Treatment of Low-Flow Tongue Lesions by Diode Laser-Intralesional Photocoagulation (ILP)

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Abstract: Purpose: Assessment of the effectiveness of Diode laser in eliminating tongue venous malformation, while conserving as much as possible lingual tissues through intralesional photocoagulation (ILP). *Patients and Methods*: A series of 9 patients (5 females & 4 males) with age from 17 years to 43 years were treated in this study. Diode laser 980nm beam was delivered through a 320um bare fibre, with 5 watt average power in continuous mode. Treatments were conducted under local anaesthesia. *Results:* At the end of the treatment, all lesions showed chief complaint elimination and at least 60% regression of the size of the lesions. There were no serious complications, such as bleeding or invasive infection. *Conclusion*: Intra-lesional photocoagulation (ILP) with a Diode laser 980nm is effective and safe for treatment of tongue venous malformations.
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1. Introduction

Venous malformation symptoms are related to the size and location of the lesions. Tongue lesions may bleed, ulcerate, cause pain, interfere with speech and swallowing, and obstruct the airway, Miyazaki et al., (2009). The goal of the intralesional photocoagulation (ILP) therapy for symptomatic venous malformations of the tongue is to eliminate the malformation and, at the same time, to conserve the lingual tissue as much as possible. Complete surgical excision of these lesions is rarely possible without causing significant functional impairment or/and disfigurement.

The intera-lesional photocoagulation (ILP) technique has been used by many authors in different medical practice with no major complications, Amin et al., (1993).

Many alternative treatment modalities for vascular lesions have been advocated; embolization and steroid therapies are standard procedures in many hospitals, whereas chemotherapy and interferon therapy are reserved for more severe cases, Ezekowitz et al., (1992).

Sclerotherapy with materials like ethanol may cause blistering and ulceration which usually resolve with conservative therapy. Nerve damage and tissue sloughing can occur and cardiopulmonary collapse necessitating cardiopulmonary resuscitation (CPR) has also been reported, Yakes and Baker (1993).

In the 1990's, fiber-coupled, high-power (5–80 W) diode lasers radiating in the (near-infrared) near IR region (800–980 nm) have become commercially available with novel developments in laser technology. They are attractive for medical applications with their lightweight, portable size, lower cost, longer operating life and better operating conditions (air-cooled, silent, ready-to-use, operating time less than one minute), G¨ulsoy et al., (1999).

The successful application of several types of lasers has been reported for smaller hemangiomas and vascular malformations, but the limited tissue penetration of laser energy makes radical regression of a voluminous vascular lesion difficult. Intra-lesional photocoagulation (ILP) may be an appropriate method for the treatment of vascular lesions, Apfelberg (1995); Angiero et al., (2009); Vesnaver and Dovsak (2009).

The use of Ga-As high-potency diode laser in the treatment of hemangiomas reduces bleeding during surgery, with a consequent reduction in operating time, and promotes rapid postoperative hemostasis. It is safe for use on large lesions and easy to manage; in addition, postoperative problems, including potential scarring, and discomfort are minimal, Genovese et al., (2010).

The neodymium: yttrium aluminum garnet (Nd: YAG) laser with the percutaneous or intralesional application technique is a valuable tool for selected patients with hemangiomas and venous malformations, Ulrich et al.,(2005).

For well-defined, circumscribed and accessible lesions, CO2 laser is suitable for complete excision. Laser therapy can be combined with conventional surgery for extensive lesions, Eivazi et al.,(2010).

2.PATIENTS AND METHODS

2.1.Patients:

Nine patients (4 males and 5 females) aged 17- 43 years with low- flow vascular lesions in the anterior

third of the tongue, were treated over 1.5 years at the Dental Unit of Oral and Dental Laser Applications, outpatient clinic, Laser Institute, Cairo University. All patients were systematically medically free; their chief complaints were: frequent bleeding, aesthetic problems and the lesions' interference with their speech and swallowing.

The minimum and average follow-up periods were 6 months and 12 months, respectively. Diagnosis was made according to the classification of Ethunandan and Mellor (2006). For all patients, the lesions were considered to be a vascular malformation, based on their medical history, age, and findings of magnetic resonance imaging (MRI) which indicated the possibility of venous malformation. All lesions appeared as lobulated masses that were slightly hyperintense or isointense on T_1 weighted images and highly hyperintense on T_2 weighted images with respect to the normal tongue muscles. They showed a slow and homogeneous filling following intravenous injection of contrast medium. The largest diameter ranged from 5 cm to 8 cm and the smallest one ranged from 1cm to 1.3cm. The patients refused to be treated surgically, because of the danger of massive haemorrhage or because total excision would leave unacceptable dysfunction. Patients were advised to be treated by ILP method using laser, and they agreed.

