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Research Article

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A comparison between diode laser 976 nm and conventional technique in treatment of gingival fibromatosis

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Abstract

Background: Gingival fibromatosis (GF) is an expansion of the gingiva's connective tissue. Appeared during the onset of teeth eruption and postponed it. In order to remove this fibromatosis, a scalpel, electrocautery, or laser surgery is recommended.
The objective of the study: is to evaluate the efficacy of a diode laser (976 nm) and its comparative benefits in the management of gingival fibromatosis, as opposed to a scalpel.
Material and method: Forty patients who complained of functional and esthetical problems due to delayed eruption were divided into two groups, one for surgical treatment with conventional scalped and another one for surgical treatment with diode laser. Follow-up visits are scheduled on the third day of treatment, 1, 2, and 4th postoperatively. Clinical assessment is done by monitoring intra-operative bleeding, pain through the first week of treatment, functional interference, and clinical healing in follow-up visits. Overall satisfaction for patients and their parents was taken at the end of the treatment visits. The t-test and the Chi-square test were utilized as statistical methodologies for conducting data analysis.
Results: No or self-limiting bleeding in the laser group, lesser pain, and function interference in the laser compared with the conventional scalped group. Better clinical healing with the laser group through the first 2 weeks than with the scalpel group; all in each group cases achieve excellent healing at the 4th week postoperatively. All patients and their parents are very well satisfied with the outcomes.
Conclusion: Diode laser is preferable in surgical conducting of gingival fibromatosis to minimize postoperative pain and discomfort, enhance healing, and, ultimately, premium outcome.

Keywords: Delayed eruption, diode laser, gingiva, fibromatosis.

1. Introduction

Gingival fibromatosis (GF) is infrequent, benign, non-hemorrhagic fibrous growth of gingival tissue. Proliferative fibrous gingiva expansion throughout development causes cosmetic, functional, and masticatory oral cavity abnormalities and psychological pain (Ramakrishnan and Kaur, 2010). It frequently

begins around the time of permanent dental eruption and less frequently around the time of primary dentition eruption. If the expansion occurs prior to tooth eruption, thick fibrous tissue may impede or prevent tooth emergence (Dhadse et al., 2012). Typically, it aligns with the emergence of permanent incisors (Gonçalves et al., 2018). It may be broad or localized, and its intensity can vary (Gandhi et al., 2018) GF may manifest as "hereditary gingival fibromatosis (HGF)", which can manifest as a standalone entity or as part of a genetic illness or syndrome, or as "idiopathic gingival fibromatosis" (Gawron et al, 2016), Clinically, gingival tissues are often of normal hue, non-bleeding, firm, fibrotic consistency, and profuse stippling (Oubenyahya and Fiqhi, 2021).

Gingivectomy with an internal or exterior bevel incision is the recommended therapy for GF (Häkkinen and Csiszar, 2007). Selecting of surgical approach depends on the age of the patient and the stage of the eruption, external bevel excision is preferred in child patients and incomplete eruption, while the internal bevel is preferred when the eruption of teeth is complete at the optimal time of treatment variable, but the negative effect of fibromatosis on patients psychology and function suggesting to do treatment at earlier age. Radiography indicated two-thirds of the root developed, suggesting to parents that surgery may fix the issue (Almiñana-Pastor et al., 2017). Traditionally, the conventional scalpel and electrocautery have been the instruments of choice for surgical removal of gingival enlargement (Gontiya et al., 2011).

