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Research Article

COMPARATIVE ASSESSMENT OF PAIN ASSOCIATED WITH SOFT TISSUE CROWN LENGTHENING USING LASER AND CONVENTIONAL SCALPEL TECHNIQUES

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ABSTRACT

Aim: The present clinical study is aimed to assess the pain associated with diode laser for crown lengthening procedure and to compare it with the conventional scalpel procedure.

Methodology: Twenty patients including males and females, aged 20- 40 years were recruited and divided into two groups to undergo crown lengthening either with the scalpel or the laser. The data obtained was analysed for intergroup comparison with an Unpaired t-test and discomfort scores between the groups and intragroup comparison was determined by ANOVA.

Results: Analysis for pain showed that there was a significant difference in VAS scores of pain on the day3 as well as on the day7 with patients in the laser group displaying significantly lower VAS scores compared to the scalpel group, but when both the groups were compared on the 7th day, there was no significant difference. Intergroup comparison of the mean VAS scores for discomfort observed on the 3rd, 5th and the 7th day of the study suggested that there was a significant difference of the VAS scores of discomfort on the 3rd and 7thday, with the patients in the laser group displaying significantly lower VAS scores for discomfort over conventional group.

Conclusion: Within the limitations of the current study it can be inferred that there is lesser pain associated with LASER and it can be a comfortable and effective alternative to traditional crown lengthening performed with the scalpel.

INTRODUCTION

Numerous clinical scenarios such as root caries, fractured teeth, gummy smile etc. are encountered in day to day clinical practice. Interdisciplinary approach which coordinates to aid the teeth through crown lengthening procedure to expose sufficient tooth structure to facilitate proper restoration as well as to enhance esthetic appearance. Various indications have been outlined in literature for crown lengthening procedure, such as exposure of fractured tooth, correction of gummy smile, exposure of subgingival caries, access to subgingival root perforations.[1, 2, 3, 4]

Based on the clinical presentation, crown lengthening procedure could be instituted with or without osseous recontouring. The patients presenting with short clinical crowns due to altered passive eruption requiring an increase in the length of the tooth structure are considered under the "esthetic crown lengthening". Here, the crown lengthening procedure is confined to the anterior esthetic zone and helps in enhancing the esthetic appearance of an individual. Crown lengthening procedure is accomplished either by the use of a scalpel, electrocautery or more recently by the use of lasers [5, 6, 7]

Owing to the advantages such as minimal discomfort and quick hemostasis and placement of restoration immediately, lasers have an added advantage over the scalpel in functional crown lengthening procedures.

Hence, our present clinical study was designed to assess the pain associated with diode laser for esthetic crown lengthening procedure and to compare it with the conventional procedure using the scalpel.

MATERIALS AND METHODS

Twenty patients including 11 males and 9 females, aged 16-40 years were screened and recruited among those who reported to the Outpatient desk, Department of Periodontology Faculty of Dental Sciences, Ramaiah University of Applied Sciences, Bengaluru.

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Inclusion criteria

- Systemically healthy patients
- Adequate attached gingiva
- Inadequate tooth structure

Exclusion criteria

- Medically compromised patients
- Smokers
- Pregnant and lactating patients
- Patients who previously underwent any surgical procedures in the same area

Crown lengthening procedure was properly explained to the patients and a signed consent was taken from them. Patients were divided into two groups by simple randomization using coin toss method

1. Group A- 10 patients who underwent diode LASER assisted crown lengthening procedure.
2. Group B- 10 patients who underwent conventional scalpel surgical procedure.

Prior to the crown lengthening procedure, patients received oral prophylaxis and necessary oral hygiene instructions were given for proper maintenance of oral hygiene.

Clinical Parameters

Patient perceptions related to pain and discomfort post operatively was assessed by a visual analog scale (VAS). The VAS scale comprised of a 10 mm scale with "0" indicated as "no" and 10 representing "worst pain". The two end points on the pain scale represented "no pain" on the left and "worst pain" on the right side. The extent of Discomfort was represented by "no discomfort" on the left and "severe discomfort" on the right. Patients were instructed to make a vertical mark between these two end points on the pain as well as the discomfort scale separately on the 3rd, 5th and the 7th days.[1]

Figure 1 Visual Analogue Scale (VAS) for Scoring Patient Perceptions

Case no: 1: A16 year old female patient was referred from Dept. of Orthodontics, with short clinical crowns in relation to six maxillary teeth requiring an increase in the length of the crown structure.

