Clinical Comparison between Diode Laser and Scalpel Incisions in Oral Soft Tissue Biopsy

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ABSTRACT

Aims of the study: To compare the new diode laser (1064nm) incision with conventional blade incision wounds after oral soft tissue biopsy in terms of haemostasis, local anaesthetic required, duration of incision and post operative pain. Materials and Methods: This study was conducted in the Oral and Maxillofacial Surgery Department at College of Dentistry/University of Mosul and Oral and Maxillofacial Surgery Department in Al-Salam Teaching Hospital between February 2010 and May 2010. Thirty patients were enrolled and divided into two groups, each consisted of fifteen patients. The first group included fifteen patients requiring biopsy (based on their indications for biopsy) in the oral cavity, where the incision was done using surgical blade no.15. The second one included fifteen patients who needed biopsy in the oral cavity (based on their indications for biopsy), here the incision was made by using diode laser (FOXTM, A.R.C. laser, Germany) wavelength 1064nm with output power (3.5Watt) CW in contact with the tip of bare fiber (200micron). All biopsies in the two groups were excisional and done under local anesthesia using infiltration technique.

Results: In comparison between the two groups: the amount of local anesthetic required in the second group (diode laser wound group 0.73 ml) was less than that required by the first group (blade incision wound group 1.6 ml) and showed statistically high significance at p value <0.05. The mean of the difference in the weight of the gauze before and after the operation in the second group(0.16 gm) was less than the difference in the weight of the gauze in the first group(0.96 gm) which showed statistically high significance at p value <0.05. The mean of the duration for incision was statistically not significant between the two groups and the mean of pain score at the first postoperative day was statistically significant in the second group in comparison to the first group but there was no statistical difference in the pain score level at the third postoperative day between the two groups. Conclusion: The use of Diode (1064nm) laser to perform oral biopsy has several advantages over the blade incisions wound including less amount of local anesthesia required, enhanced haemostasis (suturing after surgery was not necessary) , minimal...
postoperative pain.

**Key words:** Diode laser, Scalpel wound, Oral soft tissue biopsy.

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**INTRODUCTION**

Three methods for cutting oral soft tissues are used commonly in dentistry, namely blade, electro surgery and laser, each of these methods works. However, they are different from the standpoints of hemostasis, healing time, cost of instruments, width of the cut, anesthetic required and disagreeable characteristics, such as smoke production, the odor of burning flesh and undesirable taste. Steel scalpel and laser systems are widely utilized as effective tools in soft-tissue surgical procedure. A 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. Dentists also know that there are desirable aspects of using a scalpel for soft-tissue cutting, including ease of use, low cost and relatively fast and uneventful healing.

Laser light is monochromatic and has specific wave length. Laser light is coherent and organized, directional, strong and concentrated. It is not like a typical flashlight, which releases light in many directions. There are many different types of lasers e.g. Er:YAG, Co2, Nd:YAG and diode laser. The medium of light transmission can be solid, gas, liquid or semiconductor like diode laser. Researches and observations in previously referenced articles about laser use suggest the following soft-tissue uses for laser: gingivectomy; gingivoplasty, frenectomy, biopsy, operculectomy, leukoplakia, elimination of open pockets, reduction of maxillary tuberosity, vestibuloplasty and uncovering implants. The advantages of lasers for soft tissue cutting are their use requires minimal or no anesthetic; they do not harm dental hard tissues; their judicious use does not injure the dental pulp; because of low or no heat production, they can be used around dental implants; they are antimicrobial; they remove endotoxins from root surfaces. The disadvantages of lasers for soft-tissue cutting include: the cost of laser is significantly higher than that of conventional scalpel, because of the potential hazard of laser light, laser use requires a learning period and strict precautions, laser can cause eye damage, so protective glasses (protective eyes Google) are required during its use, there is a burning flesh odor and some techniques are time consuming.

