



## **Comparative Study of Diode Laser versus Diathermy in Soft Tissue Surgical Procedures of Oral Cavity**

**Chaitra Patil<sup>1\*</sup>, Narasimhamurthy Srinath<sup>1</sup>, Umashankar DN<sup>1</sup>  
and Mahesh Kumar<sup>1</sup>**

<sup>1</sup>*Department of Maxillofacial Surgery, Krishnadevaraya College of Dental Sciences and Hospital,  
Bangalore, India.*

### **Authors' contributions**

*This work was carried out in collaboration among all authors. Author CP designed the study, performed the statistical analysis, wrote the protocol and wrote the first draft of the manuscript. Authors NS and UDN managed the analyses of the study. Author MK managed the literature searches. All authors read and approved the final manuscript.*

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### **ABSTRACT**

**Aims and Objectives:** To evaluate wound healing and patient's comfort after oral soft tissue surgical procedures performed by diode laser in comparison with diathermy

**Methods:** This study includes 20 patients requiring oral soft tissue surgical procedures are randomly categorized into group A and group B of 10 patients each. Group A patients will undergo diathermy and group B patients will undergo laser therapy. Clinical assessment and photographs of patients will be done preoperatively and postoperatively on 1st day, 3rd day, 7th day, 2nd week and 4th week. Evaluation of postoperative bleeding, pain, infection and healing will be carried out.

**Results:** At the end of the study the assessment of parameters such as bleeding, swelling, wound healing, presence of infection were approximately similar in both the treatment methods to be insignificant, 70% of the patients included in this study under the laser group were very satisfied with the procedure & the pain experience by the patients in the same group was comparatively less, when compared to the diathermy group.

\*Corresponding author: E-mail: [Chaitra.appasaheb@gmail.com](mailto:Chaitra.appasaheb@gmail.com);

**Conclusion:** The observations suggest that both the treatment options were effective although laser proves better in terms of minimal bleeding, pain, reduced swelling, faster healing and patient's comfort. Further research and a longer follow up period is desirable for a definitive conclusion.

*Keywords: Bleeding; diathermy; diode laser; healing; infection; swelling.*

## 1. INTRODUCTION

The commonly used surgical methods of treating oral soft tissues lesions and oral soft tissue defects are scalpel, diathermy and laser. Each of the above mentioned methods are different from the stand points of homeostasis, healing time, cost of instrument, width of cut, anesthetic required and disagreeable characteristic such as smoke production, odor of burning flesh.

Scalpel dissection is the most commonly established method of treating oral soft lesions and oral soft tissue defects. However this instrument produces excessive bleeding during the procedure and obscures the surgical field, making accurate dissection difficult. Considerable pain and swelling after the surgery are other issues faced. To overcome these complications new technological devices like diathermy and lasers have been introduced.

Cuse in 1847 attempted to destroy a neoplasm with electric current. In 1925 the concept of electrothermy was introduced into American literature, when Ward reported the destruction of malignancies with electrothermy [1].

The surgical application of electricity is based on the principle that when one electrode is large (dispersive electrode) and other is small (active electrode), current is no longer evenly dispersed and results in concentration of current at smaller electrode causing dehydration, warming of the area, coagulation, or tissue destruction by heat depending on the type, size and frequency of the current, size of the electrode and duration of application. The techniques include electro-dessication, electrocoagulation, electrocautery and electrosurgery [1].

Electrosurgery is used most commonly in maxillofacial surgery by use of monopolar electrodes for surgical incision/excision of soft tissues with advantages like ability to coagulate and provide easy control of haemorrhage [2].

Laser is an acronym for Light Amplification by Stimulated Emission of Radiation. Maiman

coined the term LASER. Laser is a special light source because in general it has higher power and a better beam quality and coherency in comparison with the other light sources.

Many lasers with different wavelengths have been used in oral and maxillofacial surgery. Diode laser is most commonly used because of its portability, compactness & reduced cost factor when compared to other lasers. Diode is a solid active medium laser with wavelength ranging from 800 nm to 980nm manufactured from semiconductor crystals like aluminium, indium, gallium & arsenic. It delivers laser energy fiberoptically in continuous wave and gated pulsed modes for incision, excision, ablation and coagulation. They can be used in the continuous as well as pulsed mode and according to the clinical indication with a contact or non – contact mode.

