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A laser assisted approach to treat Fibroepithelial Gingival Hyperplasia: A case report

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Abstract
Fibroepithelial gingival hyperplasia (FGH) is a benign, proliferative disorder characterized by an excessive growth of fibrous and epithelial tissues in the gingiva. The etiology of fibroepithelial gingival hyperplasia is multifactorial, with various predisposing factors implicated in its development. Local factors such as poor oral hygiene, chronic irritation, trauma, and certain medications have been associated. Systemic factors including hormonal imbalances, genetic predisposition, and systemic diseases like leukemia and hereditary gingival fibromatosis have also been implicated in fibroepithelial gingival hyperplasia pathogenesis.
Clinical management of fibroepithelial gingival hyperplasia involves a multidisciplinary approach, incorporating both non-surgical and surgical interventions. Non-surgical therapies, such as meticulous oral hygiene practices, removal of local irritants, and drug substitution, may be effective in mild cases or as an adjunct to surgical treatment. Surgical options include gingivectomy, in which the excessive tissue is excised, and gingivoplasty, which involves reshaping the gingival contours. Laser-assisted techniques have also shown promising results in fibroepithelial gingival hyperplasia treatment, providing better patient comfort and improved healing outcomes. Long-term management of fibroepithelial gingival hyperplasia necessitates regular follow-up visits to monitor the recurrence or persistence of the condition.

Keywords: Fibroepithelial gingival hyperplasia, Gingival hypertrophy, LASER, Fibroma, Photobiomodulation, Blue diode laser

Introduction
Gingival overgrowth, whether generalized or localized, refers to an enlargement of the gingival tissues. This term has supplanted gingival hyperplasia, which denotes an increase in cell number, and gingival hypertrophy, which signifies an increase in cell size. True enlargement encompasses alterations in cell size, cell multiplication, gingival vasculature, and the extracellular matrix to varying extents. Following are the various gingival overgrowth conditions like Chronic inflammatory gingival overgrowth, Fibrous epulis, Pyogenic granuloma, Plasma cell gingivitis, certain benign conditions like papilloma, Peripheral giant cell granuloma, Central giant cell granuloma, overgrowths occurring due to hormonal conditions like puberty, pregnancy, menstruation, drug induced gingival overgrowths [1, 2], granulomatous disorders such as Wegener's granulomatosis, Sarcoidosis, Orofacial granulomatosis, Chron's disease, hereditary diseases like Hereditary gingival fibromatosis, Neurofibromatosis. Gingival reactive lesions represent a significant group of pathologies affecting the gingival tissue. These lesions encompass inflammatory fibrous hyperplasia, pyogenic granuloma, peripheral giant cell granuloma, and peripheral ossifying fibroma, each exhibiting distinct clinical and pathological features [3]. The histological alterations observed in the mucosal tissues can be classified as hypertrophy, characterized by an increase in the size of cellular elements, or hyperplasia, characterized by an increase in the number of cellular elements [4].
The oral mucosa is constantly exposed to various external and internal factors, leading to a wide spectrum of diseases, including developmental, reactive, inflammatory, and neoplastic conditions [5, 6]. Reactive lesions can occur anywhere in the oral cavity but are more commonly observed on the gingiva, tongue, and lip [7]. These lesions are non-neoplastic nodular swellings that develop in response to chronic and recurrent tissue injuries, eliciting an exuberant or excessive tissue response [8].

Depending on its extent, gingival overgrowth can have multiple effects on the stomatognathic system, resulting in functional disorders (such as impaired speech), difficulties in chewing, and even aesthetic concerns that may cause psychological distress [4].

Fibroma/fibro epithelial hyperplasia

Nearly all oral cavity lesions referred to as fibromas are not true neoplasms but rather fibrous overgrowths induced by chronic irritation. For these types of lesions, some authors prefer using the terms fibroepithelial polyp or fibrous hyperplasia. In a study by Axell (1976), fibromas had a prevalence of 3.25% in the adult Swedish population. They are rarely found before the fourth decade of life and do not exhibit a sex preference.

Fibroma is the predominant form of oral fibrous proliferation, characterized as a localized increase in fibrous tissue due to trauma or local irritation. This category of lesion occurs in 1.2% of adults and constitutes the leading type of oral mucosal mass undergoing biopsy. Its primary composition includes Types I and III collagen. While gingival lesions are also common, they are more likely to arise from chronic infection rather than traumatic factors [5].

