Surgical Diode Laser Excision for Peripheral Cemento-Ossifying Fibroma: A Case Report and Literature Review

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ABSTRACT: Peripheral cemento-ossifying fibroma is a rare osteogenic neoplasm that ordinarily presents as an epulis-like growth. A rare case of peripheral cemento-ossifying fibroma of the maxilla, 3.0 cm mesiodistally and 2.5 cm occluso-gingivally in diameter and causing difficulty in eating and speech, is reported. The choice of treatment should always be founded on the basic principles of pathology and sound surgical judgment. The ideal modality would allow a bloodless field, require no anesthesia, allow histological examination without distortion, provide a precise and controlled cut, enable a painless postoperative period, and cause 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. Diode lasers have several distinct advantages over the other modalities for the removal of benign lesions. Here we present a case of peripheral cemento-ossifying fibroma surgically excised using diode laser.

Keywords: peripheral cemento-ossifying fibroma, diode laser.

J Oral Laser Applications 2008; 8: 43-49.

Ossifying fibroma occurs mostly in craniofacial bones and is generally categorized into two types, central and peripheral ossifying fibroma (POF).[19] The peripheral type shows a contiguous relationship with the periodontal ligament (PDL), occurring solely on the soft tissues overlying the alveolar process. On the other hand, the central type arises from the endosteum or the PDL adjacent to the root apex and expands from the medullary cavity of the bone. Despite confusing terminology, peripheral ossifying fibroma is not the peripheral counterpart of the central ossifying fibroma of the mandible and maxilla,[4] but instead is a reactive gingival lesion known under the the generic name of epulis. Some authors have also called it calcifying fibroblastic granuloma, or peripheral fibroma with calcification.[3,14]

The POF is a common gingival growth usually arising from the interdental papilla. There is a gender difference, with 66% of the disease occurring in females. The prevalence of peripheral ossifying fibromas is highest around 10 to 19 years of age. The peak incidence of POF is between the second and third decades. It appears only on the gingiva, more often on the maxilla rather than the mandible, and is frequently found in the area around incisors and canines. The adjacent teeth are usually not affected.[11] POF is typically a solitary, slowly growing nodular mass that is either sessile or pedunculated with the size usually being less than 2

cm, but patients with lesions of 6 cm and 9 cm diameter have also been reported.[2-16]

The surface mucosa is usually smooth or ulcerated, with the color ranging from pink to red. Weeks or months may pass before it is seen and diagnosed. A lesion may vary somewhat in size over time, depending on the amount of superficial inflammation and edema. While this tumor is typically diagnosed in teenagers and young adults, it may occur at any age, especially in individuals with poor oral hygiene. Radiographs may show irregular, scattered radiopacities in the lesion.[16]

The etiology and pathogenesis of POF is unclear. Peripheral ossifying fibroma (POF) is thought to arise from cells in the periodontal ligament. Trauma or local irritation such as dental plaque, calculus, ill-fitting dental appliances, and poor-quality dental restorations are all known to precipitate the development of POF.[9,13,16] Clinical differential diagnosis includes peripheral giant cell granuloma, pyogenic granuloma, pregnancy tumor, fibroma, and peripheral odontogenic fibroma.

Histologically, the peripheral ossifying fibromas appear as a combination of a mineralized product and fibrous proliferation. The mineralized portion may be bone, cementum-like, or dystrophic calcifications. Additionally, highly developed bone or cementum is more likely to be present when the peripheral ossifying fibroma has existed for a longer period of time.[11] The recurrence rate of POF is high for a benign, reactive growth, varying from 7% to 45%.[3,5,16] Thus, total excision is the preferred management of POF.

Diode lasers have a solid active medium; it is a solid-state semiconductor laser that uses some combination of aluminum, gallium, and arsenide to change electric energy into light energy. The machine delivers laser energy fiberoptically in continuous wave and gated pulse modes, ordinarily used in contact with the tissue. The wavelength range puts this laser into the invisible nonionizing infrared radiation portion of the electromagnetic spectrum. These lasers are relatively poorly absorbed by the tooth structure, so that soft tissue surgery can be performed safely in close proximity to enamel, dentin, and cementum. The diode is an excellent soft tissue surgical laser indicated for cutting and coagulating gingiva and mucosa. The chief advantage is use of a smaller size instrument. The units are portable and compact, easily moved with minimum setup time, and are the lowest priced lasers currently available.[17] There are various diode lasers available in the market. The laser we used was the Sunny Surgical 980-nm Laser, Class II b (Mikro Scientific Instruments; New Delhi, India).