This study aimed at evaluating wound healing and patient's comfort after oral soft tissue surgical procedures performed by diode laser in comparison with diathermy.

## 2. MATERIALS AND METHODS

The study was done in the Department of Oral & Maxillofacial Surgery, Krishnadevaraya College of Dental Sciences & Hospital, Bangalore. 20 patients requiring oral soft tissue surgical procedures were randomly categorized into group A and group B of 10 patients each. Group A patients were undergone laser therapy and group B patients were undergone diathermy. All patients were informed about the study and consent was taken for the same. Clinical assessment and photographs of patients were done preoperatively.

### 2.1 Inclusion Criteria

Patients with oral premalignant lesions/ conditions, benign oral soft tissue tumors and patients requiring soft tissue surgical procedure.

### 2.2 Exclusion Criteria

Pregnancy and medically compromised patients.

## 2.3 Surgical Procedure

Detailed case history, clinical examination and necessary investigations were performed in standard manner. The surgical site was prepared and draped following standard aseptic technique. The operative site was infiltrated with 2% lignocaine with 1:200000 adrenalin. The area to be treated was marked.

The Surgical procedure was done by using diode laser (970 nm±15 nm) in group A with optical fiber thickness of 200,320 and 400 mm. The power output was kept in the standard range of 1-7 watt on continuous mode and diathermy in group B with Power supply- 50-60 hertz, Outflow power -70 watts, Frequency-2 MHz. Analgesics and antibiotics were prescribed. Patients were checked for bleeding, pain, presence of infection, granulation tissue formation and epithelisation on the subsequent follow-up.

### 2.3.1 Bleeding

It was assessed intra-operatively and post operatively on 1<sup>st</sup> and 2<sup>nd</sup> day.

- Good (2): No bleeding.
- Fair (1): Slight bleeding; requiring no hemostatic agent.
- Poor (0): Bleeding requiring hemostatic agent.

### 2.3.2 Pain

- Pain is recorded every four hourly for first 24 hours and every 8 hourly for next 24 hours by VISUAL ANALOG SCALE. It consists of 10 cm line with "no pain" at one end and "worst pain" at the other end.



Pre Operative

### 2.3.3 Swelling

It was noted on 1<sup>st</sup>, 3<sup>rd</sup> and 7<sup>th</sup> post operative day.

- 0: no swelling
- 1: mild swelling
- 2: moderate swelling
- 3: severe swelling

### 2.3.4 Granulation tissue

It was noted at the end of 2<sup>nd</sup> week

- Good (2): Entire wound
- Fair (1): Nearly entire wound
- Poor (0): Inadequate.

### 2.3.5 Epithelisation

It was noted at the end of 4<sup>th</sup> week

- Good (2): Entire wound
- Fair (1): Nearly entire wound
- Poor (0): Inadequate

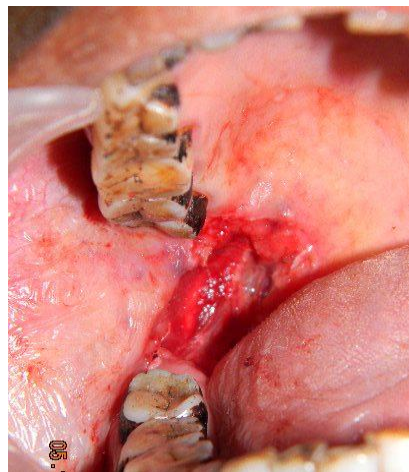
### 2.3.6 Presence of infection

Presence or absence of infection was noted on 1<sup>st</sup> day, 2<sup>nd</sup> day, 7<sup>th</sup> day of surgery.

