

Observational Study

450 nm diode laser: A new help in oral surgery

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Abstract**AIM**

To describe the performance of 450 nm diode laser in oral surgery procedures.

METHODS

The case described consisted of the removal of a lower lip fibroma through a blue diode laser ($\lambda = 450$ nm).

RESULTS

The efficacy of this device, even at very low power (1W, CW), allows us to obtain very high intra and postoperative comfort for the patient, even with just topical anaesthesia and without needing suture. The healing process was completed in one week and, during the follow-up, the patient did not report any problems, pain or discomfort even without the consumption of any kind of drugs, such as painkillers and antibiotics. The histological examination performed by the pathologist showed a large area of fibrous connective tissue with some portions of epithelium-connective detachments and a regular incision with very scanty areas of carbonization.

CONCLUSION

The 450 nm diode laser proved of being very efficient in the oral soft tissue surgical procedures, with no side effects for the patients.

Key words: Blue laser; Advantages; Oral surgery; Patient satisfaction

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Core tip: In this work we described a single case consisting of the removal of a lower lip fibroma by means of a blue diode laser ($\lambda = 450$ nm), showing its efficacy even at very low power (1W, CW) and allowing us to

obtain very high intra and postoperative comfort for the patient, even with just topical anaesthesia and without needing suture. The observed healing process after one week and the complete absence of pain during the follow-up without the consumption of any kind of drugs, such as painkillers and antibiotics, together with the perfect histological readability are very great advantages in favour of this surgical approach.

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INTRODUCTION

In 1964 Goldman introduced laser technology in dentistry field^[1] and, even if several authors in those years described several laser applications in dentistry^[2-5], only Frame was the first who showed the absence of biological damage in a laser-assisted surgical intervention with CO₂ laser^[6].

Many papers described the advantages for laser-assisted oral surgery as the reduction of the surgical time, the absence of bleeding and consequently the good vision of the surgical site, the possibility to avoid infiltrative anaesthesia and suture with a greater compliance for the patient and the better and faster healing process^[7-12].

Together with wavelengths specific for soft tissues, thanks to Hibst and Keller, since 1990, we can use also the Erbium laser (2940 nm) for decay removal in restorative dentistry^[13,14].

Today, in addition to lasers working in infrared spectrum, for oral surgery we can use wavelengths working in the visible spectrum as Argon laser (435 nm) useful in oral surgery but also in restorative dental field, and KTP laser (532 nm) well working in oral surgery thanks to its characteristics at low parameters and with a good bleeding control^[14-16].

Supercontinuum source is a device allowing to evaluate laser-tissue interactions, mainly transmission; an "ex vivo" recent study showed that the lowest transmission is in the blue and green portion of visible spectrum and in the infrared portion ranging from 1300 to 1400 nm^[17]: These results could justify the utilisation of dental blue laser, considering also the demonstration, by Enwemeka *et al*^[18], of the of blue light capacity to neutralise some bacterial species also being effective on periodontal biofilm, as shown in several *in vitro* studies^[19-21] as well as in Photodynamic Therapy field on *Streptococcus Mutans* cultures, as described by Merigo *et al*^[22].

Blue light has been evaluated also for its biomodulatory properties, with laser or LED devices, showing positive effects^[23-26].

Even if blue laser was previously proposed in den-



Figure 1 Clinical appearance of the lower lip lesion with aesthetic impairment.



Figure 2 Lower lip fibroma probably caused by a lip biting habit.

tistry field for composite resin polymerization, while argon laser showed its efficacy, diode lasers apparently are not proposed as useful for this use^[27-31].

Lately, the combined treatment with blue laser and titanium oxide has been indicated for teeth whitening, but there are still no works describing the utilisation of this wavelength in oral surgery^[32].

The purpose of this paper was to demonstrate the advantages of this wavelength in oral soft tissue surgery.

MATERIALS AND METHODS

The patient ML, a thirty-eight years old female, came to our clinic for the examination of a lesion in the margin of the lower lip. She reported that it had been present for a year and, in the last few months, she had noticed an enlargement of its size (Figures 1 and 2). She required the surgical removal for aesthetic reasons.

