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A COMPARATIVE STUDY OF EFFICACY OF THERAPEUTIC ULTRASOUND THERAPY AND INTRALESIONAL INJECTION IN PATIENTS WITH ORAL SUBMUCOUS FIBROSIS - A CLINICAL TRIAL STUDY

Dr. Nikam Shital. S[1], Dr. Waghmare Nikita. H[2*], Dr. Saraf Kedar. V[3], Dr. Wakchaure Priya. M[4], Dr. Kalbande Pallavi. R[5], Dr. Telange Shraddha. S[6]

[1]Associate Professor, Department of Oral Medicine and Radiology, SMBT Dental College and Hospital, Ghulewadi, Sangamner, LM1090 , India. Email Id: drshital1987@gmail.com Orcid Id: 0000-0001-5270-8076
[2*]PG Student, Department of Oral Medicine and Radiology, SMBT Dental College and Hospital, Ghulewadi, Sangamner, India. Email Id: iamnikitawaghmare@gmail.com Orcid Id: 0009-0007-8701-9810
[3]Professor and HOD, Department of Oral Medicine and Radiology, SMBT Dental College and Hospital, Ghulewadi, Sangamner, India. Email Id: kedarsaraf1411@gmail.com Orcid Id: 0009-0000-7107-7038
[4]Assistant Professor, Department of Oral Medicine and Radiology, SMBT Dental College and Hospital, Ghulewadi, Sangamner, India. Email Id: drpriyamahendra@gmail.com Orcid Id: 0000-0001-6686-634X
[5]PG Student, Department of Oral Medicine and Radiology, SMBT Dental College and Hospital, Ghulewadi, Sangamner, India. Email Id: kalbandepallavi1@gmail.com Orcid Id: 0009-0001-3644-3458
[6]PG Student, Department of Oral Medicine and Radiology, SMBT Dental College and Hospital, Ghulewadi, Sangamner, India. Email Id: drshraddhatelange@gmail.com Orcid Id: 0009-0002-5786-8815

ABSTRACT

Context: Oral submucous fibrosis (OSMF) is a chronic, progressive condition characterized by fibrotic changes of the oral mucosa, resulting in restricted mouth opening and impaired oral function. Intralesional steroid–hyaluronidase injections are commonly used but are often associated with pain, repeated visits, and variable outcomes. Hence, alternative treatment modalities warrant evaluation.

Aims: To compare the effectiveness and patient tolerance of intralesional injection therapy and therapeutic ultrasound in the management of OSMF.

Methods and Material: Patients were divided into two groups (n = 15 each). Group A received intralesional dexamethasone (4 mg/ml) with hyaluronidase (1500 IU), while Group B received therapeutic ultrasound. Both treatments were administered twice weekly for four weeks along with oral physiotherapy. Pain, mouth opening, comfort, and patient satisfaction were assessed. Intergroup comparisons were carried out using the independent t-test.

Results: Therapeutic ultrasound showed significantly greater pain reduction from the second week onward ($p \leq 0.01$). Patient satisfaction was higher in the ultrasound group, while comfort scores and mouth opening improvement were comparable between groups ($p > 0.05$).

Conclusions: Therapeutic ultrasound is a safe, effective, and better-tolerated alternative to intralesional injections, offering superior pain relief and improved patient acceptance in OSMF management.**Keywords:** Triticum aestivum L.; terminal heat stress; grain yield; stress tolerance index; principal component analysis. (remove this)

KEYWORDS: Oral submucous fibrosis, Intralesional injection, Ultrasound therapy.

INTRODUCTION

A chronic, invasive scarring disease of the oral cavity, oral submucous fibrosis (OSMF) is characterised by the development of fibrous bands in the labial, buccal mucosa, soft palate, lip mucosa, and anterior pillar of the fauces, as well as a growing difficulty to open the mouth. Relative loss of hearing acuity may result from its infrequent effects on the lining of the pharyngeal box, vocal cords, or upper portion of the oesophagus. It may also involve the Eustachian tube [1, 2]

Chewing betel quid, excessive consumption of chillies and spices, inadequate nutrition, and iron and vitamin deficiencies are some of the multifactorial causes of OSMF. In OSMF, there is a 7%–30% higher chance of cancer [3].