On intraoral examination: The patient presented satisfactory oral hygiene, clinical crowns in maxillary right first premolar (14), second premolar (15), first molar (16), left first premolar (24), second premolar (25), and first molar (26). The crown-to-root ratio was approximately 1:3. Sulcus Depth was 3 mm. The patient was undergoing active orthodontic treatment. Neither periodontal problems nor teeth mobility was detected. The treatment plan from the above findings was determined as crown lengthening in relation to the above teeth in order to aid in esthetics and to facilitate bracket placement to proceed with Fixed Orthodontic Treatment.

Conventional Soft Tissue Crown Lengthening Procedure

The area around the teeth which were to undergo the procedure was sufficiently anesthetized with 2% lignocaine and 1:80,000 adrenaline. Initially, the probing depth was measured and once sufficient anesthesia was achieved, biologic width calculation was done by the transgingival probing method using a William's periodontal probe. Once the biologic width was calculated and the amount of gingival tissue to be excised was demarcated with pocket marker to attain a proper exposure of the tooth structure, an external bevel incision was performed and the gingival tissue was excised. Left out tissue tags and any beads of granulation tissue were removed to attain an even surface. Post-operative instructions were given. Additional plaque control measures using 0.12% Chlorhexidine gluconate mouth rinse twice daily for two weeks was prescribed.

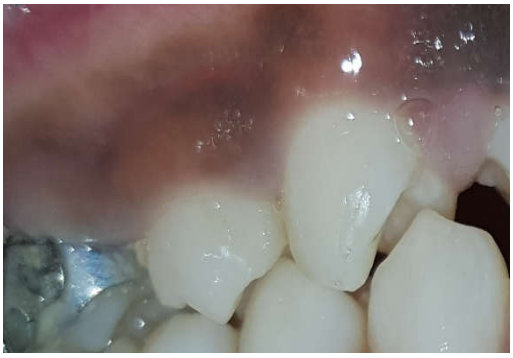


Image 1 Lateral view pre-operative photograph before crown lengthening

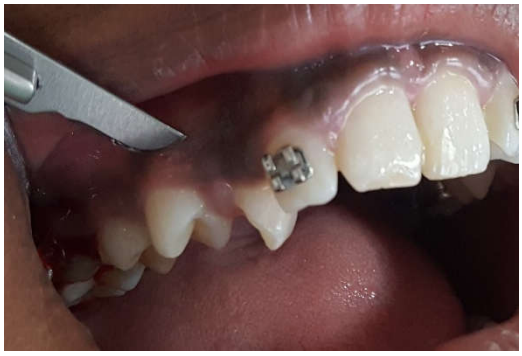


Image 2 Photograph showing the crown lengthening with scalpel

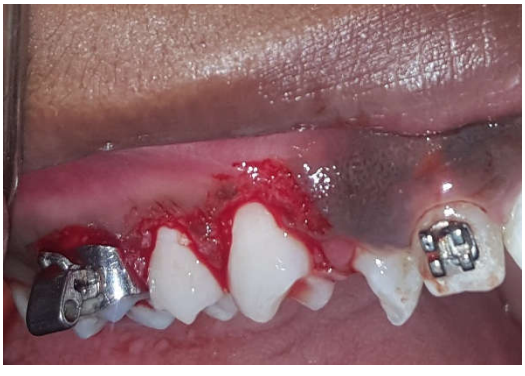


Image 3 Immediate post-operative photograph after crown lengthening with scalpel

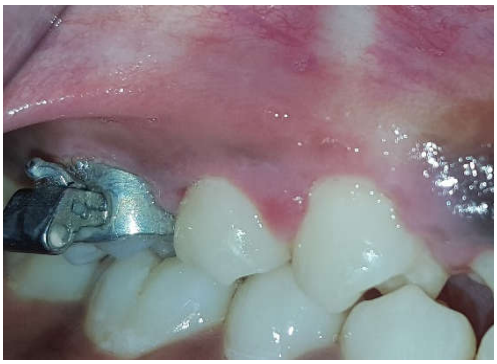


Image 4 Post-operative after a week

LASER Assisted Soft Tissue Crown Lengthening Procedure

Prior to the procedure, topical anesthetic gel was applied to the concerned area. The area was adequately anesthetized with 2% lignocaine and 1:80,000 adrenaline. Appropriate LASER Radiation safety precautions such as protective eyewear were worn by the clinician and the patient prior to the procedure.

