

Pyogenic Granuloma: Surgical Treatment with Er:YAG Laser

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Abstract:

Introduction: Pyogenic granuloma (PG) is a common tumor-like growth of the oral cavity, considered to be of non-neoplastic nature, often caused by constant low-grade trauma as well as poor oral hygiene and maybe due to hormonal disturbances. Surgical excision, and removal of underlying cause in some cases, is the preferred method of treatment as it is only a benign lesion. In order to remove this lesion, scalpel, cryosurgery and laser are used. Currently different lasers, with adequate parameters, are used for the surgery of PG, which include CO₂ (Carbon Dioxide Laser), Nd:YAG (Neodymium-Doped Yttrium Aluminium Garnet), Diode and Er Family amongst others. In this present case, due to the proximity of the lesion with dental hard tissue, Er:YAG (Erbium-Doped Yttrium Aluminum Garnet) laser appears to be the more appropriate laser. The application of Laser is also a newly recommended technique. The aim of this study is to assess the stages of treatment, recovery and recurrence of PG when the Er:YAG laser is used. Furthermore this study aims to also evaluate the friendliness of this method with regards to the surgeon (therapist).

Case report: A 24-year-old female was referred to the Laser Research Center of Dentistry of Tehran University of Medical Sciences with a complaint of gingival overgrowth and bleeding. This lesion was in the buccal and palatal side of the 5 and 6 maxillary teeth. Treatment plan included an excisional biopsy of the lesion using Er:YAG laser (3W, 300mJ, 10Hz, Short pulse, with contact headpiece). The bones were then cleaned of soft tissue before being smoothed using a curette. The excised specimen was preserved and sent for histopathological examination.

Results: The patient reported no pain after surgery and did not use any systemic antibiotics. The patient was satisfied after the surgery. Chlorhexidine mouthwash was given to the patient. Pathology results confirmed Pyogenic granuloma. After 2 weeks, complete healing was observed. The 9-month follow-up was also carried out in order to check the process of healing as well as the recurrence.

Conclusion: Excisional surgery is the preferred treatment method for PG. The application of laser can be considered as an effective and safe technique for excision of this lesion with minimal invasion and many clinical advantages such as less intra-operative bleeding, hemostasis and reduced pain and times of healing.

Keywords: pyogenic granuloma; Er YAG Lasers; laser surgery

Please cite this article as follows:

Fekrazad R, Nokhbatolfoghahaei H, Khoei F, Kalhori KA. Pyogenic Granuloma: Surgical Treatment with Er:YAG Laser. *J Lasers Med Sci* 2014;5(4):199-205

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Introduction

In 1897 Pyogenic Granuloma (PG) was described for the first time by two French surgeons Poncet and Dor^{1,2}. As the lesion is not a true granuloma, the term PG can be misleading³.

Pyogenic granuloma of the skin and oral cavity can form as a result of various etiologic factors that have been put forward by different researchers⁴. Chronic low grade trauma⁵, physical trauma⁶, hormonal factors⁷, bacteria, viruses⁸ and certain drugs⁹ have been considered as contributory factors in the development of pyogenic granulomas. Poor oral hygiene, foreign material in the gingiva, calculus, and local irritants generally are the advancing causes⁴.

These lesions possess certain clinical features such as being painless, sessile or pedunculated exophytic masses with a base beginning from the gingival margin or, in most cases, from the interproximal tissues in the maxillary anterior.

The size can vary from case to case but it hardly ever exceeds 2cm and it will return unless completely removed. In 70-75% of the cases, oral pyogenic granuloma is observed in gingiva, followed by the tongue, lips, and buccal mucosa^{4,10}.

Pyogenic granuloma can develop at any age but in the majority of cases, 60%, PG is observed in the 10-40 years old age group, with the incidence peak between the ages of 20 to 30. Moreover, the possibility of PG is twice as likely with regards to females^{1,11}.

The treatment of this lesion can be carried out using different approaches.

To remove PG, scalpel, cryosurgery and laser might be used.

Laser excision is the recommended method, which is well accepted by patients with no unfavorable consequences¹.

