

Effective management of focal reactive gingival overgrowths by diode laser: A review and report of two cases.

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Background: Focal reactive gingival overgrowths (FRGO) are a common observation in a clinical dental practice that may occur in response to external and internal chronic stimuli in form of fibrous connective tissue lesions in the oral mucosa. Gingiva is the most commonly involved site of oral reactive lesions. For the confirmed diagnosis of FRGO not only clinical, but the histopathological presentation of the lesion plays a vital role. Various surgical treatment modalities like a scalpel, cryosurgery, electrosurgery, and lasers have been applied in the management of FRGO. The laser is new treatment modality being employed for treatment of FRGO.

Case report: The purpose of this paper is to attempt short review on FRGO with the management of FRGO using diode laser. Here, we present effective management of peripheral giant cell granuloma and peripheral ossifying fibroma using diode laser. The follow-up of 01year showed no recurrence in both the cases.

Conclusions: Diode soft tissue laser has added advantages like a bloodless surgical field, reduced bacteremia, minimal intra and postoperative discomfort over conventional modalities. Thus it is highly effective in the surgical management of FRGO.

Key words: Gingival overgrowths • gingival reactive lesions • peripheral giant cell granuloma • peripheral ossifying fibroma • reactive lesions

Introduction

Focal reactive gingival overgrowths are frequently reactive, ¹⁾ inflammatory ²⁾ and commonly develop in response to local stimuli/irritation/injury such as a plaque, calculus, factors which retain plaque like crowding of teeth, inadequately finished restorations/prosthesis, presence of appliances etc. ¹⁻⁴⁾ Certain systemic conditions like puberty/pregnancy can also alter and exaggerate the response of gingival tissue to chronic irritation and can contribute to reactive gingival overgrowths. ⁵⁻⁷⁾ Other causes of gingival overgrowth include drug-induced gingival enlargements, benign and malignant neoplasms, and as a manifestation of systemic diseases or conditions. ^{8, 9)} Gingiva is the most

commonly involved site of oral reactive lesions. ^{10, 11)} Other concerned sites are tongue, palate, cheek, and floor of the mouth. ¹¹⁻¹³⁾ These lesions mostly arise from interdental papilla. FRGO manifest itself in different clinical forms. These lesions are classified into Pyogenic granuloma (PG) including pregnancy tumor, Peripheral giant cell granuloma (PGCG), Fibrous hyperplasia (FH) or fibrous epulis, Peripheral ossifying fibroma (POF) or Peripheral fibroma with calcification. ^{14, 15)} FRGO are usually associated with a particular ethnic group, specific oral site, age, sex etc. These lesions exhibit a wide range of clinical appearance from dull pink to deep red in color, size varies from few millimeters to centimeters involving one tooth to several teeth. ¹⁵⁾ They can be pedunculated or sessile at base; smooth, lobulated or ulcerated on the surface. ¹⁶⁾ Their consistency may vary from soft to rubbery and some lesions bleed profusely on slight provocation. Gen-

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erally, these lesions are painless until they are complicated by trauma or infection.

The treatment of FRGO is based on a holistic approach which includes removal of etiology, meticulous plaque control and surgical excision of the lesion. Eventually, various approaches like scalpel, cryosurgery and electrosurgical excision of FRGO have been recommended in dentistry. Lasers are the latest treatment modality and are being effectively used in the management of FRGO nowadays. Lasers were introduced in dentistry in the 1960s, since then its applicability has been evaluated by several researchers in various surgical procedures. Lasers have specific properties of being monochromatic (one wavelength color), directional (light emitted as a relatively narrow beam and in a specific direction), and coherent (wavelength of the laser light are in constant phase in space and time). These properties make laser very suitable for targeted treatment procedures. Depending upon their state of the gain medium it can be Solid state (eg. Nd: YAG, Er: YAG, Er, Cr: YAG), Gas (eg. HeNe, Argon, CO₂), Excimer (eg. ArF, KrCl), Diode (eg. GaAlAs).

