A Comparative Clinical Study Between Bone Onlay Graft And Connective Tissue Graft In Reconstruction Of Interdental Papillae Between Two Implants

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Abstract: Gingival esthetics has become a decisive factor in the overall success of an implant-supported restoration, Successful implant therapy is no longer judged by whether or not the implant simply osseointegrates. The aim of the present study was to clinically evaluate and compare between bone graft and connective tissue graft in reconstruction of inter-implants papillae.**Materials and Methods:** The present study was conducted on 16 patients; (all male) with a mean age of 34 years (25-44). Each patient received two adjacent implants placed in the anterior esthetic zone. The sixteen patients were divided into two groups: Group (A): spongy bone sheets were used in reconstruction of the papilla. Group (B): connective tissue graft was used in reconstruction of the papilla. **Results:** The comparison between spongy bone sheets (group A) and subepithelial connective tissue graft (group B) in reconstruction of inter-implants papillae showed no statistically significant difference between the two groups regarding the clinical soft tissue height at two, four and six months follow-ups , however in comparing between percentage increase in clinical soft tissue height, Group A showed statistically significantly higher mean % increase in clinical soft tissue height than Group B from 4 months to 6 months and after 6 months .**Conclusion:** Osteoplant Flex bone sheets and Sub-epithelial connective tissue graft can be successfully used in reconstruction of inter-dental papilla between two implants. However, Successful interimplant papilla reconstruction depends on a lot of variables that have to be in mind beside proper treatment plane which is the key for favorable esthetic results.

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Keyword: Bone Onlay Graft And Connective Tissue Graft In Reconstruction Of Interdental Papillae.

1. Introduction:

Inter-dental papilla is the gingival portion, which occupies the space between two adjacent teeth. Morphologically, the papillae had been described first in 1959 by Cohen. Before this time, inter-dental papilla was considered as a gingival trait having a pyramidal shape and functioning as a deflection of the inter-proximal food debris. Now it is clear that the physiology of the papilla is more complex, it not only acts as a biological barrier in protecting the periodontal structures, but also plays a critical role in the aesthetics. Hence, it is very important to respect papillary integrity during all dental procedures and to minimize as much as possible its disappearance (Tarnow et al., 1992).

Currently, with increased esthetic demands, implantologists must establish a gingival contour that is harmonious with the gingival outline of the adjacent tooth and with an intact papilla, especially in maxillary anterior teeth. To reach these objectives, the implants must be placed in adequate position and inclination (De Lange, 1995; Phillips and Kois, 1998).

Biology of peri-implant mucosa showed significant difference between the tissues surrounding the natural tooth and implants. In implants, due to the lack of cement-like structures, connective tissue fibers of the peri-implant mucosa are stretched parallel to the implant surface rather than perpendicularly attached to the root surface as seen in natural teeth. Most groups of supracrestal fibers (gingivo-dental and trans-septal fibers) do not exist in the gingival tissue surrounding the implant abutment (Berglundh et al, 1994).

Another important difference is the restricted blood supply, which is due to the absence of the periodontal ligament and the associated blood vessel branches. The blood supply to the peri-implant mucosa is only provided by the branches from the bone and the oral soft tissues. In natural teeth, the gingival vascularization is derived from the branches originating from the inter-dental septa, the

periodontal ligament, and the oral mucosa (Ericsson, 1997).

Salama et al. (2004) demonstrated that the presence of papilla drops significantly and papilla cannot be recaptured as the the interproximal height of the bone (measured from the apical extent of future contact point of the restoration to the crest of bone) exceeds 5 mm in natural teeth and 3 mm in implants. Thus, the peak of interproximal bone determines the level of papilla.

If the two implants are <3mm apart, the angular defects which usually extend up to 1.5 mm, appear to cross over, creating a horizontal interimplant crestal bone loss (Tarnow et al. 1992; Tarnow et al. 2000). Gastaldo et al, 2004 reported that a distance of 3 to 4mm is necessary between the two implants and 1.5 mm between tooth and implant to maintain the interproximal height of the bone after remodeling of the biologic width.

Periodontal biotype, thick or thin, affects the dimension of the periodontal tissue. Kan et al, 2003 stated that the implant papilla may be maintained at or reestablished to the normal level (4.5mm from the underlying bone) with the thick biotype, but it can seldom be created beyond 4 mm with the thin biotype.

Achievement of patient satisfaction requires not only the fulfillment of restorative requirements and outstanding laboratory fabrication parameters, but also the need of soft tissue in harmony with the adjacent teeth for achievement of successful esthetic results (Smith and Zarb, 1989). Reconstruction or regeneration of peri-implant papillae is the most complex and challenging aspect of implant dentistry (Lekovic et al., 1997). Some attempts have been made to correct the absence of papilla by surgical techniques; however, regeneration of papillae adjacent to dental implants is still difficult and is often unpredictable (Beagle, 1992; Jemt, 1997; Newcovsky et al., 2000).

In cases in which only a single tooth is to be restored, the establishment of the peri-implant papilla is highly predictable (El Askary, 1999; Petrungaro et al. 1999) but the inter-implant papilla is not predictable in cases of multiple neighboring implant placements (El Askary, 2001). Some authors have reported soft tissue solutions for this problem, and others have reported that the hard tissue solution is the key to regeneration of the inter-implant papilla.

