A novel single-step surgical technique for vestibular deepening using laser in conjunction with periodontal flap surgery

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Abstract:
Moderate-to-severe chronic periodontitis results in clinical loss of attachment, reduced width of attached gingiva (AG), periodontal pockets beyond mucogingival junction (MGJ), gingival recession, loss of alveolar bone, and decreased vestibular depth (VD). The encroachment of frenal and muscle attachments on marginal gingiva increases the rate of progression of periodontal pockets, prevents healing, and causes their recurrence after therapy. Loss of VD and AG associated with continuous progression of pocket formation and bone loss requires two-stage surgical procedures. In this article, one-stage surgical procedure is being described for the first time, to treat the periodontal pockets extending beyond the MGJ by periodontal flap surgery along with vestibular deepening with diode laser to increase the AG. One-step surgical technique is illustrated whereby pocket therapy with reconstruction of lost periodontal tissues can be done along with gingival augmentation by vestibular deepening.

Key words:
Attached gingiva, attachment loss, chronic periodontitis, gingival recession, laser, vestibular depth

INTRODUCTION
Various periodontal surgical procedures have been designed for the treatment of periodontal pockets, regeneration of periodontal tissues, increase in attached gingiva (AG), and root coverage. Advanced periodontal involvement in areas of minimal AG results in the base of the pocket extending close to or apical to the mucogingival junction (MGJ). These areas are associated with gingival recession (GR) and decreased vestibular depth (VD). In such type of cases, it is important to eliminate the pockets, preserve the available width of keratinized gingiva, and increase the width of attached gingiva (WAG) and the VD. Glickman advocates mucogingival surgery to be performed as an adjunct to regular pocket elimination, and all gingival-mucous membrane relationships that complicate periodontal disease and interfere with the success of periodontal treatment must be corrected. The importance of maintaining an adequate zone of AG after surgery was emphasized by Friedman in the surgical technique termed “apically repositioned flap,” where entire mucogingival complex was maintained and repositioned apically, at the level of recontoured alveolar bone.

The present article elaborates a surgical technique to augment the gingiva apical to marginal gingiva (MG) by vestibular deepening with laser in conjunction with conventional periodontal flap for reconstructive surgery.

CASE REPORT
A 25-year-old, systemically healthy female patient reported with the chief complaint of mobility in lower front teeth and difficulty in maintaining oral hygiene in lower front teeth. The patient had not taken dental consultation before. She did not want to get her teeth extracted. She was diagnosed with localized severe chronic periodontitis in relation to 41, degree 2 mobility (Miller’s index), shallow VD, limited AG, and radiographic bone loss [Table 1 and Figure 1]. Phase I therapy was given, which included oral hygiene instructions,
scaling, and root planing. Esthetic permanent fiber splinting was done on the lingual aspect of teeth #43, 42, 41, 32, and 33 for stabilizing mobile teeth (Bondable Reinforcement Ribbon, Ribbond Inc., Seattle, USA). Routine blood investigations were advised which were within the normal limits. One month after Phase I therapy, the patient was subjected to surgical procedure.

Under local anesthesia, periodontal surgical debridement was done using conventional flap for reconstructive surgery[6] [Figure 2]. Synthetic bone graft material, β-tricalcium phosphate (Resorbable Tissue Replacement [RTR], Septodont Ltd., UK), was placed in the crater defects around tooth #41. Immediately following the debridement, the flap was sutured to its original position using 3-0 silk sutures (MERSILK™, ETHICON Inc., USA). A pull on MG on slight outward movement of the lip was observed [Figure 3]. A horizontal incision with diode laser (DenLase, Diode Laser Therapy System, Daheng Group Inc., China; laser parameters: wavelength-810 nm, output power: 0.5W–7W, continuous wave [CW], and contact mode) was given at the line of tension, 1–2 mm away from the MG to detach the fibers from underlying periostium, leaving the sutures intact [Figure 4].

Care was taken not to expose the periostium and bone to laser beam. The VD was increased by separating the muscle attachments and placing them apically by 6–8 mm. The surgical area was covered by noneugenol periodontal dressing (COE-PAK™, Periodontal Dressing, GC America Inc., USA). Ibuprofen 400 mg three times a day was prescribed for 3 days to relieve any postoperative discomfort. Regular postoperative instructions were given, and the patient was recalled after a week. Periodontal pack and sutures were removed. The patient was given instructions in oral hygiene maintenance and advised to do gentle gingival massage in the surgical area. After 1 month, there was a significant gain in WAG and VD [Figure 5 and Table 2], and the results were stable after 6-month follow-up also with an improvement in clinical attachment level [Figure 6 and Table 3].

**DISCUSSION**

Periodontal inflammation causes loss of attachment followed by loss of bone and gingiva. Advanced periodontal involvement in areas of minimal attached gingiva results in the base of the pocket extending close to, or apical to, the mucogingival junction. GR displaces the gingival margin apically, thus reducing VD.[7] Frenal and muscle attachments that encroach on MG distend the gingival sulcus, fostering plaque accumulation, increasing the rate of progression of periodontal recession, and causing their recurrence after treatment.[8] A movable gingival margin would facilitate the introduction of microorganisms into the gingival crevice resulting in a thin subgingival bacterial plaque which would be difficult to detect and not easily removed by conventional toothbrushing.[9] Periodontal therapy in these teeth with bone loss and generalized GR leading to reduced VD would require two-stage surgical procedure which includes vestibular deepening followed by periodontal flap surgery for the elimination of periodontal pockets and bone regeneration. This increases the duration of treatment, causes trauma to the patient, and also may lead to further progression of disease as a definitive treatment for chronic periodontitis may take up to 4 weeks. Till date, apically repositioned flap surgery is the only technique available for the management of chronic periodontitis along with increase in WAG. Apart from the limitations such as marginal bone loss associated with root exposures, dentinal hypersensitivity, and poor esthetic outcomes,[10] one major drawback of apically repositioned flap is inability to regenerate the alveolar bone either naturally or with currently available bone regenerative techniques.

