International Journal of Dental Research
www.dentaljournal.net
Online ISSN: 2664-9055, Print ISSN: 2664-9047
Received: 03-05-2023, Accepted: 18-05-2023, Published: 03-06-2023
Volume 5, Issue 2, 2023, Page No. 27-30

Hearing efficiency in oral submucous fibrosis: A clinical study

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Abstract
Oral Submucous Fibrosis (OSMF) is a chronic, progressive disease of the oral mucosa caused by areca nut chewing, chilli ingestion, autoimmune, and genetic predisposition. The condition begins with a burning sensation and an inability to tolerate spicy meals, followed by a gradual restriction in mouth opening owing to oral mucosa fibrosis. Hearing efficiency is reduced when fibrosis spreads into the nasopharynx. Because there have been few studies to evaluate hearing disability in OSMF patients, the present research was attempted to demonstrate the same. To assess hearing efficiency in patients with varying degrees of Oral Submucous Fibrosis. The case study covers 30 osmf patients of different levels who were tested for hearing efficacy using audiometry. Hearing threshold was compared in different grades of osmf. The present study revealed a significant association between OSMF and hearing deficit. Involvement of the palatal muscles with OSMF may decrease the patency of the Eustachian tube, leading to conductive hearing loss. Therefore, the protocol for managing OSMF patients should include ENT consultation and treatment for hearing deficit in order to increase the success rate of treatment.

Keywords: palatal, paratubal muscles, eustachian tube, audiometry

Introduction
OSMF is a chronic, insidious disease that affects any area of the oral cavity and sometimes the pharynx. Although vesicle formation is occasionally preceded and/or associated with it, it is always associated with a juxta-epithelial inflammatory reaction followed by fibroelastic changes of the lamina propria, with epithelial atrophy leading to stiffness of the oral mucosa and causing trismus and inability to eat [1, 2].Burning sensation of the oral mucosa, ulceration and pain, restricted mobility and de-papillation of tongue, blanching and leathery texture of oral mucosa, loss of pigmentation of oral mucosa, and increasing reduction of mouth opening are all symptoms of this condition. Severe cases exhibit indications of hearing loss due to eustachian tube occlusion and difficulties swallowing attributable to esophageal fibrosis [1]. The eustachian tube (pharyngotympanic tube) connects the middle ear cavity with the nasopharynx and is one of the structures that communicate with the oral cavity. The eustachian tube's opening and closing activities are physiologically essential [1]. Healthy eustachian tube opening equalises air pressure in the middle ear; normal eustachian tube shutting protects the middle ear from undesirable pressure fluctuations and loud sounds. Pathologic alterations in the middle ear can be caused by aberrant or impaired eustachian tube functions (i.e., impaired opening or closure). This, in turn, can result in hearing loss.1 In OSMF, the eustachian tube may fail to efficiently regulate air pressure. As eustachian tube functionality deteriorates, middle ear air pressure declines, and ear sounds are perceived as muted, potentially causing hearing loss [1, 3].
But there is a scarcity of data on the prevalence of fibrosis in regions adjacent to the oral cavity, such as the ear (Eustachian tube), oro-pharynx, and pharynx, as well as there are only a few investigations accessible associated eustachian tube dysfunction with various clinical stages of OSMF and its association with an increase or decrease in the degree of severity of the course of the disease. As a result, the purpose of the present investigation was to assess eustachian tube functioning in OSMF patients and correlate it with various clinical phases of the disease, which may be useful in evaluating morbidity as well as determining the general outlook in order to find more appropriate therapeutic interventions [3, 4].

Materials and Method
The present study was carried out in the Department of Dentistry, Varun Arjun Medical College and Rohilkhand Hospital, Banthara, Shahjahanpur, Uttar Pradesh on 30 patients of OSMF after ethical approval by the Institutional Ethical Committee. After obtaining written informed consent, the clinical data of the patients was obtained by taking thorough case his- tory and clinical examination. After the clinical examination, the diagnosis of OSMF was made on the basis of history and characteristic clinical features of the disease. Depending on the clinical findings, cases were divided into grade I, II and III. (Early, Moderate, Severe grade.)