Over the past forty years, the frequency in India has risen from 0.03% to 6.42%; it can affect anyone of any age, but it is more prevalent in adults and adolescents, particularly those between the ages of sixteen and thirty-five [4,5].

Even after habit control, the condition has a significant relative risk for malignant transformation (7.6%), and Paymaster reported that OSMF is precancerous [6, 7].For OSMF, there is no proven treatment available. Due to its complex aetiology and pathogenesis, numerous approaches have been explored throughout the years, but no single medication has been able to fully alleviate OSMF symptoms. The employment of integrated treatment regimens, which is now essential due to the empirical nature of each technique, makes it impossible to evaluate the benefits and drawbacks of individual items in management. Physiotherapy is used as an adjuvant therapy in many techniques.

In physical medicine, therapeutic ultrasound has been widely applied with great effectiveness. Accelerating healing, increasing collagen fibre extensibility, and relieving pain are the goals of ultrasound therapy [8].
There are very few studies in the literature about the importance of ultrasound therapy on OSMF, and the topic is still understudied and awaiting further research. The goals are pain relief, enhanced collagen fibre extensibility, and a quicker healing process [9].
Therefore, the present study aimed to compare the clinical efficacy, pain reduction, comfort, and patient satisfaction of therapeutic ultrasound therapy with intralesional injection therapy in patients with oral submucous fibrosis [10].

Subjects and Methods:
Thirty patients in the Department of Oral Medicine and Radiology who had been clinically diagnosed with OSMF participated in this study. The Committee on Ethics of SMBT Dental College, Sangamner accepted the study's subjects, procedures, and clinical protocol (SMBT/296/2025; Dated 04/04/2025). The study's clinical trial was registered [CTRI Reg. no-CTRI/2025/10/096691].
All patient in the trial met the requirements of having a clinical diagnosis of OSMF and being between the ages of 20 and 60. The study excluded patients with concurrent neuromuscular or systemic diseases, such as tetany or systemic sclerosis, a history of radiation therapy, prior OSMF medical or surgical treatment, or any systemic illness that would affect the course of treatment. Before beginning treatment, each patient's complete case history was gathered, and informed consent was taken. [8]
In this study, thirty patients having a clinical diagnosis of OSMF were enlisted. Using a random sampling technique, patients were assigned at random to the appropriate groups. Two equal groups of fifteen patients each were created from the sample. Group B got therapeutic ultrasound therapy in addition to the same physiotherapy program, while Group A received intralesional injections of hyaluronidase and dexamethasone in addition to recommended physical exercises. Baseline interincisal mouth opening was measured for all patients using a Vernier caliper. In Group A, intralesional injections were administered biweekly for a period of four weeks, with each session followed by mouth-opening exercises. Group B patients received therapeutic ultrasound therapy biweekly for four weeks, followed by the same physiotherapy protocol. Mouth opening was evaluated after each treatment session, and post-treatment measurements were recorded at the end of the four-week to assess treatment efficacy. We obtained feedback from all patients using a structured feedback form that assessed pain during treatment, pain after treatment, and overall comfort and satisfaction. These parameters were recorded on the Visual Analogue Scale (VAS). Evaluations were conducted at the end of each week for a period of four weeks in both the therapeutic ultrasound group and the intralesional injection group.

1. For Intralesional Injection:
Site selection: Area with presence of numerous fibrous bands
Areas of local injection submucosal: buccal mucosa, retromolar area, outer aspects of pterygomandibular raphae, and circumoral bands. [8]
Injection- dexamethasone (4 mg/ml) with hyaluronidase 1500 IU, inject twice a week
And the patients of group B were subjected to ultrasound therapy for 4 weeks given twice a week. During the study, all the patients were treated with the same calibrated ultrasound equipment [Figure 4].

