

Periodontal Flap Surgery along with Vestibular Deepening with Diode Laser to Increase Attached Gingiva in Lower Anterior Teeth: A Prospective Clinical Study

Ashu Bhardwaj, Zeba Jafri, Nishat Sultan, Madhuri Sawai, Anika Daing

Department of Periodontology, Faculty of Dentistry, Jamia Millia Islamia University, New Delhi, India

Abstract

Background: Chronic periodontitis in lower anterior teeth results in rapidly progressive gingival recession (GR), loss of alveolar bone, decreased vestibular depth (VD) with consequential tooth mobility, and tooth loss. Treatment option for such cases in this esthetically important area of the oral cavity includes extraction followed by implants for which sufficient bone height and mucogingival complex are a prerequisite. Henceforth, an attempt was made to prolong the life of lower anterior teeth and postpone the need for implants by the treatment of chronic periodontitis with periodontal flap surgery followed by vestibular deepening in single surgical procedure. **Materials and Methods:** In this clinical, prospective study, conventional periodontal flap surgery was done on 74 sites in lower anterior teeth in 16 patients with attachment loss >5 mm due to chronic periodontitis. Vestibular deepening with diode laser at (wavelength - 810 nm, output power: 0.5–7 W, continuous wave, contact mode) was done after suturing the flap. All the clinical parameters: GR, pocket depth (PD), clinical attachment loss (CAL), width of keratinized gingiva, width of attached gingiva, and VD were assessed preoperatively after Phase I therapy and 6 months postoperatively. **Results:** At all the 74 sites, there was highly significant gain in attached gingiva, keratinized gingiva, and VD ($P \leq 0.001$). Highly significant reduction in PD ($P \leq 0.001$), significant reduction in attachment loss ($P \leq 0.01$) but no significant reduction in GR ($P = 0.897$) was observed. **Conclusions:** The combination of periodontal flap surgery with vestibular deepening with diode laser may be a suitable cost-effective treatment option to prolong the life of periodontally involved lower anterior teeth. The surgical technique can postpone the need for extraction of teeth along with all the intangible benefits of periodontal therapy.

Keywords: Laser, periodontal surgery, periodontitis

INTRODUCTION

Moderate-to-severe chronic periodontitis results in attachment loss, periodontal pockets, and bone loss in concurrence with gingival recession (GR) resulting in decreased vestibular depth (VD). Lower anterior teeth, being single rooted are more prone to progressive horizontal loss of alveolar bone, mobility of teeth, and eventual exfoliation of teeth.^[1] The encroachment of frenal and muscle attachments on marginal gingiva increases the rate of progression of periodontal disease. A movable gingival margin would facilitate the introduction of microorganisms into the gingival crevice that would be difficult to remove by conventional tooth brushing.^[2] Functionally, adequate zone of attached gingiva is that amount which is sufficient to prevent retraction of the marginal gingiva and interdental papilla.^[3]

In patients with advanced periodontal breakdown, it becomes essential to perform mucogingival surgery as an adjunct to regular pocket elimination^[4] and create a band of keratinized gingiva to facilitate healing and prevent recurrence after therapy. One such surgical procedure is apically repositioned flap,^[5] in which the entire mucogingival complex was maintained and repositioned apically, at the level of recontoured alveolar bone. Due to the associated disadvantages of bone resection, GR, root sensitivity, and the advent of periodontal reconstructive procedures, this

Address for correspondence: Dr. Zeba Jafri,
Department of Periodontology, Faculty of Dentistry, Jamia Millia Islamia
University, Jamia Nagar, New Delhi - 110 025, India.
E-mail: zjafri@jmi.ac.in

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procedure is no longer a part of the armamentarium of periodontists.

The literature on periodontology is replete with studies on reconstruction of periodontium with bone grafts,^[6] barrier membranes, and tissue engineering.^[7,8] Soft-tissue grafts^[9] are used for increasing the attached gingiva and root coverage. Modified apically repositioned flap technique^[10,11] and subepithelial connective tissue graft^[12] aim at increasing the attached gingiva on multiple teeth. Till date, no periodontal surgical procedure provides for the treatment of teeth with attachment loss of >5 mm in conjunction with gingival augmentation on multiple teeth in one sitting. Hence, the present prospective, clinical study was done to evaluate the effect of periodontal flap surgery in combination with vestibular deepening with diode laser on attached gingiva, VD, pocket depth (PD), attachment loss, and GR.

