

Diode laser assisted fibrotomy in the management of oral submucous fibrosis.

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Abstract

Introduction: Oral submucous fibrosis (OSMF) is one of the most poorly understood and unsatisfactorily treated diseases. Various medical and surgical treatments have been used but with limited benefits. However, with advent of lasers, oral surgeons are provided with new modality for treating OSMF. This study highlights the pioneering effort in treating mild to moderate cases of OSMF with Diode laser showing promising result during follow-up.

Material and method: This randomized prospective study consisted of 10 patients who met the inclusion and exclusion criteria. The patients were selected irrespective of the age, sex and socioeconomic status, with a habit of areca nut or gutkha chewing, diagnosed as group II and III OSMF patients. Laser fibrotomy procedure was carried out under local anesthesia.

Results: Pre- and post-operative mouth-opening was compared and a significant difference observed

($p=0.048$). Follow up over a period of 12 months showed encouraging results.

Conclusion This preliminary study indicated that adequate release of oral submucous fibrosis can be achieved by using a Diode laser fibrotomy procedure, with minimal morbidity and satisfactory results. These promising results should encourage more widespread use of this technique in the management of this condition for managing patients with mild to moderate OSMF.

Keywords: Oral Submucous Fibrosis, Diode Laser, Fibrotomy, Areca nut, Inter-incisal distance, Reduced mouth opening.

Introduction

OSMF is a chronic, debilitating, insidious, prevalent condition of oral cavity that occurs among Indians and occasionally in other Asians especially Taiwanese and sporadically in Europeans predominantly caused by areca/betel nut. It is characterized by juxta-epithelial inflammatory reaction followed by chronic change in the fibro-elasticity of the lamina propria and is associated

with epithelial atrophy. This leads to burning sensation in the oral cavity, blanching, and stiffening of oral mucosa and oropharynx, resulting in restricted mouth opening which in turn causes limited food consumption, difficulty in maintaining oral health, and impairs the ability to speak. What makes it more sinister is the malignant transformation rate.¹ OSMF is well known for its resistant and chronic nature. Being a premalignant condition with debilitating consequences, no conservative treatment that has given complete resolution of symptoms is identified till date.²

One of the latest revolutions in the field of medicine and dentistry has been the advent of laser. Diode laser, CO2 laser, Er Cr: YSGG laser, KTP-532 laser etc, are different laser that are used to treat OSMF. These lasers provide an easy and comfortable option of keeping the procedures efficacious as well as minimally invasive. The fibrous bands are excised with the help of the laser, which is a very good alternative for traditional surgical excision. The quicker and uneventful healing after laser therapy adds to patient satisfaction. The overall benefits of laser surgery include reduced need for local anesthesia, a relatively bloodless operative field, excellent visibility, less chances of bacterial infection, fewer sutures, quicker healing and also reduced mechanical tissue trauma, post-operative edema, scarring and tissue shrinkage. At the same time, the possible complications in laser surgery can be excessive or collateral tissue damage due to misdirected usage.³

Based on the above points, we intend to investigate the efficacy and predictability of diode laser as a treatment modality for mild to moderate OSMF (Khanna and Andrade staging).

Material And Method

A prospective study was designed to evaluate the efficacy of Diode Laser in treating OSMF. This study was conducted on the population reporting to the OPD of Department of Oral and Maxillofacial Surgery of College of Dental Sciences and Research Centre, Ahmedabad. Patients having a chief complain of reduced mouth opening and fulfilling all the inclusive criteria were considered for this study. In this study 10 patients were selected randomly according to mentioned selection criteria and source.

Inclusion Criteria

1. Patient's willingness for discontinuation of habit and undergoing surgery.
2. Patients who were diagnosed with group II and III OSMF according to Khanna and Andrade.
3. Patients between the age group of 20 to 60 years.
4. Patient's readiness to participate in the study was considered.
5. Patients who were ready to do post operative exercise sincerely.

Exclusion Criteria

1. Patients having group IV OSMF according to Khanna and Andrade.
2. Patients undergoing other forms of treatment for OSMF.
3. Patients having any other lesion in the affected site with OSMF.
4. Uncooperative patients and patients not willing to turn up for the follow up.
5. Medically compromised patients.

Pre-Operative Preparation

Prior to surgery all the patients were motivated to strictly quit the habits (smoking, areca/betel nut, tobacco chewing etc.) causing OSMF at least before 3 months of

treatment. Patients were informed about recurrence of OSMF and poor post-operative results on continuation of their habits.