2.MATERIALS AND METHODS

2.1.MATERIALS :

2.1.1.Subjects:

The present study was conducted on sixteen patients (all males) with a mean age of 34 years (range 25to 44 years). All patients were healthy and free of any systemic disease that could affect implant placement or soft tissue mangment. Selected patients had two adjacent missing maxillary anterior teeth in the esthetic zone that had been lost since at least 3 months with ridge width of at least 6mm and bone height of more than 15mm. Patients were cooperative, motivated, non smokers and hygiene conscious**.**

2.1.2. implants:

Thirty two Screw-Plant two-piece implants (Spectra System implants, California, USA) were used in this study. All implants used were of the same diameter and length which were 3.7and 13mm respectively.

2.2.METHODS

2.2.1.Design of the study:

The sixteen patients were divided into two groups:

Group (A): included 8 patients, in this group bone graft (Osteoplant Flex*) were used in reconstruction of the papilla.

Group (B): included 8 patients, in this group connective tissue graft taken from the palate were used in reconstruction of the papilla.

*Osteoplant Flex (partially demineralized flexible spongy osteoconductive bone sheets (equine derived bone graft) (25 x 25 x 3 mm) that can easily reshape and adapted to the bone (Biotec Company-Italy).

Variables that were assessed at the clinical examination:

- Soft tissue height at the site of the lost papilla to be reconstructed were assessed both clinically and radiografically before any treatment.
- Papilla height (PH): vertical distance from the tip of the papilla between the two implants to a line connecting the zeniths of the soft tissue margins at adjacent crowns (measured from photograph).
- Radiographic evaluation of Papilla height using standardized periapical radiographs: vertical distance from the tip of the interimplant papilla (using radio-opaque material to mark it) to the the crest of the alveolar bone.

2.2.2.Pre-operative measures:

- All the patients had undergone initial therapy including oral hygiene instruction and ultrasonic scaling of the entire dentition. Patients who had remaining plaque accumulation were excluded and were re-instructed on proper oral hygiene and examined during another session. Thus, patients

included in this study were devoid of supragingival plaque accumulation.

-Prior to implants placement clinical photographs were taken of the anterior part of the maxilla; photographs were taken perpendicular to the middle third of the facial surface of the edentulous area. Actual vertical height of the clinical crown of a reference tooth was measured to assess and make correction for any magnification of photographic image either prior or after surgery. Reference line was drawn from the most apical points of gingival margins proximal to the area to be measured. This reference line could be reproduced postoperatively on clinical photographs, and any changes in a vertical dimension of the soft tissue heights at the papilla site were compared to the preoperative measurements (Grossberg, 2001)**.**

-Radiographic evaluation was performed by obtaining standardized periapical radiographs with parallel technique and acrylic stent on the area of interest. The preoperative radiographs were used to estimate the implant length and soft tissue height at the site of the papilla**.**

-For the measurement of the radiographic length of the soft tissue at the site of the papilla to be reconstructed and for the papilla after surgery and at follow-ups (Lee et al, 2005), a radiopaque material consisting of a 2:1 mixture of an endodontic sealer and barium sulfate, used as the contrast media was placed with a probe on the top of the papilla. Care was taken not to place radiopaque material to the apical side, which would make the radiographic length shorter. A periapical radiograph was taken (70 KVp, 10mA, 1.0 second) using parallel cone techniques with a XCP device and acrylic stent. All films were developed using the same automatic processor following the manufacturer's instructions. The films were digitized using a digital scanner at an input resolution of 1200 ppi with 256 gray color (Attaelmanan et al, 2000). After digitization, all files were transferred to a personal computer where computer-assisted radiographic measurements had been done (Kim et al, 2002).

2.2.3. Implant placement and papilla reconstruction

2.2.4. Surgical procedures for Group (A):

1. The implant area was anesthetized using infiltration with Articaine hydrochloride 4% with 1:100000 Adrenaline tartrate as a vasoconstrictor.
2. The initial Incision was made subcrestal on the palatal aspect of the ridge at the edentulous area that had been restored, then two vertical releasing incisions were made in the buccal side and extended beyond the mucogingival junction that allowed coronal displacement of the flap (the dental papillae adjacent to the edentulous area were not included in the flap.
3. The flap was elevated buccally beyond the mucogingival junction and palatal about 2-3mm to allow insertion of the graft under the palatal mucosa.
4. Under copious saline irrigation, Implant site osteotomy preparation were done with sequential drilling starting with crestal locator drill just to locate the site of osteotomy preparation for each implant till it reached the final drill to full length of the implants that were 13mm, the final drill were undersized (3.2mm) to increase the initial stability that was needed for immediate loading.
5. The bone sheet was removed from its protective pouch and was immersed in saline at room temperature for five minutes, and then it was trimmed with scissor to suit the surgical site where it was adapted to cover the osteotomy preparation and extend buccally and palataly about 2-4mm on the alveolar bone and to be fixed in place using the two implants.
6. The implants were removed from their protective pouch and offered to the osteotomy site through the bone sheet. Each implant was placed manually and rotated clockwise till resistance for seating was achieved.
7. The ratchet wrench or Torque adjustable motor hand piece were used for complete seating of the implant so that the coronal part of the collar of the implant is flush or below the crestal bone of the alveolar ridge. Attaining primary stability of over 30N/cm was considered crucial with all the placed implants to allow for the immediate loading protocol.
8. Perpendicular incision was made in the free margin of the bucall flap just over each implant site and extended about 2 mm directed toward the vestibule, these two incisions allowed for complete coverage of the graft and gaining primary closure with the palatal side of the flap.
9. The flap was coronally advanced and adapted over the graft then sutured in place at the papillae sites with mattress and/or interrupted sutures.
10. Abutments were prepared and provisional crowns were made using the upper study cast as mentioned before.

