

# The Use of Surgical Lasers in the Treatment of Oral Leukoplakia

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**Introduction:** Surgical lasers are more and more often used in our days in medicine, including oro-maxillo-facial surgery. Because of their many advantages the application of surgical lasers became the elective method in the surgical treatment of oral leukoplakia – according to the recommendation of the WHO.

**Material and method:** In this paper two clinical cases are presented showing the methods and advantages of using surgical lasers in the treatment of oral leukoplakia. For the surgery a 15 W maximum power Biolitec diode laser was used.

**Results and conclusions:** The ideal haemostasis during surgery; the shortened intervention (and through this the reduction of physical and psychological stress of the patient); minimal scar tissue formation; the unnecessary to cover sometimes important postoperative defects, reduced risk of dissemination of modified cells are such advantages of the use of surgical lasers, that eliminate the difficulties of classic surgical techniques and lead to spreading of a new concept in the surgical treatment of premalignant lesions of the oral mucosa.

**Keywords:** laser, leukoplakia, oro-maxillo-facial surgery

## Introduction

Early diagnosis and adequate treatment of malignant tumors and premalignant lesions of the oral mucosa, are very important factors for improving the prognosis of these disorders [1, 2]. Leukoplakia is the most frequent, representing about 85% of premalignant lesions of the oral mucosa. It appears in about 3% of the white adult population, but the malignant transformation rate is appreciated differently by various authors: 0.1–28%, with an average of 4%. In the clinical evolution of oral leukoplakia four, and an inconstant fifth stage are distinguished by Bouquot and Withaker [3]. The risk of malignant transformation increases with these stages.

Surgical lasers are more and more often used in our days in medicine, including oro-maxillo-facial surgery. Numerous studies demonstrate the favorable effects of lasers on the living tissues, hereby laser treatments efficiently complete or substitute, leading – in some well defined cases – to even better results than the conventional treatment methods [3–7].

Surgical lasers have several advantages compared with conventional and electric scalpels, such as: the haemostasis during surgery is ideal; it is unnecessary to cover sometimes important postoperative defects, which reduces the length of the interventions; postoperative oedema and pain shows lower rates; scar tissue formation is minimal and the risk of dissemination of modified cells is also reduced. Because of these advantages the use of surgical lasers became the elective method in the surgical treatment of oral leukoplakia – according to the recommendation of the WHO [3, 8, 9].

Many types of lasers are known. CO<sub>2</sub> laser is the most widely used surgical laser in medicine, but it has some inconveniences. Besides the big size of the device, the conduction of the beam is possible only with an articulated arm (containing special mirrors), which makes its use more difficult [8]. Diode lasers are smaller, the beam is conducted by

a flexible optical fiber and it also can be used in other fields of dental medicine (periodontology, endodontics, implantology, bleaching) [4, 10]. Based on these properties the "classical" CO<sub>2</sub> lasers are step by step replaced by diode lasers in dentistry and oro-maxillo-facial surgery.

## Material and method

In this paper two cases of oral leukoplakia – operated at the Oro-maxillo-facial Surgery Clinic from Tîrgu Mureş – are presented, showing the methods and advantages of using surgical lasers in the treatment of oral leukoplakia. For the surgery a 15 W maximum power Biolitec diode laser was used. The 980 nm wavelength beam was applied to the tissues through a 360 µm diameter optical fiber. We used the device in continuous mode, at 6–8 W power for the removal (excision) of the lesions.

The first case is a 54 year old male patient with an extended leukoplakia verrucosa on the left retrocommissural mucosa (Figure 1a). The second patient is a 52 year old female who referred to us with a leukoplakia nodularis located also on the left cheek mucosa, in the retocommissural area (Figure 2a). In both cases we decided the excision of the lesions with the surgical laser (Figure 1b, 2b). The operations were performed in local infiltration anesthesia, afterwards the patients were recalled at 2 days, 1, 2, 4 and 6 weeks after surgery (Figure 1c, 1d, 2c, 2d).

## Results and discussion

Leukoplakia is the most frequently seen preneoplastic lesion of the oral mucosa. Its treatment begins with elimination of local irritative factors (plaque, calculus, cutting edges of the teeth, incorrect fixed or removable dentures, smoking etc.), associated with local applications of vitamin A, and of course a well structured patient recall program, but in some more advanced clinical forms the surgical treatment is indicated [1, 2].



Fig. 1. a. Leukoplakia verrucosa on the left retrocommissural mucosa; b. Postoperative aspect after removal of the lesion with diode laser; c. 2 weeks after surgery; d. 6 weeks after surgery.



