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# Use of Diode Laser for Surgical Removal of Pyogenic Granuloma of the Lower Lip in a Pediatric Patient: A Case Report

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Data Collection B  
Statistical Analysis C  
Data Interpretation D  
Manuscript Preparation E  
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**Conflict of interest:** None declared

**Patient:** Female, 11-year-old  
**Final Diagnosis:** Pyogenic granuloma  
**Symptoms:** Not painful • bleeding tendency  
**Medication:** —  
**Clinical Procedure:** Diode Laser excision  
**Specialty:** Dentistry • Surgery

**Objective:** Unknown etiology

**Background:** A pyogenic granuloma is an inflammatory exophytic lesion that can occur in the oral cavity. Numerous factors are involved in the etiology of the lesion and can lead to the tissue proliferation underlying the lesion's characteristic appearance. The main treatment is surgical excision with careful curettage of the surrounding tissues. The use of a laser has been proposed because it enables performing deep and precise incisions with better hemostasis and less invasive procedures with less discomfort to patients. The aim of this study was to evaluate the possible advantages of using a diode laser in the surgical treatment of pyogenic granuloma, particularly in the management of a pediatric patient.

**Case Report:** A swelling in the lower lip of an 11-year-old female patient was analyzed. After several evaluations, a 980-nm diode laser in continuous wave mode was chosen for excision of the lesion. The lesion was excised successfully with a diode laser as a conservative method that was nonstressful for the pediatric patient.

**Conclusions:** Among the techniques for surgical excision of a lesion, the use of a diode laser has the following advantages: less invasiveness, absence of intra- and postoperative discomfort and pain, effective hemostasis with better control of bleeding, absence of scarring, better postoperative management, and greater patient compliance.

**Keywords:** Granuloma, Pyogenic • Laser Therapy • Lasers, Semiconductor

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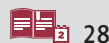
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## Background

Pyogenic granuloma (PG) is an inflammatory exophytic lesion that can occur in the oral cavity [1]. The lesion can develop owing to chronic irritation, which is a cause of “excess” proliferative tissue repair. Several factors are involved in the etiology of pyogenic granuloma associated with dental restorations and infectious agents [2], including trauma, hormonal factors, and dental plaque. Bhaskar and Jacoway [3] and Kamal et al [4] observed that pyogenic granuloma represents 1.85% of all oral pathologies, and Esmeyli et al [5] underlined in their review that reactive hyperplastic lesions represent the most common group of lesions after caries, periodontal disease, and periapical inflammatory disorders. Pyogenic granuloma can occur at any age (ranging from 4.5 to 93 years), but it appears to be more frequent in the second decade of life and is more common in women, with a ratio of 2: 1, probably due to the vascular effects of female hormones [4]. Pyogenic granuloma develops in about 5% of pregnant women. Other authors have observed that pyogenic granuloma accounted for 50.35% among reactive lesions, with a mean age of 34.27 years and a peak incidence in the third decade of life. Pyogenic granuloma was more common in females with a greater predilection for the maxillary gingivae (50.23%) [6]. Epivatianos et al. [7] reported predominance in women. Some authors have reported that patients under 18 years of age are mostly boys, patients between 18 and 39 years are mostly women, and older patients have an equal sex distribution [8].

The clinical presentation of pyogenic granuloma is an exophytic mass with a smooth or lobed surface. The dimensions can vary from a few millimeters to a few centimeters (rarely exceeding 2.5 cm), its color can vary from pink to red, and it is generally asymptomatic.

The erythematous papule generally has a sessile or pedunculated base that is easily compressible, and spontaneous or induced bleeding can occur after minor trauma [9].

In 75% of cases pyogenic granuloma occurs on the keratinized gingiva, and in the remaining cases, it presents on the lips, tongue, buccal mucosa, and palate [1]. In addition, it is more common on the maxillary gum level than the jaw gum, with a higher prevalence of the anterior sectors than the posterior [10].

The diagnosis is obtained with an excisional biopsy of the lesion and subsequent histological examination. Differential diagnosis should be carried out, with other similar-appearing exophytic lesions including peripheral giant cell granuloma, traumatic fibroma, hemangioma, Kaposi sarcoma, mucocele (if the lesion is localized on the labial mucosa) [11], metastatic carcinoma, and other malignant tumors.