Advantages of the 980-nm wavelength over other laser wavelengths

There are other lasers, such as erbium (2940 nm), CO_2 (10,600 nm), or holmium (2100 nm) that have very high absorption in water, making them very effective in cutting. However, these do not provide good coagulation, limiting their use to fewer applications. While erbium is mostly used in skin resurfacing procedures, holmium is most useful for lithotripsy.

On the other hand, there is a range of lasers that have good coagulating abilities, eg, Nd:YAG (1064 nm), diode lasers (810 to 830 nm), and KTP (532 nm) laser that are absorbed 3 to 10 times more in water compared to the Sunny diode laser (980 nm), making them less efficient in incisions/excisions. Further, these lasers require specially shaped fiber tips to cut, and cause considerable heat build up in the tissue, producing deeper damage and a larger necrotic three-dimensional zone.

The 980-nm Sunny surgical laser has the right blend of absorption in water as well as hemoglobin that makes it ideal and efficient for both cutting and coagulation. There is also no need for special tipped fibers.[21]

Advantages of the 980 nm wavelength for soft tissue procedures

A laser's tissue effect is determined by its wavelength. Depending upon this tissue effect, various applications in surgical practice is determined. Whenever a laser beam is incident on tissue, it will be absorbed, reflected, or transmitted to varying degrees, which will ultimately determine whether the desired objective of using laser can be achieved. Body tissue mainly comprises water, proteins, and several chromophores such as melanin, hemoglobin, and oxyhemoglobin. Each laser wavelength acts on these in a different way.

For example, for a surgical laser to be highly effective, the laser wavelength must be highly absorbed in water to ablate the tissue efficiently. A good absorption in hemoglobin is imperative for coagulation and successful hemostasis.

Considering the absorption characteristics of water and hemoglobin together, 980 nm is the ideal wavelength for both cutting and coagulating soft tissue, and is thus ideally suited for most surgical procedures.[21]

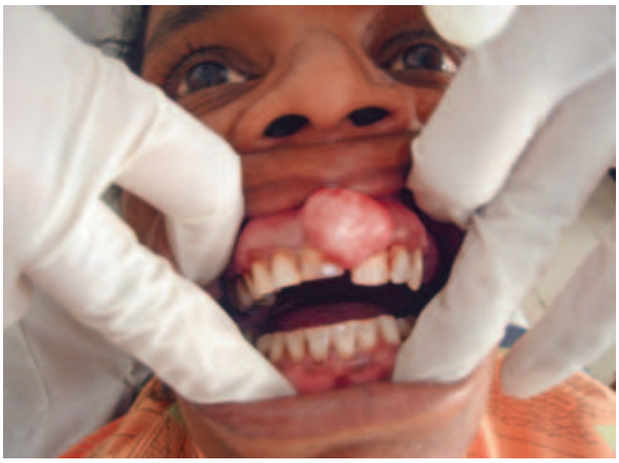

Fig 1 A lesion involving the interdental papilla and the attached gingiva, measuring approximately 3 x 2.5 cm. The growth is pedunculated with well-defined borders and firm in consistency.