Diode laser¹, Nd:YAG (Neodymium-Doped Yttrium Aluminium Garnet)¹², CO₂ (Carbon Dioxide Laser)¹³, and Er:YAG (Erbium-Doped Yttrium Aluminum Garnet)¹⁴ have reportedly been successful in treating mucosal pyogenic granulomas.

The possibility of recurrence of the lesion has reported to be 16%, however it seems that the use of laser will reduce this recurrence rate.

The purpose of this study is to assess the stages of treatment, recovery and recurrence of PG when the Er:YAG laser is used. Furthermore this study aims to also evaluate the friendliness of this method with regards to the surgeon (therapist).

Case Report

A 24-year-old female was referred to the Laser Research Center of Dentistry of Tehran University of Medical Sciences with a complaint of gingival overgrowth and bleeding. This lesion was in the right side of the maxilla. Macroscopic appearance of this lesion was a pedunculated mass in the interproximal region of 15 and 16 extended to buccal and palatal, which appeared almost round in shape. It was reddish pink covered by cream-colored mucosa. The surface was uneven with shallow grooves with ulcerations and bleeding in some areas. The lesion was approximately 14 mm × 8 mm in diameters and 6 mm in thickness with relatively soft consistency (Figure 1 and 2).

Excisional biopsy with an Er:YAG laser (2940D plus, Deka, Italy) (Output power=3W, E=300mJ, Frequency=10Hz, Short pulse, with contact headpiece, contact tip, with 50% water & 50% air, Diameter of tip=1 mm) was the main step of treatment (Figure 3). An elliptical incision was made around the peduncle, and then the lesion was lifted along with the underlying periosteum from the bone surface and removed until



Figure 1. Microscopic appearance of the lesion between the teeth 15 and 16

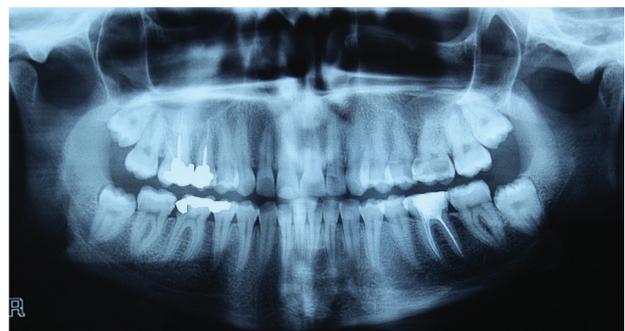


Figure 2. Preoperative panoramic view



Figure 3. The view of surgery using contact handpiece of Er:YAG laser

debris and soft tissue were eliminated (Figure 4 and 5).

In order to prevent recurrence, up to the surrounding PDLs were cleaned by laser and also up to 2mm of the safe margin of the lesion was removed.

Hemostasis was achieved with the same laser and



Figure 4. Complete removal of the lesion with elimination of debris and soft tissue from the surface of bone and teeth



Figure 5. Palatal view after removal of the lesion

healing was obtained for second intention.

In order to achieve an acceptable hemostasis, Er:YAG laser was used without water, which scanned the area of wound. After the surgery, coe-pak (GC America, USA) was placed on the area. Chlorhexidine mouthwash (0.2%) was also prescribed for the patient.

Excised specimen was preserved and the sample was placed in 10% formalin and then sent for histopathological examination.

Histopathologic Findings

For histopathological evaluation, H &E staining was carried out.

Microscopic examination (Zeiss.KF2. Germany) of sections prepared from the sample shows acanthotic and atrophic parakeratinized stratified squamous epithelium of oral mucosa and in some areas ulceration was seen with fibrino-leukocytic membrane where in the surface, epithelium had Plasma pooling areas. Supportive fibrovascular connective tissue with numerous blood vessels in various sizes with plump endothelial cells. Mild to moderate infiltration of acute and chronic inflammatory cells was evident in the whole sample. The remaining host bone was observed in some sample areas. (Figures 6 and 7)

This Histopathologic view confirmed the diagnosis of pyogenic granuloma.

The gingival tissues were revisited after seven days and were observed as healthy with successful healing (Figure 8). Furthermore full recovery was achieved within two weeks (Figure 9).