Fig. 2. a. Leukoplakia verrucosa on the left retrocommissural mucosa; b. Postoperative aspect after removal of the lesion with diode laser; c. 2 weeks after surgery; d. 6 weeks after surgery.

During the conventional surgical removal (with scalpel) of these lesions several difficulties may occur. One of these is represented by an important bleeding because of the rich vascularization of oral structures (tongue, lips, floor of the mouth, cheek, etc.) we are operating on. Another problem is caused by extended lesions (especially in surface), leaving large postoperative defects, with consecutive covering difficulties. In such cases the defects can be covered with different flap techniques or using mucosa or even skin transplantation. In both cases a longer operation and a second intervention (management of the donor site) need to be considered. In the same time surgical sutures cause some local microcirculation disorders, thereby postoperative oedema and pain, also scar tissue formation after healing is more pronounced, which is sometimes traduced by functional disturbances (ex. limitation of mouth opening). Using surgical lasers we can avoid these inconvenients of conventional surgery [4, 5].

The effects of lasers are based on the interaction of the beam with the living tissues. The laser energy is absorbed by the tissues, and a termical damaged zone will result, which

has 4 different layers. In the center, where the focalized beam acts, the cells are completely vaporized. The second layer contains carbonized cells, while the third – where the energy of the laser beam is already decreased – is formed by coagulated proteins. Finally these 3 layers are separated from normal tissue by a zone with only reversibil oedema of the cells [3]. The electric scalpel produces similar damage in the tissues, with the same 4 zones, the difference being in the width of the layers, which are 5-8 times wider than in case of lasers [4]. The width of the layers is influenced also by the type of laser being used [3].

We decided for laser surgery because of the relative big surface of the lesion, in the first case presented (Figure 1a), the multifocal aspect of the leukoplakia, in the second case (Figure 2a), and because of the simplicity and efficiency of the method. The coagulation of the blood vessels of the region by the laser beam provides a "dry" operation site, no additional hemostasis is needed [4, 11]. Figure 1b and 2b shows the immediate postoperative status – after the excision of the leukoplakias. The obliteration of blood and lymphatic vessels is also very important regarding the

oncological aspect, this way the risk of dissemination of modified cells being reduced.

The good hemostasis and protection provided by the above mentioned carbonized cell and coagulated protein layer, makes unnecessary to cover the postoperative defect [4, 11]. Therefore the surgical intervention is shortened and because we do not need to use sutures either, the postoperative oedema and pain shows lower rates.

In the beginning of the healing process a fibrin layer appears that covers the defect and below this layer epithelization starts from the margins. Step by step the fibrin layer is eliminated and approximately two weeks after the surgery a new epithelium is formed, but the region is not yet at the same level as the surrounding tissues (Figure 1c, 2c). About six weeks after the operation the healing is completed. Under the new epithelium the operation site is filled with connective tissue and the zone reaches the level of surrounding tissues. Scar tissue formation is minimal, with no functional disturbances (Figure 1d, 2d). Furthermore the healing process can be improved using a soft laser therapy with analgetic, antiinflammatory and stimulating effects on the reparatory processes [12].

Various methods of using surgical lasers are known. If the beam is defocalized it can be performed the coagulation of the tissues without interrupting the continuity of the superficial structures. This method is used especially in the treatment of haemangiomas [4, 13]. Another possibility is vaporization when tissues are removed layer by layer starting from the surface. Disadvantage of this method is that the depth of the modified tissues cannot be appreciated correctly, so thus repeated interventions may be necessary. In addition in this case we do not have a specimen, so histopathology cannot be performed, which is of great importance especially for premalignant lesions [4, 5, 14]. The third method – used by us in the presented cases – is excision, with the possibility of obtaining a specimen. In such cases an incision is performed with the laser and the modified structures are removed in one piece [4, 5, 14]. A larger excision is needed though because of the termical damage of the margins of the specimen, but this is in accordance with oncological aspects and because the defect does not need to be covered, it does not represent a great disadvantage from the point of view of the healing process.

## Conclusions

Based on the presented clinical cases we can conclude that diode lasers can be successfully used in the surgical management of oral leukoplakia. The ideal haemostasis during surgery; the shortened intervention (and through this the reduction of physical and psychological stress of the patient); minimal scar tissue formation; the unnecessary to cover sometimes important postoperative defects, reduced risk of dissemination of modified cells are such advantages of the use of surgical lasers, that eliminate the difficulties of classic surgical techniques and lead to spreading of a new concept in the surgical treatment of premalignant lesions of the oral mucosa.

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