A diode laser with a wavelength of 940nm was used for the procedure. After sufficient anesthesia was achieved, the laser unit comprising of a 400-µm disposable tip was used in contact mode with a setting of 0.8 to 1.5 watts in continuous mode along the demarcated area with a paint brush strokes progressing slowly to remove the gingival tissue and expose adequate amount of tooth structure. During the entire procedure, the tip was constantly checked for any debris of the ablated tissues and was cleaned with sterile moist gauze. Physiological gingival contour was achieved by changing the angulation of the tip as required during the procedure.

Case 2:- A 25 year old female patient reported to the department with short clinical crown in the upper right front teeth region and had just finished her teeth alignment with Fixed Orthodontic Treatment.

On intra-oral examination, blunt interdental papilla was noticed in between 13,15 and 23,25. Treatment was planned as Scaling and root planning and use of 940nm diode laser for gingivoplasty wrt 13 and 15,23 and 25, and esthetic crown lengthening wrt 12 were performed under local anaesthesia. Plaque control measures using 0.12% Chlorhexidine gluconate mouth rinse twice daily for two weeks was prescribed".

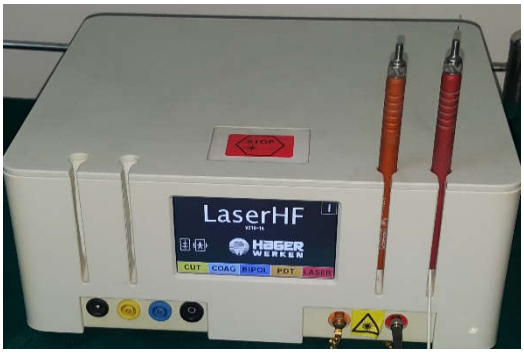


Image 5 LASER equipment used

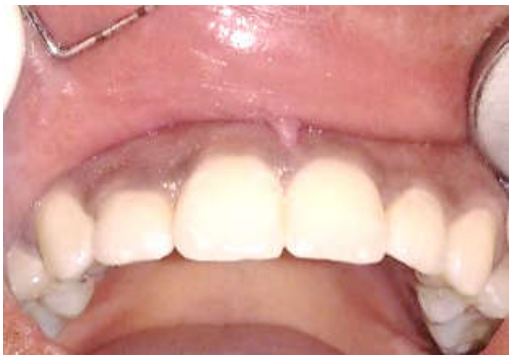


Image 6 Pre- Operative

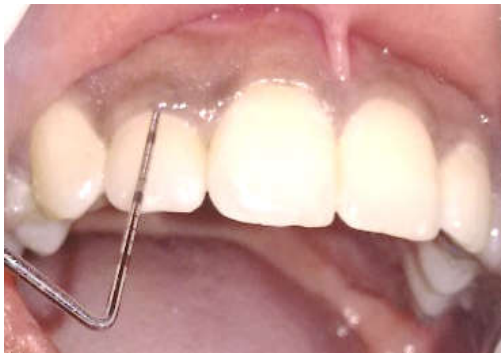


Image 7 Gingival margin coronal to CEJ

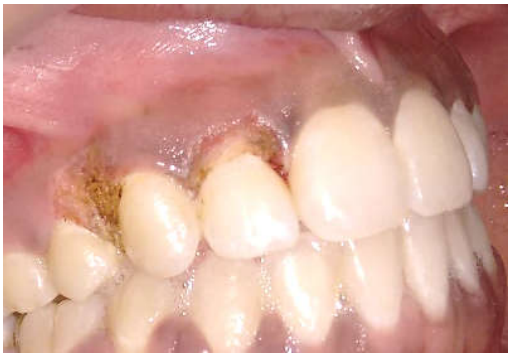


Image 8 Immediate post- operative

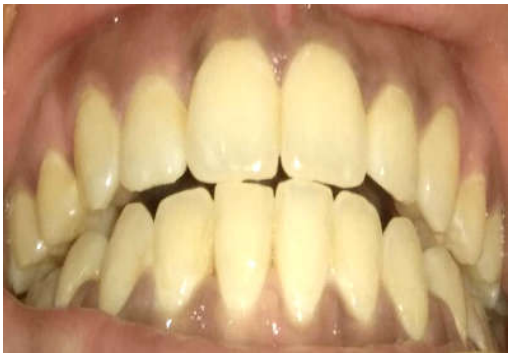


Image 9 Post- operative 2 weeks

Analgesics were prescribed for the patients and were advised to be taken if required. Out of 10 patients in scalpel group two patients reported the use of analgesics and one patients reported use of analgesics in the laser group in the immediate 24 hour post-operative period. Considering that the patients in both the groups having taken the analgesics only on the first postoperative day, this did not have an influence on the VAS scores as the patients were recalled on the 3rd day. Necessary plaque control measures and oral hygiene instructions were instructed to all the patients.