After the surgery the patient was asked about the level of pain and as there was no pain the patient was very pleased. The 9-month follow-up was also carried out

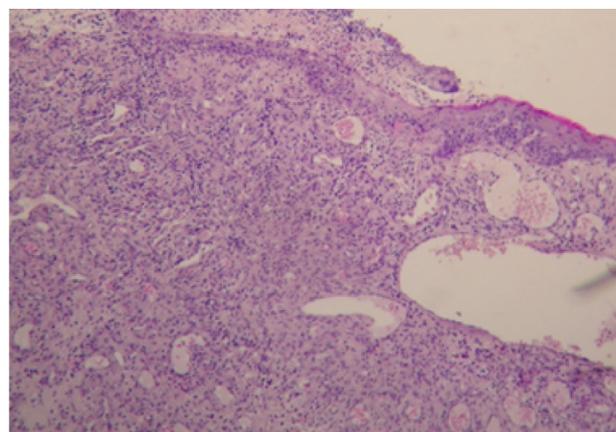


Figure 6. Microscopic view of the lesion with 100 × magnification

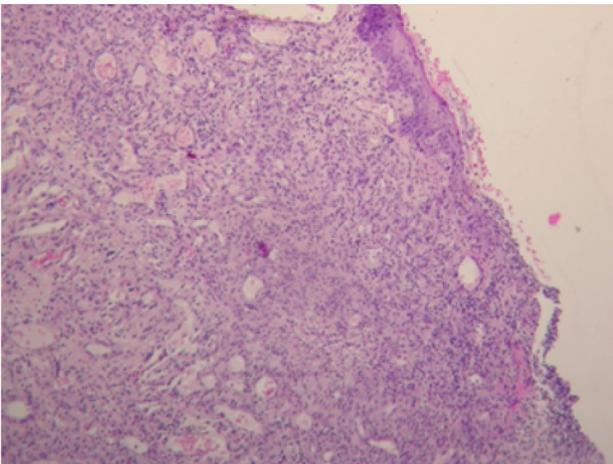


Figure 7. Microscopic view of the lesion with 100× magnification



Figure 10. 9 months after removal of the lesion using Er:YAG laser(Buccal)



Figure 8. 1 week after removal of the lesion using Er:YAG laser



Figure 11. 9 months after removal of the lesion using Er:YAG laser(Palatal)



Figure 9. 2 weeks after removal of the lesion using Er:YAG laser



Figure 12. Panoramic view of 9 months after removal of the lesion using Er:YAG laser

in order to check the process of healing as well as the recurrence (Figure 10-12).

Discussion

Pyogenic Granuloma is an inflammatory hyperplastic

lesion. The exact reason behind PG is not yet known.

Namazi et al. (2012) state that “trauma, hormonal influences, viral oncogenes, underlying microscopic arteriovenous malformation, the production of angiogenic growth factor and cytogenetic abnormalities have all been postulated to play a role”^{15,16}.

Literatures have suggested many factors such as trauma, viral oncogenes, infection, hormonal influences, poor oral hygiene, defective restorations, and residual roots^{17,18}.

Differential diagnosis of pyogenic granuloma includes peripheral giant cell granuloma, peripheral ossifying fibroma, haemangioma, conventional granulation tissue, hyperplastic gingival inflammation, and in some cases even malignant lesions such as metastatic carcinoma, amelanotic melanoma and nonHodgkin's lymphoma^{1,19-21}.

During histopathologic evaluation of the sample highly vascular proliferation resembling granulation tissue was the dominant feature of the tissue. Numerous small and large endothelium lined channels engorged with red blood cells under the ulcerated surface and the mixed inflammation led us to the diagnosis. On the other hand we did not observe any other significant element to make us take any of the other possible diagnosis into consideration.

Although the most commonly used technique for treatment of PG is surgical excision, many other methods including elimination with electric scalpel or cryosurgery²², cauterization with silver nitrate, sclerotherapy with sodium tetra decyl sulfate and monoethanolamine oleate²³ ligation, absolute ethanol injection dye²⁴, Nd:YAG and CO₂ laser¹³, shave excision, and laser photocoagulation²⁵ have been reported to be used for this purpose. Surgical excision has been reported to have 16% rate of recurrence in treatment of PG.

Recently the application of different lasers for removal of PG has increased.