### 2.3.7 Patients comfort

**Table 1. It was assessed by questionnaires with scores given to the patient**

Grade	Patients satisfaction
1	Very satisfied
2	Fairly satisfied
3	Fairly unsatisfied
4	Very unsatisfied



Intra Operative



**2<sup>ND</sup> Week Post Operative  
(Granulation Tissue)**

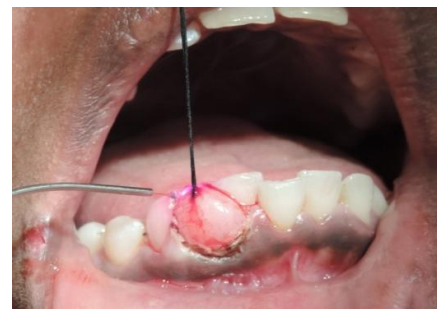


**4<sup>TH</sup> Week Post Operative  
(Epithelisation)**

**Fig. 1. Cases treated using diathermy**



**Pre Operative**



**Intra Operative**



**2<sup>ND</sup> Week Post Operative  
(Granulation Tissue)**



**4<sup>TH</sup> Week Post Operative  
(Epithelization)**

**Fig. 2. Case treated using diode laser**

### **3. RESULTS AND OBSERVATIONS**

Bleeding in laser group was comparatively less than diathermy but it was statistically non significant (Table 2).

Pain was less in laser group when compared to diathermy group on 1<sup>st</sup> day (every 4 hourly) and 2<sup>nd</sup> day (every 8 hourly) (Table 3).

Swelling was less in laser group when compared to diathermy group. The statistical values were 4.13 on 1<sup>st</sup> day, 3.94 on 3<sup>rd</sup> day and 1.05 on 7<sup>th</sup> day which was less than the significant value of about 5.991. Hence it was statistically non significant (Table 4).

Signs of healing were noticed much earlier in laser group when compared to diathermy

group. Granulation tissue formation and epithelisation was comparatively faster in laser group at the end of the 2<sup>nd</sup> and 4<sup>th</sup> week. The statistical value for granulation tissue formation and epithelisation were 1.25 and 0.27 respectively which was less than the significant

value of about 3.841. Hence healing was non significant (Figs. 3 & 4).

No infection was present in any of the patient in either group except in 1 patient in diathermy group (Fig. 5).

**Table 2. Distribution of bleeding between treatments (N=20)**

Bleeding	Laser therapy (n=10)		Diathermy (n=10)		X <sup>2</sup> value
	N	%	N	%	
Good	7	70.0	8	80.0	0.27 <sup>NS</sup>
Fair	3	30.0	2	20.0	
Poor	0	0.0	0	0.0	
Total	10	100.0	10	100.0	

NS: Non-Significant, X<sup>2</sup> (0.05,1df) = 3.841

**Table 3. Distribution of pain between treatments (N=20)**

No.	Components	Score range	Mean Response (%)						't' test
			Laser therapy (n=10)			Diathermy (n=10)			
			Mean	SD	Mean (%)	Mean	SD	Mean (%)	
<b>1st Day</b>									
1	4th hr	0-10	4.00	1.9	40.0	5.40	1.6	54.0	1.77 <sup>NS</sup>
2	8th hr	0-10	4.00	1.9	40.0	5.40	1.6	54.0	1.77 <sup>NS</sup>
3	12th hr	0-10	3.60	1.8	36.0	5.80	1.8	58.0	2.74*
4	16th hr	0-10	3.40	1.3	34.0	5.20	1.9	52.0	2.41*
5	20th hr	0-10	2.80	1.4	28.0	4.40	1.8	44.0	2.19*
6	24th hr	0-10	2.40	1.6	24.0	3.60	0.8	36.0	2.12*
<b>2nd Day</b>									
7	8th hr	0-10	1.60	0.8	16.0	3.40	1.0	34.0	4.44*
8	16th hr	0-10	1.00	1.1	10.0	2.40	1.3	24.0	2.69*
9	24th hr	0-10	0.40	0.8	4.0	1.80	1.1	18.0	3.13*

\*Significant at 5% level, NS: Non-significant, t (0.05, 18df) = 2.101

**Table 4. Distribution of swelling between treatments (N=10+10)**

Swelling level	Respondents (%)					
	1st day		3rd day		7th day	
	Laser therapy	Diathermy	Laser therapy	Diathermy	Laser therapy	Diathermy
No	90.0	50.0	90.0	50.0	100.0	90.0
Mild	10.0	30.0	10.0	40.0	0.0	10.0
Moderate	0.0	20.0	0.0	10.0	0.0	0.0
X <sup>2</sup> -Value	4.13 <sup>NS</sup>		3.94 <sup>NS</sup>		1.05 <sup>NS</sup>	