These lesions typically present as painless, sessile, round or ovoid, broad-based swellings, appearing lighter in color than the surrounding tissues due to reduced vascularity. The surface may be ulcerated, and the diameter can vary from 1 millimeter to several centimeters. Various treatment approaches can be employed, such as scalpel, laser, and electrosurgery, with a low recurrence rate expected.

The term 'LASER' is an abbreviation for 'light amplification by stimulated emission of radiation.' It denotes a device that emits light with spatial coherence and collimation, allowing a laser beam to maintain its narrow focus over long distances. Lasers find numerous periodontal applications, including calculus removal (using Er: YAG, Er, Cr: YSGG lasers), excision and incision of soft tissues, ablation, decontamination of root and implant surfaces, biostimulation, bacterial reduction, and bone removal (osseous surgery).

In the realm of laser dentistry, the latest addition to the wavelengths available is the blue diode laser, emitting light at 445 nm. Among the various diode lasers, this particular wavelength exhibits the highest absorption in hemoglobin and melanin. As a result, it allows for superior quality cuts at lower power settings while minimizing thermal damage to the surrounding tissues. Blue diode laser affects on proliferation and migration of fibroblasts. These features make blue lasers popular in dental surgery [9].

Case report

A 38 years old male patient reported to the department of periodontology and oral implantology with the chief complaint of swelling in lower left back tooth region. He had no past medical history and no relevant habits. He had past dental history of overgrowth of gingiva in the same region 6 months back which was given for biopsy. Patient had proximal caries with 36.

Clinical features: The gingival overgrowth was seen in relation to 36 and 37. Colour of the swelling was reddish pink, firm in consistency with smooth surface texture, measuring about 1×0.8 cm. False pockets were seen upto 5 mm. The overgrowth was extending till occlusal surface.

Radiographic features: IOPA was taken, no radiographic bone loss seen. Deep proximal caries were detected involving dental pulp.

Surgical phase: In surgical phase, local anaeshthesia was administered using 2% lignocaine hydrochloride via inferior alveolar nerve block, buccal and lingual nerve block. An incisional biopsy was performed at base of papilla with no. 15 blade and Bard Parker handle #3, the specimen was detached and transferred to a jar filled with 10% formalin. Immediately after the procedure a haemostasis was obtained & ablation was performed using Siro blue laser at 445nm wavelength in non-contact mode. Following this moist guaze was used to remove any surface charring. Vitamin E was capsules were prescribed to the patient. Patient was administered with antibiotics and analgesics and oral hygiene instructions were given for maintenance. Healing was uneventful. Within 1-3 days a whitish patch was seen due to protein coagulation which was after effect of laser treatment.

Histopathological features: H & E stained section showed para-keratinised stratified squamous in epithelium and underlying connective tissue. The epithelium was hyperplastic & exhibited arcading and forking at places. The underlying connective tissues composed numerous dense collagen fibre bundles interspersed with fibroblast. Few engorged blood vessels were present with chronic inflammatory cells comprising of lymphocytes and plasma cells.

Provisional diagnosis: Based on the clinical features the provisional diagnosis was made as irritational fibroma.

Differential diagnosis: Following can be given as differential diagnosis pyogenic granuloma, peripheral odontogenic fibroma, fibrosarcoma, and squamous cell carcinoma.

Final diagnosis: Based on clinical and histopathological features the final diagnosis was made as fibroepithelial hyperplasia.

Clinical pictures

Fig 1: Pre-Operative view (Buccal view).

Fig 2: Pre-Operative view (Occlusal view).

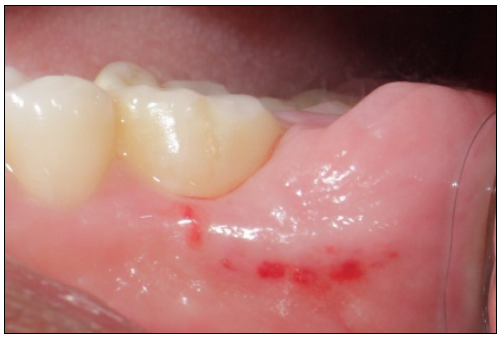

Fig 3: Transgingival probing done.

Fig 4: Incision given with No. 15 blade.

