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Laser Fibrotomy as a Therapeutic Approach for Oral Submucous Fibrosis: A Pilot Study

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KEYWORDS

Oral Submucous Fibrosis, Diode Laser, Dual Wavelength, Fibrotomy, Management

ABSTRACT:

Introduction: Oral submucous fibrosis (OSMF) is a chronic debilitating disease commonly seen in India, for which no single treatment can fully reverse the symptoms. Advanced cases carry a risk of malignant transformation. Management is challenging, as conservative and medical treatments are ineffective, while surgical options often lead to relapse due to wound fibrosis. However, diode laser therapy offers a less invasive alternative with shorter operating time, a blood-free area with improved visibility, faster recovery, and reduced risks of infection, swelling, scarring, and shrinkage. This pilot study evaluates the effectiveness of diode laser treatment in alleviating OSMF symptoms.

Methods: A total of 12 patients diagnosed with Group II and III OSMF who had quit their habits were included in this study. Under local anesthesia, a Y-shaped fibrotomy incision was performed using a dual-wavelength diode laser (455nm and 650nm) with a 400µm tip at 3.2W power. All patients continued their pre-existing regimen of topical steroids, antioxidants, and oral physiotherapy. Clinical outcomes, including mouth opening and reduction in burning sensation, were assessed weekly for the first month and then monthly for six months.

Results: At six-month follow-up, patients demonstrated significant improvement in mouth opening and reduction in burning sensation. Statistical analysis revealed a significant difference in outcomes between baseline and six months (ANOVA, $p<0.05$). No major complications, scarring, or fibrosis recurrence were observed during the follow-up period.

Conclusions: Dual-wavelength diode laser therapy appears to be a promising and minimally invasive approach for improving mouth opening and symptom relief in moderate OSMF. Further large-scale studies with longer follow-ups are required to validate these findings and establish standardized treatment protocols.

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1. Introduction

Oral Submucous Fibrosis (OSMF) is a chronic irreversible disorder of the oral mucosa, marked by persistent inflammation and progressive fibrosis of the lamina propria and deeper connective tissues. This pathological stiffening of the otherwise flexible mucosa leads to restricted mouth opening and impaired oral function [1]. Chronic areca nut use, nicotine use, nutritional inadequacies, autoimmune processes, and genetic vulnerability are among the documented etiological aspects of OSMF [2]. OSMF is characterized by hallmark symptoms such as mucosal blanching and rigidity, trismus, oral burning sensation, restricted tongue mobility, and loss of taste perception, collectively leading to a diminished quality of life (QoL) [3].

OSMF differs from other precancerous conditions in that it has an insidious onset, does not regress even after habit cessation, and may either remain stable or progress, resulting in both physical and psychological disability [4]. Globally, over 2.5 million individuals are affected by OSMF, with the highest prevalence observed in South and Southeast Asia. In India, the estimated prevalence ranges from 0.2% to 2.3% in males and 1.2% to 4.6% in females, spanning a wide age range of 11 to 60 years [5]. Notably, OSMF carries a 7.6% risk of malignant transformation [6].

The management of OSMF is primarily guided by disease staging, with the main goals being the alleviation of symptoms such as burning sensation and the improvement of mouth opening. In the early stages (Group I and II), conservative treatment is typically employed, including habit cessation, physiotherapy, antioxidant therapy, and supplementation with vitamins and iron, alongside topical corticosteroids. Adjunctive medical treatments, such as intralesional corticosteroids, hyaluronidase, placental extracts, systemic corticosteroids, immunomodulators, and pentoxifylline, may also be utilized. While these treatments are effective in the early stages, they carry risks of adverse effects, including pain, localized fibrosis at the injection site, increased treatment costs, and reduced patient compliance. In moderate and severe cases (Groups III and IV), surgical management, often involving excision of fibrous bands, is used to address trismus and improve mouth opening. However, conventional surgical approaches are associated with complications such as excessive intraoperative bleeding, secondary fibrosis, relapse, and the need for flap placement, which can result in additional risks like necrosis, intraoral hair growth, and scarring [7]. Given these challenges, alternative approaches, such as laser fibrotomy, are being explored for their potential to offer a less invasive and more effective solution in the management of OSMF.

