). This would prevent the migration of epithelial cells into the surgical field that jeopardize the process of healing, therefore, allowed proper healing underneath and formation of newly healthy gingiva covering the fixture. These results agreed with *Lekholm et al.*, (1993) who revealed that successful results were obtained with (e-PTFE) membranes that covered immediate dental implants for different lengths of postoperative periods.

By making good detailed questionnaire with the patients in BAF group which had dehiscence of their flaps, it was thought that the flap dehiscence might be due to trying of the patients all the time to pull their lips and cheeks to see the wound in front of the mirror.

The TM group showed the lowest rate of success, so, the highest rate of implant exposure after membrane removal at 1 month postsurgically might be due to the micro-pores present at the titanium membrane that allow for micro-exposure of the immediate dental implant to the oral environment, so, did not allow for fulfillment of proper submerged concept.

Conclusions:

➡ Covering of immediate dental implants with PTFE (poly tetra fluoro ethylene) membrane was the most successful technique to be used for fulfillment of submerged concept. It is also preferred than other techniques because PTFE membrane can be stretched and molded in two directions due to its plastic elasticity and tear-proof, the procedure is atraumatic, it doesn't obliterate the vestibules and the membrane removal is easy and uncomplicated.

➡ BAF for immediate dental implant coverage was preferred than SCTG as it is more successful and less traumatic.

➡ SCTG for covering immediate dental implants is a traumatic procedure to the patient and needs special oral surgeon skills to avoid permanent necrosis of the graft.

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