

**Comparative Evaluation between Diode Laser and Conventional Scalpel Technique in Minor Oral Surgical Procedures**

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**Abstract**

Comparison was done between diode laser and conventional scalpel technique for minor surgical procedures to rule out that which treatment modality was well suited with least side effect and complications. In our present study, we choose 40 cases presenting to department of OMFS in MGDCH who were requiring minor oral surgical procedure like impaction, alveoloplasty, fibrotomy, mucocele, vestibuloplasty. The entire sample was divided into 2 groups (20 patients in each group), group A-Scalpel & group B-Laser, irrespective of age, sex, caste and socio-economic status. Statistically significant results were obtained. On the basis of the clinical findings, the diode laser technique was found to have an edge over the conventional scalpel technique, but superiority of one technique over another cannot be assessed only by these findings as they have their own advantages and the disadvantages.

**Keywords:** Diode Laser, Scalpel, Vestibuloplasty.

**Introduction**

For incising the oral soft tissue different methods are used clinically such as blade, laser and electro-surgery, working of each method being different on tissue, with each device having its own advantage and disadvantage. They differ in terms of their time of healing, hemostasis, cutting width, instruments costing, requirement of anesthesia and characteristics that are disagreeable like production of smoke, burning flesh odor and unpleasant taste. Scalpel is commonly employed because of its ease of use, accuracy, and minimal damage to tissues. Scalpels do not provide good hemostasis, which is important in highly perfused tissues such as in the oral cavity<sup>1</sup>. Numerous advanced technologies were developed to provide good hemostasis, comfort to the patient's ease of use and increase visibility. Clinical use of instrument such as laser and electrocautery unit that coagulate vessels during incision has increased in both medicine and dentistry.

Laser light are monochromatic having specific wave length, is well organized and coherent, strong, concentrated and directional. It releases light in many directions unlike other typical lights. Different laser types used are e.g: CO<sub>2</sub>, Nd:YAG, Er:YAG and diode laser. Transmission of light could be through gas, solid or liquid or semiconductor like diode laser. Diode laser was introduced by HARRIS & PICK in mid 90's (1995)<sup>1</sup>. Recent studies have mentioned that a continuous or pulse mode diode laser with wavelength ranging from 810 to 980 nm is a possible instrument to be used for soft tissue surgery in the oral cavity<sup>2,3,4</sup>

### Aim & Objectives

**Aim:** The aim of this study is to compare the efficacy of diode laser and conventional scalpel technique in minor oral surgical procedures.

**Objectives:** The objective of this study is to compare and evaluate the following parameters clinically either intra or post-operatively, being performed by using diode laser and conventional scalpel technique:-

Duration of incision

Bleeding intra-operatively

Pain – both intra-operatively and post-operatively

Healing of the surgical site post-operatively

### Materials and Methods

Study includes 40 cases presenting to department of OMFS in MGDCH with patients requiring minor oral surgical procedure (impaction, alveoloplasty, fibrotomy, mucocele, vestibuloplasty). The entire sample was divided into 2 groups (20 patients in each group), group A-Scalpel & group B-Laser, irrespective of age, sex, caste and socio-economic status.

**Materials Used:** [fig 1,2,3,4]

For group A - conventional no. 15 blade on a bard parker scalpel handle no. 3 for incision

For group B - diode laser zolas & technology, a portable unit with integrated wavelength of 810nm 3w in a continuous mode incision

### Inclusion Criteria

Patients with ASA I and ASA II

Age group 15-65 years

Patients willing to participate and consenting to the study protocol

Patient who require minor oral surgical procedure for the correction of their disease

### Exclusion Criteria

Subject having cardiac pacemaker.

Patients with hematological parameters not within normal limits

Subject with concomitant cardiac or neurological disease or hypertension or relevant systemic disease

Subject on immunosuppressive drugs

Patient with ASA III, ASA IV and ASA V

### Parameters

Evaluation of the procedure

All the cases were evaluated for duration and bleeding till the elevation of the flap.

Pain post operatively (2<sup>nd</sup> and 7<sup>th</sup> post-operative day)

Healing of the surgical site post-operatively (1<sup>st</sup> and 4<sup>th</sup> post operative week) were recorded.

Bleeding was evaluated intra-operatively by the WHO Bleeding scale.

The data was collected and arranged in tabulated form for mean changes and statistical analysis has done.



Figure 1: diode laser zolas technology; a portable unit.