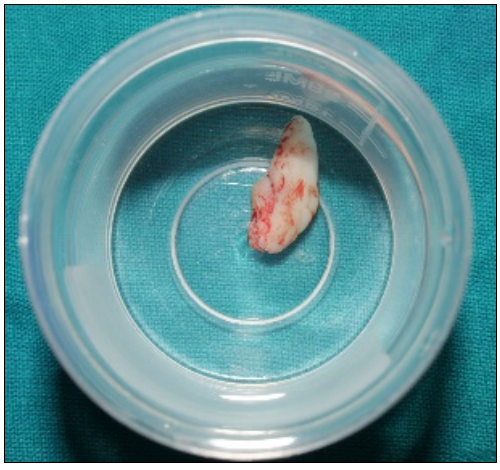

Fig 5, 6: Excised specimen stored and transported in 10% formalin.

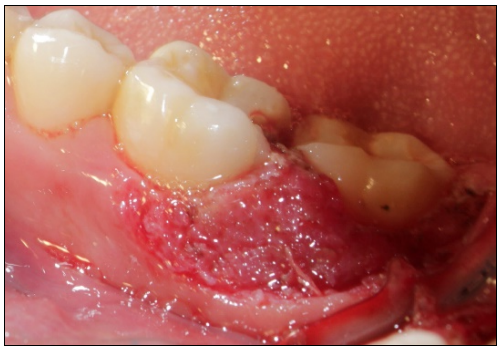

Fig 7: Immediate Post-operative view.

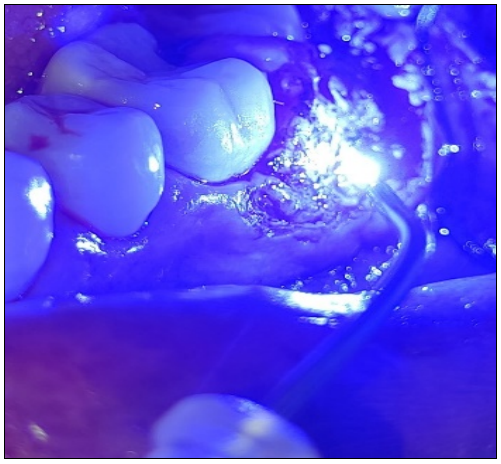

Fig 8, 9: The soft tissue surface is ablated by laser.

Fig 10: Immediate Post-operative view.

Fig 11: 1 week Post- Operative view.

Fig 12: 6 months Post- Operative view.

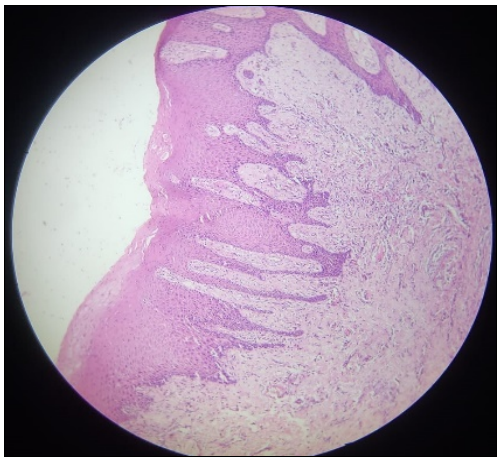

Fig 13: Histological view under microscope.

Discussion

The term "epulis" was initially introduced by Galen [10] to describe a tumor on the gums. Back then, "epulis" was used broadly to refer to any abnormal gingival growth. However, in modern times, its application has been limited to specific types of growth identified in various areas of the oral cavity. Reactive lesions of the gingiva have been categorized based on their histology. Kfir *et al.* [11] specifically classified reactive gingival lesions into pyogenic granuloma, peripheral giant cell granuloma, fibrous hyperplasia, and peripheral fibroma with calcification. A study analyzing over 30,000 oral biopsies found that nearly 13% of them were taken from the gingiva. It's worth noting that almost all lesions referred to as fibromas in the oral cavity are not true neoplasms, but rather fibrous overgrowths caused by chronic irritation. Due to this distinction, many authors prefer using the terms fibroepithelial polyp or fibrous hyperplasia for these types of lesions [12, 13].

The diverse histological characteristics observed in reactive hyperplasia may arise due to the connective tissue's reaction to different levels of gingival irritation. This reaction might be influenced by the concentrations of specific endocrine hormones present in the serum. It is crucial to clearly distinguish between hyperplasia and neoplasia, as neoplasias are not self-limiting conditions, and long-standing hyperplastic lesions in the presence of chronic irritation may transform into neoplasia.