2.2.5. Surgical procedures for Group (B):

The same for group A except step number 5, 6 and7. In this group these steps were as follow:

5- After osteotomy preparations were done, the implants were removed from their protective pouch and offered to the osteotomy site. Each implant was placed manually and rotated clockwise till resistance for seating was achieved.

6- The ratchet wrench or Torque adjustable motor hand piece were used for complete seating of the implant that the coronal part of the collar of the implant is flush or below the crestal bone of the alveolar ridge. Attaining primary stability of over 30N/cm was considered crucial with all the placed implants to allow for the immediate loading protocol.
7- The palatal mucosa between the canine and the mesial line angle of the maxillary first molar was used as the source of the connective tissue. A subepithelial connective tissue graft harvested from the palate by making a single incision parallel and at a distance of 2 mm from the gingival margin using a scalpel with a size 15 blade. Connective tissue was removed, after the separation of the tissue graft with 2 horizontal and 2 vertical incisions. The donor region was sutured and the graft was placed on top of the alveolar bone between the two implants sutured in place with an absorbable suture (Vicryl 5-0), trying to augment interimpant tissues. Then the rest of the steps were completed as in group A.

2.2.6. Post-operative care:

-All patients received Augmentin 1 gm (Glaxo Wellcome Smith Kline Beecham) every 12 hours for five days following the procedure.
-Brufen 400 mg was prescribed tds for 5 days.
-Suture removal was done 10-14 days post-operatively and new accurate temporary acrylic crowns were fabricated at the same day and cemented using zinc phosphate cement.
- Oral hygiene recommendations including the use of soft tooth brush.

2.2.7. Follow up measurements:

- Clinical photographs were taken at two, four and six months after surgical procedures for the anterior part of the maxilla to assess any changes in papilla height between the 2 implants as discussed before.
- Radiographic evaluation of Papilla height were done at two, four and 6 months.
- Papilla Index (PI) according to Jemt (1997) was assessed on digital clinical photographs of the implant restorations and surrounding soft tissues taken at 6 month.

- **Papilla Index (PI)**
  - Index score 0: No papilla is present.
  - Index score 1: Less than half of the height of the papilla is present.
  - Index score 2: At least half of the height of the papilla is present, but not all the way up to the contact point between the teeth.
  - Index score 3: The papilla fills up the entire proximal space and is in good harmony with the adjacent papillae. There is optimal soft tissue contour
  - Index score 4: The papillae are hyperplastic and cover too much of the single implant restoration and/or the adjacent tooth. The soft tissue contour is more or less irregular.

Statistical Analysis

Data were presented as mean and standard deviation (SD) values. Student's t-test was used to compare between ages and radiographic height in the two groups. Paired t-test was used to study the changes by time in radiographic height of each group. soft tissue height and % changes data showed non-normal (non-parametric) distribution, so non-parametric tests were utilized. Mann-Whitney U test was used to compare between the two groups. This test is the non-parametric alternative to Student's t-test. Wilcoxon signed-rank test was used to study the changes by time in these variables. This test is the non-parametric alternative to paired t-test. The significance level was set at $P \leq 0.05$. Statistical analysis was performed with SPSS 16.0® (Statistical Package for Scientific Studies) for Windows.

Figure (1): Pre-operative clinical photograph.

Figure (2):Pre-operative clinical photograph showing a radiopaque material placed on the top of the papilla site.

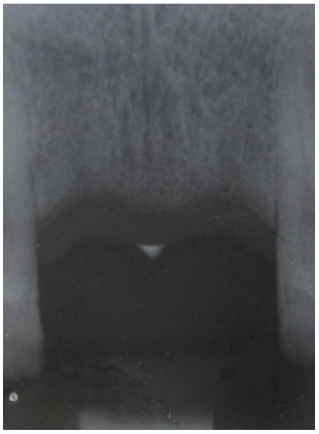

Figure (3): Radiographic length (RL) of the soft tissue was determined by measuring the distance between bone crest and apical part of the

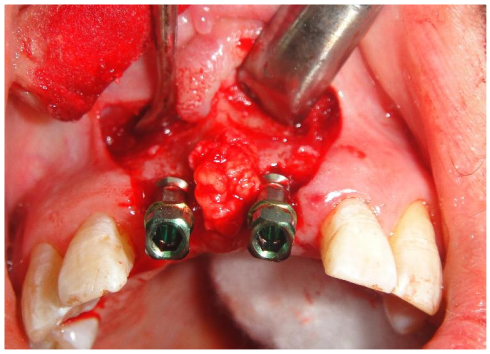

Figure (4): The connective tissue graft was placed on top of the alveolar bone between the two implants and sutured in place with an absorbable suture.