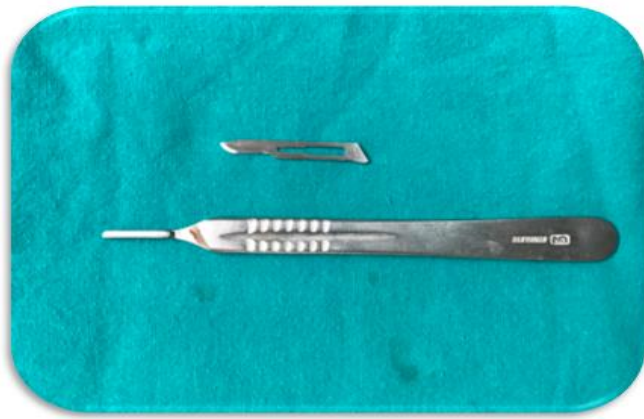


Figure 2: 15 no. blade with BP handle 3 no.

**Duration of Incision**

The table shows distribution of the time duration of incision in Group-A and Group-B subjects. The table reveals that out of 20, maximum i.e. 17 (85.00%) patients were lying in the category of 5-7 minutes duration in Group A whereas in Group B it was found to be in 8 (40.00%) patients. In the category of 3-5 min duration in Group B maximum that is 12 (60.00%) patients were present whereas only 3 (15.00%) patients were observed of Group A in the same category. This showed that the time duration of incision was less in Group B patient as compared to Group A.

Group-A & Group-B subjects

Time duration (in min)	Scalpel		Laser	
	No.	%	No.	%
3-5	3	15.00	12	60.00
6-8	17	85.00	8	40.00
Total	20	100.00	20	100.00

Mean duration (Scalpel) = 5.70 + 2.57 Mean duration (Laser) = 4.80 + 1.81

Table 1: showing time duration of incision between groups.

**Bleeding**

The above tables shows the bleeding conditions distribution among Group A and Group B, in Group A none of the patients shows grade 0 bleeding and all 20 (100.00%) patients shows grade 1/2 bleeding. In Group B grade 0 bleeding was observed in 9 (45.00%) patients

and 11(55.00%) patients showed grade 1/2 bleeding. This difference shows that bleeding was significantly less in Group B (Laser) then Group A (Scalpel).

Group-A & Group-B subjects

Bleeding	Scalpel		Laser	
	No.	%	No.	%
Grade 0	0	0.00	9	45.00
Grade 1/2/3	20	100.00	11	55.00
Total	20	100.00	20	100.00

Table 2: showing amount of bleeding present between both the groups.

**Pain**

Group-A & Group-B subjects

Pain	Scalpel		Laser	
	No.	%	No.	%
None	2	10.00	1	5.00
Mild	4	20.00	15	75.00
Moderate	12	60.00	4	20.00
Severe	2	10.00	0	0.00
Total	20	100.00	20	100.00

Table 3: shows distribution of pain reported on 2<sup>nd</sup> day by both groups.

➤ The above table shows the distribution of pain reported on the second day by Group A and Group B. No pain was observed in 2 (10.00%) patients and 1(5.00%) patient in Group A and B respectively. Pain was mild in 4 (20.00%) and 15(75.00%); moderate in 12(60.00%) and 4(20.00%) ; severe in 2(10.00%) and 0(0.00%) patients in Group A and Group B respectively. It was observed that in Group A 14 patients were reported with more pain which as compared to Group B which was reported only by 4 patients therefore there is significant association found in pain between the two group on 2<sup>nd</sup> day.

Group-A & Group-B subjects

Pain	Scalpel		Laser	
	No.	%	No.	%
Absent	13	65.00	14	70.00
Present	7	35.00	6	30.00
Total	20	100.00	20	100.00

$\chi^2 = 0.056, d.f. = 1, P > .05, NS$

Table 4: shows distribution of pain reported on 7<sup>th</sup> day by Group-A and Group-B of subjects. In group scalpel out of 20 pts, 13 (65.5%) reported no pain and only 7

(35%) reported pain. Similarly in laser group out of 20 pts, 14 (70.00%) reported no pain whereas only 6 (30.00%) reported pain. It was observed that in laser group only 30% patients reported the pain which is slightly less as compared to the patients reported the pain in scalpel group. There is no significant association found in the pain between the two group patients i.e.  $p > 0.05$ .