Numerous surgical techniques have been used for pyogenic granuloma excision. Conservative surgical excision with cold blade and removal of the causative irritant or source of trauma is considered the criterion standard treatment [12].

However, pyogenic granuloma is generally high vascularized lesion and it can bleed profusely during surgical excision procedures. This can represent a problem in terms of operative visibility for the surgeon. In addition, the risk of edema and hematoma formation is also directly proportional to the presence of bleeding.

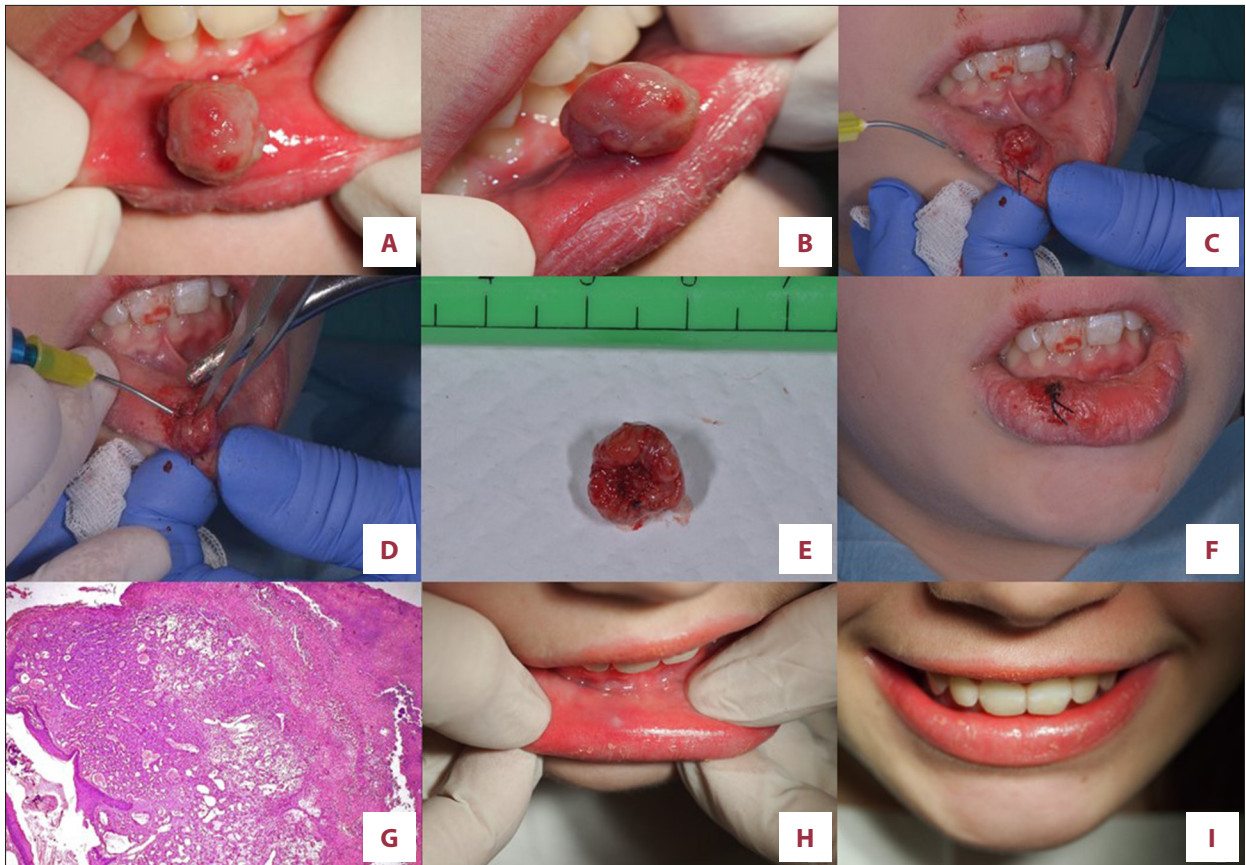
To reduce intraoperative bleeding and to simplify the surgical excision, several other techniques have been demonstrated to be valid options, including cryosurgery, absolute ethanol injection, intralesional steroids, electric cauterization, and laser surgery with the use of neodymium-doped yttrium aluminum garnet (Nd: YAG) laser, erbium-doped yttrium aluminum garnet (Er: YAG) laser, and diode laser [13,14].

