

A Feasible Procedure in Dental Practice: The Treatment of Oral Dysplastic Hyperkeratotic Lesions of the Oral Cavity with the CO₂ Laser

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Abstract

Objectives: The aim of this work is to report some cases of surgical removal of hyperkeratotic lesions of the oral cavity with the CO₂ laser. **Background:** Hyperkeratosis is an abnormal thickening of the *stratum corneum* caused by increased deposition of keratin, and its histopathologic features show wide variations. These changes are significant because they determine different biologic behavior. Several techniques are used to treat these lesions, including scalpel incision, electrosurgery, cryosurgery, photodynamic therapy, and some drugs. The use of surgical lasers has been proposed as an effective way of treating such lesions safely. The CO₂ laser is the most used laser on the oral cavity because of its affinity for water and high absorption by the oral mucosa. Several benefits of the use of the CO₂ laser are reported in the literature in regard to surgical procedures carried out on the oral cavity. **Patients and Methods:** All patients had histopathologic diagnosis of hyperkeratosis and mild epithelial dysplasia and were routinely prepared for surgery under local anesthesia. The surgical procedures were carried out by using a CO₂ laser (Sharplan 20 C; Laser Industries, Tel Aviv, Israel, λ 10,600 nm, $\phi \sim 2$ mm, CW/RSP). The beam was focused to delimit each lesion, and then lesions were excised, and the removed specimens were sent for histopathology. At the end of the surgery, the beam was used in a defocused manner to promote better hemostasis. Neither sutures nor dressings were used after the surgery. No medication but mouthwashes was prescribed to all patients in the postoperative period. **Conclusions:** The use of the CO₂ laser does not reduce the risk of relapses of the lesion, but it is an easy-to-use technique and results in both a quick surgical procedure and trouble-free postoperative period and may be safely used in dental practice.

Introduction

HYPERKERATOSIS IS AN abnormal thickening of the stratum corneum due to increased deposition of keratin.¹ It is a common finding on both benign and malignant lesions of the oral mucosa associated with human papillomavirus (HPV).^{2–5} The term “leukoplakia” has been used only on clinical grounds to define a white patch that cannot be removed manually. This term has no relation to the histologic changes.^{5–7} The histopathologic features of this condition also show a wide variation. Two of these are considered important: the hyperkeratosis and the epithelial dysplasia both have different levels of severity. These changes are significant for progression, as they determine different biologic behaviors.^{7,8}

The average prevalence of this condition is estimated at 2.60%, and malignant transformation is estimated at 1.36%.⁹ Risk factors were studied in 16,128 patients, and it was found that the prevalence of leukoplakia is directly proportional to age, being higher in male subjects. Smoking and diabetes were considered independent risk factors. Alcohol ingestion was not significant statistically as an isolated risk factor.⁵

Several techniques are used to treat oral leukoplakia; these include scalpel incision, electrosurgery, cryosurgery,^{10,11} photodynamic therapy,¹² and drugs.¹³ The use of surgical lasers has been proposed as an effective way of treating such lesions safely.^{13,14}

The CO₂ laser is the most-used laser in the oral cavity due to its affinity to water and high absorption by the oral

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mucosa. This laser emits typically at $\lambda 10,600\text{ nm}$ and has no chromatic affinity.¹¹ The interaction of the laser light with the tissue occurs through the transformation of the light into heat in the presence of fluids, mainly water.^{15,16}

Several benefits of the use of the CO₂ laser are reported in the literature in regard to surgical procedures carried out on the oral cavity. These benefits include the coagulation of small blood and lymphatic vessels, making the surgical field drier; less postoperative pain and discomfort due to the formation of thermal neuromas at the nerve endings; immediate sterilization of the wound surface due to the high temperature generated during the irradiation; minimal or no wound contraction and scarring due to the presence of small amount of myofibroblasts; no need of sutures or wound dressings; and others.^{11,16}

Conversely, few disadvantages are reported and are related mainly to a slight delay in healing that occurs because of the thermal damage around the irradiation site; the cost of the equipment; and need for training of the surgeon on the use of the laser.^{17,18}

The aim of this work is to report of a series of cases of surgical removal of hyperkeratotic lesions of the oral cavity with the CO₂ laser.

