CO_2 Lasers: A Treatment Modality for Benign Soft Tissue Tumor-like Lesions of the Oral Cavity – A Case Report and Literature Review

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Abstract: Benign soft tissue tumor-like lesions of the oral cavity are said to be any pathological growth that projects above the normal contours of the oral surface whose size may be large or small depending on the degree to which one or more of the components of inflammatory reactions and healing response are exaggerated. There are different mechanisms that lead to the development of a soft tissue tumor-like lesion in the oral cavity, the most common being reactive hyperplasia. These growths are subject to continual masticatory trauma and need to be excised early to prevent malignancy.

This article presents different clinical cases of benign reactive soft tissue tumor-like lesions of the oral cavity excised using CO_2 lasers, as they provide a bloodless field and also allow histological examination without distortion, resulting in a painless postoperative period and no collateral damage to adjacent tissues. Although scalpel surgery does allow for precise incision with minimal collateral damage, it also usually necessitates working in a bloody field and does little to decrease postoperative pain and swelling. Postsurgical healing after laser excision progressed well with no postoperative complications. Re-epithelialization was complete within 4 weeks. Thus, it is concluded that lasers can be considered as a revolutionary modality for the surgical excision of oral exophytic growths.

Keywords: benign soft tissue tumor, CO_2 laser.

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Soft tissue tumor-like lesions are said to be any pathological growth that projects above the normal contour of the oral surface.[1] Different mechanisms may lead to the development of a soft tissue tumor-like lesion in the oral cavity. The great majority of localized overgrowths of the oral mucosa are considered to be reactive rather than neoplastic in nature.[1] Many of these lesions can be identified as specific entities on the basis of their histopathological features and are divided into fibrous, vascular, and giant cell types.

Fibrous lesions occur in older age groups as compared to soft hemorrhagic lesions. Cooke[2] observed the greatest number of cases of fibrous hyperplasia in the fourth decade, while Buchner et al[3] found the

Fig 1a Growth in the maxillary anterior region.

Fig 1b Immediately postoperatively.

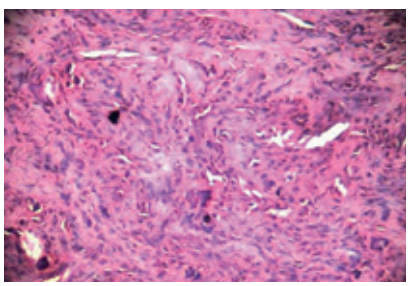

Fig 1c H&E stained slide confirming cemento-ossifying fibroma.

Fig 1d 4 weeks postoperatively.

majority of the cases occurred in the third, fourth, and fifth decade, and Kfir et al[4] found the majority of cases mainly in the second, third, and fourth decade. Pour et al[1] found the most frequently affected age was between 20 and 59 years old. These benign lesions usually had no age or gender predilection, although some previous studies reported a slightly higher incidence in females.[5-7] Pour et al[1] found that females were more commonly affected than males (61.9% vs 38.1%). These lesions are subject to continual masticatory trauma and need treatment to prevent further dysplastic changes. Erosion of the underlying cortical bone rarely occurs in fibrous lesions, but when seen, there should be a strong suspicion of malignancy and a biopsy should be taken.[8]

CASE REPORTS

The following cases of exophytic growths reported to the Department of Oral Medicine and Radiology, M. A. Rangoonwala Dental College, Pune. A thorough case history was taken, followed by appropriate examinations. Radiographically, none of them showed cortical erosion of the bone, but calcification was seen in the case of cemento-ossifying fibroma. Once the diagnosis was established, it was decided to treat the cases using CO_2 lasers, and patients' consent was obtained.

Case 1

An 18-year-old female presented with a chief complaint of a growth in the maxillary anterior region, existing for 3 to 4 months. On clinical examination, irregular growth was seen on both the labial and palatal gingiva in the maxillary anterior region about 1.0 x 0.5 cm in size (Fig 1a). The growth was red, firm, and not tender on palpation. Teeth in the area were vital. The lesion was excised using CO_2 laser (Fig 1b) and was histopathologically (Fig 1c) diagnosed as cemento-ossifying fibroma.

Case 2

A 34-year-old female reported a chief complaint of growth in the mandibular anterior region, existing for 2 to 3 months. On clinical examination, a reddish pink, shiny gingival growth was seen on the lingual side of the lower anterior region (Fig 2a). The size was ap-

Fig 2a Growth in the mandibular anterior lingual region.

Fig 2b Immediately postoperatively.

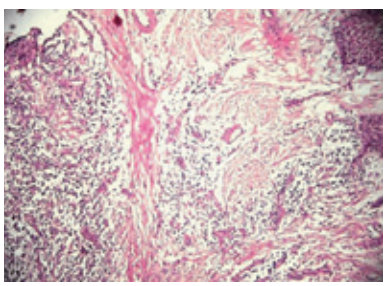

Fig 2c H&E stained slide confirming pyogenic granuloma.

