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Comparision of Healing Period after Frenectomy Using Scalpel, Electrocautery & Diode Laser

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Authors' contributions

This work was carried out in collaboration between both authors. Author DG designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Author PG managed the analysis of the study. Both authors have read and approved the final manuscript.

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ABSTRACT

Background: An Aberrant frenum encroaches 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 healing of patients after frenectomy procedure with surgical scalpel, electrocautery and diode laser technique.
Study Design: Original research article.
Place and Duration of Study: Department of Periodontics at Narsinhbhai Patel Dental College & hospital at Visnagar, between July 2015 and august 2016.
Materials and Methods: A total of 15 subjects ranging from 16 to 40 years of age group with papillary or papillary penetrating frenal attachment in the maxillary anterior region were selected. Enrolled subjects were randomly divided into three groups as follows Group A (n = 5): Comprised

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of 5 subjects selected for conventional scalpel technique. Group B (n = 5): comprised of 5 subjects selected for electrocautery technique. Group C (n = 5): comprised of 5 subjects selected for diode laser technique. Various parameters such as bleeding, pain, and swelling, presence of infection, wound healing and patient comfort were evaluated.

Results: The results indicated patients treated with the diode laser had less postoperative pain ($P < 0.0001$) and required fewer analgesics ($P < 0.001$) as compared to patients treated with the conventional scalpel & electrocautery technique. Wound healing at 7th day and after 1 month for all the groups showed statistical significant difference with better outcome in Group C. However, wound healing at the end of 3 months did not show any significant difference between the groups.

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: Frenectomy; scalpel technique; electrocautery; diode laser.

1. INTRODUCTION

The frenum is a mucous membrane fold that attaches the lip and the cheek to the alveolar mucosa, the gingiva, and the underlying periosteum. 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 are described as 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, electro surgery 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 with favorable healing [2].

The role of laser in dentistry is well-established in traditional management of oral diseases [3]. The leading laser demonstrated by Robert N. Hall in 1962 stayed a diode laser, which is 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 electro-magnetic energy into heat. The conversion of electromagnetic energy to heat effects in target tissue can only be deemed predictable if unwanted change through conductive thermal spread is prevented. Thermal relaxation rates are proportional to the area of tissue exposed & inversely proportional to the absorption coefficient of the tissues. It is usually operated in contact mode by means of a flexible fibre optic delivery system that emits in continuous- wave or gated- chopped modes [4]. Diode lasers are highly absorbable by melanin and hemoglobin allows soft-tissue manipulations such as gingival recontouring, operculectomy, or frenectomy accompanied by improved epithelization and wound healing [5,6].

Electrosurgery has been used since 1928 in dentistry for soft tissue procedures. The main advantage of the electrocautery is coagulative effect that provide bloodless area and clear view of the operative field. With any device that creates thermal energy to cut or ablate tissue, heat may be dissipated by diffusion into adjacent tissues (conduction), or into the circulating blood (convection). The resulting lateral thermal injury to tissues may result in delayed healing and increased risk of wound dehiscence [7].

Hence, the aim of this study was to compare the healing period after frenectomy using scalpel, electrocautery & soft tissue laser.

2. MATERIALS AND METHODS

These comparative surgical techniques were undertaken at Narsinhbhai Patel Dental College & hospital at Visnagar. The subjects underwent frenectomy for periodontal or orthodontic reasons.

The research protocol was initially submitted to the Narsinhbhai Patel Dental College Institution Ethical Committee and review board and ethical clearance was obtained.

2.1 Inclusion Criteria

- Subjects within age group of 18 to 26 years.
- Good oral hygiene at the time of the surgery.
- Only maxillary anterior frena were included in this study.
- All subjects were systemically healthy.

2.2 Patient Selection

Fifteen subjects with age ranging from 16 to 40 years, who required frenectomy, were randomly selected by simple randomization (toss a coin) for the study. Systemically healthy subjects with maxillary papillary or papillary penetrating type frenum attachment with good oral hygiene were only included in the study.

Subjects were divided randomly by simple randomization (toss a coin) into Groups A, B & C using flip coin technique:

Group A: Comprised of 5 subjects selected for conventional scalpel technique.

Group B: Comprised of 5 subjects selected for Electrocautery technique.

Group C: Comprised of 5 subjects selected for diode Laser technique.

All the procedures were carried out by a single operator.

The classical technique was introduced by Archer [1961] and Kruger [1964]). [8] For the conventional classical technique, the area was anaesthetized, using 2% lignocaine with 1:80000 adrenalines. The frenum was engaged with a hemostat which was inserted into the depth of the vestibule and incisions with a #15 blade were placed on the upper and the under surface of the hemostat until the hemostat was free. The triangular resected portion of the frenum with the hemostat was removed. A blunt dissection was done to relieve the fibrous attachment. The edges of the diamond shaped wound were sutured using 4-0 black silk with interrupted sutures. The area was covered with a periodontal dressing (COE–PAK^{TM} GC America). Patient was recalled after 1 week for suture removal and after 1 month for follow-up.