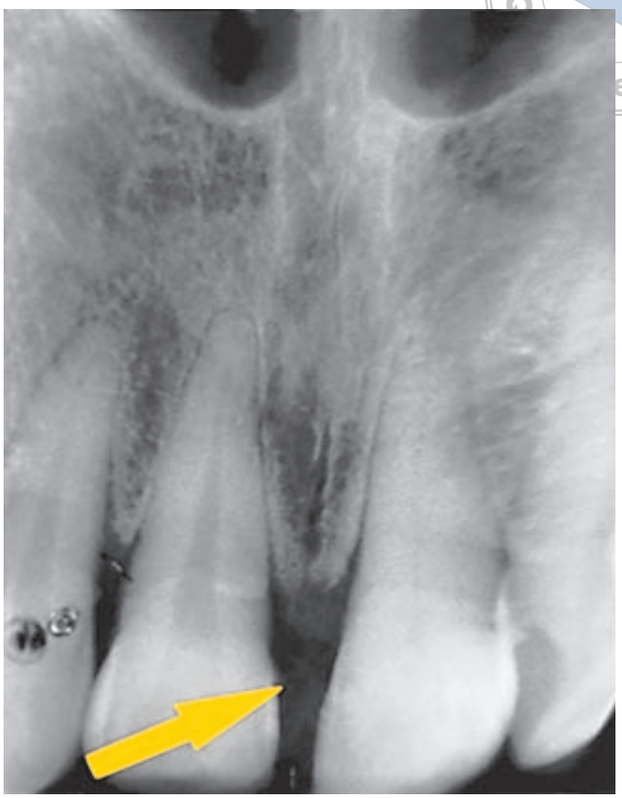

Fig 2 An IOPA radiograph with radiopacity indicated by an arrow.

CASE REPORT

A 40-year-old female patient reported to the Department of Oral Medicine, Diagnosis and Radiology of M.A. Rangoonwala College Of Dental Sciences, Pune with a chief complaint of swelling in the upper anterior region for the past 5 or 6 months. The patient also gave a past history of habitual mishri (roasted tobacco) application 2 to 3 times a day and also of chewing gutkha 7 to 8 times for the past 4 years. No other relevant history could be recorded.

On examination, there was growth in the maxillary anterior gingiva of the patient's oral cavity (Fig 1). The patient stated that the lesion (growth) had been present for approximately 5 or 6 months. Initially the lesion was only a pinpoint, but slowly it increased in size. The lesion measured approximately 3.0 cm mesiodistally and 2.5 cm occluso-gingivally. The growth was pedunculated with well-defined borders and firm in consistency. The lesion was involving the interdental papilla and the attached gingiva. There was no history of pain, pus discharge, or bleeding. The lesion was asymptomatic with the patient's only concern of bulging of the lesion from her face and interference with mastication. Oral hygiene was poor.

A radiograph was taken from the maxillary anterior region which showed radiopacity between the maxillary central incisors (Fig 2). A provisional diagnosis of pyogenic granuloma was made, while the differential diagnoses included peripheral giant cell granuloma, pregnancy tumor, and peripheral cemento-ossifying fibroma.

The patient was referred for routine blood investigations. All findings were within normal limits with the hemoglobin level of 11.2 gm%.

Considering the type and extent of the lesion, the patient was posted for laser surgery using diode laser. The clinician's safety was ensured by using protective clear eye glasses. The area surrounding the lesion was covered with wet gauze. After sufficient local anesthesia was administered, the outline of the lesion was made around 0.5 to 1.0 mm beyond its clinical extent (to compensate for the zone of thermal coagulation) in a slow and controlled fashion, using radiant energy of wavelength 980 nm at 5 W with the laser beam channeled into a 400-µm optical fiber to deliver laser en-

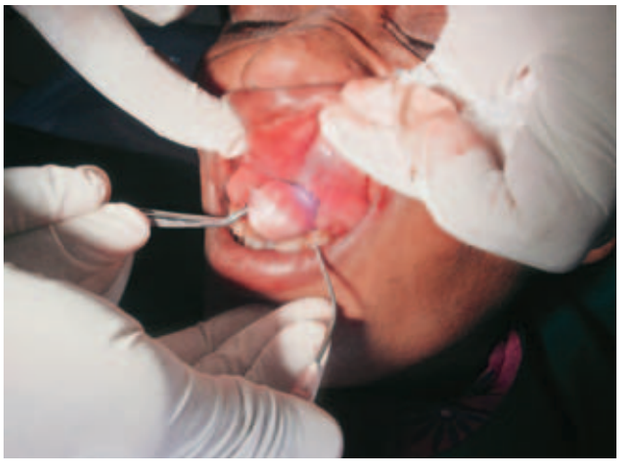

Fig 3 The outline of the lesion is made around 0.5 to 1.0 mm beyond its clinical extent in a slow and controlled fashion using radiant energy of wavelength 980 nm at 5 W, with the laser beam channeled into a 400-µm optical fiber to deliver laser energy to tissues.

