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Case Report

Use of Diode Laser in the Treatment of Pyogenic Granuloma on the Mandible- A Case Series

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Abstract

Pyogenic granuloma (PG) is a widespread tumor-like growth of the oral cavity. This lesion is generally caused by continual poor oral hygiene and low-grade trauma. Many methods have been proposed to remove these lesions. The using of lasers, one of these methods, is considered a safe and effective technique for the removal of these lesions with many clinical advantages such as hemostasis, no intra-operative bleeding and decreased times of healing and pain. The aim of this report is to evaluate the diode laser treatment of three patients with PG. In this case series three uncommon cases of histopathologically PGs in the mandible are presented with the treatment plan of using diode laser to surgically excise the lesions. The patients reported no pain after the surgery. They were discharged with a prescription of chlorhexidine mouthwash and necessary post-operative instructions. The results of this case series demonstrate successful results in the treatment of diode laser pyogenic granuloma-like gingival lesions. The diode laser can be used as an alternative treatment option for the treatment of intraoral PG lesions that minimizes recurrence and increases post-operative comfort and healing.

Keywords: Diode laser, laser, pyogenic granuloma, surgical procedure.

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INTRODUCTION

Pyogenic granuloma (PG), also known as granuloma pyogenicum, is usually a common reactive inflammatory hyperplasia of the oral cavity. PG is referred to as a tumorlike lesion because of its non-neoplastic nature [1]. Actually, the expression 'PG' can be a misnomer because the lesion does not cause pus formation; and histologically, it does not represent a true granuloma. Therefore, the term used by some researchers "lobular capillary hemangioma", is histologically a more accurate term for this lesion [2, 3]. This oral lesion is thought to be a tissue response to stimuli, such as trauma-induced injuries and low-grade local irritation [4]. Poor oral hygiene caused by the accumulation of plaque and calculus and overhanging restorations are considered to be trigger factors [5]. Connective tissue growth factor, nitric oxide synthase and vascular endothelial growth factor are related to angiogenesis, so accepted to be related to the speedy development of PG [6].

Recently, the result of immunohistochemical studies showed that PG had factors which related to vessel formation such as Tie-2, ephrinB2, ephrinB4, angiopoietin-1 and angiopoietin-2. Generally, lesions are regarded as localized swellings that result from minor injury or irritation of the connective [7-9].

Clinically, PG is lobulated or smooth exophytic lesions that show as small, red erythematous papule on a sessile or pedunculated base. PG size generally varies between 0.5–1 cm, but in rare cases, reaches 2.5 cm [1, 8, 10]. The surface is friable and ulcerated, covered in a fibrinous membrane and its color ranges from pink to purple depending on the age of the lesion [11]. Young PGs are extremely vascular due to being formed mainly of hyperplastic granulation tissue with pronounced capillaries. However, older lesions are pink and more collagenized [11].

It was shown that PGs are found in 44.4%–83% of oral cavity gum. However, it also has been reported in the literature to occur in the lingual, buccal and palatal mucosa [11, 12]. It may be encountered in different parts of the body outside of the oral cavity, such as the lips, nose, fingers and toes. PG can be seen in patients of any age; however, it is more common in those aged between 10 and 40 years. In young adult

females, it is predominant in the second decade of life. Potential reasons for this may be the vascular effects of female sex hormones [10, 13, 14].

Differential diagnosis distinguishes PG from conventional granulation tissue, hemangioma, peripheral giant cell granuloma, hyperplastic gingival inflammation, bacillary angiomatosis, peripheral odontogenic fibroma, peripheral ossifying fibroma, Kaposi's sarcoma, angiosarcoma, and metastatic cancers. Exact diagnosis of PG can be made by histopathology. The treatment of PG is based on the severity of the symptoms. When the lesion is small, painless and is not bleeding, clinical observation and follow-up are suggested. Surgical excision of the lesion is the basic treatment. During the excision, irritant factors such as dental plaque, calculus, defective restoration, foreign bodies, and sources of trauma should be removed [3, 15]. Other therapy methods include electrodessication, cryosurgery, sclerotherapy, intralesional steroids, sodium tetradecyl sulfate, monoethanolamine oleate ligation, cauterization, neodymium-doped yttrium aluminum garnet (Nd: YAG) laser, carbon dioxide (CO2) laser, erbium-doped yttrium aluminum garnet (Er: YAG) laser and diode laser [16-23].