Fig. 1. Frenectomy is carried out with help of scalpel

For the electrocautery technique, the area was anesthetized with 2% lignocaine with 1:80,000 adrenaline. Hemostat was used to elevate tissue, hold it tight and was inserted into the depth of the vestibule. The ART-E1 electrosurgery unit (Bonart Co. Ltd, Taipei country, Taiwan) was used. The setting on the cutting electrode was set with 4 RF/2MHz, power supply of 230±10% 50/60 Hz, 0.9A 210 VA. The output power was kept 38 watts rms ± 5% (Compared with 18 watts from a standard Valley Lab Electrocautery). The working frequency was adjusted to 1.5 MHz±5%. Two incisions using the electrode Continuous saline irrigation was given while using the electrocautery. The triangular tissue of labial frenum was then removed with the hemostat, and it was made free. The area was covered with a periodontal dressing (COE–PAK^{TM} GC America). Patient was recalled after 1 week and after 1 month for follow-up.

For the diode laser technique, the area was anesthetized with 2% lignocaine with 1:80,000 adrenaline. The diode laser (Picasso Lite Diode Laser, AMD GROUP LLC^{TM}) at power setting of

2.5 w fiber tip was used in a contact mode and moved, in a paint brush stroke, from the base to the apex of the frenum thereby excising it. Any remnant fiber 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^{TM}). Patient was recalled after 1 week and after 1 month for follow-up.

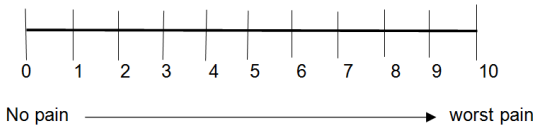
Fig. 2. Frenectomy is carried out with help of electrocautery

Fig. 3. Frenectomy is carried out with help of diode laser technique

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

2.3 Method of Scoring

A single operator recorded severity of bleeding (1: None, 2: Slight, 3: Moderate, 4: Severe) [9] and pain during the procedure and at postoperative day and on 2nd day. The subjects were asked to rate the degree of pain during eating or speech, on a 10‑cm horizontal visual analog scale (VAS) by placing a vertical mark to assess position between the two endpoints. The left end point was nominated as “no pain,” and the right end point was nominated as “worst pain imaginable.”



On the post-operative day, 1st, 3rd, & 7th day swelling (0: No swelling, 1: Mild swelling, 2: Moderate swelling, 3: Severe swelling) was assessed. Wound healing (1: Inadequate, 2: Nearly entire wound, 3: Good) was assessed after 1 month and infection (0: No infection, 1: Infection present) was assessed on 1st, 2nd and 7th day. After the 1st month reevaluation of wound healing (Figs. 1d, 2c, and 3c) was performed using same indices [9] for all the groups.

2.4 Statistical Analysis

It was performed for mean and standard deviation.

3. RESULTS

Results of the study are summarized in Tables 1 to 6.

4. DISCUSSION

In the era of periodontal plastic surgery, techniques should be more conservative and precise to create more functional and aesthetic results. Frenectomy can be performed using various techniques like conventional scalpel technique, with electrocautery or with lasers. The soft tissue laser and electrocautery is now a viable alternative to the scalpel in soft tissue surgery.

Table 1. Mean scores of bleeding during surgery, 1st post-op and 2nd post-op day

	Group	Number of subjects	Mean ± SD	Statistical significance
Intra-operative	A - scalpel	5	2.4 ± 0.54772	P = 0.000*
	B - cautery	5	1.2 ± 0.44721	
	C - laser	5	1 ± 0	
1st post op day	A - scalpel	5	2 ± 0	P = 0.006*
	B - cautery	5	1.2 ± 0.44721	
	C - laser	5	1.2 ± 0.44721	
2nd post op day	A - scalpel	5	1 ± 0	P = 0.397*
	B - cautery	5	1 ± 0	
	C - laser	5	1.2 ± 0.44721	

Table 2. Mean scores of pain on 1st and 2nd post-day after surgery

	Group	Number of subjects	Mean ± SD	Statistical significance
1st post op day	A - scalpel	5	4.4667±0.6408	P = 0.000*
	B - cautery	5	4.56±0.60663	
	C - laser	5	3.06667±0.78655	
2nd post op day	A - scalpel	5	3.7333±0.23094	P = 0.000*
	B - cautery	5	2.4±0	
	C - laser	5	2.4±0	

Table 3. Mean scores of swelling on the day, 1st, 3rd and 7th post-op day

	Group	Number of subjects	Mean ± SD	Statistical significance
On the day of surgery	A - scalpel	5	1.6 ± 0.54772	P = 0.002*
	B - cautery	5	0.8 ± 0.44721	
	C - laser	5	0.2 ± 0.44721	
1st post op day	A - scalpel	5	1 ± 0.70711	P = 0.063*
	B - cautery	5	0.8 ± 0.83666	
	C - laser	5	0 ± 0	
3rd post op day	A - scalpel	5	0.8 ± 0.44721	P = 0.133*
	B - cautery	5	0.4 ± 0.89443	
	C - laser	5	0 ± 0	
7th post op day	A - scalpel	5	0 ± 0	P = NaN*
	B - cautery	5	0 ± 0	
	C - laser	5	0 ± 0	