Laser surgery is novel because it allows the operator more control and provides a clean, hemostatic operating area, good cutting capacity, minimal tissue damage, minimal or no anesthesia, less oema, and less postoperative discomfort than previous methods (Beer et al., 2012). Few studies on the use of diode laser treatment have been reported in the literature. Camiloti et al. used a diode laser in the treatment of a seven-year-old girl suffering from generalized gingival fibromatosis on both arches. The patient received treatment well, reporting just minor pain throughout the first week (Camilotti et al., 2015). Aboujaoude and colleagues employed a diode laser and a scalpel to manage hereditary gingival fibromatosis in a pediatric patient aged six years. Generalized gingival fibromatosis was surgically removed from the patient's anterior area. The posterior portion employed an 810 nm diode laser. Reported that the diode laser method improves visibility, gingival contouring, and post-operative pain and discomfort. Diode lasers were expensive and time-consuming (Aboujaoude et al., 2016).

This study proceeds to compare a conventional scalpel and diode laser (976) in the treatment of gingival fibromatosis.

2. Material and method

The sample of the present study is forty patients (16 female and 24 male) ranging in age from 7 to 12 years old. They came to the pediatric departments of different specialized dental centers in different Iraqi health provinces with complaints of severe function interference. Clinical oral examinations determined gingival fibromatosis surgery for all patients. Some people undergo traditional surgery. The study involved the categorization of patients into two groups, namely Group A and Group B. Group A comprised 20 patients who underwent conventional surgical treatment using a scalpel (blade no. 15), while Group B consisted of 20 patients who received treatment using a diode laser at 976 nm (SOLASE). The research was conducted between December of 2021 and October of 2022. Patients with systemic diseases and mentally retarded patients were excluded from this study.

Complete medical and dental history, in addition to the assigned permission form, are taken from the patient's parents. Patients had pre-procedure X-rays. Chlorohexidine mouthwash was used as an intraoral antiseptic for approximately 30 seconds. Topical anesthesia was applied before injection of local anesthesia. Deep infiltration anesthesia with 1.2 mL cartilage containing (2% lidocaine and 1:80.000 of epinephrine) was given surrounding the fibromatosis. The borders of the lesion were demarcated with the diagnostic probe.

In group (A), the fibromatosis was resected completely with a scalpel, and the crowns of the involved teeth were discovered. Normal saline was utilized for irrigation at the operation site. The bleeding surgical margin was covered with gauze, and asked the patient to press until the bleeding was off. See Figure 1.

In group (B), firstly, the fiber tip was initiated to retain heat by fusing a thin layer of pigment, such as articulating paper on the end. The thermal energy will be concentrated in the thin absorbent material so there is less collateral damage, enhancing lesion excision and tissue thermal contact. To reduce beam reflections, all workers wore protective goggles, removed bright medical devices, jewelry, watches, etc., from the operation field, and controlled airborne pollution. The fibromatosis was resected in one piece by using a diode laser (976) in continuous wave mode and power 2.5W with a fiber tip perpendicular to the peripheral of the lesion until the lesion can be lifted easily from the crown of the tooth. The surgical site was left uncovered, as there was no bleeding, as illustrated in Figure 2.