MATERIALS AND METHODS

This prospective, clinical study was conducted on 16 patients (4 males and 12 females; mean age \pm standard deviation [SD]: 35.06 ± 7.52) diagnosed as having generalized moderate-to-severe chronic periodontitis. The individuals were recruited from patients reporting to the Department of Periodontology of Faculty of Dentistry, Jamia Millia Islamia University, New Delhi, India.

The criteria for patient selection were: (1) No history of systemic disease that could affect the outcome of periodontal therapy; (2) good compliance with plaque control instructions; (3) patients suffering from generalized moderate-to-severe chronic periodontitis; (4) at least two mandibular anterior teeth with radiographic bone loss, shallow vestibule, CAL ≥ 5 mm, and limited attached gingiva; (4) no history of smoking; and (5) absence of traumatic occlusion. Patients excluded from the study were (1) pregnant patients, (2) inadequate compliance with oral hygiene maintenance instructions, and (3) use of any medication known to influence periodontal tissues.

This study was approved by the Institutional Ethical Committee of Jamia Millia Islamia University, New Delhi, India. All the codal ethical formalities of the Institutional Ethical Committee were followed. Routine periodontal therapy was given to all the patients for generalized chronic periodontitis.

A general assessment of selected patients was made through history, clinical examination, and routine laboratory investigations. Phase I therapy including the oral hygiene instructions, full mouth scaling, and root planing for generalized chronic periodontitis was performed on all the patients. Lower anterior teeth with attachment loss >5 mm due to chronic periodontitis only were taken up for the study. A total of 74 sites in 16 patients with radiographic bone loss, tooth mobility, shallow vestibule, clinical attachment loss (CAL) ≥ 5 mm, and limited attached gingiva were considered. GR, PD, CAL, width of keratinized gingiva, width of attached gingiva, and VD were assessed preoperatively after Phase I

therapy and 6-month postoperatively. Occlusal adjustment and temporary esthetic fiber splinting wherever required were done on lingual aspect of teeth with mobility to facilitate the periodontal flap surgery.

After Phase I therapy [Figure 1a], the conventional periodontal flap for reconstructive surgical procedure was performed under local anesthesia. Periodontal surgical debridement [Figure 1b] was done followed by placement of sterile synthetic hydroxyapatite and β -tricalcium phosphate bone graft material (Sybograf™ Plus, Eucare pharmaceuticals, Chennai, India), in the bony defects, wherever required. The periodontal flap was sutured with 3-0 silk sutures to its original position [Figure 1c]. A horizontal incision was given with diode laser (DenLase, Diode Laser Therapy System, Daheng Group Inc., China; Laser parameters: Wavelength - 810 nm, output power: 0.5–7 W, continuous wave [CW], contact mode), to detach the fibers from underlying periosteum leaving 1–2 mm of marginal gingiva and sutures intact [Figure 1d]. Care was taken to direct the laser away from the periosteum and bone. VD of 6–8 mm was achieved by separating the muscle attachments. The surgical area was covered by noneugenol periodontal dressing (Coe-pak) (COE-PAK™, Periodontal Dressing, GC America Inc., USA) [Figure 1e]. Ibuprofen 400 mg was prescribed for 3 days to relieve any postoperative discomfort. Postoperative instructions included avoid food for 3 h, cold compresses and soft diet on the 1st day, avoid biting from front teeth, and passive rinsing with 0.12% chlorhexidine gluconate for 2 weeks.

Patients were advised to report in case of dislodgement of periodontal dressing and recalled after 2 weeks for pack and suture removal. A gentle gingival massage in the surgical



Figure 1: (a) Preoperative after Phase I therapy, (b) intraoperative flap debridement, (c) after suture placement, (d) vestibular deepening done with diode laser, (e) periodontal pack placed, (f) postoperative 6-month follow-up

area was advised to prevent reattachment of fibers and oral hygiene instructions were reinforced. Follow-up was done after 1 month and all the clinical parameters were recorded after 6 months [Figure 1f].

Statistical method

Variables were reported as mean \pm SD for continuous variables. Analysis for continuous variables was done using independent sample *t*-test. SPSS version 17 (SPSS, Inc., Chicago, IL, USA) was used for data analysis. A two-sided $P < 0.05$ was considered statistically significant.