In particular, dental lasers were gradually introduced in oral surgery and have been successfully applied clinically since the early 1990s. Lasers have numerous tissue interactions, such as ablation or vaporization, microbial inhibition and destruction, and hemostasis, as well as biological effects, such as biostimulation, that induce various beneficial therapeutic effects and biological responses [15].

The diode laser has become very popular in dentistry due to its small size and ease of use for minor soft tissue surgery. Based on its photothermal effect, diode lasers are classified as deeply penetrating lasers, which is related to its lower absorption coefficient in water. Its higher absorption in hemoglobin and pigments give this type of laser excellent hemostatic properties, and for this reason, its use is recommended for the removal of small benign lesions of the oral mucosa by excision or vaporization procedures [16].

Laser therapy is well accepted by children and parents due to its minimal invasiveness. Studies have demonstrated that children are more cooperative during restorative, pulpal, and surgical treatments using laser, which significantly promotes the quality of care and enhances the process of treatment [17].

In the light of these results proposed in the literature, this study was aimed at evaluating the possible advantages of using the diode laser in the surgical treatment of pyogenic granuloma and assessing the results obtained in the treatment of a pediatric patient.



**Figure 1.** (A, B) Exophytic mass with smooth surface and sessile base (1.5-cm diameter). (C, D) Excision of the lesion with a 980-nm diode laser. (E) Excisional biopsy specimen. (F) Lip after the excision. (G) Microscopic aspect (hematoxylin and eosin staining). (H, I) One-month follow-up.

## Case Report

An 11-year-old female patient, with a good general health status, came to us for a specialist evaluation of a swelling in her lower lip of less than a month's duration. The neoformation had the following clinical characteristics: swelling of soft consistency, smooth surface, a sessile base, a diameter of less than 1.5 cm, and gray and pink in color. The lesion was not painful, but during clinical examination, it was observed to have a tendency to bleed (**Figure 1A, 1B**).

An echo Doppler color ultrasound was requested, and it revealed widespread and active arterio-venous vascularization. The lesion had anatomical and vascular continuity with the muscular portion of the lower lip.

Given the patient's young age and the high vascularization of the lesion, which suggested that managing bleeding would be difficult with a conventional cold blade surgical technique, treatment with a diode laser was chosen as a minimally invasive procedure to excise the lesion.

After establishing anesthesia with an infiltration of 4% articaine with epinephrine 1: 200,000, a preventive hemostasis was performed with a suture on a horizontal mattress, and the excision of the lesion was performed with a 980-nm diode laser in continuous wave mode with a power of 1.8 W for excision and 2.5 W for hemostasis (**Figure 1C-1F**).

The patient reported no pain during surgery, no discomfort in the following days, and no postoperative complications. Healing was observed within a couple of days after surgery.

A histopathological examination was subsequently performed. Hematoxylin and eosin staining revealed numerous engorged blood vessels (high vascular proliferation) with intense inflammatory cell infiltrate and areas of fibrous connective tissue. These features confirmed the diagnosis of pyogenic granuloma (**Figure 1G**).

The patient was followed up 1 month after the excision, and the photographs in **Figure 1H-1I** show the healing of the wound and the absence of scars.

The advantages of laser use included optimal bleeding control, better compliance of the patient, reduced use of the anesthetic, absence of scarring, no pain and no discomfort during surgery, and a reduction of the surgical time.

## Discussion

The main treatment for the pyogenic granuloma is surgical excision, and careful curettage of the surrounding tissues is also recommended. When the lesions affect the gingiva, the excision should extend to the periosteum of the alveolar process periosteum and the adjacent teeth should be carefully treated to remove any form of possible chronic irritation [18].

In the current case report, laser therapy was used for the surgical removal of the pyogenic granuloma localized in the lower lip to exploit the main advantages offered by laser surgery. We used a diode laser, an instrument of small size that is less costly than other types of dental lasers and has a high affinity for both dark pigments and hemoglobin. The cutting and hemostatic actions were optimal for evaluating the histological and vascular characteristics of the neoplasm and the anatomical area in which it had developed (lower lip). The results of the follow-up showed optimal healing, which occurred without any complications and discomfort for the young patient.

