Management of Inadequate Vestibular Depth: A Comparison Between Periosteal Fenestration and Laser Assisted Vestibular Deepening

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Abstract:
Inadequate vestibular depth is a very common finding. Although techniques such as periosteal fenestration have long been used, it is more painful and uncomfortable for the patient, and postoperative bleeding is also found to be very high. Lasers have become established for oral surgical procedures due to their high absorption by oral tissues and their ability to cause rapid hemostasis. In addtion, postoperative application of low intensity laser has shown to promote healing and provide desirable results with little discomfort to the patient. Hence, the purpose of this study was to compare the outcome of surgical and laser-assisted periodontal surgical procedures in the management of inadequate vestibular depth.

Keywords: vestibular deepening, diode laser, periosteal fenestration, biostimulation.

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Periodontal plastic surgery is defined as a "surgical procedure performed to correct or eliminate anatomic, developmental, or traumatic deformities of gingiva or alveolar mucosa".[1]

Gingival recession displaces the gingival margin apically, reducing the vestibular depth, which is measured from the gingival margin to the bottom of the vestibule. Gingival augmentation should be considered where patients experience discomfort during brushing and chewing, and also when tooth movement is planned in which the final position can result in dehiscence.[3]

Techniques for treating various aspects of periodontal disease by means of denuding alveolar bone are not new. In 1915, G.V. Black described his surgical approach which included cutting away alveolar bone. Since then, many pioneers, such as Widman (1918), Neuman (1921), Ward (1928), Zemsky (1926), Bohannon (1962), and Schluger, have mentioned various methods of vestibular deepening.[2] However, Bohannon[3] reported that the procedure was severely painful for 2 weeks postoperatively. He also suggested that the surgical procedure does not produce predictable results.[1]

Traditionally, surgical blades have been used for these kind of surgical procedures. Recently, the use of lasers in dentistry has been advocated. Various lasers, such as CO_2, diode, Nd:YAG, Er:YAG, and ErCr:YSGG

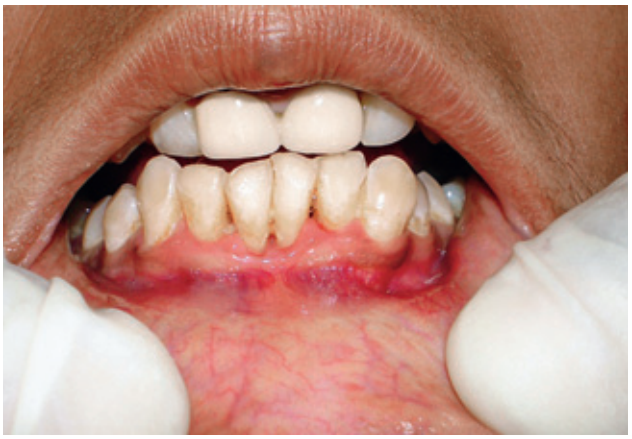

Fig 1 Case I: pre-operative situation.

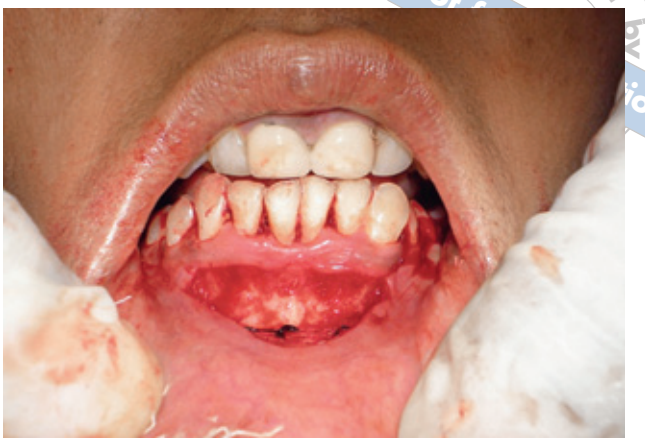

Fig 2 Case I: incision and periosteal fenestration.

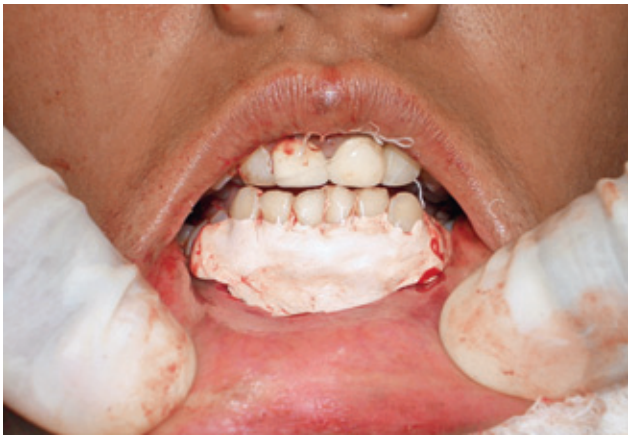

Fig 3 Case I: dressing done.

are recommended for use in dentistry. Diode lasers have a wavelength of 655 to 980 nm. These provide excellent soft tissue ablation and hemostatic characteristics. However, when applied to bone, it can lead to thermal damage.[4]

Considering these factors, we decided to compare the fenestration procedure (Robinson and Agnew)[5] with laser-assisted vestibular deepening. Two patients who had inadequate vestibular depth were selected. The exclusion criteria were systemic diseases associated with healing disturbances, disturbed wound healing (eg, uncontrolled diabetes, autoimmune disease, etc), pregnancy, and smoking. The surgical procedure and follow-up were explained in detail to the patients, who then signed a consent form.