Compared with the use of a conventional scalpel, lasers can cut, ablate and reshape the oral soft tissue more easily, with minimal bleeding and no need for suturing. Less wound contraction and minimal scarring are other advantages of laser surgery that are not observed in scalpel surgery. Thus, lasers are generally used for gingivectomy and gingivoplasty with some benefits when compared with the use of a scalpel.

Statistical Analysis: IBM Statistical Program for Social Sciences Version 17.0 (SPSS Inc, Chicago Illinois, USA) was used to perform statistical analysis.

Changes were considered significant at $P < 0.05$ and highly significant at the $P < 0.001$.

RESULTS

Eighteen patients had completed the follow-up from a total of twenty patients two patients who had enrolled for the study. Patients were recalled on the 3rd, 5th and the 7th day for evaluation of VAS scores.

Table 1 Comparison of mean VAS scores between 02 groups at different time intervals using Mann Whitney Test

Time	Groups	N	Mean	SD	Mean Rank	Z	P-Value
Day 3	Group A	10	0.50	0.53	6.25	-3.365	0.001*
	Group B	10	2.00	0.82	14.75		
Day 5	Group A	10	0.10	0.32	5.95	-3.880	<0.001*
	Group B	10	1.10	0.32	15.05		
Day 7	Group A	10	0.30	0.48	7.85	-2.260	0.02*
	Group B	10	1.00	0.82	13.15		

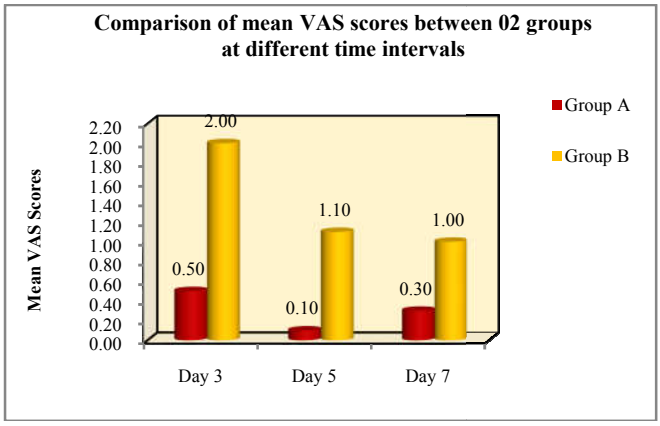
Note: Group A : Laser; Group: B:Conventional group
* Statistically Significant

Note. *P<0.001 significant

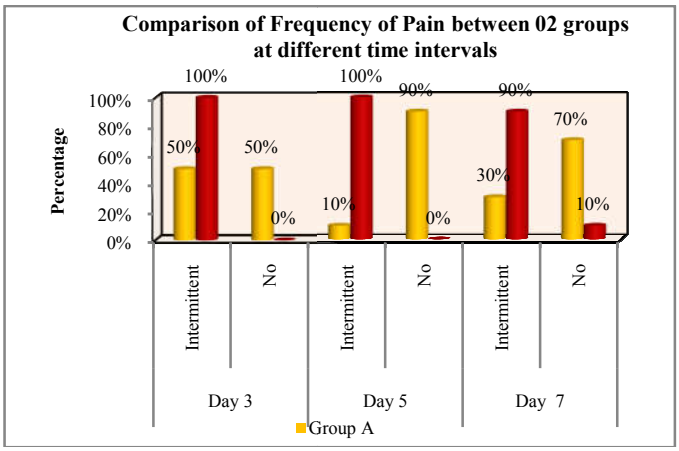
The VAS scores of pain and discomfort when compared from the 3rd day to the 5th day did show significant difference. However, when the scores from the 7th day were compared with those on the 3rd and the 5th days, a highly significant difference was found (P<0.001).