The laser is perceived as a less invasive tool than the scalpel in children, and it is better accepted by the patient. The administration of anesthetic and the need to carry out a suture at the end of the operation allowed reducing the operating time. The laser can be considered a valid tool in cases of surgical removal of lesions, sessile or pedunculated, that are frankly benign in children as well as adults.

Various methods have been proposed in the literature for the surgical removal of pyogenic granuloma. Several authors proposed the use of the laser for its ability to perform deep and precise incisions and to enable better hemostasis, less invasive procedures, and less discomfort for patients. Laser therapy has been recommended as a preferred treatment option for several soft tissue lesions. The use of the laser is associated with a lower risk of bleeding [18,19] compared with other surgical techniques, as well as the absence of pain during and after surgery [20].

In a clinical comparison between an 810-nm diode laser and conventional surgery for the management of soft tissue muco-gingival surgery, Ize-Yyamu et al [21] showed that surgical procedures performed with the diode laser had less intraoperative bleeding and a lower need for sutures compared with cold blade surgery.

Medeiros Júnior et al [22] compared the use of a diode laser with conventional surgery with cold blade and concluded

that the laser was associated with a lower mean duration of surgery, including presurgical, intraoperative, and postsurgical clinical parameters.

Isola et al [23] evaluated the surgical advantages of diode laser versus traditional surgery with a cold blade for the surgical excision of pyogenic granuloma. Twenty-one patients (10 males, 11 females) requiring pyogenic granuloma excision were enrolled in the study. All patients were randomly subjected to pyogenic granuloma surgical excision with either diode laser or cold blade. Parameters analyzed were the speed of incision, time of intervention, intraoperative bleeding, number of stitches, and patient compliance. Both treatments were successful in surgical excision of pyogenic granuloma. However, the mean speed of incision was significantly reduced in the diode laser group ( $0.61 \pm 0.29$  mm/s) compared with the cold blade group ( $1.47 \pm 1.23$  mm/s) ( $P < 0.05$ ). The mean lengths of time for the whole surgical intervention were significantly lower in the diode laser group ( $221.15 \pm 220.89$  s) compared with the cold blade group ( $316.10 \pm 248.69$  s) ( $P < 0.05$ ). The mean score for compliance of patients was  $8.56 \pm 0.53$  in the diode laser group and  $8.61 \pm 1.14$  in the cold blade group ( $P = 0.169$ ). The diode laser reduced intrasurgical bleeding and yielded better gingival healing compared with cold blade surgical treatment.

Other authors have found the advantages of the laser in the management of medically compromised patients [24]. Fekrazad et al [25] found the application of a laser to be an effective and safe technique for excision of pyogenic granuloma, with minimal invasiveness and many clinical advantages, such as less intraoperative bleeding, better hemostasis, reduced pain, and shorter healing times [25]. In a case report by Kocaman et al [26], Nd: YAG laser was used for treatment of pyogenic granuloma. The authors reported that bleeding time and operating time were reduced during surgery, rapid postoperative hemostasis was achieved, and no scarring and discomfort were observed. Other authors recommended cryosurgery as an effective, simple, and safe treatment for the lesions of the lip or buccal mucosa, especially for preschool children [18,27]. Surgical therapy is the most widely used, but it can frequently result in scarring [18,28]. Sclerotherapy through the injection of absolute ethanol, sodium tetradecyl sulfate, and corticosteroids has also been proposed as a therapy, and it can give successful results in the event of recurrent lesions. The recurrence rate of the pyogenic granuloma is about 16% [4,18]. Recurrence could result from incomplete excision, failure to remove etiological factors, or new injury of the area. It should be emphasized that gingival cases show a much higher recurrence rate than lesions from other oral mucosal sites. Furthermore, the literature underlines how considerations on treatment during pregnancy are very important because relapses are common during this period [4]. Further, the volume of the lesion may decrease after childbirth, making surgery unnecessary [18].



## Conclusions

Surgical excision is the criterion standard treatment for pyogenic granuloma. Among the techniques used for surgical excision of the lesion, the diode laser has shown the following advantages: less invasiveness, absence of intra- and postoperative discomfort and pain, effective hemostasis with better bleeding control, absence of scarring, and better postoperative management. In addition, greater patient compliance is observed because the operation is rapid and, in most cases, suturing the wound is not necessary.

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