



# Treatment of Squamous Cell Carcinoma of Lower Lip with Carbon Dioxide (CO<sub>2</sub>) Laser

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**Summary:** Squamous cell carcinoma (SCC) represents 95% of oral cavity cancers, including tongue and lips. In most cases, if this lesion is diagnosed in the initial stages, the treatment of choice is surgery under general anesthesia. This clinical study examined the efficacy of CO<sub>2</sub> laser treatment of SCC of the lower lip in an ambulatory setting. In 10 patients, SCC of the lower lip was removed using CO<sub>2</sub> laser radiation in continuous mode at 0.8 mm focus, 10 W, power density 2.5 W/cm<sup>2</sup>. Daily clinical evaluations were done until removal of the skin suture, then once a week for 1 month, and quarterly thereafter until the 5th year after surgery. The results showed that the CO<sub>2</sub> laser is an extremely useful tool, providing a clean surgical field and complying with oncological principles. The functional and esthetic results were excellent.

**Keywords:** head and neck surgery, malignant oral lesion, lasers.

*J Oral Laser Applications 2006; 6: 307-311.*

At least 95% of cancers of the oral cavity are squamous cell carcinoma. Among the most common etiological risk factors for developing oral squamous cell carcinoma are the use of alcohol and tobacco products, nutritional deficiency, exposure to ultraviolet light (sunlight), viruses, and immunosuppression.<sup>1,2</sup>

The early recognition and diagnosis of lip carcinoma tends to be challenging because there usually are no specific early symptoms, and signs can be nonspecific and mild. Following onset of malignant conversion and initial growth, lip cancer often goes through an asymptomatic early stage of varying duration, and may still present with accompanying precancerous conditions such as cheilitis or keratosis, or even leukoplakia, ery-

throplakia, or erythroleukoplakia with a high degree of dysplasia or even carcinoma in situ.<sup>3</sup>

In the initial stage, the preferential treatment modality is usually surgery (excision of the lesion with clear margins) or occasionally radiotherapy. Surgical treatment has the advantage of rapid elimination of the lesion, while providing an immediate assessment of the risk of recurrence and thus prognosis of the lesion.<sup>4</sup>

Carbon dioxide laser (CO<sub>2</sub>) radiation has been shown to be very effective for soft tissue oral surgery, including the successful surgical control of localized squamous cell carcinoma. Given the intrinsic qualities of this type of radiation when used for oral soft tissue surgery, it is reasonable to consider that this technique

may be the surgical technique of choice for small localized squamous cell carcinoma lesions, especially in terms of benefits to the patient. This report presents the results of 10 cases of squamous cell carcinoma of the lip managed with CO<sub>2</sub> laser surgery.

## MATERIALS AND METHODS

After approval of this protocol by the Ethics Commission in Local Research (protocol 12/99-PH/CEP-UNESP), 10 male patients with an initial clinical and histopathological diagnosis of primary carcinoma of the lower lip (T1NoMo) who were referred to the Department of Biosciences and Diagnosis at São Paulo State University, UNESP, consented to participate in this study (Fig 1, Table 1).

All patients completed pre-operative medical assessments that included a hemogram, blood analyses to assess creatinine, sodium, potassium, and blood glucose values. Studies to evaluate coagulation were carried out. A chest x-ray and a cardiologic evaluation were also done.

After careful surgical planning with a head and neck surgeon, local anesthesia was achieved through infiltration immediately adjacent to the lesions to be removed. The suspected carcinoma lesions were initially delimited with a 10-mm margin utilizing a CO<sub>2</sub> laser in continuous mode; the laser was then used to dissect and remove the entire lesion (Sharplan Lasers; Tel Aviv, Israel, FAPESP 97/07645-2) with 0.8 mm focus, 10 W, power density of 2.5 W/cm<sup>2</sup> in continuous mode with constant vacuum removal of the smoke plume (Surgifresh, Surgimedics; Houston, TX, USA). All the patients, as well as the surgeon and team, wore laser safety glasses and masks. Intact tissue tumour specimens obtained were forwarded for anatomical and histopathological examination.

After surgery, the sites were closed with Monocryl 4-0D; interrupted sutures were used for closing oral mucosal surfaces, and skin closure was obtained using interrupted Mononylon 4-0 sutures. All patients received postoperative antibiotic and anti-inflammatory treatment consisting of cephalosporin 500 mg every 6 h plus 50 mg diclofenac every 8 h for seven days.

Patients returned for postoperative evaluations every two days until the sutures were removed, then weekly for one month, then every three months until the 5th year post surgery. Thereafter, re-checks were performed every 6 months for five years. All the cases were photographed pre-operatively and then at each successive postoperative follow-up evaluation.

## RESULTS

In all instances, the surgeon was able to consistently control the tissue volume and maintain adequate surgical margins. Minimal bleeding was noted except in one case, where the large size of the lesion necessitated transection and suturing of an artery in the field. Intraoperatively, we observed large areas of carbonization throughout the surgical bed due to vaporization of the tissue (Fig 2). The power dose used (10 W) proved adequate for removal of tissue but did not appear to cause any vascular complications due to interruption of the blood supply to the surgical bed (eg, local ischemia and/or clinical evidence of soft tissue necrosis).