In the surgical technique described in this article, a successful attempt was made to maintain the mucogingival complex at the presurgical level using the conventional periodontal flap surgical technique[4] and by apically positioning the frenum and muscle attachments. Regeneration was obtained by placing synthetic bone graft material (RTR, Septodont Ltd., UK). Mobility of teeth was stabilized by permanent splinting done by fiber splint (Ribbond®, Bondable Reinforcement Ribbon, Ribbond Inc., Seattle, USA) on the lingual aspect of mandibular anteriors. Diode laser (DenLase, Diode Laser Therapy System, Daheng Group Inc., China; laser parameters:

| Table 1: Presurgical recordings |
|-------------------------------|
| Tooth # | 43 | 42 | 41 | 31 | 32 | 33 |
|-----------------|-----|-----|-----|-----|-----|-----|
| GR (mid-lingual, mm) | 0 | 0 | 2 | 2 | 0 | 0 |
| Lingual PD (mid-lingual, mm) | 2 | 2 | 2 | 2 | 2 | 2 |
| Labial PD (mm) | Mesial | 2 | 3 | 5 | 5 | 3 | 3 |
| Mid-Labial | 2 | 2 | 3 | 3 | 2 | 2 |
| Distal | 3 | 3 | 4 | 3 | 3 | 3 |
| GR (mid-labial, mm) | 0 | 0 | 5 | 1 | 0 | 0 |
| CAL (mid-labial, mm) | 2 | 2 | 8 | 4 | 2 | 2 |
| GM-MGJ (mm) | 2 | 4 | 0 | 3 | 3 | 3 |
| VD (mm) | 5 | 5 | 1 | 4 | 4 | 4 |
| Mobility (degree) | 2 | 1 |

| Table 2: Postoperative recording (at 1-month follow-up) |
|-------------------------------|
| Tooth # | 43 | 42 | 41 | 31 | 32 | 33 |
|-----------------|-----|-----|-----|-----|-----|-----|
| GR (mid-labial, mm) | 0 | 0 | 3 | 1 | 0 | 0 |
| GM-MGJ (mm) | 4 | 5 | 4 | 5 | 4 | 4 |
| VD (mm) | 6 | 7 | 5 | 6 | 7 | 6 |

| Table 3: Postoperative recording (at 6-month follow-up) |
|-------------------------------|
| Tooth # | 43 | 42 | 41 | 31 | 32 | 33 |
|-----------------|-----|-----|-----|-----|-----|-----|
| GR (mid-labial, mm) | 0 | 0 | 2 | 1 | 0 | 0 |
| GM-MGJ (mm) | 4 | 5 | 4 | 5 | 4 | 4 |
| VD (mm) | 6 | 7 | 5 | 6 | 7 | 6 |
| Labial CAL (mm) | Mesial | 2 | 2 | 2 | 3 | 2 | 2 |
| Mid-Labial | 2 | 2 | 3 | 2 | 2 | 2 |
| Distal | 2 | 2 | 3 | 2 | 2 | 2 |
| CAL (mid-lingual, mm) | 2 | 2 | 3 | 2 | 2 | 2 |

**GR – Gingival recession; PD – Probing depth; CAL – Clinical attachment level; GM-MGJ – Distance between gingival margin and mucogingival junction; VD – Vestibular depth**

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Figure 1: Clinical preoperative view showing gingival recession, clinical attachment loss, and periodontal pocket extending beyond mucogingival junction

Figure 2: Intraoperative view showing bone loss and clinical attachment level on raising periodontal flap

Figure 3: Sutured flap showing tension on marginal gingiva

Figure 4: Clinical view after completion of vestibular deepening using diode laser

Figure 5: Postoperative view 1 month after surgery showing significant increase in the vestibular depth and width of attached gingiva

Figure 6: Postoperative view 6 months after surgery showing stable gingival parameters with an improvement in clinical attachment level

wavelength-810 nm, output power: 0.5W–7W, CW, and contact mode) was used to make the horizontal incision to achieve simultaneous homeostasis during the second step of surgery. The flap surgery allowed the use of periodontal reconstructive procedures and the second step helped in increasing the VD and AG over multiple teeth while simultaneously relieving the tension on the gingiva. There was an improvement in all the clinical parameters along with 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 AG while performing the bone reconstructive procedures in patients suffering from moderate to severe chronic periodontitis.

CONCLUSION

With this novel technique,
1. Increase in AG along with pocket elimination on multiple teeth can be achieved in one appointment at single surgical site
2. Preservation of the entire mucogingival complex using conventional periodontal flap
3. Simultaneous increase in AG by vestibular deepening.

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Conflicts of interest
There are no conflicts of interest.

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