RESULTS

Demographic criteria of 16 patients and baseline clinical characteristics of lower anterior teeth are provided in Table 1. Out of 74 sites, 32 sites had Grade 1 mobility, 3 sites had Grade 2 mobility, and Grade 3 mobility in 1 tooth.

The amount of bone loss seen after periodontal flap reflection around roots of teeth is also depicted in Table 1. It was observed that only 1 site with Grade 3 mobility coincided with bone loss $>2/3^{\text{rd}}$ root surface. Teeth with Grade 2 mobility included 3 incisors and had $>2/3^{\text{rd}}$ bone loss. Out of the tooth sites with Grade 1 mobility, 1 incisor and 1 canine had $1/3^{\text{rd}}$ bone loss, 17 incisors had up to $2/3^{\text{rd}}$ bone loss; and 11 incisors had $>2/3^{\text{rd}}$ bone loss. In the sites with no clinical tooth mobility, $1/3^{\text{rd}}$ bone loss was seen in 7 incisors and 13 canines, up to $2/3^{\text{rd}}$ bone loss in 15 incisors and 2 canines; and $>2/3^{\text{rd}}$ bone loss in 1 lateral incisor and no bone loss in 2 canines.

There was no significant reduction in GR ($P = 0.897$), but significant decrease in post- and pre-operative means of attachment loss and PD [Table 2]. Comparison of soft-tissue parameters after 6 months showed statistically highly

significant gain in keratinized gingiva, attached gingiva, and VD as in Table 2.

DISCUSSION

Chronic periodontitis is a multifactorial infectious disease characterized by slow irreversible damage of periodontal supporting tissue loss in a period.^[13] The chronic nature of this disease and lack of severe pain allows the patient to report only when the teeth are either mobile or there is loss of clinical attachment manifested as GR. In our clinical practice, patients reported with Miller's Class 3 and Class 4 GR and mobility of teeth in lower anterior teeth. These patients were perceptively perturbed with the prospects of losing these teeth. Lower anterior teeth are of particular concern as they are esthetically important, single rooted, and are the first teeth to be extracted due to the periodontal reasons followed by upper anterior and upper second molars. However, in long-term maintenance studies molars were lost most frequently.^[1]

Results of a 40-year follow-up study on fate of 455 teeth with questionable prognosis showed that teeth with significant loss of periodontal tissues could be functionally maintained.^[14] The average prognosis of the teeth postactive treatment changed very little from initial to 5–8 years, with prognosis being more accurate for single-rooted teeth than multirooted teeth.^[15] Long-term preservation of hopeless teeth following periodontal surgery is an attainable goal with no detrimental effect on adjacent surfaces of neighboring teeth.^[16,17] However, there was a significant reduction in the mean probing depth for the adjacent interproximal surfaces, pretherapy to posttherapy.^[18] Nowadays, with the help of various new technologies, biological approaches, and biomaterials, the challenge is to introduce the experience and knowledge

Table 1: Demographic and baseline clinical criteria

Serial number/ patient	Age/sex	Teeth involved	Mobility			Bone loss		
			Grade I	Grade II	Grade III	Up to $1/3^{\text{rd}}$ root	Up to $2/3^{\text{rd}}$ root	$>2/3^{\text{rd}}$ root
1	36 males	22, 23, 24, 25, 26, 27	22, 24, 25	-	-	22, 27	23, 26	24, 25
2	28 females	22, 23, 24, 26, 27	24, 26	-	-	-	22, 23, 24, 26, 27	-
3	36 males	22, 23, 24, 26, 27	24	-	-	22, 27	23, 26	24
4	40 females	22, 23, 24, 25, 26, 27	24, 25	-	-	23, 26	24, 25	-
5	31 females	23, 24, 25, 26, 27	23, 24, 25	-	-	27	23, 26	24, 25
6	40 females	23, 26, 27	23, 26	-	-	27	23, 26	-
7	30 males	23, 24, 25, 26	24, 25	-	-	23, 26	24, 25	-
8	34 females	23, 24, 25, 26	24	-	-	26	23, 25	24
9	44 females	23, 24, 25, 26	24, 25, 26	-	-	-	23, 26	24, 25
10	45 females	22, 23, 24, 25, 26, 27	23	24, 26	25	22, 27	-	23, 24, 25, 26
11	27 males	22, 23, 24, 26, 27	23	-	-	22, 24, 27	-	23, 26
12	19 females	24, 25	24, 25	-	-	-	24, 25	-
13	50 females	23, 24, 25, 26	24, 25	-	-	-	23, 24, 25, 26	-
14	38 females	23, 25, 26	23, 25, 26	-	-	26	23	25
15	30 females	22, 23, 24, 25, 26, 27	24	-	-	22, 23, 27	24, 25, 26	-
16	33 females	22, 23, 24, 25, 26, 27	23, 24, 25	26	-	22, 27	23	24, 25, 26
Total sites		74	32	3	1	22	32	18