The recent advancement of lasers (Light Amplification by Stimulated Emission of Radiation) has gained considerable attention for their effectiveness in managing OSMF symptoms [3]. Among these, the dual-wavelength diode laser stands out as a promising alternative, offering advantages such as reduced operating time, improved visibility in a bloodless field, faster healing, and minimized risks of infection, oedema, scarring, and tissue contraction [7]. This pilot study evaluates the effectiveness of diode laser treatment in alleviating OSMF symptoms and to determine whether improvements in mouth opening following laser fibrotomy are sustained throughout the course of the follow-up period and to assess postoperative healing, side effects, and patient compliance.

2. Methods

Sample selection

A total of 12 patients were undertaken for the study. Ethical clearance was granted by our institutional ethics committee, and the study was conducted in accordance with the principles outlined in the Declaration of Helsinki. Informed written consent was taken from all patients before their inclusion in the study.

Inclusion Criteria

- Patients showing willingness to participate in the study and follow up regularly,
- Cases with stage II and stage III OSMF according to Khanna and Andrade's clinical classification [6].
- No evidence of malignancy clinically and patients who had not undergone any surgical treatment for OSMF.

Exclusion Criteria

- Those with cardiac, respiratory, renal, and hepatic diseases
- Patients who couldn't quit the habit.

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Clinical Examination

A comprehensive clinical examination was conducted, assessing burning sensation, mouth opening, tongue protrusion, and cheek flexibility.

- Burning sensation: It was recorded using VAS scale (0–10)
- Mouth Opening: It was measured using vernier calliper from the mesio-incisal edge of the upper central incisor to the mesio-incisal edge of the lower central incisor tooth in millimeters.
- Tongue protrusion: It was recorded by measuring the distance from the mesial contact area of the upper central incisors to the tip of protruded tongue and was recorded in units of millimeters.
- Cheek flexibility: Two points were measured between one third the distance from the angle of the mouth on a line joining the tragus of the ear and the angle of the mouth(v1); the subject was then asked to blow his cheeks fully, and the distance was measured between the two points marked on the cheek (v2). Cheek flexibility = v2 - v1 [1].

Procedure

The procedure was performed under strict aseptic conditions, with the entire team and patient wearing protective eyewear. A 400-micrometer fiber optic cable delivered the dual wavelength (455nm and 650nm) laser beam, and a straight handpiece was used for the incision. Preoperative mouth opening was measured. Local anesthesia (2% with adrenaline 1:80,000) was administered bilaterally to the buccal mucosa. A "Y-shaped" incision was made, extending from the retromolar area to the premolar region, approximately 2 mm deep, reaching the muscle layer (Figure 1). Using a diode laser (3.2 watts, continuous mode, 1920.0 J), fibrous bands were incised along the buccal mucosa at the occlusal plane. After resection, the mucosa was freed by finger dissection. The process was repeated on the opposite side, and the mouth was forcibly opened with a mouth gag. Postoperative mouth opening was measured from the incisal edges of the maxillary and mandibular central incisor (Figure 2).

Hemostasis was achieved, and patients were advised 5-day course of antibiotics and analgesics, along with antioxidants and topical steroids as they were on the same before laser treatment. Mouth opening exercises using wooden sticks were initiated from day one, performed 5-6 times daily to improve mouth opening. Patients were followed up at 1week interval for 4 weeks initially, and then monthly once for up to 6 months. The study parameters were subjected to statistical analysis: ANOVA.

Figure 1: Bilateral Y-Shaped Incisions on Buccal Mucosa Using Diode Laser

(A)Right buccal mucosa after laser incision. (B) Left buccal mucosa after laser incision.