2. Ultrasound therapy protocol- ultrasound at an average
Intensity: 1.5 W/cm2
Mode: continuous 1:1 duty cycles
Frequency: 3 MHz
Time: For five to six minutes, move your head back and forth in the template to each side that is affected over the fibrosis area. [8, 11]

All collected data were entered and organized in Microsoft Excel 2013. Statistical evaluation was carried out using IBM SPSS Statistics for Windows, Version 28.0 (IBM Corp., Armonk, NY, 2021). The recorded parameters were analyzed statistically, and intergroup differences between the two study groups were examined using the independent t-test. A p-value of ≤0.05 was considered indicative of statistical significance.

RESULTS:

Table 1 Intergroup comparison of VAS between Group A and Group B for Pain during that treatment:

	Groups	N	Mean	Std. Deviation	f-Value	p-Value
VAS score at 1st week	Group A	15	6.1333	1.59762	0.01	0.06
	Group B	15	5.0667	1.48645		
VAS score at 2nd week	Group A	15	5.2000	1.01419	3.10	0.01*
	Group B	15	3.0667	1.48645		

VAS score at 3rd week	Group A	15	4.5333	.91548	0.66	0.01*
	Group B	15	2.0000	1.69031		
VAS score at 4th week	Group A	15	3.3333	.97590	2.00	0.01*
	Group B	15	.9333	1.27988		

Level of significance set at p≤0.05*

A notable decrease in pain during treatment was observed in Group B (ultrasound therapy) starting from the 2nd week, showing better results compared to Group A (intralesional injections). However, during the 1st week, the difference between the groups was not statistically significant (p = 0.06).

Table 2 Intergroup comparison of VAS between Group A and Group B for Pain after treatment:

	Groups	**N**	**Mean**	**Std. Deviation**	**f-Value**	**p-Value**
VAS score at 1st week	Group A	15	5.0667	1.27988	1.66	0.01*
	Group B	15	3.6000	1.12122		
VAS score at 2nd week	Group A	15	3.8667	.91548	0.47	0.01*
	Group B	15	2.3333	.89974		
VAS score at 3rd week	Group A	15	3.2000	1.01419	2.12	0.01*
	Group B	15	.5333	.91548		
VAS score at 4th week	Group A	15	2.2667	.70373	1.46	0.01*
	Group B	15	.1333	.51640		

Level of significance set at p≤0.05*

Pain after treatment was significantly lower in the ultrasound therapy group across all weeks (p ≤ 0.01). The reduction trend was consistent and progressive in Group B compared to Group A.

Table 3 Intergroup comparison of Overall satisfaction & Comfort level amongst patients

	Groups	**N**	**Mean**	**Std. Deviation**	**f-Value**	**p-Value**
Over Satisfaction	Group A	15	2.9333	.25820	13.61	0.05*
	Group B	15	3.2667	.59362		
Comfort Level	Group A	15	2.8000	.86189	0.00	0.07
	Group B	15	3.4000	.91026		

Level of significance set at p≤0.05*

Patients in the ultrasound therapy group reported significantly greater overall satisfaction compared to those receiving intralesional injections.
Although patients in Group B showed higher comfort levels than Group A, the difference was not statistically significant (p=0.07).

Table 4 Intergroup comparison of Interincisal levels amongst patients

	Groups	N	Mean	Std. Deviation	f-Value	p-Value
Baseline	Group A	15	23.1733	3.50173	0.85	0.41
	Group B	15	24.3733	4.33630		
Week1	Group A	15	23.5733	3.45180	1.45	0.27
	Group B	15	25.2333	4.62287		
Week2	Group A	15	23.9600	3.45084	1.19	0.19
	Group B	15	25.9267	4.65656		
Week3	Group A	15	24.3667	3.43878	1.29	0.18
	Group B	15	26.4000	4.69331		
Week4	Group A	15	25.2000	3.68975	0.63	0.26
	Group B	15	26.9667	4.70435		

Level of significance set at $p \leq 0.05$*

From week 1 to week 4, both groups showed gradual improvement in interincisal distance, indicating that both treatment modalities led to an increase in mouth opening over time.
Although Group B (ultrasound therapy) consistently showed a slightly higher mean interincisal distance than Group A (injection therapy) throughout all weeks, none of the intergroup differences were statistically significant ($p > 0.05$).