CASE I

The patient reported to a dental office for oral prophylaxis. On examination, it was found that the vestibular depth in the mandibular anterior region was inadequate (Fig 1). Hence, vestibular deepening was planned. Local anesthesia was first administered bilaterally by using a mental nerve block. A horizontal incision was made using a no. 15 surgical blade (Surgeon Kehr Surgical, Kanpur, India) at the mucogingival junction retaining all of the attached gingiva. A split thickness flap was reflected sharply, dissecting muscle fibers and tissue from periosteum. This was then sutured in the depth of the vestibule using 3-0 silk sutures (Centisilk, Centennial, Thane, India). A strip of periosteum was then removed at the level of the mucogingival junction, causing a periosteal fenestration exposing the bone

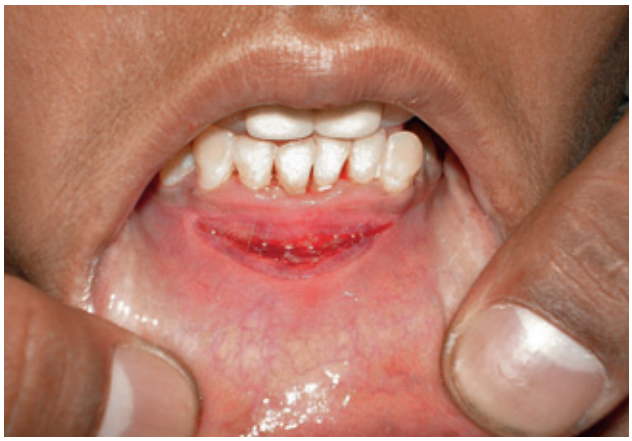

Fig 4 Case I: 1 week postoperative healing.

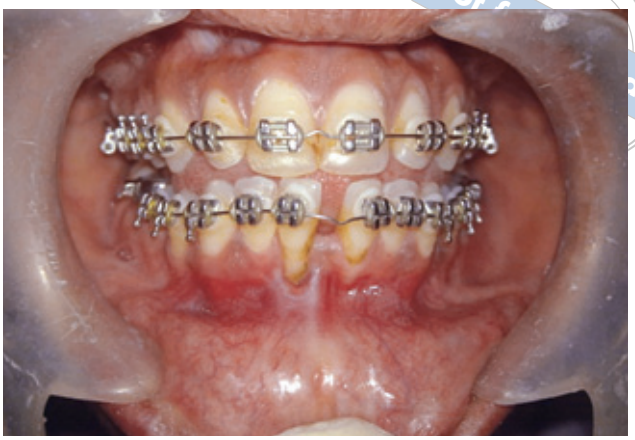

Fig 5 Case II: pre-operative situation.

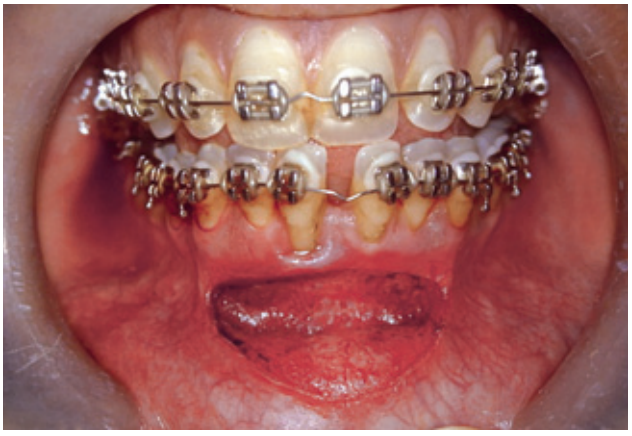

Fig 6 Case II: vestibular deepening with diode laser.

(Fig 2). A dressing (COE PAK GC America; Chicago, IL, USA) was placed over the wound (Fig 3).

CASE 2

An orthodontic patient was referred to the office for vestibular deepening since the patient had difficulty in brushing the mandibular anterior teeth (Fig 5). The vestibular depth was found to be inadequate, causing tension over the gingival margin. A diode laser of 940 nm (Ezlase, Biolase; Irvine, CA, USA) at 3.0 W power output was used in a pulsed mode. A surgical tip of 400 µm was used. The tip was first initiated as per manufacturer's instructions. The cutting of tissue was carried out in a contact mode using paint-brush-like strokes. The incision was made at mucogingival junction and the muscle and alveolar mucosal fibers were severed from the periosteum. The wound was then irrigated with saline (Fig 6). The wound was subsequently irradiated at 50 mW daily for 30 s for 1 week.[6] No dressing was placed. The maximum power output for surgery was 2.5 W. Similarly, the power used for biostimulation was 0.8 W and the energy was 25 J maximum.