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Figure 2: Laser Fibrotomy and Improvement in Mouth Opening (A) Preoperative mouth opening showing restricted interincisal distance. (B) Laser fibrotomy procedure being performed on the buccal mucosa. (C) Postoperative mouth opening showing improvement following fibrotom

3. Results

A pilot study was conducted on 12 male patients (Table 1), aged between 23 and 52 years, who were clinically diagnosed with Stage 2 and Stage 3 Oral Submucous Fibrosis (OSMF) based on the Khanna and Andrade classification. All participants reported a habitual gutkha consumption of at least 10 times per day. Fibrous band excision was performed on all patients using a diode laser under local anesthesia, and forceful mouth opening was achieved with the aid of a Heister's mouth gag. Mouth opening measurements were recorded preoperatively, intraoperatively, and postoperatively on the 7th, 14th, 21st, and 28th days, as well as during follow-up visits at the 2nd, 3rd, 4th, 5th, and 6th months.

Repeated measures ANOVA was employed to assess the effect of laser treatment on mouth opening in OSMF patients across different time intervals (Table 2). The mean preoperative mouth opening was 23.7 mm, which increased to 29.9 mm immediately postoperatively, and further improved to 34.3 mm at the end of 6 months (Graph 1). This increase in mouth opening was statistically significant (p-value = 0.000).

At baseline, the mean values for burning sensation, cheek flexibility, and tongue protrusion were 5.5, 6.0 mm, and 34.9 mm, respectively. Burning sensation was completely relieved by the 6-month follow-up. Additionally, there was a mean improvement of 17.3 mm in cheek flexibility and 46.2 mm in tongue protrusion at 6 months (Graph 2, Graph 3 & Graph 4).

No postoperative complications such as haemorrhage, infection, wound dehiscence, fibrosis, nerve injury, or collateral damage to adjacent structures were observed in any patient following laser fibrotomy. The absence of complications is illustrated in Figure 3, following the CONSORT flow chart.

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Table 1: Showing the descriptives

					95% Confidence Interval for Mean			
		Mean	Std. Deviation	Std. Error	Lower Bound	Upper Bound	Minimum	Maximum
BURNING SENSATION (VAS)	Baseline	5.5833	1.88092	0.54298	4.3883	6.7784	3.00	9.00
	Week1	3.7500	1.86474	0.53831	2.5652	4.9348	1.00	7.00
	Week2	2.4167	2.06522	0.59618	1.1045	3.7288	0.00	6.00
	Week3	1.5000	1.67874	0.48461	0.4334	2.5666	0.00	4.00
	Week4	0.5833	0.79296	0.22891	0.0795	1.0872	0.00	2.00
	Month2	0.3333	0.49237	0.14213	0.0205	0.6462	0.00	1.00
	Month3	0.1667	0.38925	0.11237	-0.0807	0.4140	0.00	1.00
	Month4	0.0000	0.00000	0.00000	0.0000	0.0000	0.00	0.00
	Month5	0.0000	0.00000	0.00000	0.0000	0.0000	0.00	0.00
	Month6	0.0000	0.00000	0.00000	0.0000	0.0000	0.00	0.00
	Total	1.4333	2.17987	0.19899	1.0393	1.8274	0.00	9.00
MOUTH OPENING (mm)	Baseline	23.7500	4.07040	1.17502	21.1638	26.3362	16.00	30.00
	Week1	24.6750	3.94488	1.13879	22.1685	27.1815	16.00	30.00
	Week2	26.0167	3.32397	0.95955	23.9047	28.1286	19.00	30.50
	Week3	27.3083	3.19956	0.92363	25.2754	29.3412	20.50	32.00
	Week4	28.4583	3.38753	0.97790	26.3060	30.6107	21.00	33.00
	Month2	29.7083	3.69556	1.06682	27.3603	32.0564	22.00	35.00
	Month3	31.0917	3.75390	1.08366	28.7066	33.4768	22.50	36.00
	Month4	32.0000	3.66804	1.05887	29.6694	34.3306	24.00	37.00
	Month5	33.2083	3.53848	1.02147	30.9601	35.4566	25.00	37.50
	Month6	34.3250	3.43700	0.99218	32.1412	36.5088	26.00	38.00
	Total	29.0542	4.89688	0.44702	28.1690	29.9393	16.00	38.00
TONGUE PROTRUSION (mm)	Baseline	34.9167	8.22920	2.37556	29.6881	40.1452	16.00	49.00
	Week1	35.7500	8.26960	2.38723	30.4957	41.0043	16.00	49.00
	Week2	37.1667	7.95251	2.29569	32.1139	42.2195	18.00	50.00
	Week3	38.4583	7.94715	2.29414	33.4090	43.5077	19.00	51.00
	Week4	39.2917	7.59922	2.19371	34.4634	44.1200	21.00	52.00
	Month2	40.9167	7.99384	2.30762	35.8376	45.9957	22.00	55.00
	Month3	42.3333	7.48736	2.16142	37.5761	47.0906	24.00	55.00
	Month4	43.9167	7.15362	2.06507	39.3715	48.4619	27.00	56.00
	Month5	45.2500	7.38703	2.13245	40.5565	49.9435	28.00	58.00
	Month6	46.2500	7.49697	2.16419	41.4867	51.0133	29.00	59.00
	Total	40.4250	8.36099	0.76325	38.9137	41.9363	16.00	59.00
CHEEK	Baseline	6.0000	2.48633	0.71774	4.4203	7.5797	3.00	11.00
	Week1	7.3333	2.18812	0.63166	5.9431	8.7236	4.00	11.00

