

Outcomes of Connective Tissue (CT) Graft on Periodontal Health in Relation to Dental Implants Placed in Esthetic Zone of Anterior Maxilla

Samar Nazir¹, Safoora Khan², Muhammad Athar Khan³, Muhammad Usman Haider⁴, Nousheen Khan⁵, Marij Hameed⁶

- Assistant Professor, Department of Oral & Maxillofacial Surgery, CMH Dental College / CIMS institute of Medical Sciences, Multan Pakistan*
Research idea and project formulation
- Dental Surgeon, Qaisrani Medical Centre Multan Pakistan*
Data interpretation
- Assistant Professor, Department of Oral & Maxillofacial Surgery, Bakhtawar Amin Medical & Dental College, Multan Pakistan*
Critical review
- Dental Surgeon, Qaisrani Medical Centre, Multan Pakistan*
Data collection and analysis
- Associate Professor, Department of Periodontology, Multan Medical & Dental College, Multan Pakistan*
Results interpretation and writeup
- Assistant Professor, Department of Periodontology, Institute of Dentistry CMH Medical College, Lahore Pakistan*
Bibliography and review of literature

CORRESPONDING AUTHOR

Dr. Samar Nazir

Assistant Professor, Department of Oral & Maxillofacial Surgery, CMH Dental College / CIMS institute of Medical Sciences, Multan Pakistan
 Email: omfsurgery_pakistan@hotmail.com

Submitted for Publication: 30-11-2022
 Accepted for Publication 29-12-2022

How to Cite: Nazir S, Khan S, Khan MA, Haider MU, Khan N, Hameed M. Outcomes of Connective Tissue (CT) Graft on Periodontal Health in Relation to Dental Implants Placed in Esthetic Zone of Anterior Maxilla. APMC 2023;17(4):300-304. DOI: 10.29054/APMC/2023.1176

ABSTRACT

Background: Since 1998, maxillary anterior single immediate implant insertion and provisionalization (IIPP) has been successful and practical. It preserves natural gingival profiles without extending treatment time or needing a removable interim prosthesis. The gingival profile includes a hard tissue zone with bone and a soft tissue zone without bone, extending from the free gingival border to the bony crest's apex. **Objective:** The purpose of this study was to examine the effect of connective tissue transplant on the thickness and appearance of soft tissue around single implants in the anterior maxilla's aesthetic zone. **Study Design:** A Prospective cross-sectional study. **Settings:** A Prospective cross-sectional study was conducted CMH Dental College Multan Pakistan. **Duration:** This study was conducted from July 2021 to October 2022. **Methods:** A total of 64 individuals were included who had criteria for a single cosmetic implant implantation. Detailed demographic information was recorded for enrolled patients once informed written consent was obtained. Patients were equally divided in two groups. Group I (consisting of 32 patients) underwent implant insertion and connective tissue graft implantation (1.50 mm thick) while group II (consisting of 32 patients) simply had implant insertion. Six-month and twelve-month clinical assessments were conducted. Postoperative pain and discomfort were measured. **Results:** There were 37 (57.8%) males and 27 (42.2%) females among all cases. Buccal tissue thickness in group I significantly increased from 2.45 ±1.80 mm at baseline to 4.0±1.1 mm after 6 months and 3.9±3.46 mm after 12 months ($P < 0.05$), whereas no change was seen in the implant group. After a year, the buccal deficiencies in Group I were significantly less than those in the implant group ($\Delta -0.46 \pm 1.42$ mm and $\Delta -1.67 \pm 2.28$ mm). After 12 months, there was a statistically significant difference in proximal bone resorption between the two groups (0.59 ± 0.37 mm and 1.0 ± 0.19 mm), with group I exhibiting less bone resorption than the implant group. **Conclusion:** In this research, we observed that a single implant placed in the front maxilla in conjunction with a connective tissue graft may enhance peri-implant mucosa thickness and decrease proximal bone resorption.

Keywords: Soft tissue grafting, Dental aesthetics, Connective tissue, Dental implants, Gingival recession.

INTRODUCTION

Since its first promotion in 1998, the success and practicality of maxillary anterior single instant implant insertion and provisionalization (IIPP) have been established.^{1,2} The IIPP is designed to keep the face's natural vertical and horizontal gingival profiles intact without extending the treatment time or necessitating a

detachable interim prosthesis. In a healthy anterior extraction socket, the gingival profile is divided into two parts: the hard tissue zone, which contains the underlying bone, and the soft tissue zone, which does not.^{3,4} The free gingival border of the face and the underlying bony crest make up the soft tissue zone, whereas the apex marks the beginning of the bony crest and the hard tissue zone.