Figure (6): Clinical photographs at 6 months post-operatively with final ceramo metal restoration.

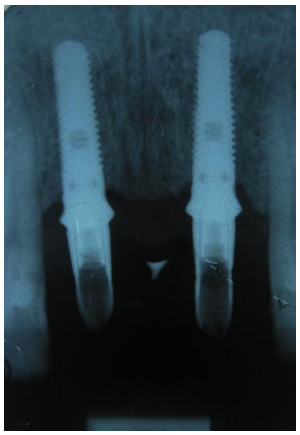

Figure (7): Radiographic length (RL) of the soft tissue is determined at 6

Figure (8):Pre-operative clinical photograph.

Figure (9): Bone sheet immersed in saline.

Figure (10): Bone sheet that was fixed in place with the two Implants.

Figure (11): Clinical photographs at 6 months post-operatively with final ceramo metal restoration.

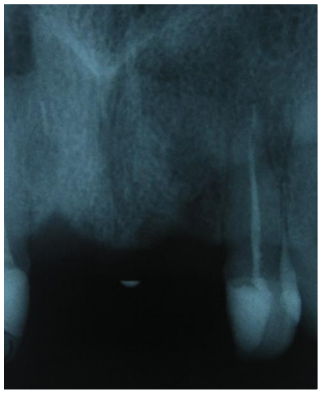

Figure (12): Radiographic length (RL) of the soft tissue was determined by measuring the distance between bone crest and apical part of the radiopaque material.

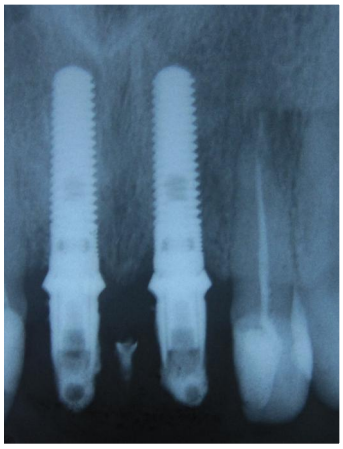

Figure (13): Radiographic length (RL) of the soft tissue determined at 6 months post-operatively.

3. Results

Comparing clinical soft tissue height at the site of the lost papilla pre-operatively, after 2 months, 4 months and 6 months, there was no statistically significant difference between the two groups.

Table-1: The means, standard deviation (SD) values and results of Mann-Whitney U test for comparison between clinical soft tissue height in the two groups

Group / Period	Group A		Group B		P-value
	Mean	SD	Mean	SD	
Pre-operative	0.79	0.46	0.81	0.29	0.874
2 months	2.70	0.83	2.44	0.46	0.340
4 months	2.98	0.82	2.78	0.47	0.461
6 months	3.26	0.77	2.86	0.44	0.114

*: Significant at $P \leq 0.05$

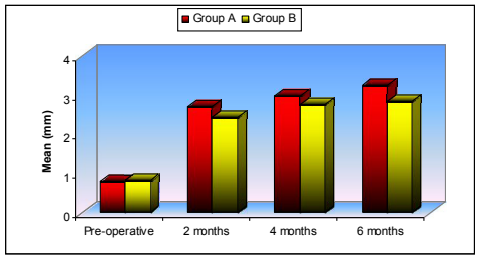

Figure (14): Bar chart representing mean clinical soft tissue height in the two groups.

Change by time in each group

In Group A, there was a statistically significant increase in mean clinical soft tissue height through all periods.

In Group B, there was a statistically significant increase in mean clinical soft tissue height through all periods except from 4 months to 6 months where there was non-statistically significant increase in mean soft tissue height.

Comparison between percentage increase in clinical soft tissue height of the two groups:

After 2 months, from 2 months to and after 4 months, there was no statistically significant difference between means % change in clinical soft tissue height of the two groups.

From 4 months to 6 months and after 6 months (Through the whole study period), Group A showed statistically significantly higher mean % increase in clinical soft tissue height than Group B.

Radiographic height:

Comparing radiographic Soft tissue height at the site of the lost papilla (in mm) preoperative, 2, 4 and 6 months postoperatively:

Pre-operatively, Group A showed statistically significantly higher mean radiographic height than Group B.

After 2 months, 4 months and 6 months, there was no statistically significant difference between the two groups.

Table-2: The means, standard deviation (SD) values and results of Student's t-test for comparison between radiographic heights in the two groups

Group / Period	Group A		Group B		P-value
	Mean	SD	Mean	SD	
Pre-operative	2.20	0.33	1.86	0.27	0.042*
2 months	3.81	0.45	3.56	0.38	0.250
4 months	3.99	0.40	3.95	0.46	0.865
6 months	3.84	0.23	4.06	0.40	0.193

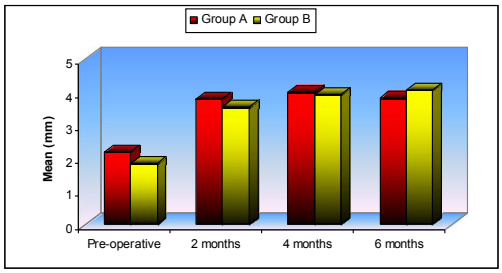

Figure (16): Bar chart representing mean radiographic height in the two groups.