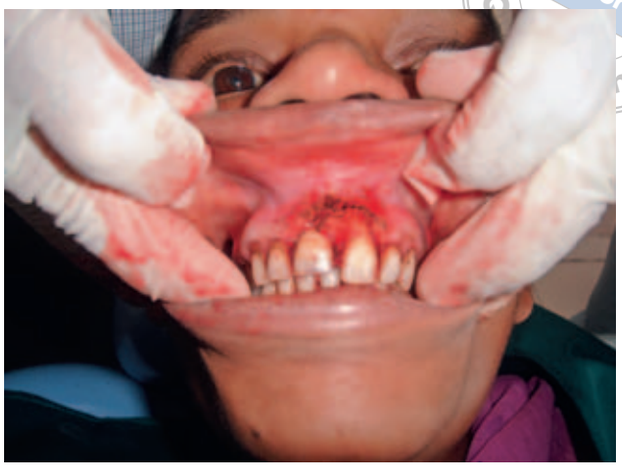

Fig 4 Immediate postoperative picture of exposed bone.

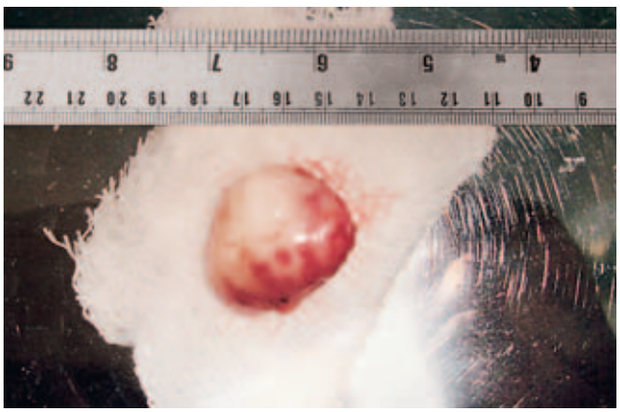

Fig 5 Excised specimen measuring approx. 3.0 x 2.5 cm.

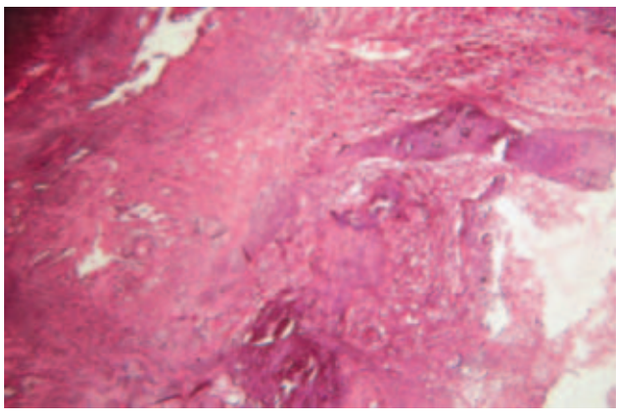

Fig 6 H & E stained slide showing parakeratinized stratified squamous epithelium. The underlying connective tissue is fibrocellular with central areas of ossification and calcification. Mild inflammatory infiltrate and extravasated blood element is seen.

ergy to tissues. Then excision was carried out with a desired depth of 2 to 3 mm below the epithelial surface (Fig 3). The procedure was painless and well tolerated by the patient. The whole procedure was completed within a period of 20 min (Figs 4 and 5).

The patient was discharged after ensuring complete hemostasis. A periodontal dressing (Coe-pak Periodontal Dressing, GC America; Alsip, IL, USA) was applied on the exposed bone surface. Analgesics were given as and when required to control postoperative pain. The patient was recalled after a period of 7 days.

The specimen was sent for histopathological examination. The H & E stained slide showed parakeratinized stratified squamous epithelium. The underlying connective tissue was fibrocellular with central areas of ossification and calcification. Mild inflammatory infiltrate and extravasated blood element was seen (Fig 6). Thus, a final diagnosis of cemento-ossifying fibroma was made.

The patient was reviewed regularly for 3 months (day 21 and after 3 months; Figs 7 and 8); no postoperative complications or recurrence of the lesion were observed. During the follow-up visits, the patient un-

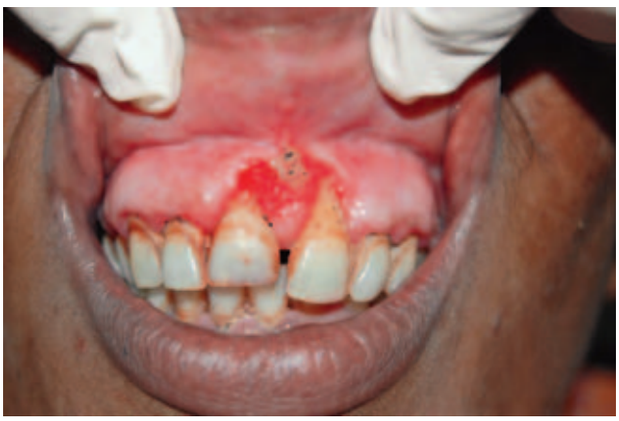

Fig 7 Twenty-one-day follow-up photograph showing mildly inflamed gingival tissues. There were signs of healing in some areas with pale pink granulation tissue, although the presence of sequestered bone was seen.

