Pyogenic granuloma refers to the focal reactive growth of fibrovascular tissue or granulation with notable endothelial proliferation.\(^1,2\) The growth is benign and slow to evolve and it appears on the skin and mucous membranes. It may be associated with pregnancy.\(^3,4\)

Although pyogenic granuloma in the oral cavity may appear at any age, 60% of cases are observed between the ages of ten and forty; incidence peaks during the third decade of life and women are twice as likely to be affected.\(^5\)

It is known to be a reactive, localized, exaggerated hyperplastic reaction of the connective tissue caused by small wounds or injuries and poor oral hygiene.\(^6\) It mostly occurs on attached gingiva, most commonly the maxillary anterior labial gingiva; other sites include the lip, tongue, buccal mucosa.\(^1,4,5,7\)

It generally appears as a solitary pedunculated or sessile nodule 0.5 to 1.0 cm in diameter with a smooth to irregular red surface. It is usually ulcerated, soft, friable, non-tender, of limited growth potential, and painless.\(^4,5\) It is a highly vascularized lesion that is ulcerated in 10% of cases and prone to bleed profusely in the event of any injury, however mild this may be. Indeed, bleeding is the main reason for medical consultation in 59% of cases. Other reasons include painless inflammation, a stinging sensation, and an unpleasant smell and/or taste.\(^8\)

Recently, immunohistochemical techniques have detected factors related to inflammatory angiogenesis (Tie-2, angiopoietin-1, angiopoietin-2, ephrin-B2 and Eph-B4) in pyogenic granuloma.\(^9\)

Differential diagnosis must be made with respect to irritation fibroma, peripheral ossifying fibroma, peripheral giant cell granuloma, soft tissue abscess, and hemangioma.\(^1,4\) These lesions must be completely removed, but may reoccur if treatment is inadequate. In addition to removing the lesion, the predisposing irritant agents must also be eliminated.\(^1,5,10\)

Laser is an acronym for light amplification by stimulated emission of radiation, and is an organized and coherent form of electromagnetic energy. The use of lasers offers pediatric dentists a new tool that can...
change the way in which existing treatments are performed, or serve to complement them. Modern or updated pediatric dentistry needs to take advantage of all new advances in order to improve the standard of care offered to children and adolescents.11

Different types of lasers are available and the properties of each type make them suitable for different tissues and procedures. Lasers containing erbium are the type most frequently used by pediatric dentists due to their versatility: they can be used in both hard and soft tissues.12,13

An Er,Cr:YSGG laser (Biolase Technology; San Clemente, CA, USA) was used for the cases presented in this paper. It is a laser-powered hydrokinetic system (LPHKS) that produces a wavelength absorbed maximally in water molecules and targets the hydroxyl groups of enamel and dentin. The Er,Cr:YSGG laser emits at a wavelength of 2780 nm and delivers photons into an air-water spray matrix, thus producing microexplosive forces on water droplets. It cuts enamel, dentin, cementum, bone, and soft tissues cleanly and efficiently. The medium, which enables photon amplification, includes heterogeneous crystals of yttrium, scandium, gallium, and garnet. The crystal matrix also contains dopants (erbium and chromium) to enhance the performance of the laser emission.14,15

There are numerous benefits to using this type of laser in surgical treatments. Rapid healing can be observed within a few days of treatment, and as blood vessels are sealed, there is both a reduced need for postsurgical dressings and improved hemostasis and coagulation. It also depolarizes nerves, thus reducing postoperative pain, and destroys many bacteria and viral colonies that may potentially cause infection. Reduced post-operative discomfort, edema, scarring, and shrinkage have all been associated with its use.11,16,17

The need for analgesics and anti-inflammatory medication has also been reduced considerably. In some treatments, there is no need for local anesthesia, while in others, a smaller amount can be used compared to that required by conventional techniques.11,17-19 Recent reports in the dental literature describe the successful use of this laser for surgical procedures.11,17

CASE REPORTS

Case 1

A ten-year-old girl with a non-contributory medical history was seen in our pediatric dental clinic for a reddish, painless mass in the buccal mucosa in the area of the permanent central and left lateral maxillary incisors (Fig 1). The lesion had been noticed by the family a few months previously, and they reported that initially it had been smaller than at present. Although the girl had been a patient of the clinic for a few years, she had not been seen for almost two years. The only treatments she had received in the past were hygiene prophylaxis with topical fluoride applications and the filling of two buccal pits in both first permanent mandibular molars. Oral hygiene had never been good.

Inspection of the area revealed the presence of a raised, reddish mass which bled easily when touched; it was smooth surfaced, had a sessile base and measured 0.5 cm in diameter. No other findings apart from poor oral hygiene and a considerable amount of plaque were observed. Radiographic examination excluded any bony lesion. The lesion was diagnosed clinically as a pyogenic granuloma.