Case Reports

General procedures

All patients were seen at the Laser Center of the School of Dentistry of the Federal University of Bahia with histopathologic diagnosis of hyperkeratosis and mild epithelial

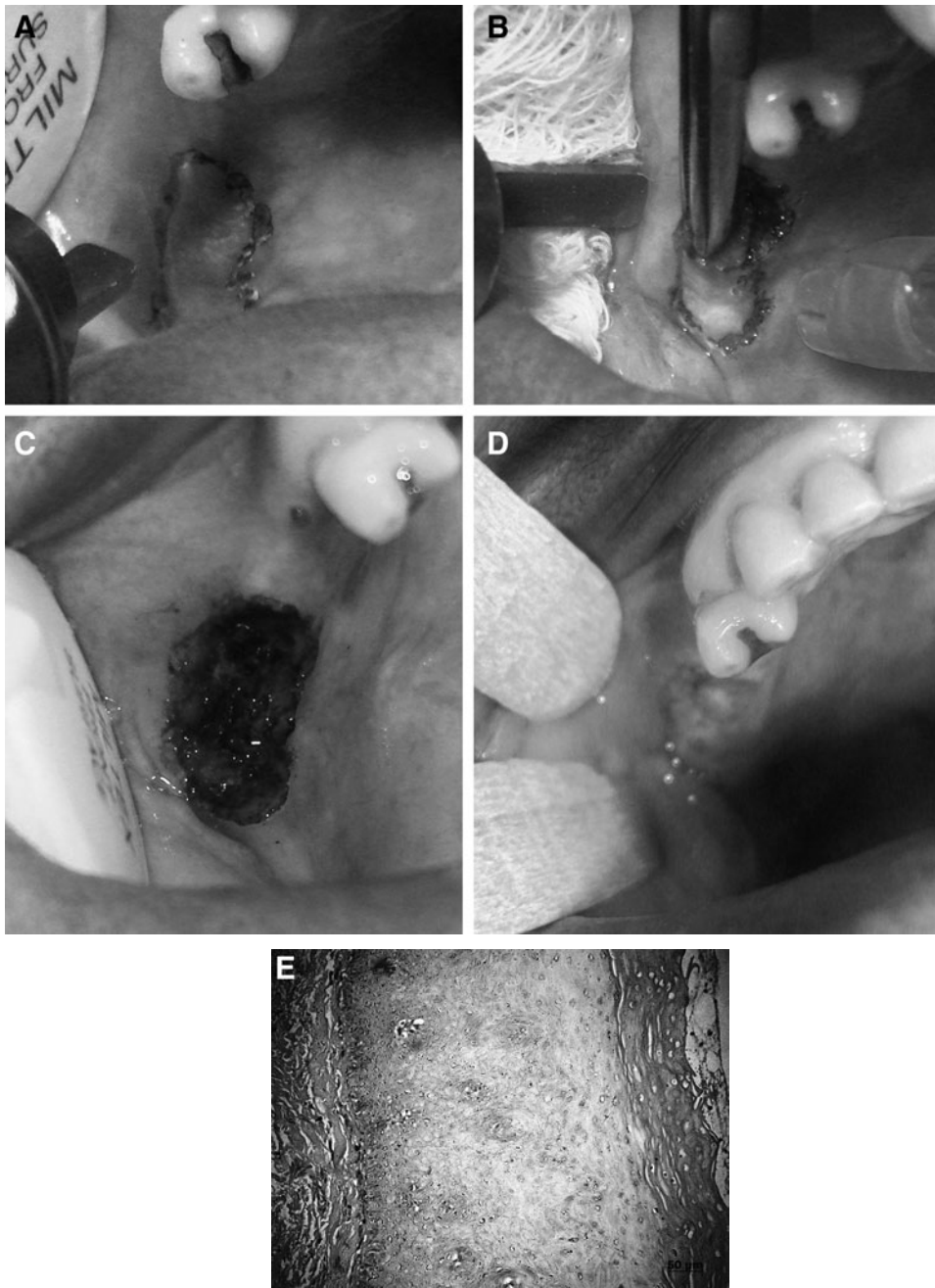


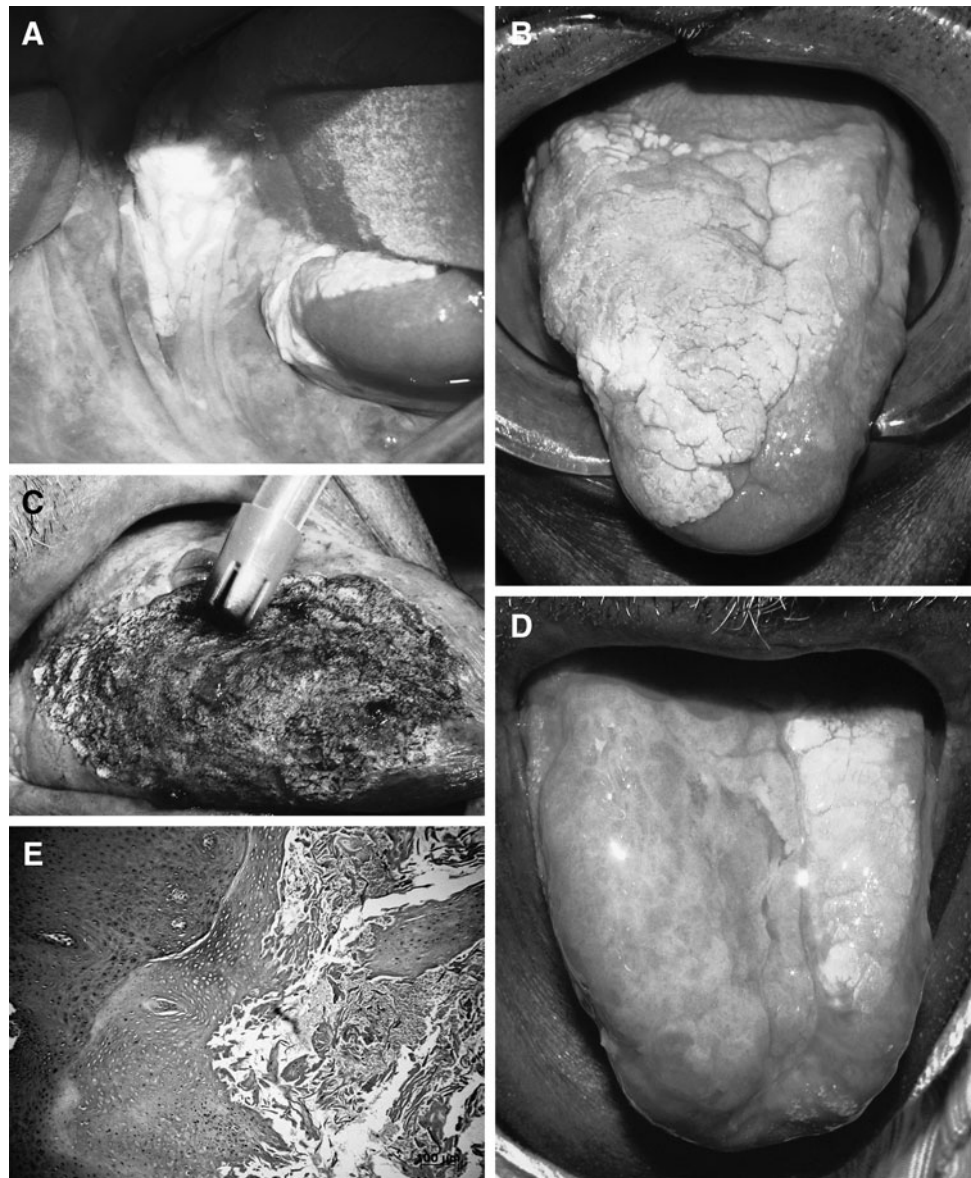
FIG. 1. (A) The lesion was initially delimited with the laser. (B) The lesion is carefully excised with the laser beam focused. (C) Immediate postoperative view showing the deposition of carbonized debris at the surface. (D) Aspect of the wound at day 7 after surgery showing that the area is not fully re-epithelialized at this time. (E) Histologic aspect of the lesion.