Three patients showed minimal bleeding when the sutures were removed. One week after the surgery, all cases showed satisfactory initial re-epithelization of the surgical site. All patients reported only minimal discomfort during the first 24 h after surgery, and there were no reported bleeding episodes. This is in stark contrast to the experience with scalpel excision for similar lip lesions, where it is common for patients to present immediately after surgery and for several days with complaints of significant pain and to have difficulty with speaking and eating. In addition, with conventional surgery, the associated postoperative edema interferes with hygiene, further impairing healing.

After 30 days, all patients demonstrated a full re-epithelization of mucosal and skin surfaces with very satisfactory esthetic and functional results (Fig 4).

The histopathological review of all surgical specimens showed that all margins were disease free. All subjects were followed-up for five years after surgery, and no patients had any evidence of recurrence.

## DISCUSSION

Surgery involving the lip vermilion presents many significant challenges due to the fact that the area is highly vascularized and there is a large number of muscles directly beneath the surface. Conventional scalpel surgery carries a significant risk of bleeding that can frequently lead to complications during surgery and makes it undesirable to conduct the surgery as an outpatient procedure. Additionally, with surgical treatment of the lips, esthetic issues have to be taken into careful consideration.

Several researchers have reported on the use of CO<sub>2</sub> laser radiation for the removal of mucosal lesions.<sup>5-11</sup> Those studies reported that the principal advantages of laser surgery over conventional surgeries



Table 1 Patient parameters										
Patient	1	2	3	4	5	6	7	8	9	10
Gender	male	male	male	male	male	male	male	male	male	male
Age	62	72	59	47	67	74	63	59	60	65
Tobacco*	20	30	20	No	30	20	40	30	20	20
Anesthetic volume (ml)	2.7	1.8	2.7	1.8	1.8	1.8	1.8	1.8	1.8	2.7
Surgical time (min)	32	17	27	24	30	22	30	25	28	25

\* number of cigarettes/day



Fig 1 Clinical image of the squamous cell carcinoma.



Fig 2 Carbonization areas after surgical removal.



Fig 3 Postoperative view after 60 days.



Fig 4 Squamous cell carcinoma.



**Fig 5** Image immediately after vaporization.



**Fig 6** Clinical image after 40 days.

include: excellent hemostasis, minimal trauma to adjacent tissues, decreased edema, sterilization of the surgical wound, minimal postoperative pain and, in most cases, minimal or no need for suture of surface lesions. These advantages were also apparent with this series of patients, except in those instances where the size of the defect and the influence of adjacent muscles on the surgical site requiring additional stabilization made it necessary to utilize sutures.

Clinical and biological studies have shown that the surgical wound created by CO<sub>2</sub> laser radiation is distinctly different from the wound produced by scalpel. Laser vaporization causes minimal damage to the adjoining tissue, and initially a coagulum cover is formed by denatured proteins covering the surface. Although there is minimal pain in the immediate period after laser surgery, episodes of pain may be noted 3 to 4 days after surgery and can persist for one or two weeks. These episodes can usually be managed with standard analgesic protocol. However, compared to conventional surgery, CO<sub>2</sub> laser surgery appears to cause less severe pain, sialorrhoea, dysphonia, and dysphagia, although of similar duration.

Clayman and Kuo<sup>11</sup> have reported that surgical wounds created with CO<sub>2</sub> laser radiation re-epithelize in approximately 3 weeks. This time period provides a suitable time for re-establishment of esthetics and function for the patient, including improvement of speech and mastication.

In the present cases, the size and clinical characteristics of the squamous cell carcinoma led us to choose

CO<sub>2</sub> laser incision and/or vaporization, especially due to possible intra-and postoperative complications and increased comfort for the patient. There have been no instances of interurrences and/or signs of recurrence.

The one major disadvantage of CO<sub>2</sub> laser radiation surgery is that the epithelial regeneration of the surgical sites takes longer when compared to healing after conventional surgery.<sup>11</sup> Cotran et al<sup>12</sup> questioned the lack of blood supply and the presence of foreign substances in the surgical wound, both of which impeded the release of growth factors fundamental to angiogenesis and re-epithelization, resulting in altered chronology of tissue repair.

Corroborating these aspects, Schünke et al<sup>13</sup> considered several factors that may have been responsible for the delay in the repair process when using the CO<sub>2</sub> laser. They highlighted thermal necrosis as a cause of endothelial damage and capillary and vein thrombosis. Kamat et al<sup>14</sup> deduced that the repair delay of irradiated tissue with CO<sub>2</sub> laser is due to the superficial denaturation of the collagen, which acts as a chemical mediator of the inflammation.

Nevertheless, there is a consensus among those authors that the repair delay in wounds produced by the CO<sub>2</sub> laser radiation is not considerable in the final stage of healing. This was confirmed in our study, given the similarity of the clinical situations, after 30 days.<sup>15-17</sup>

In all of our patients, the extent of this delay was not clinically evident compared to those submitted to conventional surgery.<sup>5,6,10,16</sup>

## CONCLUSION

Based on the results of this case series, we can conclude that the CO<sub>2</sub> laser is a surgical tool that can be extremely effective in the surgical treatment of localized squamous cell carcinoma of the lip in an outpatient setting. We have demonstrated that careful planning and utilization of the techniques described above can result in successful surgical removal of the tumor while maintaining a bloodless surgical field and including an acceptable time for postoperative healing. However, it is very important to note that CO<sub>2</sub> laser surgery clearly allows adherence to the principles of oncological surgery, including complete removal of the tumor with techniques that reduce the risk of lymphatic spread of tumor cells due to tumor manipulation. Finally, the esthetic results for patients are generally very good.

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