Roll Flap Technique for Peri-Implant Soft Tissue Augmentation in the Aesthetic Zone

Thao Thi Do[1]*, Trung Hoang Minh Nguyen[1], Van Thi Tuong Nguyen[1], Tam Quang Nguyen[2]

1. Faculty of Odonto and Stomatology, Can Tho University of Medicine and Pharmacy, Can Tho City, Vietnam.
2. Ho Chi Minh City Odonto-Stomatology Hospital, Ho Chi Minh City, Vietnam.

Abstract

This study aimed to evaluate the efficiency of the original roll flap technique for peri-implant soft tissue augmentation in the aesthetic edentulous zone, and determine the variation in labial soft tissue thickness (LSTT) with respect to age and length of edentulous time.

23 patients with 40 implant placements in the aesthetic zone (upper incisors, canines, and premolars) underwent Abram's roll flap technique. The age and length of edentulous time of each patient were recorded. LSTT was measured using Wiesner's method. Follow-up visits were performed at 2 weeks and 4 weeks post-surgery. Changes in LSTT between follow-up visits, ages, and length of edentulous time were examined using regression analysis. P-value ≤ 0.05 was considered statistically significant.

There were significant differences in LSTT at baseline (1.38 ± 0.08 mm) with respect to 2 weeks (2.87 ± 0.1 mm) and 4 weeks post-surgery (2.42 ± 0.1 mm) (P < 0.001). LSTT differed by age group (P < 0.001). No significant correlation between age and length of edentulous time with respect to LSTT or its change after surgery.

The original roll technique is relatively simple and effective in cases of moderate peri-implant soft tissue deficiencies in the aesthetic zone.

Clinical article (J Int Dent Med Res 2023; 16(2): 699-702)

Keywords: Aesthetics, periodontics, implantation, dental.

Received date: 12 February 2023 **Accept date:** 12 March 2023

Introduction

Reduction of residual ridges in patients with partial edentulism decreases tissue regeneration in the edentulous zones due to alveolar crest resorption, causing significant problems with aesthetics, pronunciation, and oral hygiene[1,2]. Implant placement in the aesthetic zone is a delicate procedure that requires high skills and must minimize mistakes as much as possible.[3] Success in implant placement in this zone is dependent on a variety of factors, not just osseointegration[3,4]. The ability to create a stable gingival structure at the marginal gingiva and between the gingival papillae is an important factor in achieving a successful dental implant in the esthetic zone. However, if the peri-implant tissue is thin, stability of the gingival margin will be difficult to achieve. Thin soft tissue phenotype is defined as thickness less than or equal to 1.5 mm[5]. Thin soft tissue phenotype tissue is a high-risk factor that endangers the peri-implant gingiva's long-term stability and cosmetic outcome[6].

The roll flap technique was first described by Abrams (1980)[7]. This procedure can be used to treat moderate tissue deficiencies, particularly in isolated edentulous areas. It has many advantages, including increased blood flow to the tissue, color matching with surrounding tissues, only one surgical site, and minor patient discomfort[8]. Over time, new techniques have been developed to treat soft tissue deficiencies in the edentulous zone, though the specific approach taken will depend on the prognosis and may differ from case to case. This study was conducted to evaluate the role of the original roll flap technique in soft tissue augmentation in the aesthetic edentulous zone, as well as determine the variation in labial soft tissue thickness (LSTT) with respect to age and length of edentulous time.

*Corresponding author:
Thao Thi Do
Faculty of Odonto and Stomatology,
Can Tho University of Medicine and Pharmacy,
Can Tho City, Vietnam
E-mail: dtthao@ctump.edu.vn

Materials and methods

1. Study design and sample

The study was conducted on 23 patients

who received implants in the aesthetic zone at the Ho Chi Minh City Odonto-Stomatology Hospital between August 2021 and August 2022. Patients were consecutively enrolled in the study if all the following inclusion criteria were met: age 18 or older, consent to participate in the study, implant and healing placement of any maxillary tooth from maxillary right second premolar to maxillary left second premolar, and labial peri-implant soft tissue thickness ≤ 1.5 mm. Patients who had bone grafting during implant insertion were excluded.

This study was approved by the Ethical Committee of Can Tho University of Medicine and Pharmacy (No. 436/PCT-HDDD). Each participant received a detailed explanation of the surgical technique and potential complications. Informed consent was obtained from all participating subjects. All procedures involving human subjects in the study conformed with the Helsinki Declaration (1964) and its subsequent revisions, or comparable ethical standards.