Surgical excision of PG has been noticed to have 16% rate of recurrence. Recently, the practice of using several lasers for the removal of PG has increased. Laser surgery presents more advantages compared to conventional therapy methods, such as instant sterilization, reduced bacteremia, reduced bleeding, less need for sutures, decreased pain and edema during and after the procedure, minimal scar tissue formation, less wound contraction, increased patients acceptance and faster healing process [21, 23].

Diode lasers have many advantages, such as less scarring, pain, bleeding, infection, swelling, decreased surgical time and good coagulation [25]. The diode laser is absorbed by pigmented tissue and hemoglobin, and it transmits energy (with wavelengths ranging from 810 to 980 nm in a continuous or pulsed mode) to the cells by heating, coagulating, welding, drying, carbonization, vaporization, and protein denaturation [25]. This technique is a safe, convenient and inexpensive patient treatment. Diode lasers are safe and useful and have been used at various wavelengths (810, 940 and 980 nm) in surgical treatments, such as frenectomy, epulis fissuratum, fibroma, facial pigmentation and vascular lesions [26]. They have a low thermal impact on the depth of carbonized zones at the surface of the tissue in histological examination [27]. This case series describes the use of diode laser in surgical excision of PG on the mandible.

Case Descriptions

The aim of this report is to evaluate the diode laser treatment of three patients with PG (two males and one females). All of the patients had complaints of bleeding, swelling, growth and uneasiness in the gingiva.

It was learned that patients who did not have any pathology in the extraoral examination. Patients had sudden gum growth in the area of the lesion, without any systemic discomfort. They said that these growths had erupted suddenly. After these growths reached a certain size, they stopped growing but the bleeding complaints started in the lesion area.

Intraoral examinations revealed that the patients' oral hygiene was poor and their gums were hyperemic and edematous there was no mobility in the teeth and nothing abnormal was detected radiographically.

All the patients were evaluated and were explained the treatment methods. Written consent and medical histories were obtained for all of the patients. Then, laser treatment procedures were done.

CASES

Case 1

A 20-year-old male was admitted with tissue overgrowth in the interdental and buccal gingiva of the canine-incisal teeth on the right side of the mandible. The macroscopic appearance of this lesion was a pedunculated mass in the interproximal region of 43 and 42 extended to buccal and palatal, which appeared almost round in shape. It was reddish pink and covered by a cream-colored mucosa. The lesion was approximately 4x3x2 mm, partially stemmed, partially ulcerated and had a hyperemic appearance on the surface (Fig-1).

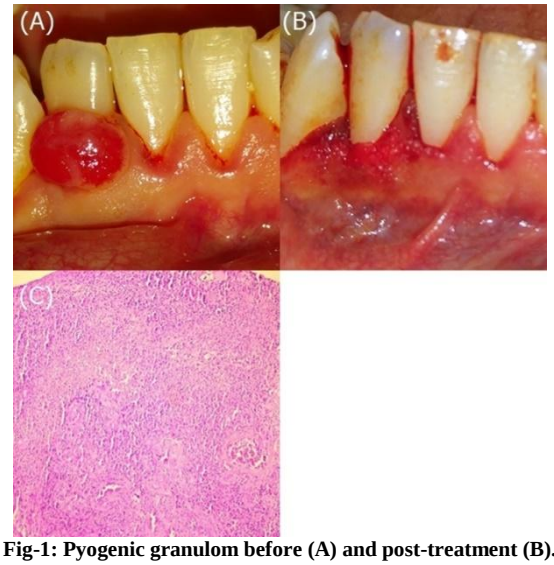

Fig-1: Pyogenic granulom before (A) and post-treatment (B). Histological appearance of a pyogenic granuloma (C) excised at an earlier stage. Widespread erosion appearance on the surface and mixed vascular proliferation with intense inflammation in all stromal areas (HE, X10)

Case 2

A 58-year-old male was suffering from an overgrowth in the interdental and buccal gingiva of the first molar teeth on the left side of the mandible. The macroscopic appearance of this lesion was a pedunculated mass in the interproximal region of 46 buccal, which appeared almost round in shape. It was reddish pink and covered by cream-colored mucosa. The lesion was approximately 6 x 3 x 2 mm, partially stemmed, partially ulcerated, hyperemic appearance on the surface (Fig-2).