The interaction of laser with hard and soft tissue is based on its absorption by tissue chromophore such as water, hemoglobin, melanin, and apatite minerals etc.^{17, 18)} Among the lasers, diode lasers are the most versatile and frequently employed for the management of FRGO due to its high affinity for hemoglobin and melanin. Hereby we present a review on FRGO along with successful surgical management of FRGO by diode laser diagnosed as POF and PGCG.

Case report

Case-1: A 72- year- old female patient reported with a chief complaint of growth of gums in upper right back teeth region since last 01 year. Slight extra-oral facial asymmetry of right upper lip region was evident on clinical examination. Detailed history revealed that the growth was initially small in size which gradually increased in the last 05 months. Growth was associated with infrequent pain. The patient was systemically healthy. Comprehensive examination showed a pink-red, solitary, pe-



Figure 1a: Pre-operative view showing gingival overgrowth i.r.t #13 and #15.



Figure 1c: Excised gingival overgrowth.



Figure 1b: Post-operative view after growth excision.



Figure 1d: After 01 year follow-up.

dunculated, lobular swelling on the right side in respect to #13 and #15 without any ulceration. The swelling measured was about 2.5 cm × 2.0 cm. On palpation, focal growth was firm in consistency. The patient was partially edentulous. Patient's oral hygiene was poor and heavy calculus was present on the teeth (**Figure 1a**). Pathological migration was present i.r.t. #13 #15. Provisionally the lesion was diagnosed as POF and PGCG.

Case-2: An 18-year old male patient reported with a complaint of soft tissue overgrowth in the upper front region. It was present since last 08 months and had slowly increased in size. Also, the patient has mentioned an increase in space between both the central incisors within a few months, though there was a little gap between the teeth since the beginning. On clinical examination, gingival overgrowth of 12 mm × 08 mm was evident as a pink, smooth surfaced, firm and sessile mass with well-defined margins on the interdental area of #11 and #12. It was extending to labial as well as the palatal aspect of the max-

illary central incisor region. There was diastema between #11 and #12 and over retained deciduous teeth #71 #81 (**Figure 2a**). Moderate amount of calculus was present in the maxillary and mandibular anterior region. The patient showed persistence of infantile swallowing during the examination. The maxillary central incisors were asymptomatic and vital. Otherwise patient was systemically healthy. Provisionally the overgrowth was diagnosed as FH, PG, and POF.

Surgical management: After completion of phase -I therapy, surgical excision by employing diode laser was planned for case-1 and case-2. In case-1 extraction of periodontally compromised #13 #15 along with growth excision by diode laser was planned. The treatment plan was explained to the patients, consents were obtained after routine investigations for both the cases. All the instructions given by the manufacturer for laser application were followed. Protective eye wears were used by the operator, assistant, and patient. The overgrowth was ex-



Figure 2a: Pre operative view showing overgrowth i.r.t. #11 #12.



Figure 2c: Post-operative palatal view after growth excision.



Figure 2b: Intra operative view showing excision of growth by laser.



Figure 2d: After 01 year follow-up.

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cised using a diode laser, under local infiltration (Lignocaine 2% with adrenaline 1: 80,000). Around 01 mm of healthy margins, circumscribing the growth, was included in excision and growth was excised up to the periosteum at its base (**Figure 1b, 2b, 1c, and 2c**). The FRGO was removed using 940 nm InGaAsP diode laser (EPIC 10TM Biolase, USA) in contact mode with surgical fiber optic tip of 300 µm at a power setting of 1.2 watts in a pulsed P3 mode (20 milliseconds on, 20 milliseconds off). After growth excision, the operated area was irrigated with normal saline. The periodontal pack was placed and postoperative instructions were given. Analgesics (s.o.s.) were prescribed after treatment for both the cases. Patients were reinforced for the mechanical and chemical plaque control. Excised tissues were fixed in 10% formalin solution and sent for histopathological examination. Both the patients reported no pain after 01-day, and thus there was no need for further analgesic intake. At 01-week follow-up healing was uneventful and satisfactory in both the cases. Case-1 was referred to Prosthodontic department and case-2 to the Orthodontics department for further needful treatment. The gingival overgrowth was diagnosed as PGCG in case-1 and POF in case-2 histologically. Patients were recalled at 06 weeks, 03 months, 06 months and 01-year interval for follow-up and maintenance. There was no sign of recurrence in both the cases during recall visits (**Figure 1d and 2d**).