The advantages of laser surgery compared with conventional methods include maintenance of sterile conditions, reduction of bleeding, good possible estimation of cutting depth, precision of cutting, reduction in the number of instruments, often no need for suturing or bandages, pain reduction intra- and post-operatively, no inhibition of, and perhaps even promotion of wound healing, less scars, staff and time^{26,27}.

Perhaps due to the high cost of laser devices it is not very cost-effective however, since Erbium laser is a kind of laser that is also used for restorative treatments, it may be used as an additional application in surgery too.

Laser surgery results in less pain, bleeding and the patient's comfort. Also in areas where aesthetics are important, laser is a suitable means. This is a less invasive method compared to scalpel and cryosurgery with less risk of infection.

Since laser involves less bleeding it is considered to be very appropriate in the view of the surgeon, however

as it is technically done using a handpiece it is more time consuming.

Despite all the advantages of laser, the skills of the dentist working with the laser are of great importance.

The type of laser used in the surgery is also very important. For example, CO₂ and Er:YAG lasers, due to their high water absorption and less penetration compared to Nd:YAG and Diode lasers, are suitable means for cutting. The coagulation caused by these two lasers is also less. Moreover Nd:YAG and Diode cannot be used for bone resection.

When using Er:YAG laser, as the lesion is less damaged, the remaining tissue has more pathological value.

In some studies, because of the bleeding of PG Nd:YAG laser was used. But it seems that for the reasons stated above the cuts should be done using the Erbium Laser and if there was a problem of coagulation in some areas then those specific areas can be coagulated with Nd:YAG or Diode lasers.

CO₂ is also difficult to work with and requires technical knowledge.

White et al. in 1998 have reported the success of CO₂ and Nd:YAG laser irradiation in surgical treatment. They stated that laser excision is a well-accepted method by patients with no adverse effects²⁸.

In a recent research in 2014 Kocaman et al. used Nd:YAG laser (power output 4W, energy 100 mJ, frequency 40 Hz, pulsed emission mode) in order to eliminate PG and concluded that the use of Nd:YAG laser in the treatment of pyogenic granuloma reduced bleeding during surgery, with a consequent reduction in operating time, promoted rapid postoperative hemostasis, and has better patient acceptance²⁹.

Meffert et al. used the flash lamp pulsed dye laser on a mass of granulation tissue and concluded that previously resolute tissue responded well to the series of treatments with pulsed dye laser³⁰. Diode laser has shown excellent results in cutaneous pyogenic granulomas with only minimal pigmentary and textural complications. González et al. investigated the use of the 585 nm flashlamp-pumped pulsed dye laser (585 nm PDL) for the treatment of eighteen patients with symptomatic pyogenic granulomas and the results showed both symptomatic and clinical clearing of the lesions with excellent cosmetic results in 16 of 18 treated patients³¹.

In 2013 Licata et al. published a case report of PG which used Er,Cr:YSGG (Erbium, Chromium doped Yttrium Scandium Gallium Garnet) laser as the treatment method but no laser parameters were mentioned in this paper³².

The advantages of application of laser include fast healing of the wound, less requirement for antibiotic therapy after the operation and less pain observed by the patient^{26,27}. Taking into account the acceptable clinical results, Er:YAG laser can be taken as an effective technique for both soft and hard tissue treatment by reducing chair time and providing more convenience to the patient due to its simple procedure.

The Er:YAG laser can further be used for root curettage. Also that PG may arise from PDL, in which case Er:YAG is the best option. Furthermore, if PG occurs around the implant, Er:YAG has the advantage of removing the lesion with minimal damage to the implant.

Considering the recovery after the surgery, logically as Erbium has less penetration and results in less damage of the tissue, the recovery will be faster and better. This issue can be discussed in a comprehensive study in future.

Considering the recurrence of lesion, it appears that the type of laser used has no effect and furthermore recurrence does not depend on the laser wavelength and it is only affected by the surgical technique. However, a comprehensive study is also required in this regard.

Conclusion

Excisional surgery is the preferred treatment method for PG. The application of laser can be considered as an effective and safe technique for excision of this lesion with minimal invasion and many clinical advantages such as less intra-operative bleeding, hemostasis and reduced pain and time of healing.

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