**Healing**

Group-A & Group-B subjects

Healing	Scalpel		Laser	
	No.	%	No.	%
Not satisfactory	2	10.00	5	25.00
Satisfactory	8	40.00	13	65.00
Good	10	50.00	2	10.00
Total	20	100.00	20	100.00

Table 5: shows distribution of healing pattern on 1<sup>st</sup> week post operatively between Group A and Group B

The above tables shows the distribution of healing pattern on 1<sup>st</sup> week post operatively between Group A and Group B. Healing was observed non satisfactory in 2 (10.00%) and 5(25.00%) out of the 20 patients in Group A and Group B respectively. Satisfactory results were observed in 8 (40.00%) and 13(65.00%) and good healing was observed in 10(50.00%) and 2(10.00%) patients in Group A and Group B respectively. It was observed that in laser group 75.00% patients reported with good or satisfactory healing which is less as compared to those who reported in scalpel group which was 90.00%. There was significant difference found in healing on the 1<sup>st</sup> week between the two group patients.

Group-A & Group-B subjects

Healing	Scalpel		Laser	
	No.	%	No.	%
Satisfactory	3	15.00	8	40.00
Good	17	85.00	12	60.00
Total	20	100.00	20	100.00

$\chi^2 = 2.006, d.f. = 1, P > .05, NS$

Table 6: shows distribution of healing pattern on 4<sup>th</sup> week of Group-A and Group-B patients

The above table shows distribution of healing pattern on 4<sup>th</sup> week of Group-A and Group-B patients. In

Group A (scalpel) out of 20 patients only 3 (15.00%) reported satisfactory healing whereas 8 (40.00%) out of the 20 patients in Group B reported satisfactory healing. Similarly good healing was observed in remaining 17(85.00%) of the patients in Group A and 12(60.00%) patients in Group B. The statistical analysis showed no significant difference in the healing pattern on 4<sup>th</sup> week between the two group patients with  $p > 0.05$ .

**Discussion**

Diode laser is a solid state semiconductor laser, associated with aluminium, gallium and arsenic. High absorption of this type of laser in tissues pigmented with hemoglobin, melanin and collagen chromophores is seen and low absorption in dental hard tissues resulting in its use for surgery of oral soft tissue lesions in close proximity to dental structures which do not involve disproportionate bleeding<sup>5,6</sup>. Heat generated by diode laser cutting reduces or eliminates bleeding or oedema by sealing the blood and the lymphatic vessels. ‘Coagulum or Char’ that preserve the surgical wound from any bacterial or frictional action is formed within tissue and plasma by denatured proteins. Scalpel wound allows lymph and blood extravasations, thus not producing any thermal damage, further leading to a more marked inflammation and swelling along with scab formation. Parameters of laser affect the healing mechanism following a laser surgery<sup>7,8</sup>. Efficacy of laser is dependent on other things like the wavelength of laser being used. Laser with shorter wavelengths (diode- 810 nm, 980 nm) transverses epithelium and penetrate to a depth of about 2-6 mm into the tissue.

Depending on the wavelength of the laser device, the following tissue interaction can be seen in varying degrees<sup>9</sup>.

Reflection – no interaction occurs as the beam reflects off the surface

Transmission - no interaction occurs as the beam passes directly through the tissue

Scattering – an interaction as the beam disperses in a non-uniform manner throughout the tissue

Absorption – light radiation is absorbed by specific tissue elements. The predominant laser interactions within oral soft tissue are absorption and scattering.

In our study parameter assessed for both the incisional technique included, time duration from incision till the elevation of mucoperiosteal flap. Time depends on various factors including amount of anesthesia given, surgeons expertise, accessibility, patient cooperation, assistance etc.

In this study, time duration (from incision till mucoperiosteal flap elevation) was less with laser when compared with scalpel because of the various factors like amount of bleeding, patient cooperation, the operative field was clear since the bleeding was minimum with laser.

Requirement of giving local anesthesia was more in scalpel group than the laser group to reduce the amount of bleeding and get a clear operative field. Statistically significant difference was measured between the two groups in amount of bleeding present. Bleeding was clinically assessed according to WHO bleeding index. The pain level statistically no significant difference was seen in the second post operative day between the two groups but statistically significant difference was seen on 7<sup>th</sup> post operative day in which laser prove to be better in the degree of pain than the scalpel technique. Pain was measured on VAS scale. The patient were asked to rate the degree of pain on the scale themselves<sup>10,11</sup>. Clinically healing of the post-op wound was assessed at the weekly follow up that is at the end of 1<sup>st</sup> & 4<sup>th</sup> week. Statistically significant difference was seen in healing at the 1<sup>st</sup> post operative week and the scalpel technique was proven to be the better than the Laser group, while statistically no

significant difference in healing was seen between the 2 groups on the 4<sup>th</sup> post operative week.