A detailed history was recorded and patient was clinically examined to reach diagnosis. Routine haematological investigations were carried out. Scaling was done and mouth wash was prescribed to patient to maintain oral hygiene. Prophylactic antibiotic was prescribed to patients one day before operative procedure (capsule Amoxicillin with clavulanic acid 625mg TID). Written informed consent for local anaesthesia and surgery was taken from the patients and their relative after explaining the procedure. The entire study was conducted after getting clearance from the ethical committee.

Surgical Procedure

All the asepsis criteria were kept in mind before and during the surgery. Painting was done with 5% povidone iodine solution and draping was done with sterile green clothes. 2% lignocaine hydrochloride with adrenaline (1:80000) was infiltrated in the surgical site. Initialization of diode laser tip was done.

A diode laser of 940nm wavelength was used and complete lasing was done at 0.5 to 2 Watts. 400 µm diameter and 4mm length glass fiber tip was used as the delivery system. The fibrous bands were palpated on the buccal mucosa. Fibrotomy was done with diode laser in continuous mode on the affected region horizontally on the buccal mucosa only where bands were present. Lasing was done in such a way that incision was made perpendicular to the fibrous bands on the buccal mucosa lasing from the retromolar area then running anteriorly till the fibrous bands were present achieving a desired depth of 2-3 mm in the submucosal plane to release the bands. Care was taken to limit the extent of the

procedure only to the mucosal and the submucosal layers avoiding penetration into the deeper muscular layer. With the use of artery forceps, the fibrous bands were further broken whenever needed. Tissue was mopped with wet gauze in between the fibrotomy procedure to permit thermal relaxation of the tissue before commencing again with the procedure. Immediately after fibrotomy procedure, forceful mouth opening was carried out using Heister's mouth gag leading to the fibres getting dissected and ruptured, resulting in an enhanced mouth opening. Same procedure was repeated on other side in bilateral cases. Bleeding and duration of operative procedure was evaluated at the time of surgery. Bleeding was assessed visually during the diode laser fibrotomy procedure. Immediate post operative mouth opening (IID) was recorded using vernier caliper. Simple dressing (sterile gauze) soaked in betadine was placed to cover the wound for about 45 minutes.

Post-Operative Management

The patients were advised to continue oral antibiotic and analgesics postoperatively for 5 days. (Amoxicillin with clavulanic acid 625mg thrice daily and combination of paracetamol and diclofenac twice daily). Topical analgesic twice daily was prescribed for 7 days and topical steroids (Triamcinolone acetonide gel 0.1%) thrice daily for 3 months. Patient was advised to take liquid diet on the day of surgery and soft diet thereon for a week.

Oral hygiene was maintained by regular intra oral flushing with 2% betadine mouthwash. Patients were instructed to start mouth opening exercise 7 days after fibrotomy procedure and exercise at least 3 times a day using Heister's mouth gag and using ice-cream sticks. Regular physiotherapy (cheek ballooning) was advised 4 to 5 times in a day for at least 30 minutes.

Patients were called for follow-up on 7th day, 15th day, 1st month, 3rd month, 6th month and 12th month post operatively, intraoral photographs were taken and other clinical evaluation were done. Clinical evaluation included mouth opening (IID), pain, total days of healing, overall general condition and life style of patient and compared with pre operative data and postoperative complications if any.

Observation And Results

A total of 10 patients were included in the study, with the age group between 20 to 65 years. 8 patients were male and remaining 2 patients were female. Sex predilection seemed to favour male over female. All the patients in the study had habits which abused the oral mucosa and gave a history of restricted mouth opening following the habit. 3 patients had habit of pure Areca nut chewing, 5 patients had a habit of chewing gutkha (Areca nut, tobacco and katha) and 2 patients had habit of chewing both Areca nut and gutkha. Duration of habit continuation ranged from minimum 5 years to maximum 30 years. The frequency varied from minimum 4-5 packets/ day to maximum 7-8 packets/ day. Blanching was evident in different areas in the oral cavity depending on the habit. The most involved site of OSMF was buccal mucosa (10) followed by retromolar area (6), labial mucosa (2), and anterior faucial pillar (1). Most of the patients in our study presented with complain of trismus, trismus with/without burning sensation, and trismus with burning sensation and pain in 3rd molar. Clinical and functional staging were done based on classification given by Khanna JN and Andrade NN in 1995. Accordingly, 50% of the patient came under group II with IID ranging between 26-35mm and 50% patients came under group III with IID ranging between 15-25mm. On clinical examination, fibrous bands were

palpable on buccal mucosa, labial mucosa, retromolar area and in few cases on anterior faucial pillars. In most patients, bands were only palpable on buccal mucosa and retromolar region. The main signs in the patients were trismus and blanching of mucosa.