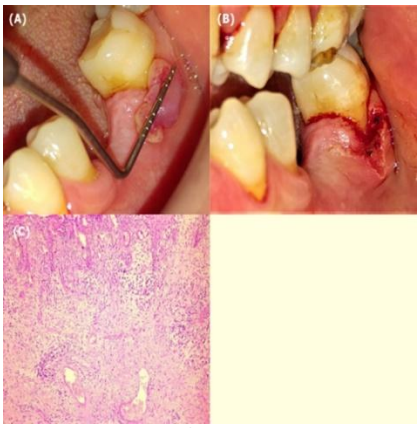

Fig-2: Pyogenic granulom before (A) and post-treatment (B). A histological picture showing mostly the stromal area of pyogenic granuloma (C). Conjunctival vascular structures are seen in edematous, inflamed stroma (HE, X10)

Case 3

A 57-year-old female had gingival overgrowth in the interdental and buccal gingiva of the canine-first premolar teeth on the left side of the mandible. Macroscopic appearance of this lesion was a pedunculated mass in the interproximal region of 33 and 34 extended to buccal and palatal, which appeared almost round in shape. It was reddish pink covered by a cream-colored mucosa. The lesion was approximately 5x4x3 mm, partially stemmed, partially ulcerated, hyperemic appearance on the surface (Fig-3).

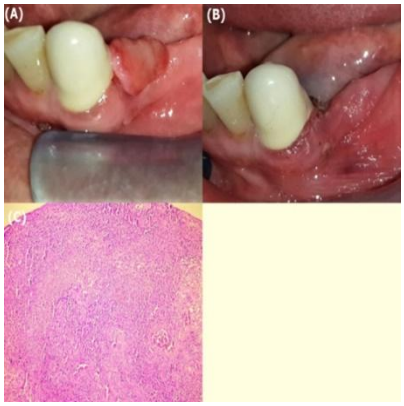

Fig-3: Pyogenic granulom before (A) and post-treatment (B). Long-lasting appearance of an existing pyogenic granuloma (C). Stroma is covered with collagenized fibrosis and vascular proliferation is seen as decreased. The surface appears to be thicker regenerative multi-layered squamous epithelium (HE, X10)

Periodontal Treatment and Surgical Procedure

Oral hygiene education was given to each patient and plaque and calculus was removed as an initial therapy. Patients' oral hygiene was evaluated at the second appointment and subgingival curettage was performed in the area where the lesion was located.

After 1 week, surgical procedures were performed under local anesthesia (2% lidocaine with 1/100,000 epinephrine) with the diode laser gallium/aluminum/arsenide (GA-AL-AS) (940 nm wavelength, Biolase Epic 10^{TM}, Irvine, USA) using the following irradiation parameters: gingivectomy mode, in contact mode, with a power output of 1.1 W, pulse frequency 50 Hz, emission mode of laser light: pulsed using 0.4 mm diameter disposable fiber optic (Fig-4) [28]. The tip was directed at an angle of 10 to 15 degrees, and moved in a circular motion around the base of the lesion. The lesions, which were retained with the help of a hemostat, were excised by applying laser energy and removed until debris and soft tissue was eliminated. Coagulation was performed in the surgical area by diode laser (hemostasis mode, in continuous mode, power output 0.5 W, frequency 50 Hz). It took 5 minutes to complete the procedure. The patients were discharged with post-operative instructions; chlorhexidine mouthwash (0.12%) was prescribed, and a follow-up appointment was arranged within 7 days.

After, the specimen sample was put in 10% formalin and then sent for histopathological investigation. After making the routine application of the biopsy specimen, it was preserved paraffin. The 0.5 µm sections were made with a microtome and stained with hematoxylin-eosin then examined under light microscope.

Fig-4: 940 nm wavelength, Biolase Epic 10^{TM}, Irvine, USA

Histopathological Examination

Histopathological examination showed a stratified squamous epithelium forming rete ridges in the underlying connective tissue. Connective tissue shows numerous small and large endothelium-lined channels engorged with blood. A moderate infiltration of mixed inflammatory cells was also evident. The

histopathological report identified these lesions to be PG.