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FLEXIBILITY (mm)	Week2	8.5417	2.18942	0.63203	7.1506	9.9328	5.00	12.00
	Week3	9.7500	2.26134	0.65279	8.3132	11.1868	5.00	13.00
	Week4	11.0250	2.83937	0.81966	9.2209	12.8291	5.00	15.00
	Month2	13.0000	2.79610	0.80716	11.2234	14.7766	7.00	18.00
	Month3	13.9167	3.05877	0.88299	11.9732	15.8601	8.00	19.00
	Month4	14.7500	2.76751	0.79891	12.9916	16.5084	10.00	20.00
	Month5	16.1667	2.82307	0.81495	14.3730	17.9604	11.00	22.00
	Month6	17.3333	2.69961	0.77931	15.6181	19.0486		22.00
	Total	11.7817	4.45248	0.40645	10.9768	12.5865	3.00	22.00

Note: VAS-Visual Analogue Scale

Table 2. Repeated measures of ANOVA

ANOVA

		Sum of Squares	df	Mean Square	F	Sig.
BURNING SENSATION (VAS)	Between Groups	399.133	9	44.348	29.328	0.000
	Within Groups	166.333	110	1.512		
	Total	565.467	119			
MOUTH OPENING (mm)	Between Groups	1418.840	9	157.649	12.087	0.000
	Within Groups	1434.718	110	13.043		
	Total	2853.558	119			
TONGUE PROTRUSION (mm)	Between Groups	1695.033	9	188.337	3.128	0.002
	Within Groups	6623.792	110	60.216		
	Total	8318.825	119			
CHEEK FLEXIBILITY (mm)	Between Groups	1599.791	9	177.755	25.750	0.000
	Within Groups	759.328	110	6.903		
	Total	2359.120	119			