Table 4. Mean scores of epithelization at the end of 4th week after surgery

	Group	Number of subjects	Mean ± SD	Statistical significance
At the end of 4th week	A - scalpel	5	1.2±0.44721	P = 0.000*
	B - cautery	5	2 ± 0	
	C - laser	5	1 ± 0	

Table 5. Mean scores of infection during 1st, 2nd, and 7th post-op day

	Group	Number of subjects	Mean ± SD	Statistical significance
1st post op day	A - scalpel	5	0 ± 0	P = NaN*
	B - cautery	5	0 ± 0	
	C - laser	5	0 ± 0	
2nd post op day	A - scalpel	5	0 ± 0	P = NaN*
	B - cautery	5	0 ± 0	
	C - laser	5	0 ± 0	
7th post op day	A - scalpel	5	0 ± 0	P = NaN*
	B - cautery	5	0 ± 0	
	C - laser	5	0 ± 0	

Table 6. Mean scores of patient comfort at the end of 4th week after surgery

	Group	Number of subjects	Mean ± SD	Statistical significance
At the end of 4th week	A - scalpel	5	1.8±0.44721	P = 0.029*
	B - cautery	5	1 ± 0	
	C - laser	5	1.4±0.54772	

** -Statistical significance; NaN – No any number*

Lasers such as Nd: YAG, Co2, and Er: YAG had been used for frenectomy procedures. Among these, Co2 laser is the one most frequently used [10-12]. In the present study, diode laser, which characteristically uses a blend of gallium, arsenide, and other elements such as aluminum and indium, was used. According to the some reference articles [13-27], there are some advantages of lasers for soft tissue cutting: 1) their use requires minimal or no anesthetic; 2) they do not harm dental hard tissues; 3) their judicious use does not injure the dental pulp; 4) because of low or no heat production, they can be used around dental implants; 5) they are antimicrobial; 6) they remove endotoxins from root surfaces; 7) there is growing evidence that

laser use may be positive therapy for periodontal disease; 8) laser technology is considered state of the art by the lay public, so patients are more accepting of its use in their treatment than of electrosurgery.

There are two basic types of electrosurgical units that can be purchased in dentistry: 1) Monopolar is one in which a single electrode exists and the current travels from the unit down in a single wire to the surgical site. 2) Bipolar is one in which two electrodes are placed in very close proximity to each other. Bipolar units are more expensive than diode lasers and the electrical current flows from one electrode to the other, thus eliminating the need for grounding pad. Bipolar units, because of the two wires, create less of a precise cut than the monopolar or diode laser.

David et al. [28] compared mucosal incisions made by scalpel, CO2 Laser, electrocautery, he concluded that, on subjective evaluation of ease of use, constant-voltage electrosurgery scored highest ($p < 0.05$) on a scale of 0 to 4, followed by the CO2 laser. The speed of incisions and excisions, measured in seconds, was faster for electrosurgery unit as compared to CO2 laser. The collateral tissue damage was less in electrocautery group as compared to laser. Elecrocautery require no safety glasses and can remove large amounts of tissue quickly [29]. In electrocautery heat is produced when the electrode contacts the tissue and due to this pain is produced, anesthetic must be used. It may also causes burns, the risk of an explosion if combustible gases are used, interference with pacemakers and the production of surgical smoke.

In our study, patients were treated with the scalpel, DIODE laser, & electrocautery. Patients treated with scalpel and electrocautery had more post-operative pain compared to laser. With the use of scalpel, there is more intra-operative bleeding. With laser, there was minimal swelling and scarring; no suturing in most cases; little mechanical trauma; reduction of surgical time; decreased post-surgical pain; and high patient acceptance [30-33]. Swelling was more in patients treated with electocautery. There is abundant evidence confirming markedly less bleeding particularly of highly vascular oral tissues, with laser and electro surgery. Some reports suggest that laser-created wounds heal more quickly and produce less scar tissue than conventional scalpel surgery [34], although contrary evidence also exists [35,36]. Though laser utilization is not simple and operators must attend to theoretical and practical training as well as to observe the safety procedures. Patient treated with electrocautery had prolonged healing period and takes more time for epithelization.

5. CONCLUSION

According to present clinical study, all 3 methods can be used successfully to treat abnormal frenal attachment. As with scalpel technique, there was more intra-operative bleeding and post-operative pain was noted. With the use of electro-cautery, there was more post-operative pain, swelling, delayed healing period was noted. Diode laser provide better patient comfort in terms of minimal intra-operative bleeding, pain, swelling, epithelization, infection and reduced operative time. 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.

CONSENT

Written informed consent was obtained from the patient for publication of this paper and accompanying images.

ETHICAL APPROVAL

As per international standard or university standard, written approval of Ethics committee has been collected and preserved by the authors.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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