Despite their interdependence, soft and hard tissue zones need different techniques to ensure their preservation and/or healing in the face of surgical damages. Hard or soft tissue contouring grafting face to the bony plate, as well as the socket shield technique, are all recommended means of protecting the hard tissue zone around implants. It is possible to transplant soft tissue using either the contour connective tissue graft (C-CTG) or the dual zone grafting approach.^{5,6}

Osseointegration is a crucial part of implant therapy. Midbuccal soft-tissue profile and interproximal papilla preservation is important for long-term stability and esthetics after dental implant insertion. Inadequately sized soft tissue can lead to cosmetic and functional issues, such as trouble with oral hygiene and phonetics and an increased chance of mucosal recession.

In order for the implant/restoration interface to look nice, the peri-implant soft tissue must be healthy and in the correct position.⁷ Surgical manipulation/augmentation of peri-implant soft tissue was suggested in this scenario to increase the width and thickness of gingival keratinized tissue, hence improving the aesthetic effects of implant therapy.⁸ Periodontal aesthetics and gingival shape can be enhanced with the use of gingival plastic surgery techniques like the sub epithelial connective tissue transplant.⁹ To develop gingival keratinized tissue and restore regions with gingival regression, as well as to improve the aesthetics and effectiveness of the periodontal contouring around dental implants,¹⁰ this technique is utilized. Several forms of connective tissue grafts have been used to repair the cosmetic zone after implant therapy but before the placement of the final crown.

Having full (i.e. free of dehiscences and fenestrations) and healthy soft tissue around the implant is essential for the implant's aesthetic success after dental implant therapy. Pink and white aesthetics^{11,12} both contribute to what is generally considered harmonious. The potential for functional injury from poorly executed treatments means that each case involving dental implants in the anterior regions must be carefully reviewed and individually planned, with the patient's expectations taking precedence. If a patient is to have cosmetically pleasing results from oral surgery, that success is contingent on the expertise of the dentist executing the process.

METHODS

A Prospective cross-sectional study was conducted CMH Dental College Multan. Total 64 patients were included in current study. This study was conducted from July 2021 to October 2022. Patients' age, gender, educational levels, and residences were recorded after receiving informed written consent. Patients with certain medical conditions,

including pregnancy and heart problems, were not allowed to participate.

Patients were equally divided in two groups. 32 patients received the implant + connective tissue graft (implant insertion and placement of a 1.50-mm-thick connective tissue graft) and group II only had implant insertion in 32 cases.

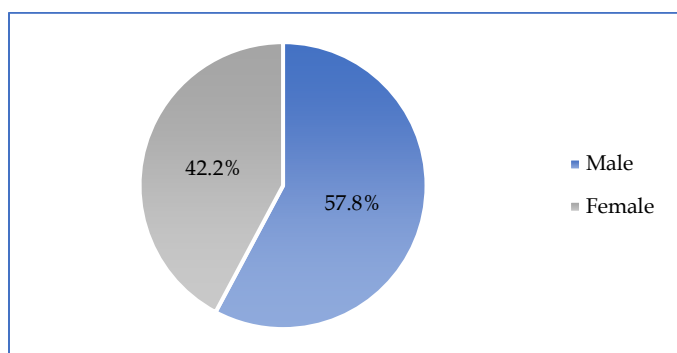
A crestal incision and two vertical incisions were performed on the mesiolabial line angles of the right central incisor and left lateral incisor after numbing the region with 2% lignocaine and 1:100,000 adrenaline. Mucoperiosteal flap was raised. A segmental ridge split required three periosteal incisions. The piezosurgery unit's saw tips and diamond-coated tips were used to conduct a crestal osteotomy and two labial vertical cuts. Crestal osteotomy measured 10 millimeters. Two vertical slices, 10 millimeters long, with 2-millimeter coronal and 3-millimeter apical depths were produced. A massive periosteal elevator separated the buccal plate from the lingual plate, increasing its breadth to 4.3 mm. A bone gauge and osteotomy drills were employed intermittently to assess the expansion's mm extent. A 3 mm diameter by 11.5 mm length implant was slowly and tightly placed into the gap, increasing bone width to 6.7 mm. Tricalcium phosphate, an alloplastic particulate bone graft material, was employed to fill the space between the cortical plates with a collagen membrane covering the ridge. To accommodate for ridge expansion, interrupted 4-0 silk sutures were used for secondary closure. No maxillary anterior tooth brushing and two daily chlorhexidine mouth rinses were prescribed for 15 days. The patient received 7 days of antibiotics (amoxicillin 500 mg and metronidazole 400 mg) and analgesics (aceclofenac 100 mg and paracetamol 325 mg). During recuperation, no issues developed. After two weeks, the sutures and wounds were cleansed.