**MATERIALS AND METHODS**

This study was conducted at the Oral and Maxillofacial Surgery Department in the College of Dentistry/ University of Mosul and Oral and Maxillofacial Surgery Department in Al-Salam Teaching Hospital between February 2010 and May 2010. Thirty patients were enrolled and divided into two groups, each consisted of fifteen patients, the first group included fifteen patients requiring excisional biopsy (based on their clinical indications for biopsy) in the oral cavity, and the incision was performed using surgical blade no.15 (Martin, Germany). The second group included fifteen patients who needed excisional biopsy in the oral cavity (based on their indications for biopsy), in this group, the incision made by using diode laser (FOXTM, A.R.C. laser, Germany) wavelength of 1064nm with output power (3.5 Watt) continuous wave in contact with the tip of bare fiber (200micron), using protective eyes glasses (supplied with the laser device, Fox Laser, A.R.C laser) for both the operators and the patients and wooden tongue spatula for tissue reflection to minimize hazardous reflection of laser radiation.

All the biopsies in the two groups were excised under local anesthesia (Lidocaine HCL 2% with 1:80,000 Epinephrine, Houns Co., ltd. Korea) using infiltration technique, a specific data form was made for each patient in the two groups and
included personal information, medical history, site and size of the lesion in (mm) by vernier gauge (Dentaurum-Germany), color and consistency of the lesion, amount of local anesthesia administered (ml), weight of the gauze in (milligram) before excision of the lesion and after excision of the lesion that had been measured using the sensitive electronic balance (Todoscan, calibration scale, China). Operation time (duration of surgery) from incision to last stitch which was measured by (CASIO illuminator count down timer, telememo 30, Japan), visual analog scale for post-operative pain, the severity of pain was assessed using scale of 0 (no pain) to 10 (unbearable pain) score recorded first and third days post operatively (16-20).

In the first group, the wound was sutured by 3/0 black silk suture (Silk Braided, Jiannan China) and the suture removed a week after the operation, while in the second group simple dressing (sterile gauze) was placed to cover the wound (Figure 1).

Figure(1) intra oral photograph show excisional biopsy for a soft tissue lesion at the hard palate by diode laser

Patients were also given appropriate instructions and recommendations regarding the postoperative recovery period. Postoperative medications were given to both groups which include a 5-day course of Amoxicillin 250mg orally three times a day, 0.2% Chlorhexidine gluconate mouthwash, Paracetamol 500mg orally three times a day. The data analyzed statistically using T test-independent sample test to compare the result of parameter changes between the 2 groups and paired sample test to study the results of parameter changes in each group separately in SPSS (statistical package for social science) V.13.0 program, Pentium 4.

**RESULTS**

The first group comprised eight females (53.3%) and seven males (46.7%) with age range between (20-55) years and mean age of (35.67) years. The second group comprised ten male patients (66.7%) and five female patients (33.3%) and age range between (7-50) years with mean age of (30.07) years.

In the first group (scalpel wound group) the mean of the lesion size that had been excised was (1.86 mm). In regard to the amount of local anesthetic that had been administered to perform the biopsy, the mean was (1.6 ml). The mean duration of surgery in this group was (8.4 minutes), the mean of the pain score at the first day postoperatively by using visual analog scale was (6.93) , while it was (2.13) for the third day. The mean of the difference in the weight of gauze before and after the operation was (0.96 gm). The four mentioned parameters in this group were illustrated in Figure (2) Table (1).
In the second group (diode laser wound group), the mean of the size of the lesion was (0.94 mm). In regard to the amount of local anesthetic that had been administered to perform the biopsy the mean was (0.73ml). The mean for duration of the surgery in this group was (6.0 minutes), the mean of the pain score at the first day was (5.20) while in the third day postoperatively was (1.33) by using visual analog scale. The mean of the difference in the weight of the gauze in this group was (0.16 gm). The mean for these parameters in this group was shown in Figure (3) Table (1).
In comparison between the two groups: the amount of local anesthetic required in the second group (diode laser wound group 0.73 ml) was less than that required by the first group (scalpel wound group 1.6 ml) and statistically highly significant difference was observed at p value < 0.05, the mean of the difference in the weight of the gauze before and after the operation in the second group (0.16 gm) was less than the difference in the weight of the gauze in the first group (0.96 gm) which was statistically highly significant at p value <0.05, the mean of the time for incision in the diode laser group was less than the mean of scalpel incision time but statistically not significant at p value <0.05), the mean of pain score at the first post operative day was statistically significant in the diode laser wound group in comparison to the scalpel wound group but there was no statistical difference in the pain score at the third postoperative day between the two groups as shown in Table (2).