Daley *et al.* [10] proposed that the vascular element of pyogenic granuloma undergoes a gradual transformation into fibrous tissue as time progresses, resulting in its identification as fibrous hyperplasia. Natheer Al Rawi [14] noted that fibrous hyperplasia on the gingiva demonstrates not only a comparable prevalence among female individuals but also manifests within the same age bracket as gingival pyogenic granuloma. Besides the reactive tissue reaction to irritants, certain researchers have documented drug-induced fibrous growth in the gingival tissue. It's important not to confuse the term "fibro-epithelial hyperplasia" with focal epithelial hyperplasia, a viral infection (HPV virus) that affects only the epithelium and not the connective tissue of the oral mucosa [15, 16].

Laser treatments have demonstrated superiority over conventional mechanical approaches in soft tissue management due to their ease of ablation, reduced contamination, better hemostasis, and lower surgical and postoperative pain. The advantages of laser application include relatively bloodless surgery, minimal swelling and scarring, no need for suturing, reduced surgical time, and less discomfort and postoperative pain [17] Furthermore, laser treatment aids in inflammation reduction, accelerated tissue repair, and cell growth [18].

In a split-mouth crossover design study, Mavrogiannis *et al.* (2006) compared laser gingivectomy to scalpel excision for managing DIGO (Drug-Induced Gingival Overgrowth) and demonstrated a significantly lower recurrence rate with laser gingivectomy during the 6-month follow-up period [19].

Photobiomodulation impacts the process of wound healing by initiating photochemical reactions that trigger effects primarily involving blue light. These effects rely on the absorption of light by photoreceptors. Among the key photoreceptors within cells is cytochrome c oxidase (CCO), which prompts the generation of nitric oxide (NO) and reactive oxygen species (ROS), alongside the activation of ion channels. The activation of CCO through photoactivation prompts an electron to become excited within its structure, initiating the transfer of electrons along the respiratory chain. As a result, the electrochemical potential of protons increases, amplifying the function of ATP synthase and cellular metabolism. This, in turn, leads to an augmentation in the metabolic building blocks of lipids, proteins, DNA, and RNA, promoting cell proliferation, migration, and adhesion while preventing cell apoptosis [20].

The consistent reduction in post-operative gingival re-growth observed in the laser-treated areas might indicate a distinct response to this treatment approach. This response could be linked to a decrease in collagen production by gingival fibroblasts and a delay in the healing process. Studies have shown that the high-energy Nd:YAG laser can inhibit collagen production in fibroblast cell cultures. This action is attributed to the laser's influence on the enzymatic reactions that regulate collagen synthesis and breakdown [19]. In our case similar results were obtained at 445 nm which has greater depth of penetration like Nd:YAG.

Conclusion

In addition to the physical attributes of the lesion, the patient's demographic information, presence of accompanying symptoms, relevant systemic conditions, as well as the location and growth patterns of the lesion, collectively offer significant insights for precise diagnosis and effective treatment aligned with its characteristic histopathological structure. A biopsy plays a crucial role in ensuring a more precise and optimal treatment plan, thereby reducing the likelihood of lesion recurrence. Molecular analysis, particularly using polymerase chain reaction (PCR), serves as a useful tool in achieving a conclusive diagnosis. Treatment options commonly utilized include scalpel surgery, cryotherapy, and cauterization. However, laser therapy is rapidly gaining popularity and is poised to become the standard of care due to its numerous advantages, such as providing hemostasis, increased patient comfort, and improved healing.

In our case, probable cause of the lesion was due to local factors (Plaque,calculus). Fibroepithelial hyperplasia was treated with combined approach of conventional and laser treatment, patient had minimal blood loss, less postoperative pain and discomfort was noticed with better healing. No recurrence was seen till 6 months postoperatively. Also the patient was acquiescent during and after laser therapy. Hence combined approach to treat such conditions has shown effective results, further more studies have to be done for longer follow up.

While conducting the ablation procedure, certain fumes were emitted due to the vaporization of the epithelium, accompanied by a burnt odor. This could potentially induce stress, underscoring the importance of utilizing a robust air evacuation system and providing a barrier through a temporary dam.

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