Change by time in each group:

In Group A, there was a statistically significant increase in mean radiographic height through all periods except from 4 months to 6 months where there was non-statistically significant decrease in mean radiographic height.

In Group B, there was a statistically significant increase in mean radiographic height through all periods.

Comparison between percentage change in radiographic height of the two groups:

Group B showed statistically significantly higher mean % increase in radiographic height than Group A through all periods.

Papilla index score

Papilla Index (PI) scores according to Jemt (1997) assessed on digital clinical photographs of the implant restorations and surrounding soft tissues at 6 month after implant placement:

Comparison between the two groups, there was no statistically significant difference between the two groups.

Table-3: The means, standard deviation (SD) values and results of Mann-Whitney U test for comparison between papilla index score in the two groups

Group A		Group B		P-value
Mean	SD	Mean	SD	
2.25	0.71	2.13	0.64	0.680

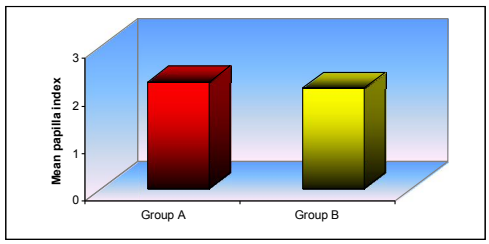

Figure (18): Bar chart representing mean papilla index score in the two groups.

4. Discussion

Implant dentistry has been established as a predictable treatment modality that has been gaining increased interest over the years. However successful bony integration of an implant does not ensure patient satisfaction and the role of peri-implant plastic surgical procedures in the creation and maintenance of the peri-implant soft tissue heights to facilitate better esthetics has become more popular (Kazor et al 2004)

In the periodontal literature, the reconstruction of lost or collapsed interdental papilla for cosmetic reasons has not received too much attention. Although several human case reports have showed different periodontal plastic surgical, prosthetic, and orthodontic techniques for correcting lost papillae, no scientific research or reliable data are available for clinicians (Kramer ,1980; Ingber,1989 and Belser et al. 2004)

Papilla defects present in a variety of ways and the surgical approach must be tailored to the challenges faced with each different presentation. This makes systematic study difficult. Additional work is needed to develop predictable papilla reconstruction techniques (Greenwell et al. 2005).

Reconstruction and long-term maintenance of esthetically satisfactory papilla-like soft tissue between two adjacent implants in the esthetic zone is generally regarded as very difficult and unpredictable procedure (Elian et al., 2003; Belser et al., 2004; Buser et al. 2004; Takahashi 2006; Shahidi et al., 2008)

During this study, evaluation of the inter-implant papilla was carried out with extreme caution using clinical photographs, standard periapical radiograph and Jemt's Index. This is in fact in line with a recommendation by Glauser et al. (2006), who carried out a systematic review of marginal soft tissue at implants subjected to immediate loading and concluded that, when documenting the aesthetic outcome related to inter-proximal soft tissue response, future studies should consider quantitative metrical measurements instead of Jemt's Index alone.

The papilla index (PI) as described by Jemt (1997) was used in this study, in an attempt to describe papilla fill in a systematic and objective manner. Gastaldo et al., (2004) defined in their study a papilla as present when it filled the entire proximal space or part of that space. This is probably not an accurate enough description since, according to the PI that would be a score of 0, 1, 2, or 3. Choquet et al. (2001) reported both presence/ absence of papilla and PI, and noted that the latter was a more descriptive and scientific evaluation of papilla presence.

In the present study, for the reason of patient comfort, the vertical dimension of the papilla was measured using a non-invasive method introduced by Lee et al. (2005) to measure the soft tissue height from the tip of the papilla to the bone crest, by applying a radiopaque material to the papilla tip and taking standard periapical radiograph with parallel technique. This was supported by Klinge and Flemmig (2009) who recommend that non-invasive measurements to quantify soft-tissue volume and esthetic outcomes should be validated and used in clinical trials.

Soft tissue grafting was suggested to enhance papillary appearance around dental implant and teeth, the use of connective tissue graft in reconstruction of interdental papilla had been reported by many authors. In a single case report, Price and Price (1999) described the use of subepithelial connective tissue graft to restore papillae adjacent to a single dental implant. The authors showed clinical follow-up with complete gingival papillae. Similarly, Azzi et al 2002 reported three successful cases, in which a subepithelial connective tissue graft was inserted in a pouch to move the entire peri-implant gingivopapillary unit incisially.

Carnio (2004) in a case report presented complete papilla reconstruction in a 20-year-old woman using an interposed subepithelial connective tissue graft. The author reported that subepithelial connective tissue can be successfully used in treating the loss of papillae.

Lai et al.,(2007) reported that immediate restoration during implant placement in the premaxillary area can achieve a favorable esthetic result. However, the treatment always poses a great challenge to clinicians, especially for patients with preexisting soft and hard tissue deficiencies.