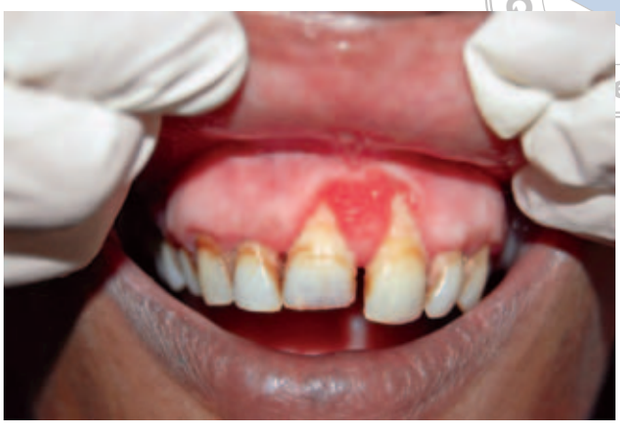

Fig 8 Three-month follow-up photograph after regular scaling and root planing. Patient showed complete healing and resolution of the lesion.

derwent scaling and root planing. There was re-establishment of the gingival architecture with resultant clinically normal gingival tissues.

DISCUSSION

The commonly used synonyms for POF include peripheral cementifying fibroma, peripheral fibroma with cementogenesis, peripheral fibroma with osteogenesis, peripheral fibroma with calcification, calcifying or ossifying fibrous epulis, and calcifying fibroblastic granuloma.[3-14] Though the etiopathogenesis of POF is uncertain, an origin from cells of the periodontal ligament has been suggested.[1-7] The reasons for considering a periodontal ligament origin for POF include: exclusive occurrence of POF in the gingiva (interdental papilla), the proximity of gingiva to the periodontal ligament, the presence of oxytalan fibers within the mineralized matrix of some lesions, the age distribution which is inversely related to the number of lost permanent teeth, and the fibrocellular response in POF which is similar to other reactive gingival lesions of periodontal ligament origin.[7-15] Classically, local factors such as trauma, or irritants such as dental plaque, calculus, microorganisms, masticatory forces, ill-fitting dentures, and poor quality restorations are implicated in POF induction or progression. In addition, factors such as a high female predilection (approximately 3:2) and a peak occurrence in the second decade of life suggest hormonal influences.[14] Most often, it is located in the gingival papilla between adjacent teeth. A peripheral cemento-ossifying fibroma manifests as a sessile or pedunculated mass and may occur in persons of any age, but is most often seen in persons aged 10 to 20 years. The maxillary gingiva is involved more often than the mandibular gingiva; usually, the anterior region is affected. Surface ulceration is common. Mobility and/or migration of adjacent teeth are occasionally observed.[3,6,9]

Radiographic changes are not always seen with POF; occasionally foci of radiopaque material may be seen, particularly in larger lesions or lesions with overt mineralization.[5-8] In children, POF has been noted to cause alveolar erosion, displacement of teeth, and a delay in tooth eruption.[5] POF can produce a mild cupping defect of adjacent alveolar bone.

The definitive diagnosis of POF is made by histopathological evaluation of biopsy specimens. The following features are usually observed during microscopic evaluation: 1) benign fibrous connective tissue with varying content of fibroblasts, myofibroblasts and collagen, 2) sparse to profuse endothelial proliferation, 3) mineralized material which may represent mature, lamellar or woven osteoid, cementum-like material, or dystrophic calcifications. Acute or chronic inflammatory cells can also be identified in lesions.[20]

The clinical differential diagnosis of a peripheral cemento-ossifying fibroma includes peripheral odontogenic fibroma, pyogenic granuloma, peripheral giant cell granuloma, giant cell fibroma, inflammatory gingival hyperplasia, pregnancy tumor, and fibroma.