DISCUSSION

Diode lasers are used for many procedures. These include excisional and incisional biopsies; exposure of unerupted teeth; fibroma removal; frenectomy and frenotomy; gingival troughing for crown impressions; gin-

Fig 7 Case II: 3 days postoperatively.

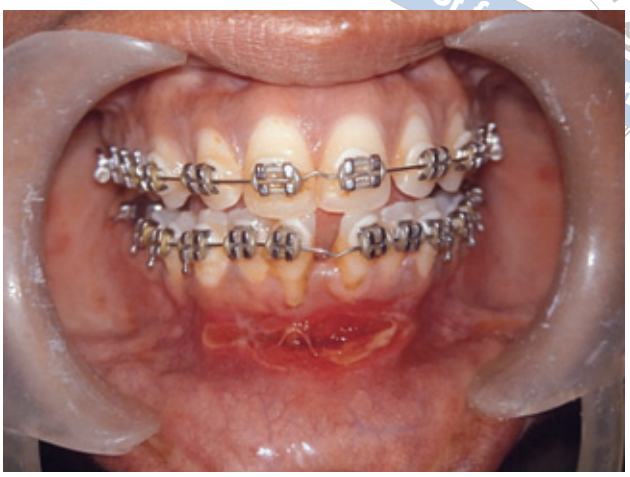

Fig 8 Case II: 1 week postoperatively.

givectomy or gingivoplasty; implant recovery; incision and drainage of abscesses, leukoplakia; operculectomy; oral papillectomies; pulpotomy; reduction of gingival hypertrophy; soft tissue crown lengthening; treatment of canker sores, herpetic and aphthous ulcers of the oral mucosa; vestibuloplasty; deep-epithelialization of reflected flaps; removal of granulation tissue; gingival depigmentation.

There are many advantages of lasers, including dry surgical field, tissue surface sterilization, decreased swelling and edema, decreased pain, faster healing and increased patient acceptance.[4]

Low-level laser therapy (biostimulation) means the use of low-output laser systems for a variety of unrelated conditions and usually without any controls.[7] However, the term "biostimulation" has been replaced with an array of nearly interchangeable descriptive phrases, such as low intensity, low level, and low power, which emphasize the nonthermal, low-energy characteristics of the approach. In practice, laser therapy typically involves the delivery of ≤ 1-4 J/cm^2 to treatment sites with lasers having output powers between 10 mW and 90 mW.[6]

One week postoperatively, the patients who had undergone the conventional vestibular deepening procedure had a raw wound covered with granulation tissue, food debris, and slough. The slough and food debris was cleaned using surgical gauze wetted with saline. The patient reported severe pain and postoperative swelling, even though the wound was dressed. The exposure of bone leads to bone resorption and further compromises the results.[8,9] Patients who had undergone laser-assisted vestibular deepening were comfortable and had very little pain after the effect of the local anesthetic wore off. This can be explained by the fact that the wound was exposed to low-level laser therapy daily for 1 week.[6,10] In vivo studies of the analgesic effect of low-level laser therapy on nerves have demonstrated that it decreases the firing frequency of nocioceptors, with a threshold effect seen in terms of irradiance required to exert maximal suppression.[11] Further, low-power laser irradiation on inflamed regions has a marked analgesic effect, and certain mechanisms that are not related to endogenous opioids are involved in part of the pain-relief processes.[12] Some authors believe that reduced sensory nerve conduction by laser therapy was one of the main mechanisms of pain relief. There is stabilization of the cell membranes that regulate the transmission of the nervous impulse. Such regulation inhibits depolarization by an increase in ATP synthesis, which promotes a significant increase in nerve latency. As sensory nerve conduction velocity is reduced, pain relief is observed.[13]

Since the rise in temperature with diode laser is found to be minimal when used in continuous motion, the chance of thermal damage to bone is reduced.[14] It was also found that bleeding during and after surgery was minimal. Wound healing, when compared with the conventional vestibular deepening technique, was found to be faster. The amount of slough was much less and the wound had almost healed with some amount of vestibular depth achieved, relieving the ten-

sion over the marginal gingiva (Fig 8). This may be due to the enhancement of the phagocytic activity of macrophages during initial phases of the repair response (6 hours after trauma).[10] There is direct evidence that 940 nm light can trigger mast-cell degranulation. Mast cells contain pro-inflammatory cytokines which promote leukocyte infiltration.[11] Additionally, laser irradiation enhanced the percentage of wound closure over time. Histological evaluation showed that laser irradiation improved wound epithelialization, cellular content, granulation tissue formation, and collagen deposition in laser-treated wounds.[15] Another advantage of using a diode laser was that it has a strong bactericidal effect and hence prevents secondary infection of the wound.[14]

CONCLUSION

From the above comparison, it is clear that the use of laser for surgery and postoperative low-intensity laser therapy is advantageous for the patient and the operator in every respect. Although the case report yielded a positive results, further studies on predictability and outcome of procedures using lasers should be conducted.

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