Note: VAS-Visual Analogue Scale * Highly significant

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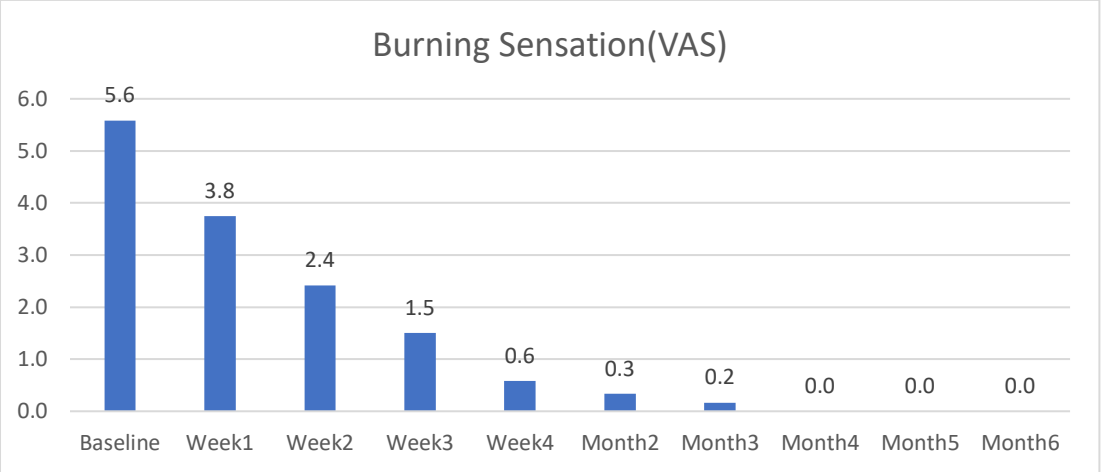
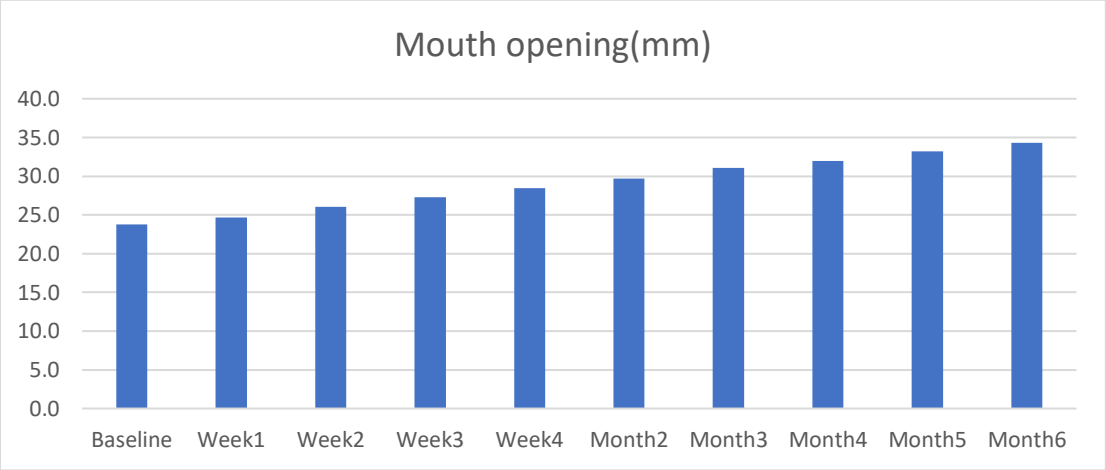
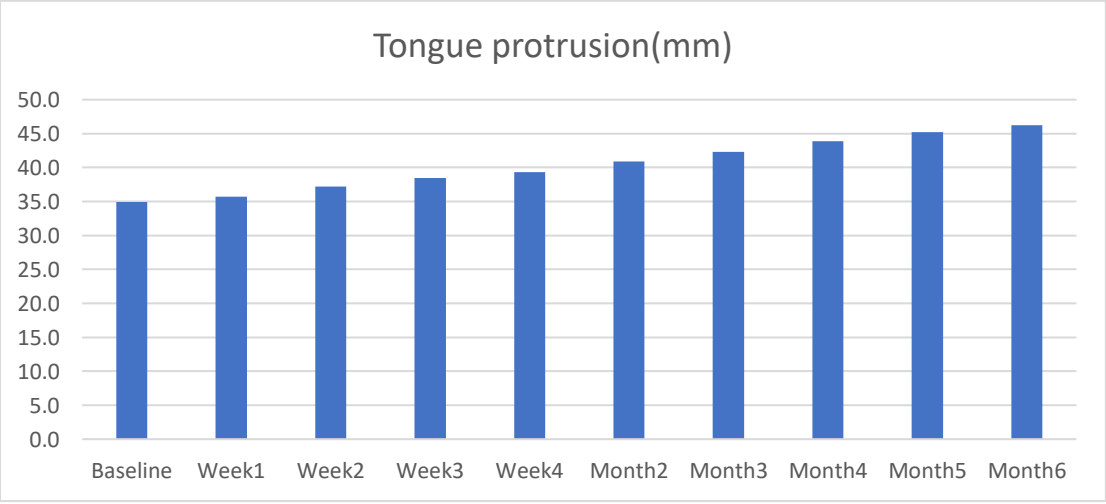
Graph 1: Burning Sensation