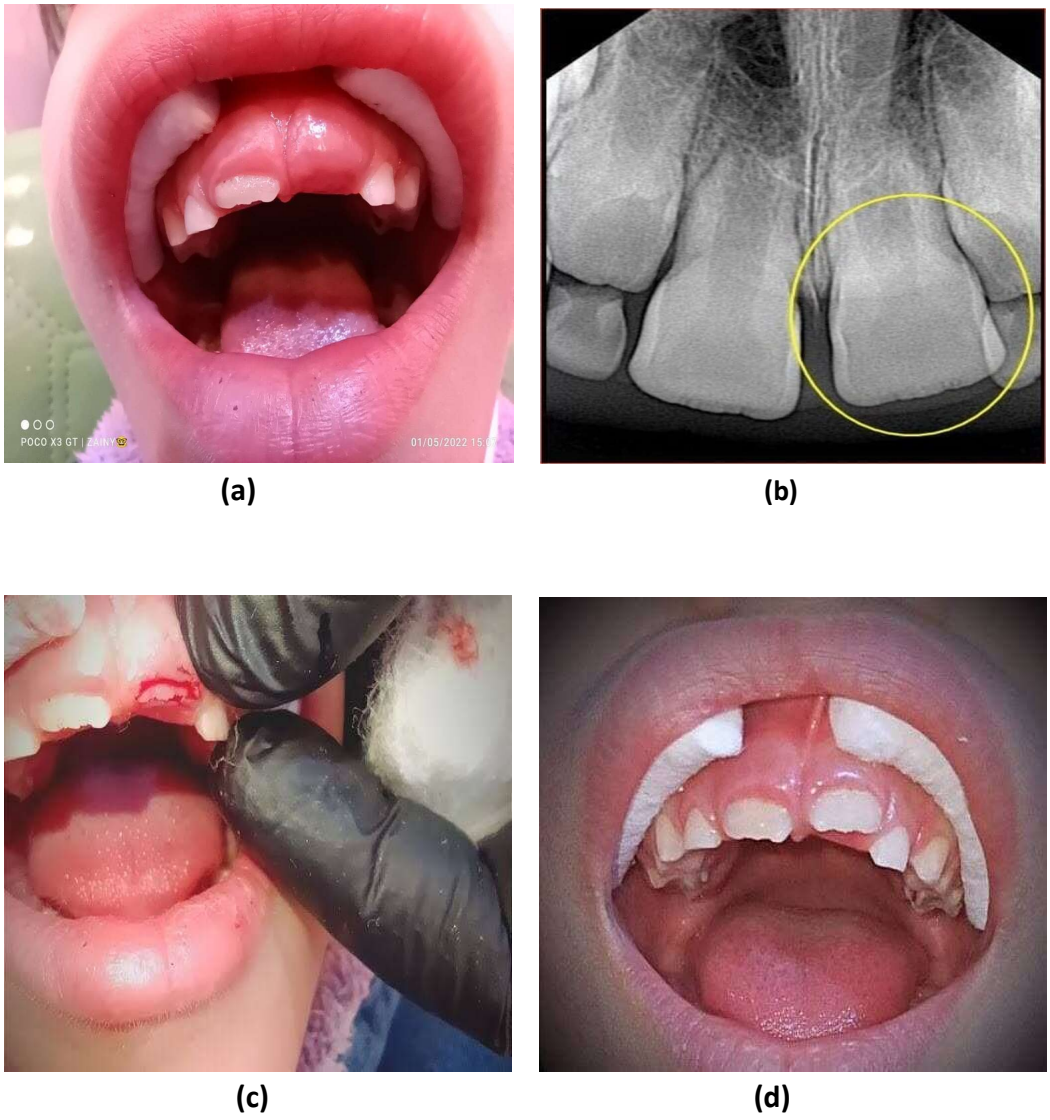

Fig.1: Surgical blade excision technique of gingival fibromatosis in left central incisor region for the 9-year-old female patient: (a) Pre-operative clinical feature, (b) Pre-operative per apical radiograph, (c) Immediately postoperative view and (d) Complete healing and eruption of the affected tooth after four weeks post-operatively.

For histological confirmation, all specimens were kept in 10% formaldehyde. To avoid subsequent infection, Patients are instructed to gargle twice a day with 0.12% chlorhexidine and given ibuprofen syrup as needed. All patients were monitored on the third day, then 1-2and4 weeks postoperatively for clinical evaluation. Clinical evaluations were done for the severity of bleeding noticed during and immediately after the procedure (1=no bleeding, 2= self-limiting, 3= required pressure, 4=required coagulation) (Musaa et al., 2017). The severity of pain by using a verbal rating scale (VRS) through the first week postoperatively (0 = no pain, 1= considerable discomfort). (2 = Moderate pain, 3= extreme pain) were written on a form for patients to fill out anytime they felt pain (Hjermstad et al., 2011). Clinical healing (healing index by Landry et al.: 1= very poor healing, 2= poor, 3= good, 4= very good, 5= excellent) & function interference (0=no interference, 1= mild interference, 2= moderate interference, 3= severe interference) evaluated in follow up visits (.Aldelaimi and Khalil, 2015). At the end of the follow-up, the overall satisfaction of patients and their parents about the outcome was evaluated (poor (%): 0–25, fair (%): 26–50, excellent (%): 51–75, excellent (%): 76–100) (.Aldelaimi and Khalil, 2015).