2. Surgical protocol

All surgical procedures were performed by a single experienced surgeon (T.H.M.N) under local anesthesia (Lidocaine Hydrochloride 2% and Epinephrine 1:100 000, Lignospan standard 1.8ml; Septodont, Créteil, France). The initial step was to make two full-thickness vertical incisions from the ridge's crest to the palate, with the length determined by the amount of connective tissue required. To ensure blood circulation to the connective tissue and epithelium, these two vertical incisions should be approximately parallel to each other. At the palatal margin of the healing abutment, a full-thickness horizontal palatal incision connecting two vertical incisions was made (Fig. 1). The incisions should be at least 1.5 mm from the sulcus of the tooth adjacent to the edentulous region to minimize damage to the interproximal papilla and epithelial attachment[9]. The full-thickness flap was elevated buccally using a small periosteal elevator. Then, the flap was lifted with Adson tissue forceps, and a part of the flap was de-epithelized depending on the amount of augmentation required using a flame diamond bur (Fig. 2) to reveal the connective tissue below. The de-epithelized connective tissue pedicle was rolled into the buccal envelope to achieve a buccal connective pedicle of at least 2 mm 9 and then secured with sutures (Fig. 3). If needed, a single U stitch could be used to stabilize the connective pedicle. 5-0 monofilament polypropylene non-absorbable suture materials (Polypropylene 5-0 suture, Ethicon, Johnson & Johnson, Arlington, TX, USA) were used for the suture procedure. After 2 weeks, patients were called back for a follow-up checkup and suture removal.

3. Post-operative care

Referrals for postoperative management were made to keep the wound stable, manage pain, and prevent infection. Postoperative instructions were given in both written and oral form. Systemic antibiotics were administered to the patients for 5 days (2 x 625 mg amoxicillin clavulanate/day, Augmentin 625 mg; GlaxoSmithKline, Istanbul, Turkey), oral analgesics (500mg acetaminophen every 6 hours as needed, Efferalgan 500mg; UPSASAS, Rueil Malmaison, France), and NSAIDs (2 x Ibuprofen 400mg/day, Ibuprofen STADA 400mg; STADA, Bad Vilbel, Germany) for 3 days. Chlorhexidine digluconate 0.12% mouthwash (Kin gingival; KIN, Barcelona, Spain) was also prescribed for 4 weeks. Furthermore, all patients were instructed on proper oral hygiene.

4. Data collection

Information on sex, age, length of edentulous time, and LSTT was recorded for each patient. After 2 weeks and 4 weeks of surgery, all patients returned for a follow-up visit. According to Wiesner's method[10], a periodontal probe with a rubber stopper was used to measure the LSTT at the midpoint of the healing and 5 mm high toward the gingiva, and then an endodontic ruler was used to determine the thickness. After three assessments, an average thickness was calculated. A photo of the probe with a rubber stopper and the ruler was taken 20 cm away with a Canon 650D and calibrated using ImageJ software (Fig. 4). This technique was used to assess the LSTT of the edentulous zone before surgery, 2 weeks after surgery, and 4 weeks after surgery.

5. Statistical analysis

Descriptive statistics were performed using the mean ± standard deviation (SD) for quantitative variables and percentage for qualitative variables. The change in LSTT between follow-up visits, ages, and length of edentulous time was examined using regression analysis. The intra-examiner agreement was evaluated using Kappa statistics. All assessments were repeated by a second person

to determine the diagnostic reproducibility of the initial examiner. The Kappa test of the results reveals no statistically significant differences, confirming diagnostic reproducibility. Statistical procedures were carried out in IBM SPSS Statistics 22.0 (SPSS Inc., Chicago, IL, USA). P-value ≤ 0.05 was considered statistically significant.

Results

The study included 23 patients (10 males, accounting for 43.5%, and 13 females, accounting for 56.5%) with 40 implant placements. The average age of the patients was 48,3 ± 16,6 years (range, 18-81 years). During the four-week follow-up, no patients were lost. Postoperative discomfort was mild for each patient. On average, the patients returned to their daily activities within a week.