De Castro Pinto et al., (2010) reported two cases with clinical application of the coronally advanced flap procedure associated with the subepithelial connective tissue pedicle graft in the reconstruction of interdental papilla. The results showed an increase in papillary height and significant reduction of the black triangle. They concluded that Subepithelial connective tissue pedicle graft associated with a coronally advanced flap yielded satisfactory esthetics and may be considered a viable approach for the treatment of missing papilla. However, further investigation is required.

Jaiswal et al., (2010) evaluated the effectiveness of a subepithelial connective tissue graft with a coronally advanced flap to reconstruct an interdental papilla. Five systemically healthy patients between the ages of 23 and 52 years were included in the study. Loss of interdental papillary height was classified using the Nordland and Tarnow classification system as class 1 to 4. All five patients received a subepithelial connective tissue graft (SCTG) with a coronally advanced flap (CAF). Soft tissue (papilla) heights in the interdental areas were measured at baseline and at six months post-surgery. They concluded that the periodontal surgical technique used for the five reported cases successfully reconstructed the interdental papilla in just one type of papilla loss, the class I situation. Therefore, it should not be concluded that the technique shown would be equally as successful for every type of papilla loss. A subepithelial connective tissue graft supported by a coronally advanced flap should be considered to surgically correct the loss of an interdental papilla in class I cases.

The results of the current study regarding the use of connective tissue graft in reconstruction of the papillae were in agreement to all the above presented studies that achieve a favorable esthetic result. There was a statistically significant increase in mean clinical soft tissue height through all periods except from 4 months to 6 months where there was non-statistically significant increase in mean soft tissue height and this may be due to some crestal bone resorption that limited the increase in soft tissue height at six months follow-up which was confirmed by the radiographic findings that reported a statistically significant increase in mean radiographic height through all periods.

This was supported by a recent study conducted to evaluate changes which occur in the alveolar bone crest after implant placement and revealed that clinically significant remodeling of the marginal bone occurred during the first six months after implant

placement, after which clinically insignificant mean changes in the bone were observed (Cochran, 2009).

There are scarce studies reporting the use of bone graft in reconstruction of papillae (El-Askary2000; Azzi et al 2001; Rebaudi et al 2007).

El-Askary (2000) used titanium housing or stent filled with grafting material, is placed on the ridge between two implants and fixed it with screw as disscused before. Although the use of these templates has revealed exciting clinical results, in some cases they showed exposure through the mucosa. This was considered one of the major complications in the use of those templates with thin scalloped tissue biotype patients.

Azzi et al., (2001) reported that reconstruction of a stable, long-term papilla for esthetic purposes requires consideration of interdental bone reconstruction. Autogenous osseous graft was harvested from the tuberosity and fixed with a screw and augmented with a subperiosteal connective tissue graft for papilla reconstruction between the maxillary central incisors.

Rebaudi et al., (2007) tried papilla reconstruction with autogenous free gingival-bone grafts. The clinical results of this study suggest that the free gingival-bone graft technique may favor hard and soft tissue reconstruction of the sites treated, with esthetic and functional advantages. As vertical ridge augmentation with autogenous bone blocks carries the risk of graft resorption and donor site morbidity. More over the use of titanium housing or stent is liable for exposure through the mucosa. Due to these drawbacks in mind, the choice of Osteoplant Flex (equine spongy bone sheets) was done.

Danilo et al.,(2009) treated five patients showing localized mandibular ridge defects. Ridge augmentation was performed through an onlay apposition of equine spongy bone sheets covered by a titanium-reinforced membrane. After 6 months of healing, they concluded that these Equine bone sheets appeared to be biocompatible and to be associated with new vessel ingrowth and could be used in localized ridge augmentations.

Rothamel et al., (2009) compared histologically the healing following vertical ridge augmentation using screwable, xenogenous deproteinized blocks or autologous bone blocks in dogs. The results revealed that xenogenous blocks, used alone or combined with a collagen membrane, exhibited osteoconductive properties on a level equivalent to that of autologous blocks. Rothamel et al (2009) concluded that the examined screwable xenogenous bone block might be a useful scaffold for ridge augmentation procedures. However, the combination of xenogenous blocks with a cross-linked collagen membrane did not appear to improve outcomes.

The results of the present study regarding the use of equine spongy bone sheets (Osteoplant Flex) in reconstruction of the papillae were promising and gave favorable esthetic results. There was a statistically significant increase in mean clinical soft tissue height through all periods. The radiographic findings at six months showed evidence of some crestal bone deposition which may explain the none statistically significant decrease in mean radiographic height from 4 to 6 months which was due to bone deposition and not tissue recession and this was confirmed by the clinical increase in soft tissue hight during the same period. Bone deposition with the use of these bone sheets was reported by Danilo et al (2009).

Clinically and not statistically, there was no clinical significant difference between the two groups and this was reflected on comparing the Papilla index score between the two groups at the end of the study that showed no statistically significant difference between the two groups.

The favorable results gained in both groups may be due to careful case selection and optimizing other risk factors that may influence papillary reconstruction, concluding that, besides the importance of having favorable existing osseous and gingival tissue architecture, appropriate treatment planning is the key to predictable success.