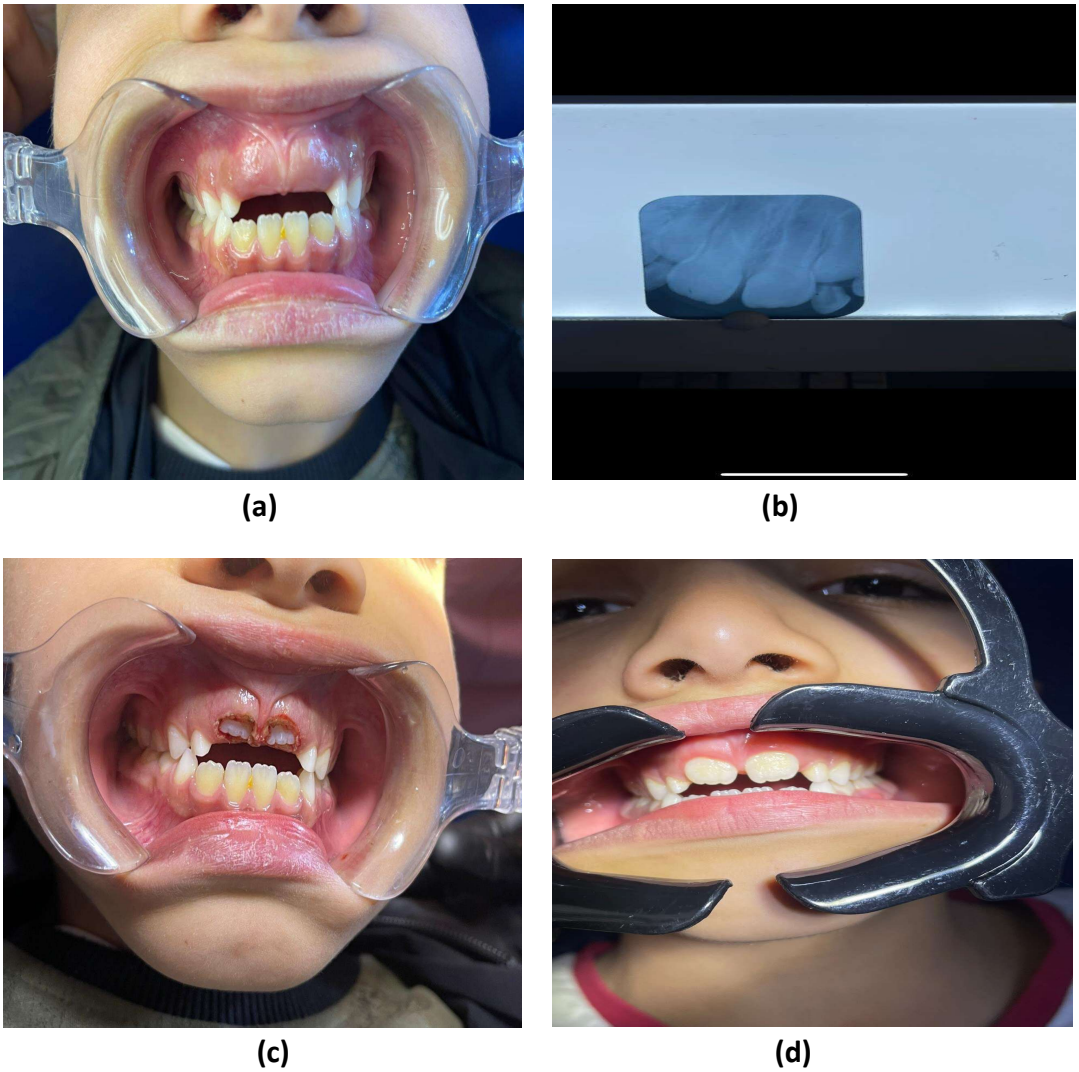

Fig. 2: Laser excision technique of gingival fibromatosis in central incisor region for 9-year-old male patient: (a) Pre-operative clinical feature, (b) Pre-operative per apical radiograph, (c) Immediately postoperative view and (d) Complete healing and eruption of affected teeth after four weeks.

3. Statistical analysis

Statistical P package for Social Sciences (SPSS) version 21 is used to interpret the data. Mean, standard deviation and ranges are provided. Frequencies and percentages show categorical data. Independent t-tests compared continuous variables. When the expected frequency was less than 5, the Fisher exact test replaced the Chi-square test to establish the link between provisional diagnosis and particular data. 0.05 Or less was significant.

4. Results

This study included 40 patients (16 female and 24 male). They ranged in age from 7 to 12 years. Table (1). They all had surgical resection of gingival fibromatosis either by a surgical blade or diode laser. They were allocated equally in two groups. In the laser group, 18 patients had no intraoperative bleeding, and only 2 patients had just self-limited bleeding, while in the surgical blade group, all 20 patients had intraoperative bleeding and required pressure. As in (Table 2). Postoperative pain scores differed significantly across approaches. The laser group had lower first-day discomfort than the surgical blade group (only 45% of patients scored mild pain in the laser group vs. 25% scored mild and 75% scored moderate in the surgical blade group).On the second day (15% mild pain in the laser group vs. 35% mild Pain in the surgical blade group). Both laser and surgical blade groups had no pain on other days. (Table 3). The clinical healing was significantly higher in the laser group compared to the surgical blade group on the third day (5% of patients scored Very poor healing in the laser group vs. 45% in surgical blade group), first week (15% of patients scored good healing vs. 0% in laser groups), in the second week (85% scored very good healing with laser vs. 15% in surgical blade group).