1. Pre-surgical labial soft tissue thickness

Pre-surgical LSTT was 1.38 ± 0.08 mm on average, with a range of 1.15-1.48 mm. The thickness of labial soft tissue by age group was shown in Table 1. The thickness of soft tissue differed by age group (P < 0.001), with the lowest in the 18-30-year-old group (1.26 ± 0.05 mm) and the highest in the 41-50-year-old group (1.45 ± 0.07 mm). There was a positive correlation between soft tissue thickness and the length of edentulous time, however, the correlation was very weak (r = 0.177, P = 0.276).

Age group	Soft tissue thickness Mean ± SD	*P*-value
18-30	1.26 ± 0.05	< 0.001
31-40	1.40 ± 0.07	
41-50	1.45 ± 0.07	
> 50	1.37 ± 0.02	

Table 1. Mean and standard deviations (SD) of LSTT by age group.

2. Post-surgical labial soft tissue thickness

Pre-surgical and post-surgical LSTT were shown in Table 2. The thickness of soft tissue reached 2.87 ± 0.1 mm 2 weeks after surgery and 2.42 ± 0.1 mm 4 weeks after surgery, compared to 1.38 ± 0.08 mm at baseline, and the difference was statistically significant at P < 0.001. There was a negligible positive correlation (r = 0.037 and P = 0.869) between the patient's age and the change in soft tissue thickness after 4 weeks. The change in LSTT after 4 weeks had a very weak positive correlation with the length of edentulous time (r = 0.118 and P = 0.469).

	Mean ± SD (mm)	*P*-value
Baseline	1.38 ± 0.08	< 0,001
2 weeks	2.87 ± 0.1	
4 weeks	2.42 ± 0.24	

Table 2. Mean and SD of pre-surgical and post-surgical LSTT

Discussion

This study investigated the change in labial peri-implant soft tissue thickness before and after using roll flap technique, as well as its correlation to patients' age and length of edentulous time.

The results demonstrated that age and length of edentulous time had no appreciable impact on labial peri-implant soft tissue thickness at the baseline. This finding differed from that of the Kolte et al. (2014) study[11], which found that younger age groups had significantly thicker gingiva than older age groups. The change in LSTT after 4 weeks of treatment had a negligible positive correlation with age and length of edentulous time.

LSTT increased significantly after surgery. The thickness increased shortly after surgery, reaching a peak of 2.87 ± 0.1 mm 2 weeks post-surgery, before settling back down to a still significantly thicker level than pre-surgery at 2.42 ± 0.1mm 4 weeks post-surgery. These results were similar to that of the study by K. Barakat et al. (2013)[12], which showed that soft tissue thickness peaked after 15 days, then slightly decreased and stabilized after 3 and 6 months.

Abrams' roll flap technique was one of the first to use the palatal connective tissue pedicle[13]. In 1992, the first modified roll technique was developed by Scharf and Tarnow, based on the work of Abrams, harvested a pedicle connective tissue graft from the palatal side of a deficient edentulous ridge[14]. Since then, new modified roll techniques have been developed continuously throughout the years, such as double-fold connective tissue pedicle graft, pouch roll, trapdoor, and simplified roll[15-19]. The roll flap technique and its modifications have shown high clinical success in reducing soft tissue deficiencies and producing long-term stability[8,9]. The advantages of Abram's technique are ease

of performance and vascularity preserved tissue through pedicle graft[17]. While many roll technique modifications are challenging and require skilled surgeons, the original roll technique may be simpler for less experienced surgeons to perform. In particular, the original roll technique may provide less experienced surgeons with a greater sense of security and confidence. However, it has some drawbacks, such as the requirement for an appropriately thick palate soft tissue, healing with a depressed and concave area on the palatal side, and the potential of exposed or denuded bone during healing[17]. The original roll technique still results in a significant improvement in soft tissue augmentation in cases with moderate soft tissue deficiencies, and each patient's postoperative discomfort was minimal, according to the study's findings.

This study's possible limitations, including its small sample size and short follow-up period, could affect its external validity. The correlations between the patient's age or length of edentulous time and LSTT could be found if the sample size was larger. The follow-up period was only allowed to last for 4 weeks postoperatively due to the study's time constraints. Despite the limitations, this study could be a starting point for further research on the subject. Further studies with a larger sample size and a longer follow-up period are needed to more accurately assess the change in LSTT over months or years, as well as the impact of age or length of edentulous time on LSTT.

Conclusions

The original roll technique is relatively simple and effective in cases of moderate peri-implant soft tissue deficiencies in the aesthetic zone. Age and length of edentulous time had no appreciable impact on labial peri-implant soft tissue thickness at the baseline and after utilizing roll flap technique.

