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RESEARCH ARTICLE

LASER IN DENTISTRY: A CASE SERIES

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ABSTRACT

Lasers were introduced into the field of dentistry as they are a precise and effective way to perform many dental procedures. Treatment with lasers provides a hope of overcoming the disadvantages of conventional dental procedure, the purpose of this article is to describe three cases illustrating the application of Diode laser on soft tissue as gingival recontouring, lingual frenectomy and disengagement of healing abutment.

Abreviations: HA: healing abutment.

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INTRODUCTION

Laser is the abbreviation of the words 'Light Amplification by Stimulated Emission of Radiation'. It has come a long way since Albert Einstein described the theory of stimulated emission in 1917 (Aoki *et al*., 2004). Laser in dentistry is considered to be a new technology which is being used in clinical dentistry to overcome some of the drawbacks posed by the conventional dental procedures. Generally, there are two main types of lasers :the first one are hard lasers, such as, Carbon dioxide (CO2), Neodymium Yttrium Aluminum Garnet (Nd: YAG), and Er:YAG, which offer both hard tissue and soft tissue applications, but have limitations (Walsh, 1994; Pick, 1995) due to high costs and a potential for thermal injury to tooth pulp, whereas, in cold or soft lasers, based on the semiconductor diode devices, which are compact, low-cost devices used predominantly for applications, are broadly termed as low-level laser therapy (LLLT) or 'biostimulation' (Parker, 2007). On account of the ease, efficiency, specificity, comfort, and cost over the conventional modalities, lasers are indicated for a wide variety (Gerald, 2004; Parker, 2007 and Sarver, 2005) of procedures in dental practice. The aim of this clinical study is to focus on the applications of diode laser operating at 810–980 nm wavelengths (Fig 1) on soft tissues

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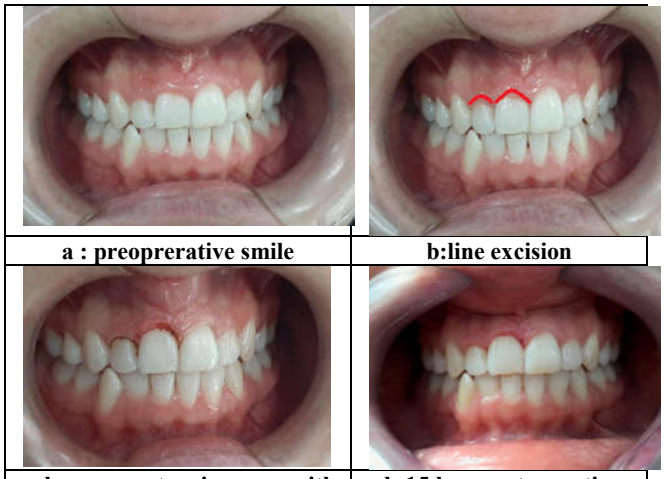
Clinical cases

Case1: A female patient aged 23 years was referred to the outpatient department of dental clinic of Monastir, Tunisia, with an esthetic chief complaint .Clinical examination of the patient revealed excessive gingiva covering the right upper incisive and the right upper lateral incisive (fig2. a) that makes the smile disharmonious. Patient's medical history was noncontributory and there were no contraindications to surgical treatment, so laser gum recountouring was advised for the anterior region. Informed consent was obtained from the patient after discussion of the procedure that will be carried out. Local anesthesia was administered. Bleeding points were marked with the help of the CP12 probe; the points were joined to prepare a line of excision (Fig 2.b). The patient was instructed to wear protective goggles before activation of laser. Gingivectomy was performed using diode laser delivered using fiber optic technology at 980 nm wavelength, a frequency of 1 Hz, and time of 0.5 ms-cw, with 300 nm fiber diameter and 3.4 W of potency. the fiber optic tip was used in contact mode to perform gingivectomy. The laser was activated and gingival tissue was removed in a sweeping stroke joining the bleeding points (Fig 2.c). A high-volume suction device was used during the procedure. The patient was recalled on day 15 for postoperative evaluation and it was found that healing was uneventful (Fig 2.d).