Table 1. Distribution of study patients by age and gender.

Demographic Data	Study groups Mean ± Sd	
	Surgical blade group	Laser Group
Age (Years)	**8.7±1.2**	**8.5±1.1**
Gender	N (%)	N (%)
Male	13(%56)	11(%55)
Female	7(%35)	9(%45)

Table 2. Percentage distribution of patients according to intraoperative bleeding score by study groups.

Study groups	Bleeding Score N (%)				
	None	Self-limiting	Required pressure	Required coagulation	Required Ligation
Laser Group Patient No.(20)	18 (90%)	2 (10%)	0(0)	0(0)	0(0)
Surgical blade group Patient No. (20)	0(0)	0(0)	20 (100%)	0(0)	0(0)

Table 3. Comparison between the study groups by means of postoperative pain score through seven days from operation time.

Study Groups	Postoperative Pain Mean ± Sd						
	1st day	2nd day	3rd	4th	5th	6th	7day
Group A	1.25±0.4	0.35±0.4	0 ± 0	0 ± 0	0 ± 0	0 ± 0	**0 ± 0**
Group B	0.45±0.5	0.15±0.3	0 ± 0	0 ± 0	0 ± 0	0 ± 0	**0 ± 0**
P value	0.001	0.05	--	--	--	--	--

There is no significant difference in the fourth week (Table 4). A statistical difference was found between the study groups in regard to postoperative function interference score. The function interference score was significantly higher in the surgical blade group as compared to the laser technique on the third day (in the laser group: 25% have no function interference, 45% and 30% moderate vs. 65% mild interference, 25% moderate and 10% severe in surgical groups), first week (in laser groups 40% scored no function interference and 60% mild function interference vs. 20% no interference, 70% mild and 10% moderate in surgical laser group). Both laser and surgical blade techniques had no function interference in the second and fourth weeks (Table 5). Regarding Patient satisfaction scores, there was no significant difference between study groups. 100% of the laser group and 95% of the surgical blade group reported excellent satisfaction. (Table 5).