NS: Non-Significant, X<sup>2</sup> (0.05,2df) = 5.991

**Table 5. Distribution of patients comfort between treatments (N=20)**

Patients comfort	Laser therapy (n=10)		Diathermy (n=10)		X <sup>2</sup> value
	N	%	N	%	
Very satisfied	7	70.0	0	0.0	14.00*
Fairly satisfied	3	30.0	3	30.0	
Fairly unsatisfied	0	0.0	5	50.0	
Very unsatisfied	0	0.0	2	20.0	
Total	10	100.0	10	100.0	

\*Significant at 5% level, X<sup>2</sup> (0.05,3df) = 7.815

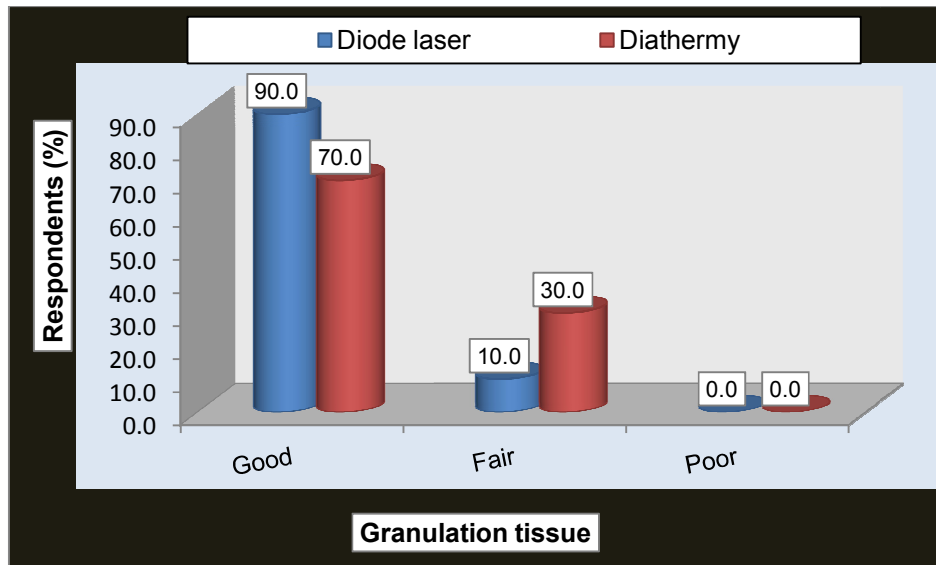


Fig. 3. Distribution of Granulation tissue formation between treatments

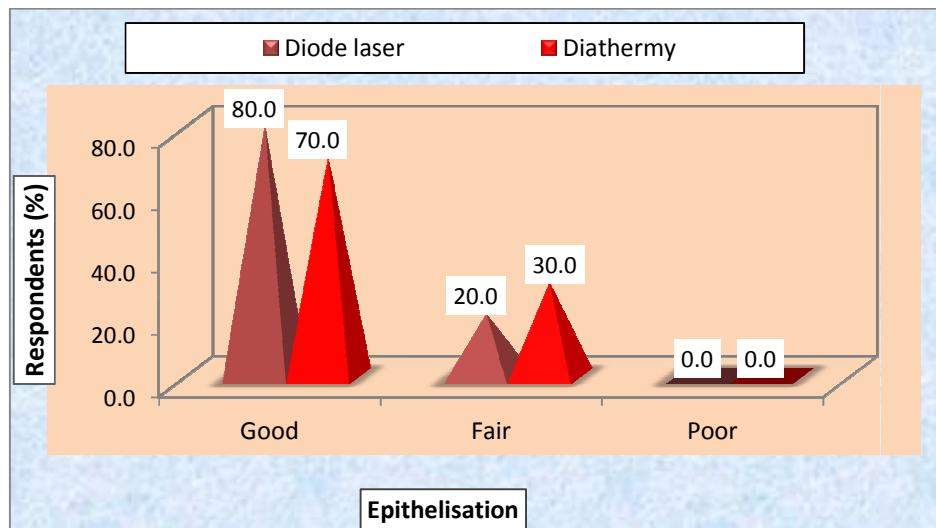


Fig. 4. Distribution of Epithelisation between treatments

In laser group 70% of the patients were very satisfied and 30% were fairly satisfied. In diathermy group 30% of the patients were fairly satisfied, 50% were fairly unsatisfied and 20% very unsatisfied. Hence patients comfort was statistically significant (Table 5).