Mouth opening: Pre operative mouth opening ranged from 17-30mm with a mean of 23.1mm. Intra-operative mouth opening ranging from 25-44mm was achieved with a mean of 33.2mm. Results showed a mean IID of 23.1mm pre-operatively and 31.6mm at 12 months post-operatively. On comparing pre-operative and post-operative mouth opening at 12 months, statistically significant difference was found ($p=0.048$).

Post-operative pain: This was evaluated using Visual Analogue Scale. Pain was persistent till 1 week follow-up in most of the cases. On 3rd day post operatively, 60% patients had mild pain, 20% patients had moderate pain whereas, 20% patient had no pain at all. On 1st week follow-up, 50% patients had mild pain, 10% patients had moderate pain and 40% patients had no pain at all. On 15th day follow-up, almost 90% patients had no complain of pain and only 10% had mild pain present. Pain was absent in 100% cases on 1st month follow-up. Complete healing occurred usually in 14 to 20 days post operatively.

Discussion

The study carried out at our institute from 2019-2021 consisted of total 10 patients, where the youngest being 25 and the oldest 64 years of age. In this study, 10 patients were in the age range of 20-65 years, with a peak incidence in 20-40 years (50%), followed by 41-60 years (30%). Hence, it can be concluded that the occurrence of OSMF is seen most commonly in age group 20-40 years. The observation of present study was similar to study conducted by Nigam, who reported the

maximum number of OSMF cases were in the age group of 36-40 years.⁴ Also, males outstand the females in harbouring the disease,⁵ as out of 10 patients, 8 were male and 2 were female.

Early lesions of oral submucous fibrosis can present as blanching of the mucosa, imparting a mottled, marble-like appearance. Progressive lesions show palpable, vertical, fibrotic bands in the buccal mucosa and in a circular fashion around the mouth and lips.⁶ It is generally believed that oral submucous fibrosis originates at the posterior part of oral cavity and subsequently involves the anterior locations. As regard the site distribution of oral submucous fibrosis, buccal mucosa and retromolar area were involved in all cases of this study. In 3 cases, fibrous bands were present only on right buccal mucosa and there was an associated history of tobacco placement in right buccal mucosa. In 2 cases, along with buccal mucosa and retromolar area, labial mucosa was also affected. On the basis of clinical symptoms, all patients had trismus. 3 patients had associated complain of burning sensation with trismus and 2 patients had complain of pain in the 3rd molar area also. Bilateral involvement was most common as seen in 90% of the patients similar to that described by Chaudhry et al.⁶ in their study (87.5%).⁷

According to Khanna and Andrade, the disease has been classified clinically into four groups depending on the severity of trismus and extent of fibrosis of oral mucosa.⁸ Once the trismus develops the disease would be considered as mild to moderate (group II and III). The gold therapy is to maintain oral function and prevent the progression of the disease. The management is empirical, depends on the staging of the disease and mainly comprises of various combinations of conservative/medical or surgical interventions. There is

no absolute cure for OSMF and all current interventions have been found to be of little benefit. Early and mild disease like Group I and II OSMF are mainly managed conservatively by cessation of habit, oral physiotherapy, anti-oxidant therapy, nutritional, vitamin and iron supplements along with topical corticosteroids.¹⁰ Moderate (Group III) OSMF, in addition to conservative therapy has been managed by adjuvant medical treatment like intralesional injections of corticosteroids, hyaluronidase or placentex, systemic corticosteroids, immunomodulators and pentoxifylline. The surgical management is directly proportional to the extent of the fibrosis. Excision of the fibrous bands and propping the mouth open allow secondary epithelialisation during healing. Surgical management for trismus has been used in moderate and severe OSMF (Groups III and IV) with some success. In severe cases of OSMF if only surgical intervention is done with simple division of fibrotic bands using blade, it heals with secondary healing which results in more fibrosis and disability. In such cases, defects can be reconstructed using split thickness skin grafts, buccal fat pad grafts, microvascular free radial forearm flaps, tongue flaps and nasolabial flaps. Additional procedures like masticatory muscle myotomy and bilateral coronoidectomy are performed to enhance mouth opening.⁹