Table 4. Comparison between the study groups by means of clinical healing score at three days, one week, two weeks, and four weeks.

Healing	Study groups		P value
	Group A Mean ± Sd	Group B Mean ± Sd	
3 days	1.55±0.5	1.85±0.4	0.01 SIG
1 week	2.15±0.4	2.85±0.4	0.01 SIG
2 week	3.1±0.5	3.85±0.4	0.01 SIG
4 week	5±0	5±0	NS

Table 5. Comparison of function score after three, one, two, and four weeks following surgery across study groups.

Function	Study groups		P value
	Surgical blade group Mean ± Sd	Laser Group Mean ± Sd	
3 days	1.45 ± 0.7	1.05 ± 0.8	0.03 SIG
1 week	0.9 ± 0.6	0.6 ± 0.5	0.05 SIG
2 week	0 ± 0	0 ± 0	--
4 week	0 ± 0	0 ± 0	--
P value	0.01 SIG	0.01 SIG	

Table 6. Overall satisfaction at the end of the follow-up visit.

Overall satisfaction	Study groups		P value
	Surgical blade group	Laser Group	
Poor $(0-25)\%$	0 (0)	0 (0)	---
Fair $(26-50)\%$	0 (0)	0 (0)	---
Good $(51-75)\%$	1(5)	0 (0)	Ns
Excellent $(76-100)\%$	19(95)	20(100)	Ns

5. Discussion

Laser technology and its applications in dentistry are evolving rapidly. Oral soft tissue surgery might employ diode lasers with wavelengths from 810 to 980 nm in Continuous or pulsed mode. Diode laser photothermal action removes oral mucosa lesions by excision or ablation/vaporization (Desiate et al., 2009). In photothermal, tissue absorbs radiant light and converts it to heat energy, hence altering tissue structure. When suitably administered, laser-tissue interaction may induce responses ranging from incision, vaporization, and coagulation (Kishen et al., 2007). Hemoglobin and melanin chromophores absorb the wavelengths of the diode laser more than dental hard tissue. Hence, it has selective action and can be used safely in cutting, blood coagulation, ablation, or vaporizing soft tissue near the dental structure with reduced damage and better recovery (Derikvand et al., 2016). The objective of the study is to characterize the efficiency of diode laser and assess its advantage over conventional surgical blade techniques for the treatment of gingival fibromatosis. The study depended on different clinical criteria that included intraoperative bleeding, postoperative pain and discomfort, clinical healing, function interference, and overall satisfaction. The result of this study suggests that diode laser surgery was effective in the treatment of gingival fibromatosis.