Figure 1. Laser diode device used



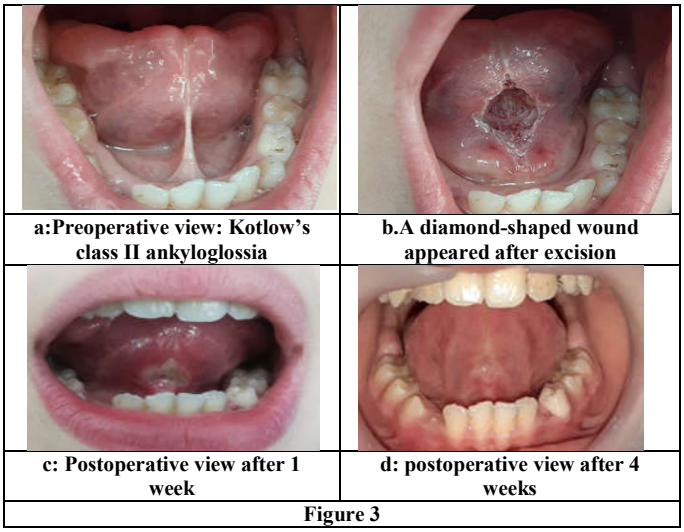
a : preoprerative smile	b:line excision
c: laser recontouring gum with diode laser	d: 15days postoperative photograph

Figure 2

Case 2: A 9 year old patientwasreferred to the outpatient department of dental clinic of Monastir, Tunisia with the chief complaint of difficulty in complete protrusion of tongue and slight impairment of speech. The eye, nose and throat and physical examination was normal. On intraoral examination, the case was diagnosed with class II ankyloglossia using Kotlow assessment with fibrotic and thick frenum. (Fig 3.a). Kotlow classified ankyloglossia depending on the range of free tongue as follows (Kotlow, 1999)

- Class I: Mild with 12 to 16 mm of free tongue
- Class II: Moderate with 8 to 11 mm of free tongue
- Class III: Severe with 3 to 7 mm of free tongue
- Class IV: Complete with <3 mm of free tongue

There was neither any gingival recession in relation to mandibular incisors lingually nor any malocclusion present. After thorough examination, lingual frenectomy with diode laser was planned. Lingual frenectomy by soft-tissue laser was carried out after the informed consent from his parents was taken. Safety measures were taken for operator, patient, and assistant by wearing the recommended laser protective eyewear. Local anesthesia was injected in the frenum. Diode laser with delivered optical power of 7 W maximum, with an initiated fiberoptic tip of 300 mm in pulse mode with pulse length 100 µsec and pulse interval of 200 µsec delivering an average power of 2.3 W was used for lingual frenectomy. The tongue was held backward and the diode laser was applied in a contact mode with focused beam forexcision of tissue. The tip of laser was moved from apex to base of frenum in brushing method excising it slowly and continuously mopping with wet gauze preventing excessive thermal damage to the excised tissue. A diamond-shaped wound appeared after excision (Fig 3.b), and protrusive tongue movement was checked postoperatively. There was minimal bleeding and suturing was not required. Patient was given analgesics and recalled after 1 week (fig3.c) and 1 month (Fig 3.d). Healing was uneventful and the protrusion of tongue improved.



a:Preoperative view: Kotlow's class II ankyloglossia	b.A diamond-shaped wound appeared after excision
c: Postoperative view after 1 week	d: postoperative view after 4 weeks

Figure 3

Case 3: A 19-year-old woman was referred to, the outpatient department of dental clinic of Monastir, Tunisia with an aesthetic chief complaint which is a congenitally missing upper left lateral incisor. The placement of 2 implants 3, 3/10mm was carried out for the patient after the informed consent was taken. After the oral surgery procedure, presented with the fully integrated implant that had healed for 6 months, the HA was placed and after 14 days it was completely covered in the vestibular side with gum tissue (Fig 4.a). Local anesthesia was administrated and Diode laser with delivered optical power of 2,3W, with an initiated fiberoptic tip of 300 mm in pulse mode with pulse length 100 µsec and pulse interval of 200 µsec delivering an average power of 1.3 W was used at 5 W, continuous wave. The overlying soft tissue was removed (Fig 4.b) the soft tissue healed well after 15 days. (Fig 4.c) Finally, the ceramic prostheses were sealed one week later (Fig 4.d).

DISCUSSION

The diode laser is manufactured from solid semiconductor crystals made from a combination of aluminum (with wavelength of 800 nm) or indium (900 nm), gallium and arsenic. These wavelengths penetrate deep into the mucosa and highly attenuated by the pigmented tissue, although hemostasis is slow as compared with the argon laser. These lasers are excellent soft tissue surgical lasers, so surgery can be performed safely as these wavelengths are poorly absorbed by the dental hard tissue. This laser is indicated for gingivoplasty, sulcular debridement and deeper coagulation process on gingival and mucosa. The chief advantage of the diode lasers is being one of a smaller size, portable instrument.

a.The HA covered by gingiva on the buccal surface

b.The HA uncovered by the diode lase

c. Postoperative view15days after

d. the final aesthetic result

Figure 3.