Conventional surgical techniques aimed at excision of fibrous bands are associated with increased intra operative bleeding, which is difficult to manage in presence of trismus. Secondary healing seen after simple excision of fibrous band leads to further fibrosis, disability and relapse. Electro surgical techniques, though associated with reduced bleeding ends up in deep tissue damage, which in turn leads to increased post-operative fibrosis.¹⁰ Lasers can be used as an alternative

technique for surgical fibrotomy in OSMF as they have many advantages over current techniques. In our study, based on clinical examination and long-standing positive history of habits, all the cases were diagnosed as mild to moderate - group II and III (Khanna and Andrade) OSMF and were planned for laser laser fibrotomy procedure.

In this study, fibrotomy in all the cases was performed using 940nm Diode Laser at 0.5 to 2 watts power for all cases on continuous mode. Shah et al.¹¹ and Talsania et al.¹² have performed diode laser fibrotomy for treatment of OSMF however, they have performed the procedure under general anesthesia and we have performed the procedure under local anesthesia as a chair side procedure. Local anesthesia is typically safer than general anesthesia, because it bypasses the systemic effects seen with the latter. Unlike general anesthesia, which exerts its effects on the entire body, especially the central nervous and cardiopulmonary systems, local anesthesia has more confined, site-specific effects. Pre-operative IID ranged from 17-30mm. Thus, all the patients included in this study were having moderate disease and were managed by laser fibrotomy.

The laser surgery was a chair side procedure performed under local anesthesia (2% lignocaine with 1:80,000 adrenaline) and the duration of surgery ranges between 18-36 minutes with a mean duration of 26.10 minutes for entire procedure. Mean surgery time in study conducted by Chaudhry et al.¹⁰ was 20 minutes for each side. Thus, duration of surgery in our study was comparatively less which was due to good bleeding control obtained because of laser. Conventional surgical techniques aimed at excision of fibrous bands are associated with increased intra operative bleeding, which is difficult to manage in presence of trismus. Intra operative bleeding

was present only in one case in this study. Laser damage to erythrocytes attracts a population of platelets which encourage intraluminal thrombosis, further decrease in the blood loss and this explains why the laser excision had minimal blood loss.¹³ This is in accordance to the study conducted by Goharkhay et al.¹⁴ who used Diode laser on soft tissue lesions resulted in excellent coagulation ability.

In our study, we used incision perpendicular to fibrous bands on buccal mucosa lasing from the retromolar area then running anteriorly till the fibrous bands were present achieving a desired depth of 2-3 mm in the submucosal plane to release the bands similar to once used by Talsania et al.¹² which achieved good results in relieving trismus. Nayak et al.¹⁵ used multiple parallel incisions in his study. They also excised the fibrous bands in the soft palate in addition to those in the buccal mucosa, anterior faucial pillars and retromolar trigone, which may have contributed to the final outcome, although their procedures were done under general anesthesia. We did not attempt to excise the fibrous band in the anterior faucial or soft palate as our procedure was done under local anesthesia. Shah et al. and Kameshwaran et al. reported to have used inverted 'Y' and 'Z' incisions respectively yielding good results under general anesthesia.¹⁰ Nayak et al.¹⁵ used multiple parallel incisions perpendicular to the fibrous bands over the anterior faucial pillar, soft palate and retromolar trigone.

Immediately after fibrotomy procedure, forceful mouth opening was carried out using Heister's mouth gag leading to the fibres getting dissected and ruptured, resulting in an enhanced mouth opening ranging from 25-44mm with a mean of 33.2 mm. 1-week post-operative mouth opening ranged from 18-36mm with a

mean of 29.2mm which further increased on 15 days post operative follow-up to 29.6mm which ranged from 20-37mm. On 1st month post operative follow-up, mean mouth opening of 31.1mm where minimum mouth opening was 21mm and maximum being 41mm, on 3rd month follow-up, it ranged from 22-40mm with mean mouth opening of 31mm. On 6th month follow-up, mean mouth opening was 31.3mm. Finally, 12 months follow-up mouth opening ranged from as low as 22mm to as high as 41mm with a mean mouth opening of 31.8mm. Chaudhry et al. in their study mentioned that the mouth opening achieved intra operatively tends to decrease in the immediate post-operative period till the first month and then increases progressively.¹⁰ This could be due to pain in the immediate post operative period. The increase in the mouth opening at 12-month follow-up was significant which goes positively with our study too. Shah et al. also noted in his study that during follow-up period, slight improvement in mouth opening was found which could be due to intensive physiotherapy postoperatively.¹¹