Graph 2: Mouth Opening



Graph 3: Tongue Protrusion



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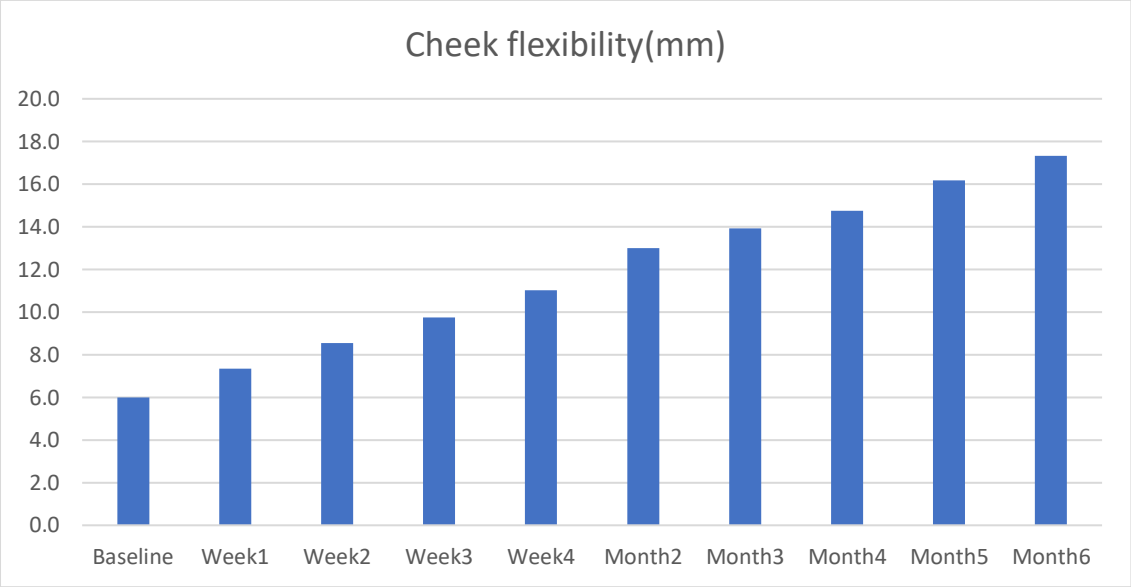
Graph 4: Cheek Flexibility