5. References

1. **Attaelmanan A, Borg E, Grönndahl HG.** Digitisation and display of intra-oral films. Dentomaxillofac Radiol 2000; 29:97-102.
2. **Azzi R, Etienne D, Takei H, Fenech P.** Surgical thickening of the existing gingiva and reconstruction of interdental papillae around implant supported restorations. Int J Periodontics Restorative Dent 2002; 22:71-77.
3. **Azzi R, Takei HH, Etienne D, Carranza FA.** Root coverage and papilla reconstruction using autogenous osseous and connective tissue grafts. Int J Periodontics Restorative Dent. 2001 Apr;21(2):141-7.
4. **Beagle JR**. Surgical reconstruction of theinterdental papilla: Case report. Int J Periodontics Restorative Dent 1992;12: 145–151.
5. **Belser C, Schmid B, Higginbottom F, Buser D**. Outcome analysis of implant restorations located in the anterior maxilla: A review of the recent literature. Int J Oral Maxillofac. Implants 2004;19(suppl):30-42
6. **Berglundh T, Lindhe J, Jonsson K, Ericsson I**. The topography of the vascular systems in the periodontal and peri-implant tissues in the dog. J Clin Periodontol 1994;21:189-193.

7. **Buser, D., Martin W., and Belser U.** Optimizing Esthetics for Implant Restorations in the Anterior Maxilla: Anatomic and Surgical Considerations. Int J Oral Maxillofac Implants, 2004, 19, pp. 43–61.
8. **Carnio J.** Surgical reconstruction of interdental papilla using an interposed subepithelial connective tissue graft: a case report. Int J Periodontics Restorative Dent. 2004 Feb; 24(1): 31-7.
9. **Choquet V, Hermans M, Adriaenssens P, Daelemans P, Tarnow DP, Malevez C.** Clinical and radiographic evaluation of the papilla level adjacent to single-tooth dental implants. A retrospective study in the maxillary anterior region. J Periodontol 2001; 72: 1364-1371
10. **Cochran D.** Minimal bone loss results from dental implants, study finds. 2009-05-22 14:29:50 in Aesthetic Medicine
11. **Cohen, B.** Morphological Factors in thepathogenesis of the periodontal disease. British Dental Journal (1959) 7, 31–39.
12. **Danilo S, Luciano A, Giovanna I, Adriano P, Stefano P, Marcello P, Vittoria P.** Alveolar Ridge Regeneration with Equine Spongy Bone: A Clinical, Histological, and Immunohistochemical Case Series. Clinical Implant Dentistry and Related Research Volume 11, Issue 2, pages 90–100, June 2009
13. **De Castro Pinto RC**, **Colombini BL**, **Ishikiriama SK**, **Chambrone L**, **Pustiglioni FE**, **Romito GA**. The subepithelial connective tissue pedicle graft combined with the coronally advanced flap for restoring missing papilla: a report of two cases. Quintessence Int. 2010 Mar; 41(3):213-20.
14. **De Lange GL.** Aesthetic and prosthetic principles for single tooth implant procedures: an overview. Pract Periodontics Aesthet Dent. 1995; 7:51–62.
15. **El Askary AS.** Esthetic considerations in anterior single tooth replacement. Implant Dent. 1999; 8:61–67.
16. **El Askary AS**. Interimplant papilla reconstruction by means of a titanium guide. Implant Dent. 2000;9:85–89**.**
17. **El Askary AS.** Multifaceted aspects of implant esthetics: The anterior maxilla. Implant Dent 2001; 10:182-191.
18. **Elian N, Jalbout Z,Cho S-C, Froum S, Tarnow DP**. Realities and limitations in the management of the interdental papilla between implants. Three case reports. Proceed Aesthet Dent 2003;15:737-744.
19. **Ericsson I.** Biology and pathology of the peri-implant soft tissue (in German). Implantologie 1997; 1:7-18.
20. **Gastaldo JF, Cury PR, Sendyk WR**. Effect of the vertical and horizontal distances between adjacent implants and between a tooth and an implant on the incidence of interproximal papilla. J Periodontol 2004; 75:1242-1246.
21. **Glauser R, Zembic A, Hammerle CHF.** A systematic review of marginal soft tissue at implants subjected to immediate loading or immediate restoration. Clin Oral Implants Res 2006; 17(suppl. 2); 82-92.
22. **Greenwell H; Fiorellini J; Giannobile W; et al.** Oral econstructive and Corrective Considerations in Periodontal Therapy. J Periodontol 2005; 76:1588-1600.
23. **Grossberg DE.** Interimplant papilla reconstruction: Assessment of soft tissue changes and results of 12 consecutive cases. J Periodontol 2001; 72:958-962.
24. **Hurzeler MB, Dietmar W.** Periimplant tissue management: Optimal timing for an aesthetic result. Pract Periodontics Aesthet Dent. 1996 Nov-Dec;8(9):857–869.
25. **Ingber JS**. Forced eruption. In: Marks MH, Corn H (eds). Atlas of Adult Orthodontics: Functional and Esthetic Enhancement. Philadelphia: Lea & Febiger, 1989:413– 447.
26. **Jaiswal P, Bhongade M, Tiwari I, Chavan R, Banode P.** Surgical reconstruction of interdental papilla using subepithelial connective tissue graft (SCTG) with a coronally advanced flap: a clinical evaluation of five cases. J Contemp Dent Pract. 2010 Dec 1; 11(6):E049-57.
27. **Jemt T.** Regeneration of gingival papillae after singleimplant treatment. Int J Periodontics Restorative Dent 1997;17:326-333.
28. **Kan JY, Rungcharassaeng K, Umezu K, Kois JC.** Dimensions of peri-implant mucosa: An evaluation of maxillary anterior single implants in humans. J Periodontol 2003;74:557-562.
29. **Kazor CE, Al-Shammari K, Sarment DP, Misch CE, Wang HL**. Implant plastic surgery: a review and rationale. J Oral Implantol. 2004;30(4):240-54.
30. **Kim TS, Ben DK, Eickholz P.** Accuracy of computerassisted radiographic measurement of interproximal bone loss in vertical bone defects. Oral Surg Oral Med Oral Pathol Oral Radiol Endod 2002; 94:379-387.
31. **Klinge B, Flemmig T.** Tissue augmentation and esthetics. Clinical Oral Implants Research Special Issue: European Association for Osseointegration; 19-22 February 2009, Pfaffikon, Switzerland; 2nd Consensus