Similar to our study, a study conducted by Romanos et al in 1999 on the effect of diode laser in wound healing in oral surgical procedure on a sample size of 22 patients concluded that application of diode laser is beneficial in daily practice and has advantage of lack of swelling, minimal bleeding, pain, scar formation & good wound healing which correlates with our study.

Shalawe WS et al in 2012 compared diode laser with conventional bade incision wound after oral soft tissue biopsy in terms of hemostasis, local anesthetic required, duration of incision, and post operative pain on 30 patients, 15 patients in each group hemostatsis and amount of local anesthesia required is less in laser group than the scalpel group which is similar to our study duration of incision was statically not significant then scalpel mean of pain score was statically significant in this study in laser group contradictory to our study in which on 2<sup>nd</sup> post operative day there was no significant difference in mean score in between two groups<sup>12,13</sup>.

Alketa & Afmolla et al in 2014 studied to compare the treatment of mucocele with cold scalpel versus diode laser on 10 cases and concluded that laser was rapid and bloodless and good modality of treatment which coincides with our study<sup>14</sup>. Pradeep koppolu et al in 2014 compared the excision of lesion with diode laser and scalpel in terms of hemostasis, LA required, duration of incision and post operative pain and concluded that in all parameter lasers was feasible substitute to the scalpel which is similar to our study results<sup>15</sup>.

M Gokul Chandra Reddy et al in 2015 compared the post operative pain, swelling, bleeding, and healing following intraoral surgical procedure with scalpel and laser technique on 190 patients and concluded that laser is beneficial compared to scalpel which were similar to our



study results, except from the parameter of healing in which scalpel proved to be best<sup>16</sup>.

Bhatsange A et al in 2016 conducted a study to clinically and histopathologically compare the mucosal incision of oral tissue after surgical procedure with scalpel, electrocautery and diode laser on total of 9 incision, 3 for each group in terms of duration of surgery, bleeding, post operative pain and healing<sup>17</sup>. They concluded that in the 1<sup>st</sup> three parameter respectively laser and electrocautery provide to be the better then scalpel but have delayed wound healing and costing similar to our results.

### Limitation

Our study sample size was limited to 40 patients in single center. The study was not confined to single procedure

### Conclusion

The conclusion thus derived is “on the basis of the clinical findings, the diode laser technique was found to have an edge over the conventional scalpel technique, but superiority of one technique over another cannot be assessed only by these findings as they have their own advantages and the disadvantages.” Further studies with larger study sample size is needed

### Reference

1. Ehsan Azma, Nassimeh Safavi. Diode Laser Application in Soft Tissue Oral Surgery. J Lasers Med Sci 2013; 4(4):206-11
2. Romanos GE, Henze M, Banihashemi S, Parsanejad HR, Winckler J, Nentwig G-H. Removal of epithelium in periodontal pockets following diode (980 nm) laser application in the animal model: An *in vitro* study. Photomed Laser Surg 2004;22:177-183.
3. Ramirez A. M., Silvestre F. J., Simo J. M. Oral biopsy in dental practice. Med Oral Patol Oral Cir Bucal. 2007; 12(7):504-10.
4. Christensen G. J. Soft-tissue cutting with laser versus electrosurgery. J Am Dent Assoc. 2008;139: 981-982.