Fig 2d 4 weeks postoperatively.

proximately 2.8 x 2 cm. Growth was soft, sessile, highly vascular, and bled readily on palpation involving the interdental papilla. The lesion was excised using CO_2 laser (Fig 2b) and was histopathologically (Fig 2c) diagnosed as pyogenic granuloma.

Case 3

A 19-year-old male presented with a chief complaint of a growth in the maxillary anterior region, existing for 3 to 4 months. On clinical examination, the growth extended from the mesial surface of the maxillary left lateral incisor to the mesial surface of the maxillary left canine region and also interdentally (Fig 3a) over the palatal aspect of the lateral incisor region (Fig 3b). It was irregular in shape, soft, highly vascular, and the size was approximately 1.5 x 2 cm. Teeth in the area were vital. The lesion was excised using CO_2 laser (Fig 3c) and was histopathologically (Fig 3d) diagnosed as pyogenic granuloma.

Case 4

A 32-year-old female reported with a chief complaint of a growth on the left buccal mucosa for the past 5 to 6 months. On clinical examination, an ovoid growth was seen on the left buccal mucosa about 1.2 x 1 cm in size, just opposite teeth 36 and 37 with well-defined borders (Fig 4a). The growth appeared to be sessile with smooth contours and firm in consistency, and was not associated with bleeding. The lesion was excised using CO_2 laser (Fig 4b) and was histopathologically (Fig 4c) diagnosed as traumatic fibroma.

Case 5

A 26-year-old male reported with a chief complaint of a growth on the right buccal mucosa for the past 4 to 5 months. On clinical examination, an ovoid growth was seen on the right buccal mucosa about 1.0 x 1.0 cm in size just opposite teeth 47 and 48 with well-defined borders (Fig 5a). The growth appeared to be sessile with smooth contours and firm in consistency, and was not associated with bleeding. The lesion was excised using CO_2 laser (Fig 5b) and was histopathologically (Fig 5c) diagnosed as traumatic fibroma.

Fig 3a Growth extending labially from the mesial surface of the maxillary left lateral incisor to the mesial surface of the maxillary left canine region and also interdentally.

Fig 3b Growth extended also on the palatal aspect of the lateral incisor.

Fig 3c Immediately postoperatively.

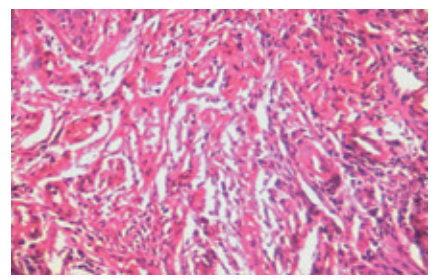

Fig 3d H&E stained slide confirming pyogenic granuloma.

Fig 3e 4 weeks postoperatively labially.

Fig 3f 4 weeks postoperatively palatally.

All the above cases had satisfactory healing and no complications (Figs 1d, 2d, 3e, 3f, 4d, 5d). None of them showed any malignancy. No case has shown any recurrence or any kind of scar formation. All the above cases were under observation for one year.

DISCUSSION

The term exophytic means any pathological growth that projects above the normal contours of the oral surface.[9] The size of exophytic growth may be large or small depending on the degree to which one or more of the components of inflammatory reactions and healing response are exaggerated. The major etiological factor of these lesions is generally assumed to be chronic trauma from poorly fitting dentures, calculus,

Fig 4a Growth on the left buccal mucosa.

Fig 4b Immediately postoperatively.

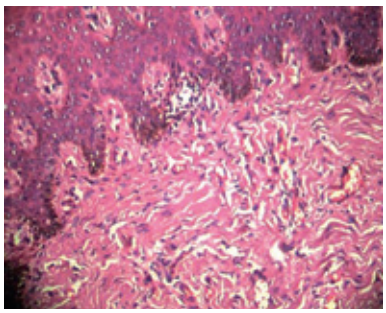

Fig 4c H&E stained slide confirming fibroma.

Fig 4d 4 weeks postoperatively.

Fig 5a Ovoid growth on the right buccal mucosa.

Fig 5b Immediately postoperatively.

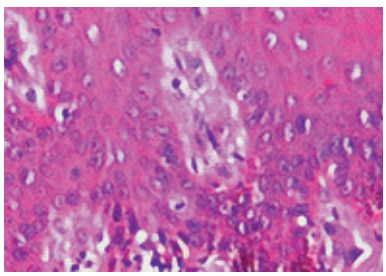

Fig 5c H&E stained slide confirming fibroma.

Fig 5d 4 weeks postoperatively.

overhanging dental restoration, acute or chronic tissue injury from biting, or fractured teeth. With some lesions, the levels of circulating hormones play a role. The majority of lesions occur peripherally on the oral mucosal surface, where irritants are quite common and therefore are subject to continual masticatory trauma.[8] The clinical aspect appears to be swollen, distended, ulcerated, and red to purple in color due to dilated blood vessels. They exhibit acute and chronic inflammatory exudates and localized abscesses.