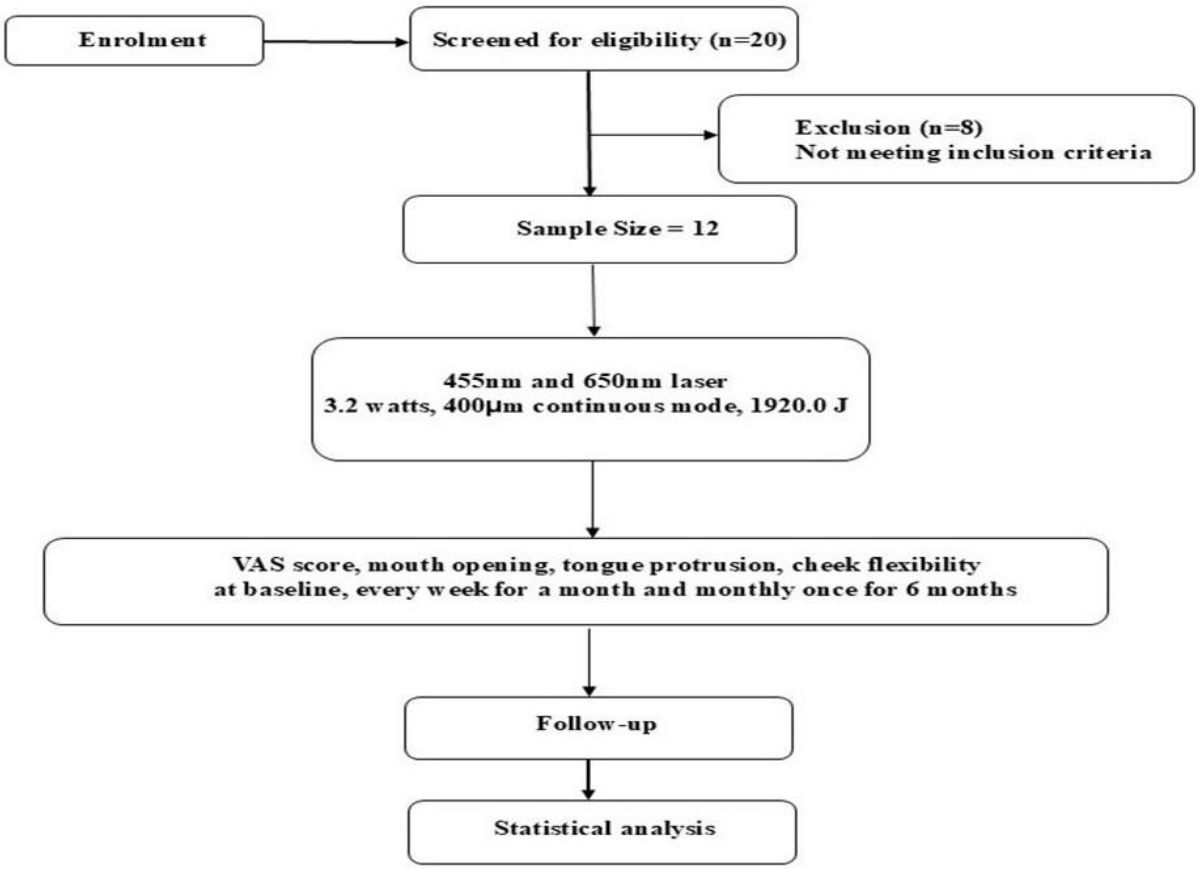


Figure 3: Showing the consort flow chart

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4. Discussion

Oral submucous fibrosis is a long-standing, progressively worsening, and debilitating disorder, initially reported in India in 1953 [8]. OSMF is among the most common premalignant conditions in India—readily diagnosable yet challenging to treat. It has even been described as an epidemic in the country [1]. Managing OSMF presents a considerable challenge for clinicians due to the absence of a standardized treatment protocol. The primary goals of treatment are to alleviate symptoms, halt disease progression, and minimize the risk of malignant transformation [5].

In the modern era of advanced science and technology, lasers offer an effective means to release fibrotic bands, promoting faster healing [9]. Diode lasers are commonly used for soft tissue procedures in the oral cavity, though there is limited research on their use in treating OSMF [10]. The laser beam, transmitted through an optical fiber system, enables highly precise tissue incision with a penetration depth of under 0.01 mm, thereby limiting injury to adjacent tissues. Moreover, it produces a layer of denatured proteins on the tissue surface, which functions as a protective dressing over the treated area [9].

In OSMF, diode lasers enhance visibility and control bleeding, enabling outpatient procedures under local anesthesia with minimal postoperative inflammation, infection, and scarring [11]. Use of Dual wavelength has added benefits of cleaner, efficient cut with less tissue charring and faster healing. Laser fibrotomy was done as a chair-side procedure under LA with an average operating time of 15 min for each side.

The size of the hand piece and surgical tips provide good access to the surgical site. There is limited research published regarding use of diode lasers in OSMF and there is no study reported till now using Dual laser wavelength in management of OSMF. Previous studies using diode lasers by Mudigonda et al [2], Babaji et al [8], Farista et al [12], Gupta et al [1], Talsania et al [6] have similarly reported significant improvement in mouth opening & burning sensation in OSMF.

All patients underwent fibrous band resection using a diode laser under local anesthesia, with minimal intraoperative bleeding. All 12 patients attended regular follow-up appointments without any missed visits. Postoperative measurements were recorded on the 7th, 14th, 21st, and 28th days, as well as during follow-up visits at the 2nd, 3rd, 4th, 5th, and 6th months. The mean preoperative mouth opening was 23.7 mm, which increased to 34.3 mm at the 6-month follow-up. At baseline, the mean values for burning sensation, cheek flexibility, and tongue protrusion were 5.5, 6.0 mm, and 34.9 mm, respectively. By the 6-month follow-up, the burning sensation was completely resolved, and there was a mean improvement of 17.3 mm in cheek flexibility and 46.2 mm in tongue protrusion, all of which were statistically significant.

In this study patients showed improvement in cheek flexibility & tongue protrusion as well which were not assessed in any of the previous studies. The increased mouth opening obtained with laser fibrotomy will only sustain with rigorous daily physiotherapy & cessation of habit which can be achieved by patient motivation and counselling.