Table 2 Comparison of Pain characteristics between 02 groups at different time intervals using Chi Square test

Variable	Groups	Group A		Group B		K^2 Value	P-Value
		n	%	n	%		
Frequency of Pain	Day 3	5	50%	10	100%	6.667	0.01*
		5	50%	0	0%		
	Day 5	1	10%	10	100%	16.364	<0.001*
		9	90%	0	0%		
	Day 7	3	30%	9	90%	7.500	0.006*
		7	70%	1	10%		



Graph 1



Graph 2

Within the laser group, The VAS scores of pain and discomfort when compared from the 3rd day to the 5th day did show significant difference. However, when the scores from the 7th day were compared with those on the 3rd and 5th days, a highly significant difference was found (P<0.001).

The intergroup comparison of the mean VAS scores of the levels of pain observed on the 3rd, 5th and 7th day of the study. The results showed that there was a significant difference (P<0.002) in VAS scores of pain on the 3rd day as well as on the 7th day, with patients in the laser group showing significantly lower VAS scores compared to the scalpel group, but when both the groups were compared on the 7th day, there was no significance (P<0.14).

DISCUSSION

LASER is an abbreviation for Light amplification by Stimulated emission of radiation, here an electron from a high energy orbit jumps to a lower energy orbit by emission of a High energy photon. This collectively leads to a powerful beam of light which is unidirectional, coherent and monochromatic and has various applications.

In LASER assisted soft tissue surgery radiant energy interacts with the tissue in several ways: reflection, transmission, scattering and absorption. When the tissue is incidentally heated by laser beam to temperatures over 60^0C, it undergoes coagulation[12]. This coagulation phenomena are the basis of most surgical applications of laser and as a result of photo-coagulation, protein, enzymes, cytokines and other bioactive molecules are heated to temperatures over 60^0C, the result being instant denaturation. Alteration in the molecular structures of tissue collagen from trihelical to randomly disturbed helical polymers and coils after laser beam radiation is the basic physical event which will lead to shrinkage of the collagen fibers after photocoagulation, the lased tissue constricts against the proximal vasculature and the vessels shrink as a result of the collagen in their walls which result in enhanced hemostasis[12]. The extraordinary rapid cell vaporization with loss of intracellular fluid, chemical mediators (cytokines) and denaturation of intracellular substance and protein is posited to result in a markedly less intense local inflammatory response and consequently less local pain, edema and cicatrix formation [13,14] and this may explain lower pain associated while performing laser surgery in comparison to the scalpel procedure according to Shuller *et al*[15]. Diode LASER

offers an advantage of surgical efficacy and practicality. Additionally, coronal gingival regrowth is often an undesired sequela of traditional crown lengthening procedure[8].

Comparing both the laser and the scalpel techniques, the patients in the laser group had minimal bleeding with acceptable visualization of the working area and better assessment of the tooth structure to be exposed whereas the scalpel wound resulted in unpleasant bleeding with poor visualization of the working area. Our findings were in accordance with Lag dive SB *et al* [9] and Guy *et al*[12].

A Visual Analogue Scale was used in our study to assess the patient pain perception and discomfort between both the groups. With conventional scalpel procedure the cell destruction that occurs leads to the release of cytokines characteristic of acute inflammatory phase with pain. Patients in the LASER group exhibited a reduction in the VAS scores on the 3rd day and the 7th day compared to the scalpel group primarily because lasers deposit a protein coagulum sealing the sensory nerves leading to a reduction in inflammation this finding was in accordance with Fisher *et al*[16].

There is evidence in literature that a thin layer of denatured collagen on the surface of the lased tissue acts as a relatively impermeable membrane more like a dressing immediately after lasing by LASER, thus reducing the amount of tissue irritation from physical and biochemical agents in the intra-oral environment and this may explain why the lased tissue exhibit minimal postoperative pain in agreement with findings of Frame *et al*[17].

CONCLUSIONS

Within the limitations of the current study it can be inferred that there is lesser pain associated with LASER and it can be a comfortable and effective alternative to traditional crown lengthening performed with the scalpel. In particular, the diode laser is safe and useful for esthetic periodontal soft-tissue management due to its limited depth of soft tissue penetration compared to other forms of LASER.

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