Discussion

FRGO shows a broad clinical expression varying from; inflammatory reactive lesion to benign neoplasias. Various authors have reported different prevalence rates. Most of the researchers have observed higher female predilection for FRGO. Zhang W (2007)⁵ observed 2439 cases of gin-

gival lesions and found highest incidence of peripheral fibroma (61.05%), which was similar with the reported incidence of Kfir et al. (1980).³ In contrast to this Effiom OA (2011)⁴ reported PG (57%) as the commonest reactive gingival lesion among oral reactive lesions in the Nigerian population. POF is the third most common lesion among FRGO.^{3, 5} PGCG is the least encountered lesion among FRGO.^{4, 5} However, a retrospective study by Naderi NJ (2012)¹⁹ has reported highest prevalence of PGCG (30.12%) among 2068 reactive lesions of oral cavity and lesions were more common in males (**Table 1**).

The mechanism of etiopathogenesis of FRGO is still unsolved and considered to be multifactorial.²⁰ The long-standing, low-grade irritation due to the plaque accumulation is the most important predisposing factor reported by various researchers.²⁻⁴ The chronic injury results in fibrovascular cellular hyperplasia as an inflammatory reparative response of periodontal ligament/periosteum. Authors have also observed hormonal influence as another important predisposing factor for the occurrence of FRGO.⁶ It is an established fact that gingival tissue has receptors for progesterone and estrogens. Increased plasma estrogens and progesterone levels can increase inflammatory response to the chronic irritation. It explains the higher incidence of FRGO in females than males. Also, the case report of PGCG as a manifestation of primary hyperparathyroidism has been reported.²¹ A group of researchers have associated fibrovascular reactive lesions with antigenic proliferation and they have demonstrated the presence of factor XIIIa+ cells in such proliferative lesions.^{22, 23} Some authors have interrelated the occurrence of POF and PGCG, and they mentioned that both the lesions are progressive forms with the same spectrum of pathogenesis.²⁴ FRGO exhibit many similar clinical features.^{3, 4} Therefore differential diagnosis of

Table 1: Distribution of FRGO reported by various authors.^{3, 4, 5}

		PG	PF/FFH	POF	PGCG	TOTAL
Kfir et al. (1980)	Distribution of the lesion	26.8%	55.9%	10.6%	6.7%	100%
		(199)	(414)	(78)	(50)	(741)
	Mean Age (Years)	34.4	37.1	31.5	39.6	35.7
	M/F	1:1.8	1:1.4	1:2	1:1	1:1.5
Zhang et al. (2007)	Distribution of the lesion	19.76%	61.05%	17.67%	1.52%	100%
		(482)	(1489)	(431)	(37)	(2439)
	Mean Age (Years)	35.54	45.44	44.18	49.60	43.39
	M/F	1:1.99	1:1.31	1:1.22	1:1.47	1:1.40
Effiom et al. (2011)	Distribution of the lesion	57%	19.4%	20.4%	3.2%	100%
		(179)	(61)	(64)	(10)	(314)
	Mean Age (Decade)	3rd	2nd and 3rd	2nd and 3rd	2nd and 3rd	2nd and 3rd
	M/F	1:2.1	1:1.2	1:1.4	1:1.5	1.6

FRGO is very critical and challenging. Histopathological examination plays a key role in the diagnosis of such lesions.^{25, 26)} PG is histologically characterized by the presence of enormous immature/mature endothelium lining containing central vascular space along with inflammatory cell infiltrate covered with thin, normal/ulcerated stratified squamous epithelium. Histological findings of FH show encapsulated proliferative connective tissue mass.^{27, 28)}

Provisional diagnosis in case-1 included POF and PGCG on the basis of the clinical appearance of the lesions. The overgrowth was involving maxillary canine-premolar region. Histopathological examination of PGCG exhibits presence of hyperplastic parakeratinized stratified squamous epithelium. The underlying connective tissue stroma shows numerous immature proliferating fibroblasts in a vascularized stroma. Numerous multinucleated giant cells throughout the stroma are seen (**Figure 3a**).