Presence of pain (mild to moderate pain) in the immediate post-operative period after laser fibrotomy was seen in our study. It was observed that on 3rd post operative day, 2 patients had moderate pain, 6 patients had mild pain and 2 patients had no pain. On 1st week follow-up, 5 patients had mild pain, 1 patient had moderate pain and 4 patients had no pain at all. On 15th day follow-up, 9 patients had no complain of pain and only 1 patient had mild pain present. Pain was absent in 100% cases on 1st month follow-up. It was observed in the present study that pain reduced gradually after the treatment. The post operative pain occurred in the immediate post-operative period but improved after the first month. This symptom is probably due to the open

wound in the buccal mucosa, which heals, by secondary intention. The pain improves once the wound undergoes epithelialization.

In laser excision group; duration of healing after surgery ranges between 14-20 days and mean of 17.90 days. Disadvantages of laser usage in soft tissue lesions mainly includes prolonged healing time due to the sealing of blood and lymphatic vessels and also epithelial regeneration is delayed, and wounds take longer to re epithelialize. However, Nihat Akbulut et al. has evaluated the effects of the 810-nm diode laser in the treatment of various benign oral soft tissue lesions and noticed no complications in the surrounding soft tissue or hard tissue, with complete healing of white and vesicubullous lesions in duration of 6 weeks.¹⁶ Other post-operative complications following laser fibrotomy like hemorrhage, post-operative infection, wound dehiscence, nerve damage, collateral damage to adjacent tissues and teeth were not found in any case.

Conclusion

Following conclusion is made from the study.

- It is a simple chair side procedure which eliminates the use of general anesthesia for managing patients with mild to moderate disease. This technique is associated with less morbidity, less hospital stays and less follow-up.
- It can control haemorrhage both during and after the operation. The surgeon has excellent visibility during the operation; this enables shortening of the operative time. Also, patients do not require a special method to stop bleeding after surgery and it is possible, as a rule, to leave the excised edges unsutured in the excision technique.

- Processes of wound healing are excellent, because of the limited scarring and contraction, and there is satisfactory elasticity of the soft tissue.
- Epithelial regeneration is delayed, and wounds take longer to re epithelialize as compared to excision surgery with sutures.
- Minimal damage to adjacent tissue, thus reducing acute inflammatory reactions and postoperative pain, swelling, edema or infection.
- The cost of laser treatment is affordable and there is no need for additional training of the surgeon as no major skills are required for operating the laser device.

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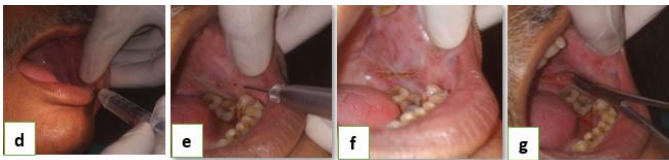
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follow-up IID = 40mm. (m) 3 months follow-up IID = 41mm. (n) 6 months follow-up IID = 41mm. (o) 12 months follow-up IID = 41mm.

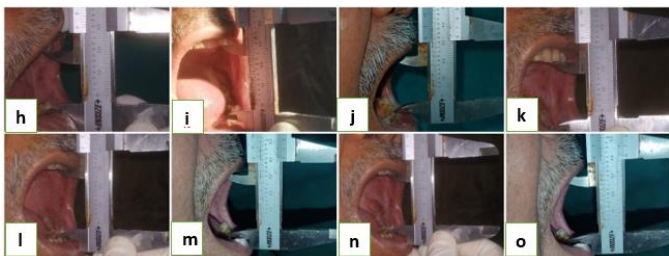
Legend Figure



(a) Diode laser unit, Disposable tip, protective eye glasses, tip initiator, (b) 4mm disposable tip for surgical fibrotomy, (c) Armamentarium for laser fibrotomy.



(d) Infiltration of local anesthesia at surgical sight. (e) Marking on buccal mucosa, (f) laser fibrotomy, (g) Breaking of fibrous bands with curved artery.



(h) Pre operative IID = 30mm. (i) Immediate post operative IID = 41mm. (j) 7 days follow-up IID = 34mm. (k) 15 days follow-up IID = 36mm. (l) 1 month follow-up IID = 40mm. (m) 3 months follow-up IID = 41mm. (n) 6 months follow-up IID = 41mm. (o) 12 months follow-up IID = 41mm.