In this study, the definitive excision of fibromatosis was performed in a hemostatic field with good visibility in the laser group, whereas in the surgical blade group, visualization was hampered by bleeding, necessitating the application of pressure and dressing to the surgical site for coagulation. The temperature of soft tissue was raised by laser light. 60 C Causes coagulation. This is crucial to laser surgery. Photo-coagulation instantly denatures proteins, enzymes, and other bioactive compounds. Tissue collagen shrinks due to molecular changes. Irradiated tissue constricts against the proximal vasculature and shrinks blood vessel collagen, improving hemostasis. Laser damage to erythrocytes increased platelet aggregation and intraluminal thrombosis, reducing blood loss (Aoki et al., 2004). Laser hemostasis explains why the laser group had less blood loss. The study indicated that post-operative pain and discomfort disappeared on the third day of surgical treatment in both groups but showed significant differences in the first and second days post-operatively. These results are in line with results reported by Aboujaoude et al. (Aboujaoude et al., 2016). Thermal necrosis produced by tissue vaporization closes sensory nerve terminals and decreases their capacity to transmit stimuli, and denaturation proteins diminish discomfort in oral cavity diode laser surgery patients (Abdulhamed and Merry, 2012). Diode lasers may reduce pain by breaking down cell membrane sodium and potassium pumps, which impede impulse conduction (Chandna and Kedige, 2015). In this study, clinical healing with the laser group was less eventful, with faster recovery compared with the conventional technique on 3rd day and 1 week. At 2 weeks postoperatively, most cases healed with significant differences for faster healing in the laser group. On the last visit follow-up all patients achieved excellent healing. A diode laser application can accelerate wound healing by stimulating fibroblast proliferation, collagen synthesis, vascular proliferation, and increased epithelial cell division (Ghadimi et al., 2015). Regardless of bacterial contamination, laser tissue contact will reduce temperature and photon scatter to achieve tissue confinement at a distance from the wound. This lowers the temperature differential, stimulating tissue, energizing tissue molecules, and increasing local blood flow. A scatter gradient reduces energy to bio-modulating levels (Coluzzi and Parker, 2017). At the end of follow-up treatment, all patient and their parents were well satisfied with the outcome of both techniques, which is the ultimate goal of any

treatment. The gingival fibromatosis makes patients have aesthetic problems, severe function interference, and social well-being. Thus, they were very happy with the outcome, disregarding any treatment modality. The traditional surgical blade is still the gold standard tool because it is the most effective and cost-effective and does not necessitate as much extra skill or special precautions as a laser. In comparison to other laser types, the diode laser is a very effective alternative device in the excision of oral soft tissue when used properly with appropriate parameters. Diode lasers are very preferred by clinicians and patients due to their advantages, in spite of the special precautions and skills needed in comparison to conventional blades.

6. Conclusions

This study showed that diode laser 976nm was effective in the resection of gingival fibromatosis in continuous mode with a power of (2.5w). Better visibility during the surgery by diode laser due to the excellent hemostatic effect of the laser when compared to the traditional methodology. The use of a diode laser leads to minimal postoperative pain and discomfort with improved healing. The patients were well satisfied about the treatment of gingival fibromatosis.

Ethical consideration

The research was approved by the research ethics committee of the Institute of Laser for Postgraduate Studies, University of Baghdad. It has an ethical approval number (1385).

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مقارنة بين الدايود ليزر(976) والطريقة التقليدية لمعالجة الورم الليفي اللثوي

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الخلاصة:

الخلفية والمعلومات : الورم الليفي اللثوي حالة من تمدد اللثة تحدث خلال بزوغ الاسنان وتاخر ضهورها . كل من تقنية استخدام الشفرة الجراحية والكي الكهربائي والليزر يمكن استخدامه لاستئصال الورم الليفي اللثوي.

الهدف من الدراسة: تقدير كفائة الدايود ليزر وفوائده فوق الشفرة الجراحية لمعالجة الورم الليفيي اللثويز.

المواد والطريقة: 40 مريض يشكون من المشاكل الوظيفية والجمالية بسبب تأخر ظهور الاسنان. قسموا الى مجموعتين ، احداهما للمعالجة بتقنية الشفرة الجراحية والاخرى للمعالجة باستخدام الليزر. جدولت لهم جلسات المتابعة لتقدير النتائج . تم استخدام اختباري واختبار مربع كي لتحليل البيانات.

النتائج والاستنتاجات: لايوجد نزف او نزف متوقف تلقائيا في مجموعة الليزر، الم اقل وممارسة للوظيفة افضل في مجموعة الليزر، شفاء اسرع في مجموعة الليزر مقارنة بمجموعة الشفرة الجراحية. كل المرضى او والديهم كانوا جدا راضين عن المعالجة. طبقا للنتائج ليزرالدايود جدا كفوء في معالجة الورم الليفي اللثوي.