She had a medical history without significant diseases and the oral clinical examination did not reveal any suspicious aspect.

The clinical diagnosis was positive for fibroma, probably related to a lip biting habit. Based on the age of the patient, the anatomical area and the size of the lesion, it was decided to perform a laser-assisted surgery session for the lesion removing, so avoiding the complications related to the conventional surgery, such



Figure 3 Image of the surgical site immediately after surgery.



Figure 4 Sample for histological analysis.

as the formation of post-operative scars and bleeding^[33]. Regarding the choice of the wavelength, in order to limit the thermal elevation and, at the same time, to obtain a good sample for histological observation^[34] and to offer the patient the most comfort during the healing process, it was decided to use the blue diode laser (Ermes Blue Diode, Gardalaser, Italy, $\lambda = 450$ nm) with this protocol: Power 1W in CW (Continuous Wave) with an optical fiber of 320 μm of diameter in contact mode at a speed of around 5 mm/s (Power density 1244 W/cm², Total fluence: 95790 J/cm²).

The patient was informed about all the aspects of the intervention, and she signed the consensus for the surgical removal of the fibroma. The use of anaesthetic injection and the sutures apposition were avoided; only a topical anaesthetic was applied (EMLA, Astratech, Sweden) and the duration of the intervention was 77 s.

The patient was instructed on the need to record the intensity of the pain she felt through a visual analogue scale (VAS) and a numerical rating scale (NRS) every day after surgery beginning with the first day after surgery until the re-evaluation we performed seven days after surgery.

Clinical observations at 1 and 3 mo after surgery did not show any sign of recurrence.

RESULTS

During the whole duration of the intervention patient

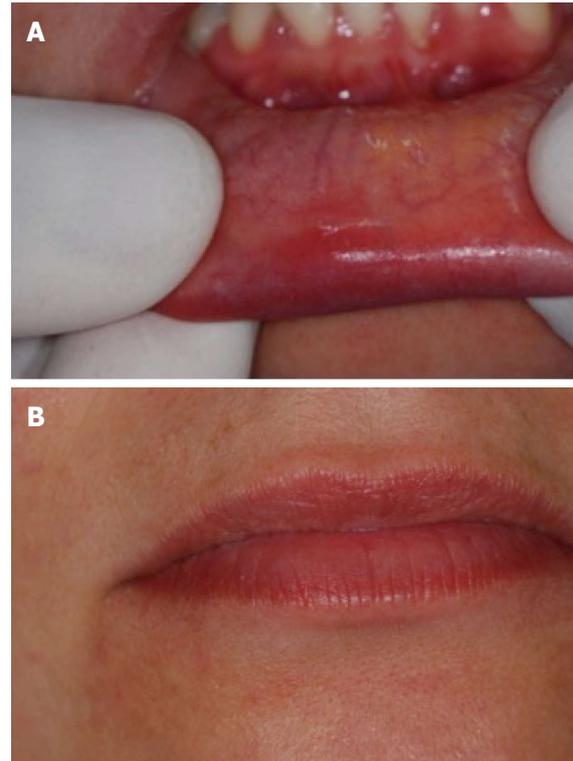


Figure 5 The healing process was completed in seven days. A: Surgical site seven days after surgery; B: Appearance of the lip seven days after surgery with a complete recovering of aesthetic aspect.

described the absence of pain or discomfort.

The site of the lesion, after the removal, did not show any bleeding and did not require any suture (Figure 3).

Both the site and the sample removed did not evidence any sign of carbonization (Figure 4) and the healing process was completed in seven days (Figure 5).

During the follow-up the patient did not take any drugs, such as painkillers and antibiotics, did not reveal any sign of oedema and/or infection and reported that she did not feel any form of pain (VAS and NRS were 0 in every record), discomfort or other problems.

The histological evaluation of the sample, performed by the pathologist, showed a large area of fibrous connective tissue with some portions of epithelium-connective detachments and a regular incision with very scanty areas of carbonization (Figure 6).