The lesion was removed with a Waterlase YSGG laser using a sapphire cylindrical tip (length = 6 mm; diameter = 6 μm). The tip was kept at a distance of 1 mm from the soft tissue throughout the treatment. Only topical anesthesia was used, in the form of a 20% benzocaine gel for 4 min. The laser treatment began by desensitizing the tissue with low wattage (0.25 W), low water (7%) and low air flow (7%) for 2 min, followed by the lasing of the lesion until complete removal, following manufacturer’s instructions on the settings for soft tissue surgery (1.50 W, 10% water, 11% air). Finally, coagulation was achieved by setting the laser at 0.50 W, 0% water and 7% air (Figs 2 to 4). Wound healing was observed to be highly advanced one week after the intervention (Fig 5). The patient was seen again four months later and examination revealed complete wound healing and the presence of a normal gingival mucosa (Fig 6). There have been no recurrences in the twenty months since the intervention.

Case 2

An eighteen-year-old female with a non-contributory medical history was seen in our pediatric dental clinic three years after her previous visit. She attended due to the presence of a painless mass in the gum at the level of the right maxillary canine tooth, and reported its continuous growth over the previous six months (Figs 7 and 8). She had been a regular patient at the clinic for many years and had received regular preventive and restorative treatment. She had always maintained excellent oral hygiene.
**Fig 1** Case 1: preoperative view of the lesion.

**Fig 2** Case 1: surgical procedure.

**Fig 3** Case 1: surgical procedure.

**Fig 4** Case 1: surgical procedure.

**Fig 5** Case 1: one week after treatment.

**Fig 6** Case 1: four months after treatment.
**CASE REPORT**

**Fig 7** Case 2: preoperative view of the lesion.

**Fig 8** Case 2: preoperative view of the lesion.

**Fig 9** Case 2: surgical procedure.

**Fig 10** Case 2: surgical procedure.

**Fig 11** Case 2: surgical procedure.
Clinical examination revealed the presence of a raised, smooth-surfaced sessile lesion which bled easily. The tumor had a diameter of approximately 0.5 cm. No dental anomalies were observed and oral hygiene was excellent. We suspected that this adolescent patient was excessively vigorous when brushing and this was confirmed by questioning her about and supervising her hygiene routine. In this case as well, radiographic examination excluded the presence of any bony lesion.

The lesion was removed following exactly the same protocol described above in Case 1 (Figs 9 to 11). In this case, a 0.2-cm fragment was sent for biopsy and this confirmed the clinical diagnosis of pyogenic granuloma. Examination of the lesion eight days later showed would healing to be advanced (Fig 12). The patient was seen again eleven months later, at which point the mucosa had a totally normal appearance (Fig 13). There have been no recurrences in the two years after the intervention.

**DISCUSSION**

Gingival irritation is the factor that triggers the development of pyogenic granuloma. It may be that microulceration, due to predisposing irritant factors, in already inflamed gums enables oral microflora of low virulence to reach the gingival connective tissue, thus producing a hyperplastic vascular response that leads to the formation of the pyogenic granuloma. Several authors describe the presence of an initial oral injury as the main etiologic factor in the development of pyogenic granuloma.

When making the differential diagnosis, it is important to consider other gingival lesions that resemble pyogenic granuloma, as it may be difficult to distinguish the latter from other hyperplastic lesions, especially peripheral giant cell granuloma and peripheral ossifying fibroma. Peripheral giant cell granuloma is an aggressive oral lesion associated with tooth displacement and alveolar bone resorption. Peripheral ossifying fibroma is formed by a reactive overgrowth of gingival tissue that frequently contains calcified fragments resembling cementum or osteocementum.

Although the conventional treatment for pyogenic granuloma is surgical removal, there are also reports of the lesion being eliminated with an electric scalpel or cryosurgery, the latter using either a liquid nitrogen spray or a cryogenic probe. Following removal, the irritant factors related to the appearance of the lesion must also be eliminated.

In the cases described, the Er,Cr:YSGG laser proved excellent for dealing with the lesions. No infiltrative anesthesia was required in either case and the use of topical benzocaine rendered the surgical procedure painless for both patients. Although our experience suggests that not all treatments can be performed with-
out infiltration, this is clearly possible in some cases. At present, we are unaware of any references or specific protocols that enable a decision to be made in advance regarding the need for anesthetic infiltration; we currently rely on our previous experience with laser treatments and on careful patient selection based on our accumulated knowledge of patient management in pediatric dentistry. In the two cases described here, wound healing can be considered excellent. The surgical technique is not difficult for a pediatric dentist to perform and the field remains quite clean with minimal bleeding throughout the procedure. No sutures were necessary; neither did the patients require any postoperative analgesic or anti-inflammatory medication, this being another obvious advantage.

Both lesions were clinically diagnosed as sessile pyogenic granulomas. One was almost flat and thus it was not possible to remove a fragment for biopsy using only the laser for granuloma removal. However, in the second case the lesion was raised and biopsy of the removed fragment confirmed the diagnosis. This raises the question as to whether this would contraindicate the removal of certain types of pyogenic granulomas with laser technology. However, this remains an open question, and further research and clinical experience are required to develop protocols for pediatric treatments.

Although the use of lasers among pediatric dentists is not widespread, we believe it will gain greater acceptance, particularly for surgical treatments. In our opinion, pediatric laser dentistry can improve some conventional treatments and is another tool enabling better care to be provided to child and adolescent patients.

REFERENCES