Four months after implant implantation, the healed abutment was removed and a prosthetic abutment was placed to measure the collar's height and width. The abutment's labial side had thin biotype and no soft tissue. A pouch-style connective tissue grafting operation was performed to enhance the soft tissues around the abutment. Next to it, an attractive central incisor had its crown extended. After four weeks, the abutment's soft tissue was adequate to produce an imprint.

Data was entered and analyzed by SPSS 25.0. Descriptive analysis was conducted. Postoperative pain and discomfort were measured by using VAS score. Mean standard deviation was used for data presentation.

RESULTS

There were 37 (57.8%) males and 27 (42.2%) females among all cases. (figure 1)

Figure 1: Gender distribution among all cases

Patients mean age was 26.8 ± 6.74 years. 35 (56.5%) patients were educated and 27 (43.5%) patients were non-educated. 40 (64.5%) patients had urban residency. (table 1)

Table 1: Cases included and their characteristics

Variables	Frequency	Percentage
Mean age (years)	26.8 ± 6.74	
Education status	Yes	35 56.5%
	No	27 43.5%
Residence	Rural	22 35.5%
	Urban	40 64.5%

Buccal tissue thickness in group I significantly increased from 2.45 ± 1.80 mm at baseline to 4.0 ± 1.1 mm after 6 months and 3.9 ± 3.46 mm after 12 months ($P < 0.05$), whereas no change was seen in the implant group. After a year, the buccal deficiencies in Group I were significantly less than those in the implant group ($\Delta -0.46 \pm 1.42$ mm and $\Delta -1.67 \pm 2.28$ mm). (table 2)

Table 2: Comparison of outcomes among both groups

Variables	Group I	Group II
Buccal tissues Thickness		
At baseline	2.45 ± 1.80 mm	2.71 ± 5.57 mm
After 6 months	4.0 ± 1.1 mm	2.9 ± 1.26 mm
After 12 months	3.9 ± 3.46 mm	2.5 ± 3.37 mm
Buccal deficiencies		
At Baseline	$\Delta -2.68 \pm 6.79$ mm	$\Delta -2.18 \pm 9.67$ mm
After 12 months	$\Delta -0.46 \pm 1.42$ mm	$\Delta -1.67 \pm 2.28$ mm

After 12 months, there was a statistically significant difference in proximal bone resorption between the two groups (0.59 ± 0.37 mm and 1.0 ± 0.19 mm), with group I exhibiting less bone resorption than the implant group. (table 3)

Table 3: Frequency of bone resorption among both groups

Variables	Group I	Group II
Buccal tissues Thickness		
At baseline	2.18 ± 5.7 mm	2.59 ± 6.8 mm
After 12 months	0.59 ± 0.37 mm	1.0 ± 0.19 mm

Post-treatment significantly low pain score was noted in group I as compared to group II with p value < 0.002 . Frequency of discomfort in group I was 4 (12.5%) and in group II discomfort was found in 10 (31.3%) cases. table 4

Table 4: Post-treatment comparison of pain score among both groups

Variables	Group I (32)	Group II (32)
Pain score		
At baseline	6.7 ± 3.17	6.2 ± 4.8
After 12 months	0.15 ± 0.19	3.1 ± 2.15
Discomfort		
Yes	4 (12.5%)	10 (31.3%)
No	28 (87.5%)	22 (68.7%)

DISCUSSION

Dental implant therapy is considered successful if the patient is happy with the results, and this requires that the teeth look good once the procedure is done. Recently, esthetic outcomes of anterior implant-supported crowns have been evaluated using indices for assessing pink and white esthetics (PES/WES scores).¹³ In certain circumstances, the cosmetic results of dental implant procedures have been shown to be excellent and predictable. Final results from this operation may differ depending on whether surgical and prosthetic methods are used.¹⁴ Due to the increased risk of esthetic issues in patients with a thin gingival biotype, proper peri-implant soft tissue treatment in anterior areas is of paramount importance. In order to achieve desirable peri-implant esthetics,¹⁵ it is crucial to do a detailed analysis of the smile line, gingival architecture (periodontal biotype), and soft tissue level (height). In our study, post-treatment significantly low pain score was noted in group I as compared to group II with p value < 0.002 . Frequency of discomfort in group I was 4 (12.5%) and in group II discomfort was found in 10 (31.3%) cases

