Research Article

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Effectiveness of Diode Laser in Compare to Scalpel in Treatment of Frenectomy: A Randomized Clinical Study

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ABSTRACT

Background: An Aberrant frenumen crouches the gingival health when it is attached too closely to the gingival margin, either due to interference in the plaque control or due to a muscle pull. Such condition has to be treated by frenectomy which can be performed by scalpel, electrocautery, or with soft tissue lasers. Hence, the aim of the study is to compare the degree of postoperative pain and healing experienced by patients during frenectomy procedure with surgical scalpel and diode laser technique.

Materials and Methods: A total of 20 subjects ranging from 16 to 40 years of age group with papillary or papillary penetrating frenum attachment in the maxillary and mandibular anterior region were selected. Enrolled subjects were randomly divided into two groups as follows Group A (n = 10): Comprised of 10 subjects selected for conventional scalpel technique. Group B (n = 10): Comprised of 10 subjects selected for diode laser technique. Various parameters such as Visual Analog pain score, intraoperative bleeding, number of analgesics used, and healing outcome 3 months postoperatively were recorded.

Results: Group B patients experienced less pain (P = 0.018), less bleeding (P = 0.018), and Required fewer number of analgesics (P = 0.009). Healing outcome at 3 months showed no significant difference between the two groups (P = 0.096).

Conclusion: Based on current findings and clinical outcome, diode lasers provide better patient perception and an efficient and satisfactory option for procedures such as frenectomy.

Keywords: Diode laser, frenectomy, scalpel, wound healing.

INTRODUCTION

The frenum is a collagen fibre with connective tissue, forms a folded mucous membrane, where the muscle fibres originated from orbicularis oris muscles. A frenum is categorized in two for maxillary and mandibular. Content of frenum is; Variable amount of loose connective tissue with elastic and dense collagen fibres, Fat cells, Occasionally acini of mucous producing salivary glands, Muscle fibres, Mucogingival junction closely associated.

Classification of frenum by Placek et al. 1994;

- Mucosal
- Gingival
- Papillary
- Papillary penetrating

This frenum is shielded by means of stratified layered epithelium which contains vascular structures with thin peripheral nervous ramifications. Hypertrophic, fibrotic, ample, fan-shaped or bifid ending construction is described as

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an abnormal frenum whose development is not dependent upon its point of insertion.[1]

The unusual frenum can be treated by *frenectomy*or by *frenotomy*procedures. Surgical removal of the unusual frenum is known as frenectomy that includes its attachment to the underlying bone, whereas *frenotomy*is the incision and the repositioning of the frenal attachment. Frenectomy can be consummated either by the routine scalpel technique, electrosurgery or via lasers. The conventional technique comprises excision of the frenum by using a scalpel. Conversely, it carries the routine risks of surgery like bleeding and patient compliance.[2]

The role of laser in dentistry is well-established in the traditional management of oral diseases.[3] It is an instrument that has achieved maximum oral health in a minimally invasive fashion, so far, that laser technology is developing very quickly.[4] The leading laser demonstrated by Robert N. Hall in 1962 stayed a diode laser, which stands a solid-state semiconductor laser that classically uses a combination of Gallium (Ga), Arsenide (Ar), and supplementary elements, such as Aluminium (Al) and Indium (In), to change electrical energy into light energy. It is usually operated in contact mode by means of a flexible fibre optic delivery system that emits in continuous- wave or gated- pulsed modes.[5]

MATERIALS AND METHODS

This comparative clinical study was carried out in the department of Dentistry, Anugrah Narayan Magadh Medical College And Hospital, Gaya, Bihar.

Patient selection

Twenty subjects, with age ranging from 15 to 40 years, which required frenectomy, were randomly selected for the study. Systemically healthy subjects with good oral hygiene were only included in the study.

Subjects were divided randomly into Groups A and Busing flip coin technique:

- Group A: Comprised of 10 subjects selected for conventional scalpel technique
- Group B: Comprised of 10 subjects selected for diode Laser technique.

All the procedures were carried out by a single operator. For the conventional classical technique (Archer [1961]and Kruger [1964]), the area was anaesthetized with2% lignocaine with 1:80,000 adrenaline (LOX 2%Adrenaline). The frenum was held with a pair of hemostats, and the whole band of tissue together with its alveolar attachment was excised with a#15 blade [Figures 1 and 2].

Fig 1: Preoperative (Papillary penetrating frenum).