DISCUSSION

This report confirms the advantages of the utilization of 450 nm laser in oral surgery, showing undeniable benefits for its use at very low power. During the operative session it allows for the reduction of the time of the intervention, the avoidance of the anaesthetic injection and the control of the tissue bleeding. From the patient's comfort point of view, it allows us to minimize the pain and avoid the use of suture. During the follow-up, the use of drugs is not requested, and pain, discomfort, oedema and infection are not present. The healing process is very fast and was completed in a

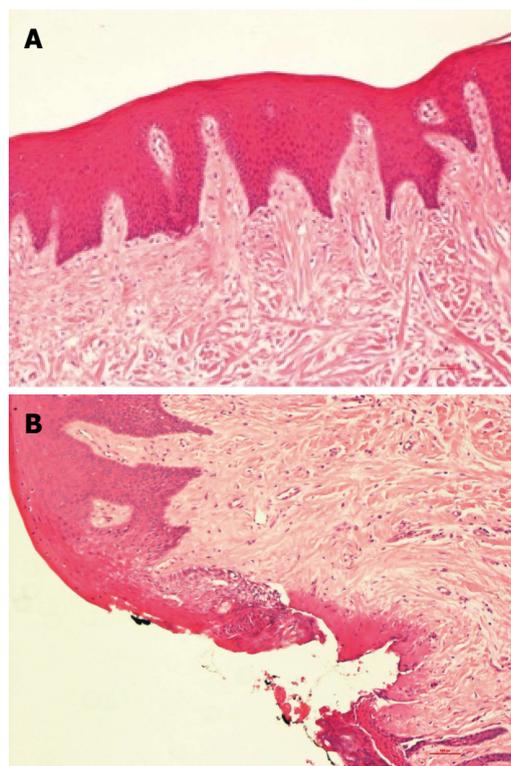


Figure 6 A large area of fibrous connective tissue with some portions of epithelium-connective detachments and a regular incision with very scanty areas of carbonization. A: Fibrous connective tissue without signs of inflammation; B: Regular incision with discrete signs of coagulations.

week without side effects.

From the histological point of view, the sample removed shows significantly fewer zones of carbonization, so as avoiding the risk of the impossibility of not being able to make a correct diagnosis of the lesion. This technique may be considered a good approach in oral soft tissues surgery.

COMMENTS

Background

Many papers described the advantages for laser-assisted oral surgery as the reduction of the surgical time, the absence of bleeding and consequently the good vision of the surgical site, the possibility to avoid infiltrative anaesthesia and suture with a greater compliance for the patient and the better and faster healing process. Blue light has been evaluated for its biomodulatory properties, with laser or LED devices, and for its usefulness in dental bleaching procedures, showing positive effects.

Research frontiers

Actually there are still no works describing the utilisation of this wavelength in oral surgery. The purpose of this paper was to demonstrate the advantages of this wavelength in oral soft tissue surgery.

Innovations and breakthroughs

This report confirms the advantages of the utilization of 450 nm laser in oral surgery, showing undeniable benefits for its use at very low power. During the operative session it allows for the reduction of the time of the intervention, the avoidance of the anaesthetic injection and the control of the tissue bleeding. From the patient's comfort point of view, it allows us to minimize the pain and avoid the use of suture. During the follow-up, the use of drugs is not requested,

and pain, discomfort, oedema and infection are not present. The healing process is very fast and was completed in a week without side effects. From the histological point of view, the sample removed shows significantly fewer zones of carbonization, so as avoiding the risk of the impossibility of not being able to make a correct diagnosis of the lesion.

Applications

This technique may be considered a good approach in oral soft tissues surgery.

Terminology

CW or continuous wave is a working mode of laser devices. VAS or visual analogue scale and NRS or numerical rating scale are two methods to evaluate the discomfort or pain felt by the patient in the intra and postoperative period.

Peer-review

Interesting case report of the use of blue diode laser for the removal of oral and intraoral soft tissue benign tumors. The case report is well written with a comprehensive description of the application of the blue diode laser.

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