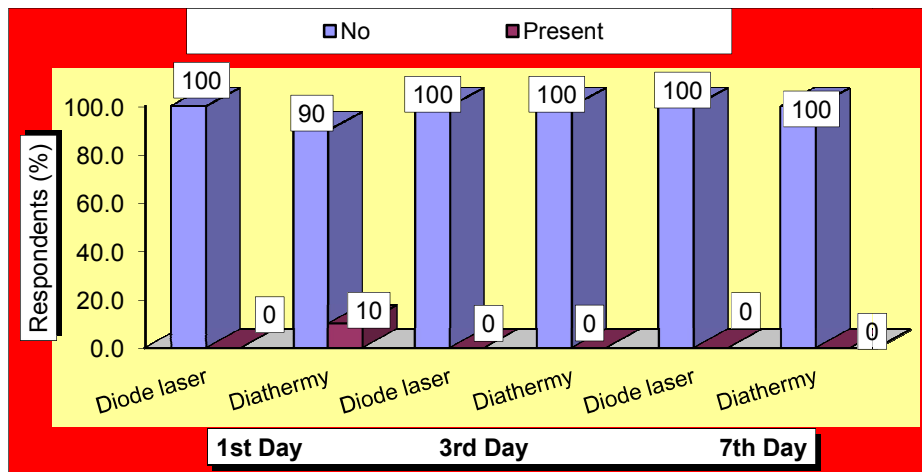
#### 4. DISCUSSION

The art of surgery demands that we evaluate the risks and benefits of each treatment modality and apply it appropriately to each patient. Scalpel dissection is the most commonly used method for, surgeries. However scalpel produces

excessive bleeding intraoperatively and obscures the surgical field, making accurate dissection difficult. Considerable pain and swelling postoperatively are other issues faced. To overcome these complications new devices like diathermy and lasers have been introduced. The present work focuses on two treatment modalities viz. diode laser and diathermy for the oral soft tissue surgical procedures.

Bleeding and swelling were comparatively higher with diathermy group. Lesser bleeding and swelling in laser group is due to sealing of the small blood vessels and lymphatic vessels as a





**Fig. 5. Distribution of presence of infection between treatments**

result of the heat generated and therefore lesser inflammatory response [3,4]. Due to good hemostasis, suturing after surgery was not necessary (economical advantage), the surgical period was extensively reduced [5]. Time required for the incision was less with diathermy than with the carbon dioxide laser or scalpel [6]. Same was found in our study.

Pain in laser group was comparatively less than diathermy group on 1<sup>st</sup> day and 2<sup>nd</sup> day. Pain gradually decreased in laser group but it was higher in diathermy group. Lesser post-operative pain in laser group was due to the formation of protein coagulum on the wound surface, thereby acting as a biological dressing leading to the sealing of the sensory nerves endings [7,8].

Wound healing process after laser application was slightly accelerated compared to diathermy application. Sloughing was observed on day 1 in laser group and day 3 in diathermy. Granulation tissue formation was seen at the end of the 2<sup>nd</sup> week in laser group but in diathermy group formation of granulation tissue was delayed comparatively. The diodes cause less lateral thermal damage, which may result in faster healing with less postoperative pain [9]. Hence wound healing was rapid in laser group. Similar findings were noted in Misir et al. study [10].

One of our case treated by diathermy reported back with infection which was relieved by antibiotics and mouth wash. None of the cases in laser group reported with infection. Due to its high temperature, laser beam results in sterile and contamination free wound. Irradiation with laser facilitates considerable bacterial elimination and this could positively influence the healing [7].