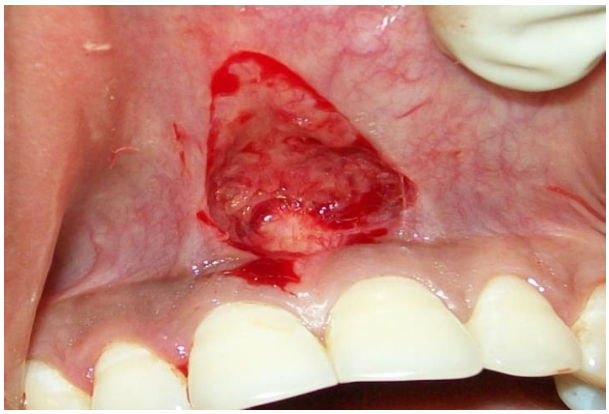

Fig 2: Excision of frenum with a scalpel.

After freeing any remaining fibrous adhesions to the underlying periosteum, the wound was closed with 3-0 silk interrupted sutures [Figure 3]. The area was covered with a periodontal dressing (COE–PAK, GC America Inc., AL SIP, IL, USA). Subjects were recalled on the 7th day for suture removal [Figure 4]. For the diode laser technique, the area was anesthetized with 2% lignocaine with 1:80,000adrenaline (LOX 2% adrenaline). The diode laser (Photon Plus; Zolar Tech Technology and MFGCo. Inc., Canada, wavelength 980 nm) at powersetting of 10 W fiber tip was used in a contactmode and moved, in a paint brush stroke,

from thebase to the apex of the frenum thereby excising it [Figures 5 and 6]

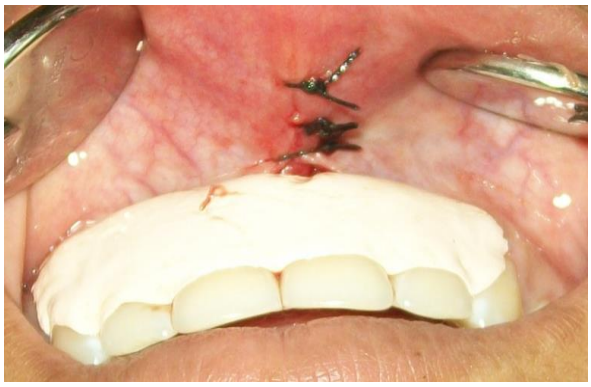

Fig 3: Suture of the site.

Fig 4: Postoperative after 1 week

Fig 5: Preoperative(Papillary penetrating frenum).

Any remnant fibre over the periosteum was removed by gently sweeping the laser tip, and the ablated remnant tissue was cleaned with gauze soaked in saline. The area was covered with a periodontal dressing (COE–PAK, GC America Inc., ALSIP, IL, USA). Subjects were recalled on the7th day for suture removal. [Figure 7]

Fig 6: Excision of frenum with Laser

Fig 7: Postoperative after 1 week

Both groups received postoperative instructions and were prescribed also told to use an analgesic containing diclofenac sodium and advised to use when needed.

Scoring of pain

Visual Analog Scale (VAS) was used to rate the pain experienced by each patient. Immediately after the procedure, each patient was asked to make a vertical mark on a 10-cm VAS. On the pain scale, the left endpoint indicated “no pain,” whereas the right endpoint indicated “worst pain imaginable.”[2]

Severity of bleeding

The severity of bleeding was recorded by the operator by scoring the amount of bleeding during the procedure for each patient (1: none, 2: mild, 3: moderate, and 4: severe).[6]

Wound healing

Three months postoperatively, each patient was recalled to determine the wound healing. For each patient, the healing was scored as 1: complete

epithelialization, 2: incomplete epithelialization, 3: ulcer, and 4: tissue defect or necrosis.[7]

Number of analgesics

Each of the patients during the recall appointment was questioned about the number of analgesics used during the healing phase. The entire scoring process was done by a single operator trained for the purpose.[8]

Statistical analysis

Statistical analysis was performed using the Statistical Package for the Social Sciences software version 19. Since the data were not distributed normally, nonparametric tests were chosen. For intergroup comparisons, Mann–Whitney U-test was used. Results were represented as median and range, $P < 0.05$ was considered statistically significant.

RESULTS

Median and range for each parameter were used to compare both the groups. Comparison of the median and range for VASscore, intraoperative bleeding, healing outcome, and the number of analgesics used are summarized in Table 1. The analysis showed that VAS score for pain was significantly lower in the laser group as compared to the scalpel group ($P = 0.018$). Intraoperative bleeding scores were found to be significantly higher for Group A than Group B ($P = 0.018$). Furthermore, the number of analgesics used by patients in Group Awas significantly higher ($P = 0.009$) than by patients in

Group B. The comparison of healing outcomes 3 months postoperatively showed no significant difference between the two groups ($P = 0.096$).