Acknowledgments

This work was supported by the Faculty of Odonto and Stomatology, Can Tho University of Medicine and Pharmacy.

Declaration of Interest

The authors have no conflicts of interest to declare.

References

1. Atwood DA. Reduction of residual ridges: a major oral disease entity. J Prosthet Dent. 1971;26(3):266-279.
2. Atieh MA, Alsabeeha NH, Payne AG, Ali S, Faggion CMJ, Esposito M. Interventions for replacing missing teeth: alveolar ridge preservation techniques for dental implant site development. Cochrane Database Syst Rev. 2021;4(4):Cd010176.
3. Guglielmotti MB, Olmedo DG, Cabrini RL. Research on implants and osseointegration. Periodontol 2000. 2019;79(1):178-189.
4. Velasco Bohórquez P, Rucco R, Zubizarreta-Macho Á, et al. Failure Rate, Marginal Bone Loss, and Pink Esthetic with Socket-Shield Technique for Immediate Dental Implant Placement in the Esthetic Zone. A Systematic Review and Meta-Analysis. Biology. 2021;10(6):549.
5. Steigmann L, Steigmann M, Wang HL. Mucosal Detachment Technique for Flap Advancement in a Thin Tissue Phenotype: Technique Illustration. Int J Periodontics Restorative Dent. 2021;41(4):555-560.
6. Bienz SP, Pirc M, Papageorgiou SN, Jung RE, Thoma DS. The influence of thin as compared to thick peri-implant soft tissues on aesthetic outcomes: A systematic review and meta-analysis. Clin Oral Implants Res. 2022;33 Suppl 23(Suppl 23):56-71.
7. Abrams L. Augmentation of the deformed residual edentulous ridge for fixed prosthesis. Compend Contin Educ Gen Dent. 1980;1(3):205-213.
8. Saquib SA, Bhat MYS, Javali MA, Shamsuddin SV, Kader MA. Modified roll technique for soft tissue augmentation in prosthetic rehabilitation: A case report. Clinics and practice. 2019;9(1):1110.
9. Pandolfi A. A modified approach to horizontal augmentation of soft tissue around the implant: omega roll envelope flap. Description of surgical technique. Clin Ter. 2018;169(4):e165-e169.
10. Wiesner G, Esposito M, Worthington H, Schlee M. Connective tissue grafts for thickening peri-implant tissues at implant placement. One-year results from an explanatory split-mouth randomised controlled clinical trial. Eur J Oral Implantol. 2010;3(1):27-35.
11. Kolte R, Kolte A, Mahajan A. Assessment of gingival thickness with regards to age, gender and arch location. J Indian Soc Periodontol. 2014;18(4):478-481.
12. Barakat K, Ali A, Abdel Meguid A, Abdel Moniem M. Modified roll flap a handy technique to augment the peri-implant soft tissue in the esthetic zone: A randomized controlled clinical trial. Tanta Dental Journal. 2013;10(3):123-128.
13. Kulkarni MR, Bakshi PV, Kavlekar AS, Thakur SL. Applications of a modified palatal roll flap in peri-implant soft-tissue augmentation - A case series. J Indian Soc Periodontol. 2017;21(4):333-336.
14. Scharf DR, Tarnow DP. Modified roll technique for localized alveolar ridge augmentation. Int J Periodontics Restorative Dent. 1992;12(5):415-425.
15. Barone R, Clauser C, Prato GP. Localized soft tissue ridge augmentation at phase 2 implant surgery: a case report. Int J Periodontics Restorative Dent. 1999;19(2):141-145.
16. Gasparini DO. Double-fold connective tissue pedicle graft: a novel approach for ridge augmentation. Int J Periodontics Restorative Dent. 2004;24(3):280-287.
17. Jordan E, Chan H-L, Saglik B, Fu J-H, Oh T-J, Wang H-L. Simplified Rolled Technique at Implant-Uncovering Surgery for Correcting Horizontal Ridge Defect. Clinical Advances in Periodontics. 2014;4(3):140-146.
18. Park SH, Wang HL. Pouch roll technique for implant soft tissue augmentation: a variation of the modified roll technique. Int J Periodontics Restorative Dent. 2012;32(3):e116-121.
19. Tinti C, Parma-Benfenati S. Minimally invasive technique for gingival augmentation around dental implants. Int J Periodontics Restorative Dent. 2012;32(2):187-193.