The universal tooth numbering system (1-32) is used

Table 2: Comparison of means of pre- and post-operative means of soft-tissue parameters and their level of significance

Soft-tissue parameters	Mean±SD		P
	Preoperative (n=74)	Postoperative (n=74)	
PD	2.67±0.96	1.38±0.36	<0.001
CAL	4.04±1.94	3.11±1.62	<0.002
WKG	2.53±1.67	3.97±1.58	<0.001
WAG	1.03±1.28	2.9±1.53	<0.001
VD	7.47±1.97	9.62±1.48	<0.001
GR	2.16±1.57	2.12±1.60	0.897

PD: Pocket depth, GR: Gingival recession, CAL: Clinical attachment loss, WKG: Width of keratinized gingiva, WAG: Width of attached gingiva, VD: Vestibular depth, SD: Standard deviation

contributing to patient outcomes in terms of function, ease of care, esthetics, and long-term maintenance.^[19]

With this background, the authors hereby describe a surgical technique which is a combination of conventional periodontal flap surgery^[20] with vestibular deepening procedure with diode laser, to retain and prolong the life of periodontal teeth.

In our study, out of 74 sites treated, 36 teeth were mobile [Table 1]. The treatment of the periodontitis and occlusal adjustment is usually enough to strengthen the supporting tissue and reestablish function, especially in Miller Grade 1 tooth mobility.^[21] However, splinting is needed in cases of Miller Grade 2 tooth mobility in addition to the treatment of the periodontitis and occlusal adjustment. Splinting is sometimes indicated in cases of Miller Grade 3 tooth mobility where tooth extraction is not acceptable or contraindicated. Although splinting provides some beneficial distribution of occlusal forces that cause tooth mobility, occlusal adjustment alleviates these occlusal forces by removing destructive contacts and creating proper occlusal clearance.^[22,23] Therefore, the mobile teeth were temporarily splinted to facilitate periodontal therapy.

Diode laser was used to make the horizontal incision to achieve simultaneous homeostasis during the second step of surgery. There are many advantages of lasers including excellent homeostasis, precision, tissue surface sterilization, decreased swelling and edema, decreased pain, faster healing, and increased patient acceptance.^[24,25] A diode laser is a solid-state semiconductor laser that typically uses a combination of gallium, arsenide, and other elements, such as aluminum and indium, to change electrical energy into light energy.^[26] It does not interact with dental hard tissues, making it an excellent soft-tissue surgical laser. It is used for cutting and coagulating gingiva and oral mucosa and for soft-tissue curettage or sulcular debridement.^[27] The soft-tissue diode laser is not only beneficial to the patient but also to the operator as the results are more predictable and less stressful to patients and clinicians.^[28]

Out of 72 teeth with bone loss [Table 1], 22 sites showed up to 1/3rd bone loss, 32 teeth had up to 2/3rd bone loss, and

18 teeth displayed more than 2/3rd bone loss after raising the periodontal flap. The conventional periodontal flap surgery allowed use of bone graft for periodontal reconstruction and vestibular deepening with diode laser helped in maintaining the mucogingival complex at the presurgical level by apically repositioning the frenal and muscle attachments. The combination of the two surgical procedures in one sitting resulted in highly significant increase in attached gingiva, keratinized gingiva, and VD over multiple teeth while simultaneously relieving the tension on the gingiva. There were minimal patient discomfort and postoperative complications. This one-step surgical technique without involving any other site as in soft tissue graft allows the clinician to increase the VD and attached gingiva while performing the bone reconstructive procedures in patients suffering from moderate to severe chronic periodontitis.

CONCLUSIONS

The surgical technique described in this article is a cost-effective method to prolong the life of lower anterior teeth with questionable prognosis. The increase in VD and attached gingiva can improve the success of implants if required in the future. Limitations of the study include long-term follow-up of patients with regard to bone regeneration and effect on tooth mobility.

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Conflicts of interest

There are no conflicts of interest.

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