DISCUSSION

For many intraoral soft tissue surgical measures, the laser is a feasible substitute for conventional methods. The commercially obtainable dental instruments have emission wavelengths ranging from 488 nm to 10,600 nm and are entirely non-ionizing radiations to circumvent any mutations in the cellular DNA components which ionizing radiations are known to cause.

Table 1: Median, range, and significance values of each group for each parameter

Parameters	Group	Median	Range	Significance P
Visual Analog	A-Scalpel B-Laser	2 1	2-3 1-2	0.018
Bleeding	A-Scalpel B-Laser	2 1	2-3 1-2	0.018
Healing Outcomes (3 months)	A-Scalpel B-Laser	2 2	1-2 2-3	0.096
Number of Analgesic used	A-Scalpel B-Laser	2 1	2-3 1-2	0.009

One of the main benefits of using diode lasers is the ability to selectively and precisely interact with diseased tissues. Lasers permit the clinician to reduce the number of bacteria and other pathogens in the surgical field, as well as, in the case of soft-tissue measures, achieve good haemostasis with the reduced precondition for sutures. The claimed benefits of lasers via contrast to conventional surgery comprise increased coagulation that yields a dry surgical field and better visualization; the ability to negotiate curvatures and folds within tissue contours; tissue surface disinfection and consequently, decrease in bacteraemia; reduced distension, oedema, and scarring; decreased pain; faster healing response; and increased patient appreciation. Once laser cutting is in progress, minor blood and lymphatic vessels are impassable due to the produced heat, thus reducing or eliminating the flow of blood and oedema. Denatured proteins restricted tissue and plasma are the sources of the layer characterized "coagulum", which is formed as a result of laser action and serves to protect the wound from bacterial or frictional feat. On the contrary, the diode laser did not profit any deleterious effects on the root surface. Hence, diode laser surgery can be performed safely in close proximity to dental hard tissue.

In our study, subjects treated with the DIODE laser had significantly less postoperative pain both on day 1and day seven as compared to scalpel surgery as well as a number of analgesics used were lower in the laser group. These findings were consistent with the studies carried out by Haytac*etal*.[9] and Butchibabu*et al*.[10]wherein they suggested that soft tissue laser treatment used for frenectomy operations provides better patient perception in

terms of postoperative pain and function than that obtained by the scalpel technique. It is theorized that decreased pain perception after the use of laser may be due to the protein coagulum that is formed on the wound surface, thereby acting as abiologic dressing and sealing the ends of the sensory nerves.[11, 12]the increased pain perception associated with the scalpel frenectomy might be attributed to the fact that itis a more intrusive surgical procedure involving bloodloss, wide surgical wound and suturing. The sutures also contribute to the discomfort postoperatively since they interfere with regular functions such as speech and intake of food.[10,]In the present study, the healing pattern of laser wounds after the seventh day and 1 month was found to be delayed as compared to scalpel wound, which reached to statistically significant difference. However, after 3 months there was no significant difference in healing between scalpel and laser group. Delayed healing in cases of laser and electrocautery can be attributed to damage produced by lateral heat. Lateral heat damage is the area of coagulation necrosis produced around the incision line due to unwanted heat production.[13-14]These results were similar to the studies carried out by Frame *et al.*[15,] and Buell *et al.*[16] and contrary study carried out by Fisher *et al.*[11] suggested that laser created wounds heal more quickly and produce less scar tissue than conventional scalpel surgery. There is abundant evidence confirming markedly less bleeding particularly of highly vascular oral tissues, with laser surgery. The laser technique offers some advantages, such as a relatively bloodless surgical and postsurgical event; the ability to precisely coagulate, vaporize, or cut tissue; sterilization of the wound site; minimal swelling and scarring; no suturing in most cases; little mechanical trauma; reduction of surgical time; decreased postsurgical pain; and high patient acceptance.[15,2,16] In the present study, subjects treated with the DIODE laser had significantly relatively less bleeding and was easy to perform than conventional scalpel surgery.

CONCLUSION

This clinical study indicates that diode lasers provide better patient perception in terms of reduced operative time, pain, and bleeding than encountered by the scalpel. Based on current findings and abovementioned factors and in spite of certain demerits, diode laser is still a dependable alternative as it is an efficient, secure, and satisfactory option for soft tissue surgeries such as frenectomy. Diode laser also has few demerits such as lateral heat damage, delayed wound healing, the skill of the operator, and higher cost. However, there is a need for further longitudinal studies with larger sample size to establish the exact efficacy of laser technique over the conventional scalpel technique for frenectomy procedure.

CONFLICTS OF INTEREST

The authors declare they have no potential conflict of interests regarding this article.

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