PGCG is one of the commonly occurring giant cell lesions of the gingiva. The term PGCG was suggested by Bernier and Cahn (1954),^{29, 30)} which is a universally accepted term now. Earlier it was also known as peripheral giant cell tumor, osteoclastoma, giant cell epulis, giant cell hyperplasia of the oral mucosa and reparatory giant cell granuloma.³⁾ Peripheral type and central type are variants of giant cell granuloma. The lesions may appear at any age, though the highest incidence observed is the third to fifth decade of life.^{3, 5)} PGCG is believed to be benign hyperplastic reactive lesion and originate from tissue directly associated with bone-like periosteum, periodontal ligament, connective tissue of gingiva.³¹⁾ Chronic irritation due to the presence of an abundance of plaque & calculus on the affected site is the possible cause of occurrence of the lesion in the present case. Histopathologically a confirmed diagnosis of PGCG was made

(**Figure 3a**).

Histologically POF is characterized by highly cellular and fibrous stroma with multiple irregular areas of the calcified osseous structure. Peripheral fibroma may show calcified bone-like structures in the form of osteoid or the calcification may resemble cementum-like substance.^{27, 32)} In case-2 the connective tissue is covered with ulcerated and acanthotic stratified squamous epithelium and stroma is showing few calcifications in the form of osteoid (**Figure 3b**). The overgrowth was involving midline in relation to diastema of #12 and #21. Accumulation of bacterial plaque due to the presence of diastema can be explained as a possible cause of development of POF. On the basis of histopathology, a diagnosis of POF was made (**Figure 3b**). The term POF was coined by Eversol and Robin 1972.³³⁾ In literature different names have been suggested for POF depending upon its histologic variants; such as Peripheral odontogenic fibroma, Peripheral Cementifying fibroma, Calcifying or ossifying fibroid epulis, Peripheral fibroma with calcification. Literature supports the periodontal origin of the lesion on the basis of its gingival interdental papilla as the predominant site of occurrence; gingival proximity to periodontal ligament, the presence of oxytalan fibers within the mineralized matrix of some lesion, the fibro cellular response in periodontal ligament, and interdental bone destruction along with pathological migration of teeth.²³⁾

Application of lasers in the surgical management of FRGO is being well acknowledged nowadays. The advantages of lasers include superior hemostasis in comparison to the conventional surgical techniques, ease of surgical procedure and bactericidal properties. Semiconductor diode lasers are introduced in the mid-1990s. It is one of the most versatile laser systems among the currently available systems. It has a range of wavelength from 635

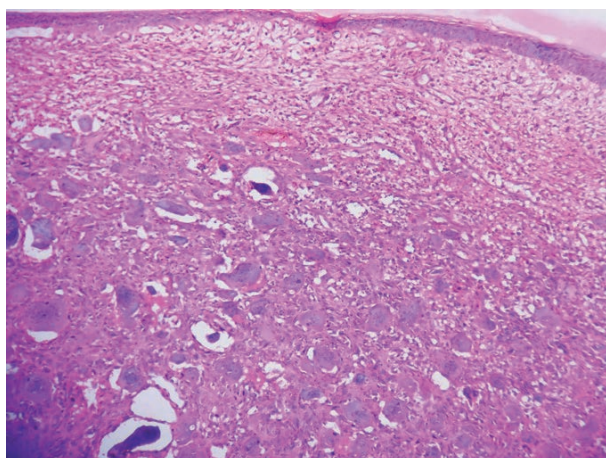


Figure 3a: Showing peripheral stratified squamous epithelium with underlying fibrous connective tissue stroma with numerous multinucleated giant cells.