In laser group 70% of the patients were very satisfied and 30% were fairly satisfied. In diathermy group 30% of the patients were fairly satisfied, 50% were fairly unsatisfied and 20% very unsatisfied. The patient in the laser group were quite pleased with the results as there was no bleeding, sutures, swelling or any post operative discomfort. Similar observations were made by Negm Sam [11].

Based on the post operative evaluation of patients it can be said that both diode laser and diathermy are effective treatment modalities for oral soft tissue surgical procedures. Although both are effective treatment modalities laser surgery is found to be more advantageous compared to diathermy when measured in terms of parameters like pain and patients comfort.

Both these treatment modalities have their own advantages and disadvantages. This study is based entirely on clinical parameters and cannot be used to make inferences about healing at a finer level. Histological analysis is the best way to assess post operative healing.

## 5. CONCLUSION

A treatment modality is considered ideal when it has no intra-operative or post-operative complications, it should be convenient to use by the operator, provide good patient compliance and it should be cost effective. Both laser and diathermy are effective treatment options for oral soft tissue surgical procedures and can be performed with relative ease and comfort for the patient. Laser showed reduced pain and excellent patient's compliance which were statistically significant. Although bleeding,

swelling and wound healing were not statistically significant, but laser showed good results to certain extent when compared to diathermy. This study tends to favor laser surgery more than diathermy for treatment of oral soft tissues lesions and oral soft tissue defects.

Both these treatment modalities have their own advantages and disadvantages. However continued research at clinical as well as microscopic levels for proper assessment of wound healing along with a large sample size and long follow-up of patients is necessary.

### DISCLAIMER

The products used for this research are commonly and predominantly use products in our area of research and country. There is absolutely no conflict of interest between the authors and producers of the products because we do not intend to use these products as an avenue for any litigation but for the advancement of knowledge. Also, the research was not funded by the producing company rather it was funded by personal efforts of the authors.

### CONSENT

All patients were informed about the study and consent was taken for the same.

### ETHICAL APPROVAL

This study has got approval from institutional ethical committee.

### COMPETING INTERESTS

Authors have declared that no competing interests exist.

### REFERENCES

1. Laskin, Daniel M. Oral and Maxillofacial Surgery. 1980;1:283-285.
2. Poswillo DE. A comparative study of effects of electrosurgery and cryosurgery in management of Benign Oral Lesions. British Journal of Oral Surgery. 1971;1-7.
3. Principles of electrosurgery book. Successful training in gastrointestinal endoscopy; 2011.
4. Gordon J. Christensen Soft Tissue Cutting With Laser versus Electrosurgery. Journal of American Dental Association. 2008; 139:981-984.
5. Appollonia Desiate, Stefania Cantore, Domenica Tullo, Giovanni Profeta, Felico Roberto Grassi, Andrea Ballini. 980 nm diode lasers in oral surgery and facial practice: Current state of the science and art. International journal of medical sciences 2009;6(6):358-364.
6. Pearlman NW, Stiegmann GV, Vance V Norton LW Bell RC, Staerkel R, Van Way CW, Bartle EJ. A prospective study of incisional time, blood loss, pain and healing with carbon dioxide, scalpel and electrosurgery. Arch surg 1991;126:1018-1020.
7. Lagdive sushma, Doshi Yogesh, PP Marwar. Management of gingival hyperpigmentation using surgical blade and diode laser therapy: A comparative study. Journal of oral laser applications. 2009;9:41-47.
8. Simsek kaya G, Yapici Yavuz G, Sumbullu MA, Dayi E. A comparison of diode laser and Er: YAG lasers In the treatment of gingival melanin pigmentation. Oral Surg Oral Med Oral Pathol Oral Radiol 2012; 113(3):293-9.
9. Koora K, Muthu MS, Rathna P. Spontaneous closure of midlines following frenectomy. J. Indian Society of Pedodontics and Preventative Dentistry. 2007;25(1):23-26.
10. Misir AF, Demiriz L, Barut F. Laser treatment of an oral squamous papilloma in a pediatric patient: A case report. Journal of Indian Society of Pedodontics and Preventive Dentistry. 2013;31(4):279-81.
11. Negm SAM. Use of Diode Laser (980 nm/7 W) in Labial Frenectomy for a child of 11 years old. A Case Report. Sudan Journal of Medical Sciences. 2014;9:49-54.

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