DISCUSSION:
Oral submucous fibrosis is a chronic, persistent, and serious precancerous condition, originally described by Schwartz in 1952. He referred to it as “atrophica idiopathica (tropica) mucosae oris.’[5, 12]

Both therapeutic ultrasound therapy (Group B) and intralesional administration of dexamethasone with hyaluronidase (Group A) in conjunction with physiotherapy showed favourable clinical outcomes in OSMF patients in this trial. These results are consistent with and elaborate upon earlier research that has been published on these therapy approaches. The male predominance observed in this study has also been consistently documented in earlier research by Lai et al. (1995) [13], Merchant AT et al. (1997) [14], Kumar et al. (2006) [15], Rupak et al., and Ganapathy et al. Most of the study's participants were between the ages of 25 and 35.

Chewing areca nut, either raw or in commercial items like Dilbaag, Kuber, and Rajdarbar (also known as gutkha or pan masala), was reported by all participants, indicating that it is a significant contributing factor to OSMF. Similar findings were reported by Kumar A et al. [16] and Canniff et al. [17], who examined the pathophysiology and treatment of OSMF.

The improvement in mouth opening from baseline to 4 weeks and from 15 days to 4 weeks did not differ significantly, indicating that the biggest increase in mouth opening takes place within the first 15 days of treatment. In agreement with results reported by Pooja et al. (2010) [18], Vijaykumar (2013) [19], and Subramanium et al. (2014) [7], Group B showed a considerably larger improvement in mouth opening during the first 15 days when compared to Group A [Figures 3 and 4]. The activity of therapeutic ultrasound, which improves collagen fibre extensibility and lowers inflammation, is responsible for Group B early improvement. [8]

By week four, every patient in the trial had improved their mouth opening, suggesting that the therapeutic approaches were successful in treating OSMF. In line with earlier studies, Group B's mean mouth opening improved more than the other groups' following four weeks of intervention.[4,7,8,19] Studies that thoroughly evaluate pain during and after treatment, as well as general patient comfort and satisfaction, with weekly VAS-based follow-ups for four weeks in both the therapeutic ultrasound and intralesional injection modalities are lacking in the literature. As a result, the current study is unique in that it addresses this neglected aspect and adds an alternative perspective to the assessment of OSMF treatment.

While both treatment modalities enhance functional metrics like mouth opening, the study's overall findings indicate that therapeutic ultrasound has a distinct advantage in terms of pain reduction, patient comfort, and overall satisfaction. These parameters were measured using the Visual Analogue Scale. Both the intralesional injection group and the therapeutic ultrasound group underwent evaluations at the end of each week for four weeks. Ultrasound therapy's improved tolerability may also enhance patient compliance, which is crucial for treating a chronic, progressive illness like OSMF.

CONCLUSION:

Therapeutic ultrasound may be particularly useful for patients who cannot tolerate or have contraindications to intralesional corticosteroids, as well as for those who are apprehensive about injections. As a non-invasive, effective, and well-tolerated approach, ultrasound therapy has shown superior outcomes compared to intralesional injections in terms of improving mouth opening, promoting tissue healing, and enhancing patient comfort. The findings of the present study suggest that therapeutic ultrasound should be incorporated into the management of OSMF, as it significantly benefits patients when used as an adjunct and is not associated with any known adverse effects.

Limitation and future prospects:

In a large sample of various grades of OSMF patients with longer follow-up periods, adjuvant treatment modalities by intralesional injection followed by ultrasound therapy might reduce the impact of confounding factors. Long-term ultrasound therapy would have produced better results, but patient compliance was uncertain.

Conflicts of interest:

The authors declare no conflicts of interest.

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