The soft tissue tumor-like growths in the oral cavity have been widely documented and include irritation fibroma, epulis fissuratum, peripheral ossifying fibroma, squamous papiloma, myxofibroma, pyogenic granuloma, pregnancy tumor, epulis granulomatosum and peripheral giant cell granuloma.[10,11] The prevalence of these lesions has been determined in different studies around the world. Cooke et al[2] observed that irritation fibroma was more common in females. Also, these researchers found no marked difference in location of irritation fibroma between the maxilla and mandible. Pyogenic granuloma is a common tumor-like growth of the oral cavity that is considered to be non-neoplastic in nature.[12] They are commonly seen on the gingiva, where they are presumably caused by calculus or foreign material within the gingival crevice.[13] Peripheral giant cell granuloma (PGCG) is a relatively common tumor-like growth of the oral cavity and accounts for 7% of all benign tumors of the jaw.[14] In their study on 13 cases of PGCG, Gandara et al[15] found 8 lesions to be located in the maxilla. Cemento-ossifying fibroma is a benign tumor that commonly occurs during the third and fourth decade of life, more often in women than men. Clinically and microscopically, it is similiar to ossifying fibroma.[13] All of our cases were found in patients between 18 and 35 years of age and majority of lesions occur peripherally on the oral mucosal surface, where irritants were quite common and were subject to continual masticatory trauma.

The soft hemorrhagic lesions are highly vascular and hemorrhage is a prominent clinical and histological feature. Fibrous inflammatory hyperplasias may occur on any surface of the oral mucous membrane as either pedunculated or sessile growth.[1] An excisional biopsy is indicated except when the procedure shows marked deformity. In such cases, incisional biopsy is mandatory to establish the diagnosis. If the chronic irritant is eliminated when the lesion is excised, the majority of soft tissue growths will not recur, thus confirming the benign nature of the lesion.[8]

Lasers are an ideal treatment modality for benign oral exophytic growths for several reasons, as they provide a bloodless field with minimal or no need for anesthesia. They also allow histological examination without distortion and provide a precise and controlled cut, enable a painless postoperative period, and cause no collateral damage to adjacent tissues.[16] Different laser media, because of their particular atomic, molecular, or ionic structure and energy levels, emit light of characteristic wavelengths. The different type of surgical lasers used in dentistry may be classified as [17,18]

- CO_2 lasers – medium: CO_2 gas
- Nd:YAG lasers – medium: yttrium-aluminum-garnet crystal doped with neodymium
- Argon lasers – medium: argon gas
- He-Ne lasers – medium: helium and neon
- Diode lasers

Four basic interactions of carbon dioxide laser with tissue are absorption, scattering, reflection and transmission.[19] The lasers also exert photochemical and photoacoustic effects on the tissuses.

The CO_2 laser is the workhorse of contemporary laser surgery and emits a coherent light beam in the mid-IR region at 10,600 nm, which is near a major spectroscopic absorption peak for water. Because the target chromophore is water and all tissues contain water, all tissues have the capability of interacting with the CO_2 beam. These lasers have a unique application in the evaporative ablation (photovaporisation) of superficial mucosal disease of the oral cavity and also function as a precise thermal knife for the excision of soft tissue lesions affecting mucosa or skin. The CO_2 lasers produce results either superior to or not achievable with a scalpel or electrocautery. The laser offers a number of advantages when used as an excisional instrument, particularly for small to moderately sized mucosal, submucosal and cutaneous lesions.[20] The excisional depth can be easily controlled. A good specimen can be obtained with little damage to the margins, although one must include 1 to 2 mm of marginal tissue more than would otherwise be adequate with a conventional scalpel, to allow for tissue lost by vaporization or damaged by coagulation necrosis. An outline is rapidly made using repeated single pulses (175 mJ/pulse, 0.2 mm spot at 5 W) to circumscribe the desired target tissue. CO_2 radiation is rapidly absorbed and dissipated, having a minimum depth of penetration 0.02 mm. This results in a system that produces a precisely accurate effect.[19] The noncontact technique with a free beam laser theoretically offers the advantage of limiting transplantation of malignant or infected

cells, because in the process of thermovaporization and thermocoagulation, the heat produced sterilizes the surgical field. Re-epithelialization is achieved with minimal wound contraction.[21] It reduces the amount of intra-operative bleeding compared to conventional techniques, thus eliminating the need for suturing the mucosa. Lasers produce a sterile surgical field based on instant vaporization of tissue and adjacent vascular and lymphatic sealing. This helps in prevention of seeding of the dysplastic cells in adjacent soft tissue.[22, 23] The CO_2 laser prevents intra- and postoperative complications and the recurrence rate is low.

CONCLUSION

In an era when the medical consumer makes decisions based on the efficacy of treatment by using criteria such as pain and length of operative time, CO_2 laser has emerged as a surgical tool that can fulfill these criteria for such procedures. Although scalpel surgery does allow for precise incision with minimal collateral damage, it also usually necessitates working in a bloody field and does little to decrease postoperative pain and swelling. The use of the carbon dioxide laser presents several advantages over conventional techniques when treating soft-tissue lesions. Also, early detection and excision of these lesions is important to minimize potiential dentoalveolar complication.

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