dysplasia. The patients were routinely prepared for surgery under local anesthesia with 2% xylocaine (Lidocaine). The surgical procedures were carried out at the Oral Maxillofacial Surgery of the School of Dentistry of the UFBA. All procedures were carried out with a CO₂ laser (Sharplan 20 C; Laser Industries, Tel Aviv, Israel, λ 10,600 nm, ϕ ~2 mm, CW/RSP, power output varied according to the lesion). The laser plume was aspirated with a high-potency vacuum-pump device. All safety procedures were observed during the surgical procedures. The beam was focused to delimit each lesion, and then the lesions were excised, and the removed specimens were sent for histopathologic examination to assess whether the surgical margins were clean. At the end of the surgery, the beam was used in a defocused manner to promote better hemostasis. Neither sutures nor dressings were used after the surgery. All patients received standard instructions for the postoperative period. No medication but mouthwashes was prescribed to all patients in the postoperative period.

Case 1. White woman, 61 years old, ex-smoker (40 years). The patient reported the use of blood pressure-control medication (captopril, 15 mg, once daily) and three previous cardiac surgeries. The patient also reported pain and burning sensation at the lesion site. The white patch was located at the upper right alveolar ridge extending to the sulcus. The lesion was excised as previously described by using 6 W of laser output. The wound was left to heal by secondary intention. The patient has been on follow-up for >1 year without clinical signs of relapse (Fig. 1A–E).

Case 2. White man, 86 years old, smoker (40 years), complained of pain and burning sensation on the dorsum and border of the tongue. The patient reported two previous surgical procedures (scalpel) to remove the lesions, followed by relapse of the lesions at varied times. The clinical examination showed a large white patch covering most of the tongue, extending down to the floor of the mouth. Incisional biopsies were carried out on different areas of the lesion

FIG. 2. (A) Extensive hyperkeratotic area affecting the tongue and buccal mucosa. (B) Hyperkeratotic area affecting most of the tongue. (C) Immediate postoperative aspect of the wound after vaporization. (D) Fifteen days after the surgery, the area showed the presence of a newly formed epithelium. (E) Histologic aspect of the lesion.



before the surgical removal. Before the surgery started, the whole tongue and floor of the mouth were painted with methylene blue solution. Because of the size of the lesion, it was removed with vaporization by using a defocused 8-W beam. After each irradiation, the MB solution was again applied to the area. The procedure was carried out until no staining was observed at the site. The wound was left to heal by secondary intention. The patient was followed up for

9 months without clinical signs of relapse (Fig. 2A–E). The patient later died of natural causes.

Case 3. White man, 44 years old, complained of burning sensation on the lips. The patient also reported hypertension and cardiopathy and that the burning sensation was present over the last 2-year period. The clinical examination showed large white patches on both cheeks. The lesion was delimited