2.2. Methods:

2.2. 1.Laser Treatment

Diode laser 980nm laser (Sirolaser –Sirona dental company –Germany) was used in this study. Laser energy was delivered through a fibre - optic with gauge 320 um and average power 5 w in a continuous mode from 10 to 60 seconds, according to the size of the lesion (energy ranged from 50 Jole – 300 Jole).

Treatment was performed on an outpatient basis under local anaesthesia. All patients were warned regarding the potential for postoperative swelling and pain. Cases of so-called high-flow lesions or those requiring pathologic examination were excluded from treatment by ILP. Prior to Laser application,corticosteroids(0.2mg/kgdexa-methasone) was injected intra - lesion to prevent serious tongue oedema.

2.2. 2.Surgical Technique

A convenient site for insertion of the fiber was allocated 2-3 cm in normal tissues adjacent to the lesion. The tip of the fiber was gently pressed to the mucosa and the laser was activated momentarily to open a track to the centre of the lesion. The laser was applied to the vascular lesion while the fiber tip was slowly withdrawn, and popping sounds (popcorn effect) could be heard during laser application.

Care was taken not to over - treat the covering mucosa. Several holes had been needed for large lesions. Superficial fiber was visualized by trans-illuminating the mucosa by laser aiming beam; thereby, disclosing its general location. Changes of colour, visible shrinkage, and firmness of the lesion were used as signals for the end point of treatment.

To decrease the operation time and laser power, a slight pressure was applied with the thumb of the left hand to evacuate a large volume of blood from the lesion, so the heat capacity of the lesion was decreased. Also, the operator's finger could feel the temperature changes during laser application, so laser was stopped when rise in mucous membrane temperature was felt, which prevented the possibility of mucous membrane damage.

The interval between laser sessions was 4-6 weeks. The treatment was stopped if the patient got a satisfactory result (i.e. about 75 % improvement in his chief complaint), or if no noticeable improvement appeared after two successful laser sessions.

2.2. 3.Clinical assessment

The outcome was assessed by:

A-Disappearance of patient's chief complaint.

B-A panel of three observers, and the response rate was graded as follows:

1- Complete involution implying > 90% reduction in size,
2- High involution implying a reduction in size of 75 to 90%,
3- A partial involution implying a reduction in size of 50 to 75%,
4- A small involution implying a reduction in size of 25 to 50%, and
5- Non involution implying a reduction in size of <25%, Chen et al.,(2003)

3.RESULTS

After receiving their first treatment, all treated lesions were reduced in size, with no increase in the size of lesions observed after initial edema subsided. There were no infections, hematomas, or damage to vital structures, and any ulceration from the burn of the fiber healed with inconspicuous scars.

Slight disturbances of taste and sensation of the tongue appeared just after treatment but resolved within the first month. There were no significant complications, such as excessive bleeding, severe pain, or delayed wound healing. If clinical examination after the first treatment session demonstrated incomplete regression of the mass or persistence of the patient's chief complaint, another laser session was applied one month later (Table 1) the number of treatment sessions and the grade of clinical improvement were directly proportional with lesion size (Figure 1 & 2).

Table (1): Summary of the clinical finding

Case No.	Type of complaint(s)	Grade of clinical improvement	No. of sessions	Follow up period
1	Bleeding	One	Three	6 Months
2	Functional & esthetic problems	Two	Two	6 Months
3	Bleeding	Two	Four	16 Months
4	Bleeding & functional problems	Two	Three	14 Months
5	Bleeding	Three	Six	15 Months
6	Esthetic & Functional Problems	One	One	13 Months
7	Esthetic, bleeding & Functional problems,	Three	Three	11 Months
8	Bleeding & esthetic problems	Two	Two	15 Months
9	Bleeding & speech difficulty	Three	Four	12 Months

Fig1a: A venous malformation occupies the entire anterior on third of the tongue.

Fig 1b: The lesion after six sessions with grade three improvements.

Fig 2a: A venous malformation occupies half of the movable tongue.