Bone volume can be increased in a number of ways, some of which include distraction osteogenesis, GBR, the segmental ridge-split technique, and onlay/inlay bone grafting operations. Segmental RSP was a good option for this instance since the alveolar ridge had compressed to a width of 3.61 mm and a vertical height of sufficient. Factors such the need for a second donor site, the complexity of the surgery, the risk of graft rejection, membrane exposure or collapse, and the length of therapy were all taken into account before segmental RSP was selected.¹⁶

The natural gingival thickness is generally insufficient to conceal many underlying restorative/implant materials, hence it is important to thicken the peri-implant soft tissue zone while preserving the topography of the soft tissues.¹⁷ The face gingival thickness of the maxillary front teeth ranges from 0.7 to 1.5 mm.¹⁸ Interestingly, one

study indicated that a tissue thickness >2.0 mm is necessary to conceal a zirconium restorative material. The peri-implant free gum tissue thickness can be increased after IIPP without connective tissue grafting by under-contouring the facial rising profile of the prosthesis, however this is still insufficient to conceal the underlying restoration components.¹⁹

Buccal tissue thickness in the current study significantly increased in group I ((implant insertion as well as location of a 1.50-mm-thick connecting tissue graft) from 2.45 1.80 mm at baseline to 4.0 1.1 mm after 6 months and 3.9 3.46 mm after 12 months (P 0.05), while there was no change in the implant group. After a year, the buccal deficiencies in Group I were significantly less than those in the implant group ($\Delta -0.46 \pm 1.42$ mm and $\Delta -1.67 \pm 2.28$ mm). These were comparable to the previous studies.^{20,21} After 12 months, there was a statistically significant difference in proximal bone resorption between the two groups (0.59 ± 0.37 mm and 1.0 ± 0.19 mm), with group I exhibiting less bone resorption than the implant group. Connective tissue transplant survival is dependent on graft vascularization and graft stability.²² The size of the vascular bed required is determined by the size of the connective tissue grafts. Although research has demonstrated the benefit of C-CTG extending from the soft to the firm tissue zone to retain aesthetic form at the time of IIPP, implantation of a larger C-CTG necessitates a flap reflection or tunnelling therapy to provide sufficient vascularization. When the periosteum separates from the face bone plate, blood supply is compromised and the risk of resorption is increased. This demonstrates a feedback loop between the need for flap reflection to make room for the bigger C-CTG and the subsequent need for the insertion of an enormous C-CTG to prevent further face bone resorption. Donor site morbidity can also be increased by an oversized C-CTG.²³

CONCLUSION

In this research, we observed that a single implant placed in the front maxilla in conjunction with a connective tissue graft may enhance peri-implant mucosa thickness and decrease proximal bone resorption.

LIMITATIONS

The limitation of the study was that this study only focus on the surgical outcomes only.

SUGGESTIONS / RECOMMENDATIONS

It was recommended that further investigation with more outcome variables should be included like patients' satisfaction, quality of life and functional outcome etc.

CONFLICT OF INTEREST / DISCLOSURE

There will be no conflict of interest.

ACKNOWLEDGEMENTS

The author acknowledge the CMH Dental College Multan for their continuous support throughout the research