These lasers can also stimulate fibroblastic proliferation at low energy levels (Moritz *et al* ., 1997; Coluzzi, 2002).This among the various lasers used indentistry diode lasers, this is more frequently used. The oral tissue is composed of > 90% water; therefore, a diode laser is easy and effective for use in intraoral soft tissue surgery. Based on its characteristics, this type of laser was used for the treatment of our three cases

Gingival recountouring: Aesthetic gum contouring with diode laser is predictable and minimally invasive procedure that can produce immediate results and is easily acceptable by the patient. The use of diode laser enables complete control over the procedure for even the general dentist as it allows for repeated contouring, better vision in a bloodless field to bring out excellent results in terms of height, contour and symmetry of the gingiva (Coluzzi, 2002) According to a study carried out by HADEEL MAZIN AKRAM *et al* in 20017 (Akram, 2017) they compared clinical results obtained on 50 patients divided into 2equal groups :Group 1 gingivectomy was done by Diode Laser, Group 2 gingivectomy was done by scalpel, they found that the surgery was easier and quicker in laser than conventional gingivectomy.

Bleeding was observed in the conventional gingivectomy while relatively blood-less in laser. Less anesthesia is needed in laser gingivectomy (Mosby's, 2008) in addition that the pain post-operatively was less compared to the pain in c pain receptors9 and the coagulation which provided a dry and isolated environment and less infection to the wound (15,16)conventional gingivectomy this could be attributed to the heat generated by laser that inhibit the pain receptors

Lingual fenectomy: Restricted tongue movement in ankyloglossia may cause speech difficulty for pronunciation of dentolingual-labial sounds. Consonants, like t, d, n and, 1, are difficult to pronounce and frontal and lateral lisping may be seen. Tongue-tie has also been associated with problems like malocclusion and gingival recession (Ewart, 1990).

Most often, ankyloglossia is seen as an isolated finding in an otherwise normal child. Segal *et al* . considered the effectiveness of frenectomy in treating ankyloglossia. In the present case report, laser was opted for frenectomy as it was considered safe and a minimally invasive procedure (Segal, 2007). The results of a randomized clinical trial carried out by Dr. Purushottam Singh and Dr. Sonia Nathshowedconfirmed that diode laser is beneficial in achieving better clinical and healing outcomes compared to conventional scalpel technique (Purushottam Singh, 2019). What has been confirmed by Reddy *et al*. (20) in their case series who indicated that laser provides better patient perception than scalpel technique for lingual frenectomy. Iyer and Sudarsa (Iyer, 2015) and Bader (Bader, 2020) also highlighted the advantages of lasers for lingual frenectomy. Histologically, Laser induced wounds because of definite and clean wound, generally heal with secondary intention and no scar formation compared to scalpel incisions. This is may be due to the minimal degree of wound contraction following laser irradiation which occurs through induction and formation of smaller number ofmyofibroblasts and collagen (Gargari *et al*., 2012). In addition ,the hemostatic effect of laser overall and as seen in the present case can be due to sealing of the capillaries by protein denaturation and stimulation of clotting factor VIII production which results in improved hemostasis and visualization of surgical site which can be left without sutures (Pirnat, 2007)

Disengagement of HA: the removal of the gum which covers the healing abutments in certain cases like ours can be accomplished by several methods Traditionally, cutting instruments, such as a scalpel blade or tissue punch has been utilized to incise all around the HA in order to expose it for the restorative phase. The resulting bleeding edge can interfere with impressions that may be taken at the same appointment. Postoperative sensitivity can also result due to the fresh cut edge and typically a delay of 2 weeks is required before impressions can be taken so that bleeding does not hamper the accuracy of how the soft-tissue is captured.

The advantages of using lasers in implant dentistry are the same as for any other soft tissue dental procedure. These advantages include increased hemostasis, minimal damage to the surrounding tissue, reduced swelling, reduced infection, and reduced pain postoperatively. Due to the hemostasis provided by lasers, there is a significant advantage of improved visibility during surgery (Genovese, 2020). One advantage of the use of lasers in implantology is that impressions can be taken immediately after the second stage of surgery because there is little blood contamination in the field due to the hemostatic effect of the lasers but in our case we had chosen to delay the impression after one week of eliminating the excess of the gum around the HA because there also is minimal tissue shrinkage after laser surgery (Martin, 2004)

Conclusion

The use of laser technology has been widely used in dentistry. When used efficaciously and ethically, lasers have been an essential tool in many dental treatments as was described in our study .However, lasers have got its own limitations: it requires additional training and education for various clinical applications and types of lasers. High cost required to purchase equipment, implement technology and invest in required education. More than one laser may be needed since different wavelengths are required for various procedures. The success of a treatment depends on the adequacy between the clinical case, the setting of a good indication and the choice of adapted laser equipment which requires good knowledge by the practitioner of the modes of action of each laser, its main indications and its therapeutic limits

Conflict of Interest: All authors declare that they have no conflict of interest with respect to the research, authorship, and/or publication of this article.

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