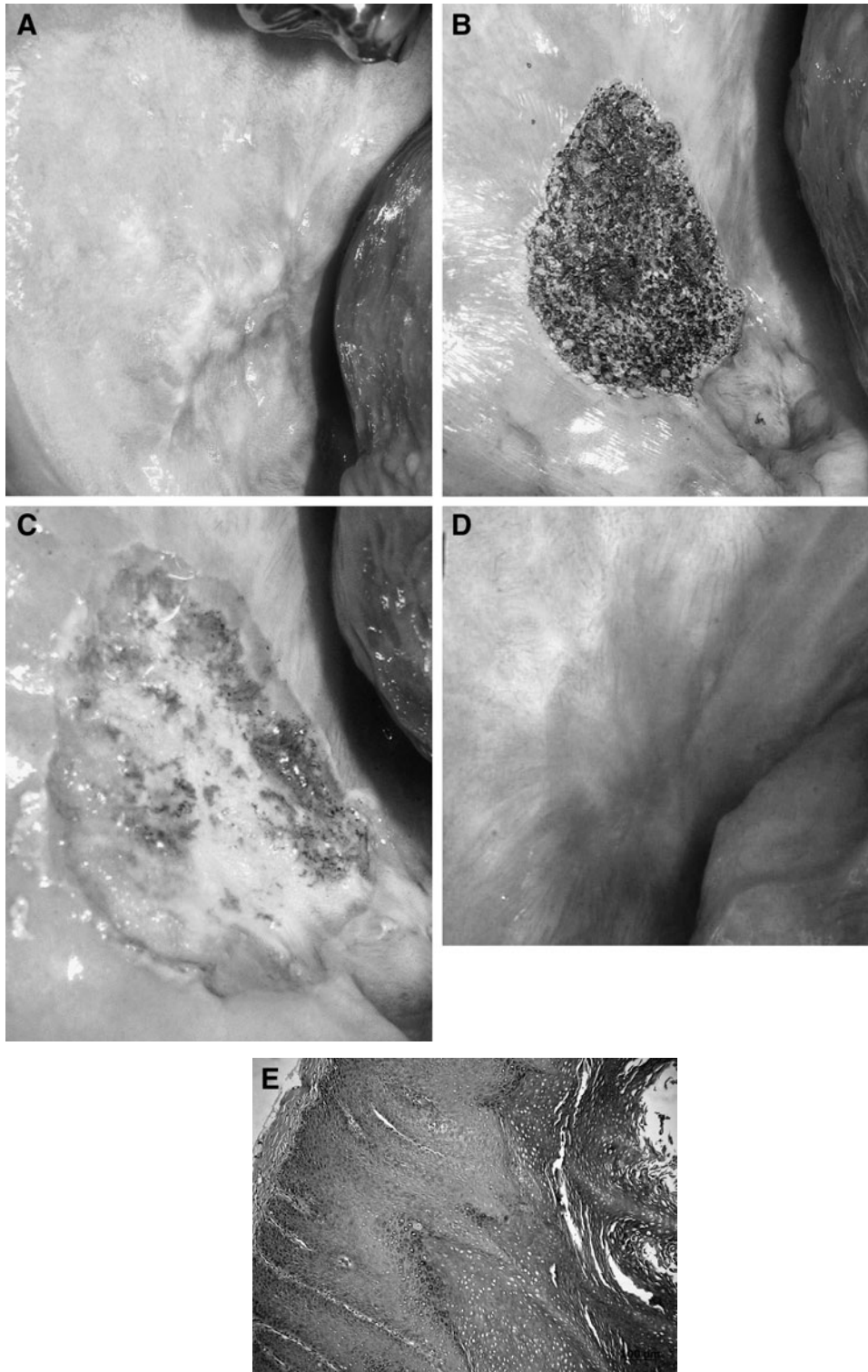


FIG. 3. (A) Initial aspect of the lesion on the cheek. (B) Immediate postoperative aspect. (C) Aspect of the lesion 7 days after surgery showing incomplete reepithelialization. (D) Aspect of the treated area 6 months after surgery. No sign of relapse was seen. (E) Histologic aspect of the lesion.

with the laser and excised properly by using 8 W. After the complete removal, the wounds were irradiated with the laser beam defocused for a better control of the bleeding and wound protection. The wound was left to heal by secondary intention. The patient has been followed up for >1 year without clinical signs of relapse (Fig. 3A–E).