Treatment consists of excision down to the periosteum and the elimination of any local irritants. Care must be taken to maintain or re-establish acceptable gingival architecture and periodontal integrity. A recurrence rate of 7% to 45% is reported. Even in cases complicated by recurrence, re-excision is generally successful, with the retention of the associated teeth.[3,6,9]

POF should be distinguished from peripheral odontogenic fibroma. Unlike POF, peripheral odontogenic fibroma is a real tumorous condition and has an odontogenic epithelium and dysplastic dentin. A peripheral odontogenic fibroma is a rather uncommon neoplasm that is believed to arise from odontogenic epithelial rests in the periodontal ligament or the attached gingiva itself. The entity, formerly confused with peripheral cemento-ossifying fibroma, is considered to be the extra-osseous counterpart of the central odontogenic fibroma as defined by the World Health Organization. A peripheral odontogenic fibroma manifests as a firm, slowly growing, sessile, and nodular growth of the gingiva, most often on the mandibular buccal or labial aspect. It occurs in persons of a wide age range and affects both sexes equally. Microscopically, the tumor consists of an unencapsulated mass of interwoven cellular fibrous connective tissue that contains scattered nests or strands of odontogenic epithelium. Recurrence is rare.[9]

POFs can be clinically misdiagnosed as a pyogenic granuloma at an early stage. Pyogenic granulomas are highly vascular nontumorous conditions involving gingival tissues, with a tendency to hemorrhage. Pyogenic granulomas are usually very small (from a few millimeters to 1 cm) and only occasionally show calcification.

Peripheral giant cell granuloma is set apart from other inflammatory hyperplastic lesions by the presence of multinucleated giant cells. The lesion is polypoid or nodular,[7-12] located on the gingiva or edentulous alveolar ridge, rubbery to soft on palpation, more common in the mandible,[10-12] in the premolar or molar regions. Although all ages may be affected, there is a relative predilection for 30- to 70-year-olds.[12] There may be cupping type of resorption in the underlying bone.

A giant cell fibroma appears as an asymptomatic sessile or pedunculated nodule that is smaller than 1 cm in diameter. Often, it has a bosselated or somewhat papillary surface. Most cases are diagnosed in persons aged 10 to 30 years. No sex predilection has been reported. The most common sites are the mandibular gingiva, followed by the maxillary gingiva, the tongue, and the palate.[6] Microscopically, a giant cell fibroma is an unencapsulated mass of fibrous connective tissue that contains numerous characteristic large, plump, spindle-shaped and stellate fibroblasts, some of which are multinucleated.

The diode laser has been approved by the Food and Drug Administration (FDA) for virtually all of the soft tissue procedures performed by the Nd:YAG and CO_2 lasers. These procedures include soft tissue curettage, incisions, pocket debridement and ablative excisions. Herbert I. Bader said that the diode laser seems to be as versatile and predictable clinically as CO_2 and Nd:YAG lasers. The soft laser effect of the low-powered diode laser may be a useful adjunct in reducing gingival inflammation[18] and providing analgesic effects.[22] The Sunny surgical diode laser was used, as it induces excellent hemostasis while ensuring superior cutting capabilities, reduced pain, and edema. It also provides fast recovery, and the pattern of healing is predictive. The chief advantage of the diode lasers is use of a smaller size instrument.

CONCLUSION

POF has always been described as a solitary, slowly growing nodular mass treated by simple excision. The case described here is unique because it is the first time a POF has been treated with laser excision. Unfortunately, little is known with respect to the pathogenesis and molecular or genetic profile of these lesions. Tissue specimens acquired from the patient after future excisional biopsy will be used to develop in vitro cell cultures in order to serve as an experimental model so that we may begin to characterize the gene expression patterns linked to the pathogenesis of POF. Further, since the mineralized component of POF is generally poorly understood,[20] it will be interesting to investigate the mineralization patterns of these lesions and compare that to known hard-tissue forming cells, genes, and molecular signals that are classically associated with mineralization or ossification. It may be necessary to treat a series of cases with laser excision so that the recurrence pattern of these lesions can be established, thus confirming the efficacy of diode laser surgery. A long-term follow-up is also required, which may be helpful in the future to recognize the late complications of diode laser surgery of benign oral soft tissue masses.

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