Figure (13): Radiographic length (RL) of the soft tissue determined at 6 months post-operatively.

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32. **Kramer GM**. Rationale of periodontal therapy. In: Goldman HM, Cohen DW (eds). Periodontal Therapy, ed 6. St Louis: CV Mosby, 1980:378–402.
33. **Lai YL, Chou IC, Liaw YC, Chen HL, Lin YC, Lee SY.** Triple immediate therapy (ridge expansion, soft tissue augmentation, and provisional restoration) of maxillary anterior single implant. J Periodontol. 2007 Jul; 78 (7): 1348-53.
34. **Lee DW, Kim CK, Park KH, Cho KS, Moon IS**. Non-invasive method to measure the length of soft tissue from the top of the papilla to the crestal bone. J Periodontol 2005; 76: 1311-1314.
35. **Lekovic V, Kenney EB, Weinlaender M, Han T, Klokkevold P, Nedic M, Orsini M.** A bone regenerative approach to alveolar ridge maintenance following tooth extraction. Report of 10 cases. J Periodontol. 1997;68:563–570
36. **Nemcovsky CE, Moses O, Artzi Z**. Interproximal papillae reconstruction in maxillary implants. J Periodontol 2000. 2000; 71: 308-314.
37. **Nordland, W. P. & Tarnow, D. P.** A classification system for loss of papillary height. Journal of Periodontology. 1998, 69, 1124–1126.
38. **Petrungaro PS, Smilanich MD, Windmiller NW**. The formation of proper interdental architecture for single tooth implants. Contemp Esthet Restor Pract. 1999; 3:14–22.
39. **Phillips K, Kois JC**. Aesthetic peri-implant site development. The restorative connection. Dent Clin North Am. 1998;42:57–70
40. **Price RB, Price DE**. Esthetic restoration of a singletooth dental implant using a subepithelial connective tissue graft: A case report with 3-year follow-up. Int J Periodontics Restorative Dent 1999;19:92-101.
41. **Rebaudi A**, **Massei G**, **Trisi P**, **Calvari F**. A new technique for bone augmentation and papilla reconstruction with autogenous free gingival-bone grafts. Int J Periodontics Restorative Dent. 2007 Oct;27(5):429-39.
42. **Rothamel D, Schwarz F, Herten M, Ferrari D, Mischkowski RA, Sager M, Becker J**. Vertical ridge augmentation using xenogenous bone blocks: a histomorphometric study in dogs. Int J Oral Maxillofac Implants. 2009 Mar-Apr; 24(2): 243-50.
43. **Salama, H., Salama, M., Garber, D. & Adar, P.** The inter-proximal height of bone: a guidepost to esthetic strategies and soft tissue contours in anterior tooth replacement. Submitted to The Journal of Practical Periodontics and Aesthetic Dentistry, Anthology edition, adapted from the www.goldsteingarber. com. 2004.
44. **Shahidi P, Jacobson Z, Dibart S, Pourati J, Nunn ME, Barouch K, et al.** Efficacy of a new papilla generation technique in implant dentistry: a preliminary study. Int J Oral Maxillofac Implants 2008; 23:926–934.
45. **Smith DE, Zarb GA.** Criteria for success of osseointegrated endosseous implants. J. Prosthet Dent. 1989; 62:567–572.
46. **Takahashi Y.** Two case reports of interimplant papilla reconstruction in the esthetic zone. Eur J Esthet Dent 1(2):100-10 (2006)
47. **Tarnow D, Elian N, Fletcher P, et al**. Vertical distance from the crest of bone to the height of the interproximal papilla between adjacent implants. J Periodontol 2003;74:1785-1788.
48. **Tarnow DP, Cho SC, Wallace SS**. The effect of interimplant distance on the height of inter-implant bone crest. J Periodontol 2000;71:546-549
49. **Tarnow DP, Magner AW, Fletcher P.** The effect of the distance from the contact point to the crest of bone on the presence or absence of the interproximal dental papilla. J Periodontol 1992;63:995-996

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