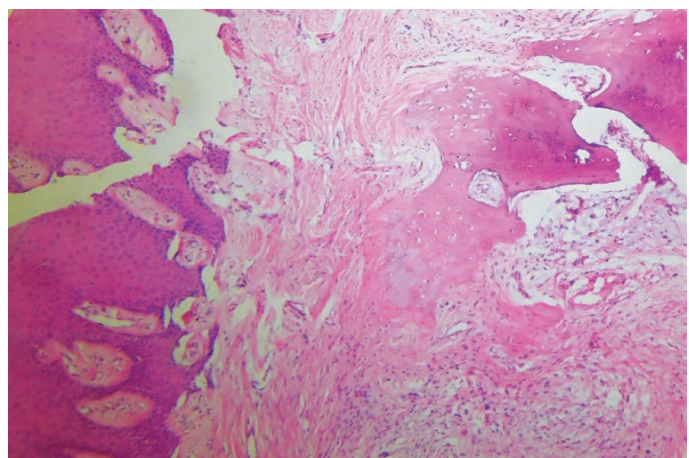


Figure 3b: Showing peripheral stratified squamous epithelium with underlying fibrous connective tissue stroma showing few calcifications in the form of osteoid.

to 950 nm. The InGaAsP (Indium Gallium Arsenide Phosphide) and GaAlAs (Gallium-Aluminium-Arsenide) are the most commonly used diode laser medium. They have an affinity for pigmented tissue compared to non pigmented tissue due to the presence of hemoglobin, melanin and other pigmented proteins.^{18, 34)} The popularity of diode lasers has been highly increased due to added advantage like the small size, portable, price range and wide range of application.^{35, 36)} Currently, diode lasers are widely used in various soft tissue procedures such as frenectomies, crown lengthening, vestibuloplasty, gingivectomy, and gingival de-pigmentation etc. in the field of dentistry.³⁷⁾ Due to high affinity for oxygenated hemoglobin, it promotes hemostasis, coagulation, and carbonization of targeted soft tissue, resulting in high precision and clean incision.^{17, 38)}

Diode laser provides a clean surgical field by fastening small blood vessels and denaturation of proteins through heat generation.^{39, 40)} Authors have also reported its effect on clotting factor VII and thus promoting hemostasis.⁴¹⁾ It also, decreases postoperative distress thus reduces shrinkage of tissue.^{38, 42)} The protective layer (coagulum, char, and laser bandage) on wound is formed by denatured proteins. It aids in wound protection and reduced requirement of suturing. This layer eventually breakdown and helps in healing and tissue formation.^{35, 42)} Diode laser are able to secure sensory nerve endings for short time period which decreases pain during the procedure.⁴³⁾ Additionally, diode laser has bactericidal effect which produces sterile wound after surgery and same time reduces risk of infection.⁴⁴⁾ The faster movement of laser beam and use of coolants assist in removal of carbonized debris, excised tissue and minimize heat build-up.^{35, 45)}

In the presented cases excellent incision, hemostasis and good patient cooperation experienced during procedure. At the same time less anesthesia, no suturing and no postoperative discomfort was noted. No systemic anti-

microbial was prescribed in both the cases as an advantage of bactericidal properties of the laser. Lasers also reduced the use of postoperative analgesics. The follow-up session showed excellent soft tissue healing with no recurrence. Researchers have shown less recurrence and minimal alteration in the excised biopsy tissue, facilitating more accurate diagnosis.⁴⁶⁾ Diode lasers are promising alternative treatment modality for the management of FRGO.

The requirement of specific training and its high expenditure limits the use of laser in routine dental practice. Every laser has different and specific properties, as well as there, are a different laser for different procedures. The clinician must be aware of the precautions, possible risk during irradiation and limitations of the use of the laser. In addition use of protective eyewear, high vacuum suction, good control on foot pedal and avoidance of shiny metal surfaces are advocated to prevent inadvertent irradiation.

Conclusion

Diagnosis and management of FRGO are very important in clinical practice. The laser-assisted surgical excision is safe with several clinical benefits. Elimination of the irritant and/or local contributory factor is equally important to surgical excision in the management of such lesion. Application of diode laser not only provides the psychological advantage for the patient but also the skilled execution of the procedure by the operator due to hemostasis and improved precision. Consequently, it adds in avoiding recurrence of gingival reactive lesions. Patient motivation and long-term follow-up are highly recommended to prevent recurrence of FRGO. Therefore the application of the diode laser is found to be a very effective and predictable approach in the management of FRGO in present case reports. The long-term studies are recommended in the future to establish the outcome.

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