Fig 2b: The lesion after three sessions with grade one improvement.

4-DISCUSSION

Lymphatic or venous malformations are one of the more common causes of soft-tissue masses of the tongue. Unfortunately, many surgeons are still unfamiliar with the less-invasive treatment option for venous malformations (VMs); many still prefer the more invasive therapeutic modalities such as surgical excision, Sato et al., (1997).

The purpose of using intra-lesional photocoagulation (ILP) was control of symptoms, as vascular malformations are not a true neoplasm, and therefore treatment centred on control of symptoms, rather than wide excision of the lesion, Dixon et al., (1986).

The Nd: YAG laser therapy is an effective treatment for hemangiomas and vascular malformations as an alternative to conventional strategies, Shapshay et al.,(1987); Werner et al.,(1995). The Nd: YAG laser is known for its high tissue penetration of up to 1cm, Chang et al.,(1999).However, in many cases, superficial Nd: YAG laser irradiation alone cannot affect sub-mucosal angioma remnants, Shapshay et al.,(1987).

High-intensity diode laser Photocoagulation has been used successfully for the treatment of the venous lake of the lips in a non contact manner,

without postoperative discomfort or scar formation, Azevedo et al.,(2010) .

In 1991, Gregory suggested that ILP may be preferable to cutaneous laser treatment for several reasons: This technique allows the laser to be delivered while preserving the form and function of oral tissue; operative time is reduced; all treatments could be performed on an outpatient basis under local anaesthesia. Intra-operative and postoperative bleeding should be minimal. Taste and sensation disturbances are usually resolved within 2-3 months.

Dixon and Chang reported the effectiveness of ILP of vascular anomalies of the tongue using an Nd: YAG laser, Dixon et al.,(1986);Gregory(1991). In this study, the Diode laser 980nm which has a coagulation property comparable to the ND: YAG laser, Chang et al.,(1999)was chosen because of its smaller size and price compared with the Nd: YAG laser, Gregory(1991).

Werner examined the use of Ultrasonography (US) for guiding laser fiber insertion safely and for assessment of ILP in subcutaneous vascular lesions, Werner et al.,(1995)but unfortunately there are many cases in which the probe cannot be applied to a lesion, based on its location in the oral cavity, despite the use of a mini -probe for ultrasound, Miyazaki et al.,(2009). Also, using US would prevent the operator from monitoring the surface temperature changes during laser application through feeling surface temperature elevation, and so would prevent extensive mucosal thermal damage.

Several authors have reported an ulceration rate of 5%-20% during treatment, Romanos and Nentwig(1999); Achouer et al.,(1998) and ulcer formation after laser treatment is a common complication. However, it is well known that a wound in the oral cavity heals faster without severe scar formation or contraction by scar compared with a skin wound, Burstein et al.,(1998) ; Shannon et al.,(2006). Small or superficial ulceration is not considered as a complication, Shannon et al.,(2006),therefore, removal of lesions can take precedence over this concern.

In order to decrease the risk of intra -operative bleeding or haemorrhage just after the operation, ulcer formation during surgery was avoided. However, the success of ILP is not dependent on ulceration, McKeown et al.,(2007), and in this study there was no significant difference in the clinical course between cases with and without ulceration.

Fibrosis associated with intra-lesional therapy has been greatly decreased by injecting steroid solution during treatment of the deep component, Azevedo et al.,(2006)

Brietzk et al. ,(2001) reported the use of an Nd: YAG laser directed via bare fiber to the centre of vascular lesions. In this study, the same technique was used. As in the oral cavity the distances which were transferred by the bare fiber were very small, so there was no need to use angio-catheter to protect the fiber or to open its path. Bare fiber was used to drill its path through shooting laser from normal tissues 2-3 cm away from the lesion, to the centre of the lesion.

Application of pressure by the thumb of the operator offered many advantages as helping in evacuation of the lesion and so decreasing the thermal capacity of the lesion. Furthermore, decreasing the volume of the lesion would reflect on lowering the laser power used. Also, the laser beam would be directed mainly on the blood vessels not on the blood content.

In conclusion, results of this study showed that Diode laser 980nm intra-lesional therapy allows treatment of tongue vascular lesions in a simple, fast and safe manner, with minimizing the danger of massive haemorrhage or huge tongue structure loss. Hence, the approach is simple with few complications and satisfactory results.

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