Table (2): Independent Sample Test show the P value and the significant parameters changes between the two groups

<table>
<thead>
<tr>
<th>Parameter</th>
<th>p-value</th>
<th>Significance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Local anesthesia</td>
<td>0.000</td>
<td>Significant</td>
</tr>
<tr>
<td>Difference in weight of gauze</td>
<td>0.000</td>
<td>Significant</td>
</tr>
<tr>
<td>Duration of the incision</td>
<td>0.648</td>
<td>Not significant</td>
</tr>
<tr>
<td>Pain/day 1</td>
<td>0.000</td>
<td>Significant</td>
</tr>
<tr>
<td>Pain/day 3</td>
<td>0.740</td>
<td>Not significant</td>
</tr>
</tbody>
</table>

DISCUSSION

Laser 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 600C, it undergoes coagulation. This coagulation phenomena are the basis of most surgical applications of laser and as a result of photocoagulation, protein, enzymes, cytokines and other bioactive molecules are heated to temperatures over 600C, 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 photocogulation, 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. Laser damage to erythrocytes attracts a population of platelets which encourage intraluminal thrombosis,\(^{(21)}\) further decrease in the blood loss and this explains why the laser wound group had minimal blood loss in comparison to the scalpel wound group and this is especially important in our study as we used diode laser device with a wave length 1064 nm which is similar to the wave length of Nd-YAG laser devices with the advantage that the diode laser has continuous steady mode with constant energy delivered to the tissue so more control output power than pulsed mode Nd-YAG laser devices with little risk of damaging the adjacent structures (tooth structures, nerves and vessels). With the 1064 nm wave length in diode laser, deeper coagulation tracts (1.5 mm) are obtained by selective photocogulation of tissue containing so called target chromophore such as water, melanin and reduced and oxygenated hemoglobin.\(^{(21)}\) The small, portable size of diode laser unit is of beneficial effect to the general practitioner who is not able to move easily from office to office the big size laser unit like Nd-YAG laser unit. In addition, the diode laser unit is less expensive than the Nd-YAG laser device.\(^{(22)}\)

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,\(^{(23,24)}\) and this may explain the need for small amount of local anesthesia required to perform laser surgery in comparison to the scalpel incision.\(^{(25)}\) Frame and Fisher describe the pattern of cell destruction that occurs without the usual release of cytokines characteristic of acute inflammation. They also described how the thin layer of denatured collagen on the surface of the lased tissue acts as a relatively impermeable membrane or impermeable dressing immediately after lasing, thus reducing the amount of tissue irritation from physical and biochemical agents in the intraoral environment and this may explain why the lased tissue exhibit minimal postoperative pain.\(^{(26,27)}\) Basu and colleagues made several observations that contradicted the earlier observations on myofibroblasts and sealed nerve endings in the laser wound and this later finding has been used to explain the relative lack of pain after laser surgery.\(^{(28)}\) The time to perform laser incision is some-times less than the time required to perform scalpel incision but this not always true as laser may in some cases prolong the operation time rather than shorten it and the time may be affected by the skill of the operator, the equipment available and the clinical entity of the lesion.\(^{(29)}\)

**CONCLUSION**

The use of laser to perform oral biopsy has several advantages over the scalpel wound including less amount of local anesthesia required, enhanced haemostasis (suturing after surgery was not necessary which is economical advantages), minimal postoperative pain, edema with less inflammatory response.

**REFERENCES**

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