Discussion

A clinical diagnosis of oral leukoplakia demands histologic typing of the lesion to determine its histologic pattern, which will dictate the therapeutics to be used. Some not visually aggressive lesions may have aggressive histologic changes. These lesions are mostly surgically removed, as no conclusive studies have been performed on the effectiveness of other methods.¹⁹

On the reported cases, we used medium-output power. The use of small-output power has been shown to cause less damage and to be effective on the removal of oral mucosal lesions. The less the thermal damage, the better the repair.¹⁰ The use of different outputs in this series is explained by the fact that the amount of keratosis observed on each case was different. With much keratosis present, the tissue was thicker. Thick tissues demand higher energy for an efficient cut and less accessory thermal damage.

Another subject for discussion is the technique used for the removal of the lesions. In two cases, we opted to excise the lesion, and in another, we decided to vaporize. Both methods are acceptable for the removal of lesions. On premalignant lesions, excision is always preferred to vaporization. However, some conditions may not allow the use of excision. One of these is the size of the lesion. In one of the reported cases, the lesioned area was extensive, the patient was very old, we had carried out biopsies on different areas of the lesion, and no severe dysplastic areas were detected.

The most interesting features of CO₂ laser surgery are local hemostasis, cauterization of nerve endings, and the sealing of lymphatics. Besides these features, the very high temperatures generated by the laser result in sterilization of the wound surface.^{18,20} We observed that no patient complained of pain or showed signs of infection in the postoperative period.

The sealing of the blood vessels results in a clean surgical field, allowing good visualization of the area and significantly reducing transoperative blood losses. Besides, the sealing of lymphatic vessels results in less edema.¹⁸ In this series, no post- or transoperative bleeding was observed. Another important aspect is the reduction of the surgical time and less stress for both patient and surgeon in the postoperative period.^{21,22}

The cauterization of the nerve endings is important, as it causes the formation of thermal neuromas at the endings of the nerves, causing less pain after surgery and avoiding the use of painkillers.²³ In the present series, no analgesic was prescribed, and the patients did not complain of pain in the postoperative period, even when extensive areas were removed.

The high temperatures caused by the laser beam on the tissue show the capability of sterilizing the site, reducing the risk of postsurgical infection and avoiding the use of antibiotic therapy.¹¹ We prescribed no antibiotic to any of the patients, and none showed signs of local infection during the follow-up.

Additionally, scar formation is minimized because of the sparse presence of myofibroblasts. This late feature is very important in the treatment of oral lesions, especially in areas in which scar tissue may cause impairment of function.^{11,18} It has been shown that the number of myofibroblasts on CO₂ laser wounds is 3 times fewer than those found in scalpel wounds.^{11,15,18} In these procedures, no sutures or dressings were used, and the healing occurred by secondary intention. These aspects also influenced on the cost of the procedure. In the present series, we observed no scarring of the operated-on area, even when large areas were removed.

Despite many advantages when compared with other surgical techniques, CO₂ laser surgery also has some disadvantages, such as a small increase of the healing time due to the additional thermal damage of the tissue. This thermal damage also is observed when the cautery is used. The use of the cautery causes 3 to 5 times more thermal damage depth than the CO₂ laser beam.²⁴ Conversely, the use of the CO₂ laser causes very limited thermal damage because of its high precision,^{15,22} causes no mechanical trauma to the tissue, as it is used mostly in a noncontact manner,^{10,22,23} and its manipulation in certain sites of the oral cavity is easier than that with the scalpel.²¹

The use laser surgery has been increasingly over the last 10-year period. However, the cost of the equipment and need for qualification in surgical specialties have limited the access of dentists to its benefits. The correct indication for using this surgical technique is both cost effective and reliable for the treatment of oral lesions, including premalignant ones. The use of the CO₂ laser does not reduce the risk of relapses of the lesion, but it is an easy-to-use technique and results in both a quick surgical procedure and a silent postoperative period and may be safely used in the dental practice.

Author Disclosure Statement

No competing financial interests exist.

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