5. Conclusion

Dual-wavelength diode laser fibrotomy performed under local anesthesia presents a practical and minimally invasive therapeutic option for managing Group II and III Oral Submucous Fibrosis (OSMF). It is economically feasible and does not necessitate flap reconstruction, even in cases requiring extensive tissue release. This method has shown minimal to no post-operative complications. Considering the considerable impact OSMF has on patients' quality of life, laser-based intervention may serve as a valuable alternative. However, further comparative or randomized controlled clinical studies with larger sample sizes and longer follow-up are needed to validate these findings.

References

1. Gupta, S.; Piyush, P.; Mahajan, A.; Mohanty, S.; Ghosh, S.; Singh, K. Fibrotomy with Diode Laser (980 nm) and Habit Correlation in Oral Submucous Fibrosis: A Report of 30 Cases. *Lasers Med. Sci.* **2018**, *33* (9), 1739–1745.
2. Mudigonda, J.; Naik, S.; Reddy, S.; Balreddy, P.; Kumar, G. P. Treatment Outcome of Diode Laser for Symptomatic Relief in Oral Submucous Fibrosis: A Pilot Study. *Adv. Hum. Biol.* **2016**, *6* (1), 37–41.

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www.jchr.org

JCHR (2025) 15(5), 292-301 | ISSN:2251-6727

3. Upadhyay, P.; Bhalla, M.; Sharma, A.; Pradhan, A.; Goswami, A.; Kumar, S. Comparative Evaluation of Low-Level Laser Therapy with Intralesional Injections and Intralesional Injections Alone for the Treatment of Grade II OSMF. *Asian J. Biol. Biomed. Sci.* **2024**, *6* (12), 5663–5672.
4. More, C.; Shah, P.; Rao, N.; Pawar, R. Oral Submucous Fibrosis: An Overview with Evidence-Based Management. *Int. J. Oral Health Sci. Adv.* **2015**, *3* (3), 40–49.
5. More, C. B.; Patil, D. J.; Rao, N. R. Medicinal Management of Oral Submucous Fibrosis in the Past Decade—A Systematic Review. *J. Oral Biol. Craniofacial Res.* **2020**, *10* (4), 552–568.
6. Talsania, J. R.; Shah, U. B.; Shah, A. I.; Singh, N. K. Use of Diode Laser in Oral Submucous Fibrosis with Trismus: Prospective Clinical Study. *Indian J. Otolaryngol. Head Neck Surg.* **2009**, *61*, 22–25.
7. Chaudhry, Z.; Gupta, S. R.; Oberoi, S. S. The Efficacy of ErCr:YSGG Laser Fibrotomy in Management of Moderate Oral Submucous Fibrosis: A Preliminary Study. *J. Maxillofac. Oral Surg.* **2014**, *13* (3), 286–294.
8. Veena, G. C. Diode Lasers for Oral Submucus Fibrosis—An Experimental Study.
9. Singh, A. G.; Roy, S.; Oza, S.; Singhavi, H.; Chatterjee, K.; Chaturvedi, P. A Contemporary Narrative Review to Guide Molecular Epidemiology of Oral Submucous Fibrosis. *Int. J. Mol. Epidemiol. Genet.* **2021**, *12* (4), 61
10. Chandra, S.; Gujjari, S. K.; Sankar, A. R. Biostimulation with Diode Lasers: A Novel Futuristic Approach in the Treatment of Oral Submucous Fibrosis—A Case Report. *Int. J. Med. Dent. Case Rep.* **2019**, *6*, 1–4.
11. Chhabra, A. K.; Sune, R.; Reche, A. Oral Submucous Fibrosis: A Review of the Current Concepts in Management. *Cureus* **2023**, *15* (10), e.
12. Farista, S.; Kalakonda, B.; Farista, S.; Iyer, V. H. Diode Laser-Assisted Fibrotomy in the Management of Oral Sub-Mucous Fibrosis: A New Technique in Surgical Management. *J. Clin. Diagn. Res.* **2018**, *12*, ZH01–ZH02.