REFERENCES

1. Kan JY, Rungcharassaeng K, Lozada J. Immediate placement and provisionalization of maxillary anterior single implants: 1-year prospective study. *International Journal of Oral & Maxillofacial Implants*. 2003 Jan 1;18(1):31-39.
2. De Rouck T, Collys K, Cosyn J. Immediate single-tooth implants in the anterior maxilla: a 1-year case cohort study on hard and soft tissue response. *Journal of Clinical Periodontology*. 2008 Jul;35(7):649-57.
3. Chu SJ, Salama MA, Salama H, Garber DA, Saito H, Sarnachiaro GO, et al. The dual-zone therapeutic concept of managing immediate implant placement and provisional restoration in anterior extraction sockets. *Compend Contin Educ Dent*. 2012 Jul 1;33(7): 524-532.
4. Grunder U. Stability of the mucosal topography around single-tooth implants and adjacent teeth: 1-year results. *International Journal of Periodontics & Restorative Dentistry*. 2000 Feb 1;20(1): 11-17.
5. Edel A. The use of a connective tissue graft for closure over an immediate implant covered with occlusive membrane. *Clin Oral Implants Res*. 1995 Mar;6(1):60-5.
6. Kan JY, Rungcharassaeng K, Lozada JL. Bilaminar subepithelial connective tissue grafts for immediate implant placement and provisionalization in the esthetic zone. *J Calif Dent Assoc*. 2005; 33(11): 865-871.
7. Polimeni G, Koo KT, Qahash M, Xiropaidis AV, Albandar JM, et al. (2004) Prognostic factors for alveolar regeneration: bone formation at teeth and titanium implants. *J Clin Periodontol* 31: 927-932.
8. Raigrodski AJ, Block MS (2002) Clinical considerations for enhancing the success of implant-supported restorations in the aesthetic zone with delayed implant placement. *Pract Proced Aesthet Dent* 14: 21-28.
9. Khoury F, Hoppe A (2000) Soft tissue management in oral implantology: a review of surgical techniques for shaping an esthetic and functional peri-implant soft tissue structure. *Quintessence Int* 31: 483-499.
10. Langer B, Langer L (1985) Subepithelial connective tissue graft technique for root coverage. *J Periodontol* 56: 715-720.
11. Tettamanti S, Millen C, Gavric J, Buser D, Belser UC, et al. (2016) Esthetic Evaluation of Implant Crowns and Peri-Implant Soft Tissue in the Anterior Maxilla: Comparison and Reproducibility of Three Different Indices. *Clin Implant Dent Relat Res* 18(3): 517-526.
12. Brånemark P I, Hansson B O, Adell R, Breine U, Lindström J, et al. (1977) Osseointegrated implants in the treatment of the edentulous jaw. Experience from a 10-year period. *Scand J Plast Reconstr Surg Suppl* 16: 1-132
13. Belser UC, Grütter L, Vailati F, Bornstein MM, Weber HP, et al. (2009) Outcome evaluation of early placed maxillary anterior single-tooth implants using objective esthetic criteria: a cross-sectional, retrospective study in 45 patients with a 2- to 4-year follow-up using pink and white esthetic scores. *J Periodontol* 80(1): 140-151.
14. Pollini A, Morton D, Arunyanak SP, Harris BT, Lin WS (2020) Evaluation of esthetic parameters related to a single implant restoration by laypeople and dentists. *J Prosthet Dent* 124(1): 94-99.
15. Cosyn J, Eghbali A, De Bruyn H, Dierens M, De Rouck T (2012) Single implant treatment in healing versus healed sites of the anterior maxilla: an esthetic evaluation. *Clin Implant Dent Relat Res* 14(4): 517-526.
16. Kirmani M, Zia A, Ahad A, Bey A. Hard- and soft-tissue augmentation around dental implant using ridge split and connective tissue graft for esthetic rehabilitation of atrophic

- anterior maxilla. *J Indian Soc Periodontol.* 2018 Nov-Dec;22(6):555-558.
17. Rungcharassaeng K, Kan JY, Yoshino S, Morimoto T, Zimmerman G. Immediate implant placement and provisionalization with and without a connective tissue graft: an analysis of facial gingival tissue thickness. *Int J Periodontics Restorative Dent.* 2012; 32(6): 657- 663.
 18. Kan JY, Morimoto T, Rungcharassaeng K, et al. Gingival biotype assessment in the esthetic zone: visual versus direct measurement. *Int J Periodontics Restorative Dent.* 2010; 30(3): 237- 243.
 19. Jung RE, Sailer I, Hämmerle CH, Attin T, Schmidlin P. In vitro color changes of soft tissues caused by restorative materials. *Int J Periodontics Restorative Dent.* 2007; 27(3): 251- 257.
 20. Andreas L. Ioannou, Georgios A. Kotsakis, Michelle G. McHale, Donald E. Lareau, James E. Hinrichs, Georgios E. Romanos, "Soft Tissue Surgical Procedures for Optimizing Anterior Implant Esthetics", *International Journal of Dentistry*, vol. 2015, Article ID 740764, 9 pages, 2015.
 21. Ashurko I, Blagushina N, Borodiy A, Magdalyanova M. Hard and Soft Tissue Augmentation with Single-Implant Restoration in the Esthetic Zone. *Case Rep Dent.* 2021 Nov 17;2021:5737665.
 22. Mörmann W, Ciancio SG. Blood supply of human gingiva following periodontal surgery. A fluorescein angiographic study. *J Periodontol.* 1977; 48(11): 681- 692.
 23. Cosyn J, Hooghe N, De Bruyn H. A systematic review on the frequency of advanced recession following single immediate implant treatment. *J Clin Periodontol.* 2012; 39: 582- 589.