5. Sharma, N. et al. A Comparative study of electrosurgery and scalpel surgery. Health Talk, (2012). 5(1), 36-38.
6. D Arsengilio, G. et al. A preliminary study of healing of diode laser versus scalpel incisions in rat oral tissue: A comparison of clinical, histological, and immunohistochemical results. Oral Surg Oral Med Oral Pathol Oral RadiolEndod. (2007). 103(6), 764-773.
7. Coluzzi DJ. Lasers and soft tissue curettage: an update. Compend Contin Educ Dent, 2002; 23(11A):1104-1111.
8. Suter VG, Altermatt HJ, Sendi P, Mettraux G, Bornstein MM. CO2 and diode laser for excisional biopsies of oral mucosal lesions. A pilot study evaluating clinical and histopathological parameters. Schweiz Monatsschr Zahnmed 2010;120:664-71
9. Funde S, Dixit MB, Pimpale SK. Comparison between laser, electrocautery and scalpel in the treatment of drug-induced gingival overgrowth: A case report. IJSS Case Rep Rev 2015;1:27-30.
10. Vasconcelos BC, Freitas LH, Santos LK, Pereira JR, Frota R, Porto GG. Comparison between electrosurgery and cold blade in tongues of rats: A preliminary experimental study. Acta Cir Bras 2009;24:362-6.
11. Shalawe WS, Ibrahim ZA, Sulaiman AD. Clinical Comparison between Diode Laser and Scalpel Incisions in Oral Soft Tissue Biopsy. Al-Rafidain Dent J. 2012; 12(2): 337-343.
12. Bhatsange A, Meshram EP, Waghmare A, Shiggaon L, Mehetre V, Shende A. A clinical and histological comparison of mucosal incisions produced by scalpel, electrocautery, and diode laser: A pilot study. J Dent Lasers 2016;10:37-42.

13. Parker S. Efficacy of diode laser on oral soft tissue. Dent J 2007; 202:185-91.
14. Pedron IG, Galletta VC, Azevedo LH, Correa L. Treatment of mucocele of the lower lip with diode laser in pediatric patients: Presentation of 2 clinical cases. Pediatr Dent 2010;32:539-41..
15. Pradeep Koppolu, Ashank Mishra. Fibroepithelial polyp excision with laser and scalpel: A comparative evaluation, Int.J.Curr.Microbiol.App.Sci (2014) 3(8) 1057-1062.
16. Konuru S, Asimuddin S, Reddy V, et al. A study of immediate implant placement in fresh extraction socket. J. Evolution Med. Dent. Sci. 2019;8(08):489-493.
17. Bhatsange A, Meshram EP, Waghmare A, Shiggaon L, Mehetre V, Shende A. A clinical and histological comparison of mucosal incisions produced by scalpel, electrocautery, and diode laser: A pilot study. J Dent Lasers 2016;10:37-42.

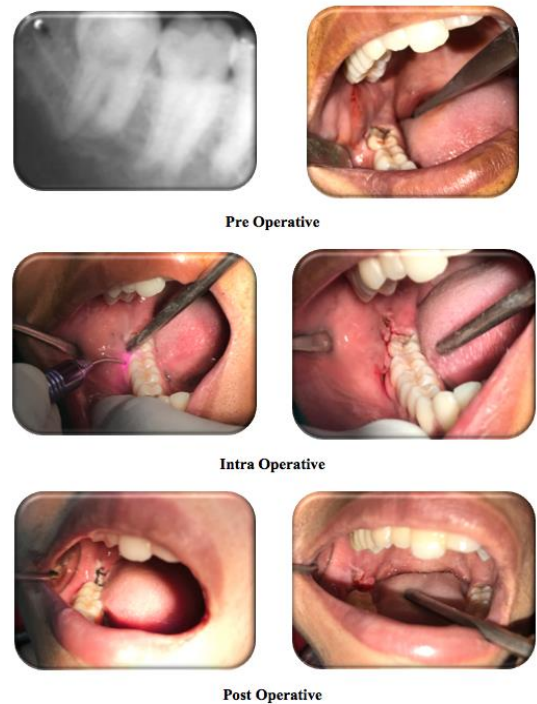


Figure 4: case 2 shows treatment of impaction by laser.

**Legends Figures:**

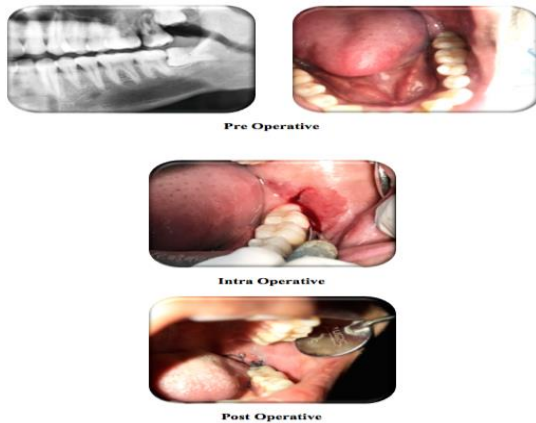


Figure 3: case 1 shows impaction preoperative and postoperative by incision.