DISCUSSION

PG is a form of inflammatory hyperplasia, which is defined as nodular growths of the oral mucosa. Histologically, PG has granulation tissue and inflamed fibrous tissue [1, 3]. Roughly one-third of PG lesions occur after trauma, but a history of trauma is not necessary for the formation of these lesions. In the majority of patients, poor oral hygiene accelerates the progression of lesions [4].

The lesion is generally neither painful nor symptomatic, but minor trauma can cause significant bleeding. Furthermore, PG affects swallowing, causing functional problems with mastication and speaking and may also cause aesthetic problems [1, 14, 21]. In this study, the lesions were painless, although they caused bleeding and discomfort during eating, which made the patients seek treatment.

Oral PG usually occurs on the gingiva; however, it can also affect the tongue, lips, buccal mucosa, and infrequently, as in one of these cases, it can be seen on the hard palate [10, 13, 14]. PG can be viewed in any dimension from a few millimeters to several centimeters. The highest prevalence is seen in adolescents and young adult women. In this report, lesions were buccal mucosal and their sizes varied between 0.2–0.7 cm.

PG is mostly cured by surgical excision; but many other treatment modalities, including various types of laser, have also been successfully used [2, 10, 21, 23]. The advantages of laser surgery compared to conventional methods include decreased bleeding, and a probable reduction in the depth of cut, post-operatively, promotion of wound healing, fewer scars, staff and time. The laser may be thought as a good method even for very large lesions [29].

Fekrazad et al. used Er: YAG laser for the excision of a gingival PG and reported that using Er: YAG laser caused less injury at the site of the lesion [23]. Though Er: YAG and CO_2 lasers are appropriate for removing lesions owing to their less penetration and higher absorption in water, they are less effective at coagulating blood than Nd: YAG and diode lasers.

Powell et al., reported the decreased risk of bleeding in comparison to other methods along with superior coagulation characteristics of Nd: YAG lasers for PG lesions [30]. Kocaman et al. proposed using Nd: YAG lasers to treat PG, because it is associated with decreasing bleeding during the operation and promotes the post-operative hemostasis outcome, reducing the operating time, and better patient acceptance [21].

Diode lasers have many advantages such as reduced scarring, pain, bleeding, infection, swelling, decreased surgical time and a good coagulation. Diode laser wavelengths are poorly absorbed by teeth and bones, but highly absorbed by pigmented tissue. Therefore, soft tissue surgeries can be safely made close to tooth structures. Additionally, diode lasers can be used in gated or continuous pulse mode in contact with or at a close distance to the tissue, which avoids harm to other tissue and it prohibits 'beam escape' into an open field. So that makes this laser more secure than other laser sources [25]. Moreover, Janda et al. reported that diode lasers possess low thermal influence on depth of carbonized zones at the surface of the tissue [27].

Rai et al., recommended diode lasers as a powerful tool for the therapy of oral PG; they used 808 nm diode laser with an output energy of 0.1-7.0 W for the successful removal of PG [8]. Iyer and Sasikumar reported it to be advantageous to use a 940 nm diode laser over the conventional treatment option to excise oral PG [31]. In addition, diode lasers with 810-980 nm wavelengths can be used to remove soft tissue lesions in pediatric patients without the need for anesthesia [2]. The use of a 940nm diode laser in the presented case reports were a successful treatment choice for decreasing the risk of post-operative infection and impaired healing as well as increasing the patient's comfort [31, 32]. For our PG patients, the selected treatment option of 940 nm diode laser excision resulted in successfully healed lesions.

CONCLUSION

Pyogenic granulomas can often be confused with gingival tissue enlargement. It is very important to make a careful and accurate diagnosis so that these lesions are not confused with vascular lesions. Improving oral hygiene affects the course of the lesion and its outcome. Consequently, effective patient follow-up in the post-operative period is important. In spite of the possibility of recurrence, all dental stones should be cleaned, especially in the neighboring tooth surface and periosteum and bone in the lesion area should be removed to reduce the risk of recurrence. The diode laser can be used as a safe and efficient technique for the treatment of intraoral PG that minimizes recurrence and increases post-operative comfort and healing.

Ethical Considerations: Written informed consent was obtained from the patient prior to treatment.

Conflict of Interests: The authors have no conflict of interest to declare.

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