Clinical Criteria for Grading of OSMF
Grade I (Early OSMF)
Burning sensation on hot and spicy food, blanching, pal- pable fibrosis of buccal mucosa and fibrosis of faucial pillars, pterygomandibular raphae and soft palate; Mouth opening 25–35 mm.

Grade II (Moderate OSMF)
Burning sensation on hot and spicy food; Palpable fibrosis of buccal mucosa, faucial pillars, pterygomandibular raphae and soft palate extends anteriorly to involve labial mucosa,

floor of the mouth and tongue; Tongue movements are restricted to some extents; Loss of flexibility of buccal mucosa; Mouth opening 15 mm–25 mm.

Grade III (Severe OSMF)

Burning sensation on absence of stimuli; Severe fibrosis of entire oral cavity; Severe restriction of tongue movements; Severe loss of flexibility of buccal mucosa; Circular band (fibrotic rim) around lips and mouth; Fibrosis of soft palate and shrunken uvula; Difficulty in swallowing and deglutition; Difficulty in speech and nasal voice; Restricted mouth opening less than 15 mm.

The ENT Department examined the ear and ruled out other reasons of hearing loss such as tympanic membrane perforation, cholesteatoma, previous surgery, and ear infections. In all of the instances studied, pure tone audiometry (PTA) was used. Hearing loss was assessed in both the right and left ears (for a total of 60 ears). The hearing level is indicated in decibels over the typical threshold. (Figures 1a, b, and c) The frequencies measured were typically between 125 and 8000 Hz. The amount of intensity that must be increased over the normal level represents the degree of hearing impairment at that frequency.

Depending upon the AC–BC Gap values, hearing impairment was quantitatively graded into several categories as follows: [1, 4, 5]

1. 10–15 dB—Normal Hearing.
2. 16–25 dB—Minimal Hearing Loss.
3. 26–40 dB—Mild.
4. 41–55 dB—Moderate.
5. 56–70 dB—Moderate to Severe.
6. 71–90 dB—Severe.
7. Above 90 dB is profound deafness.

All subjects were evaluated for hearing loss according to age, and grades of OSMF and it tabulated as shown below.

Result and Discussion

OSMF is mostly an oral cavity and oropharynx illness. The condition is distinguished by increasing fibrosis of the mouth's mucus membranes, particularly the buccal mucosa, soft palate, lip mucosa, and anterior pillars. It rarely affects the pharyngeal box membrane lining or vocal cords, but it can include the eustachian tube [2,5-7]. It affects approximately 0.2-1.2% of the Indian population, with the majority of cases occurring in South Asia and South-East Asia - India, Bangladesh, Sri Lanka, Pakistan, Taiwan, Southern China, and so on - where consumption of arecanut or its flavoured formulations or as an ingredient in betel quid is more common. [8, 9]. The cancerous transformation rate of oral submucous fibrosis has been estimated to be 4%-13% globally, with 7.6% occurring in the Indian population [5, 10, 11]. OSMF mainly impacts men in their second and third decades of life [2, 5, 7]. Table 1 illustrates the age-group connection of OSMF grade with hearing loss. The subjects in the current research varied in age from 16 to 60 years. The majority of the subjects in Grade I OSMF ranged in age from 15 to 30 years. The bulk of subjects in Grade II OSMF ranged in age from 31 to 45 years. The bulk of patients in Grade III OSMF ranged in age from 31 to 45 and 46 to 60 years.

Statistically, significant difference was present between age groups and OSMF Grades. (P B 0.005) Most of these patients were in the second and third decade of life [83.33%] patients being in the age group of 15–45 years. This is in accordance with the studies by Gupta *et al*. and Shah *et al*. [6, 7].

Table 2 demonstrates the associations between hearing loss categories and OSMF grades. In the current investigation, pure tone audiometry of 60 ears in 30 OSMF patients revealed that hearing was normal in 42 ears (70%), that there was minor hearing loss in 5 ears (8.33%), that there was mild hearing loss in 6 ears (10%), and that there was moderate hearing loss in 7 ears (11.66%). These findings were consistent with the findings of Gupta *et al*. (10), who discovered that hearing was normal in 79.2% of ears, mild to moderate hearing loss was present in 18.0%, and hearing loss was present in 2.8%. According to Shah *et al*., 67% of the 54 ears in their OSMF group had normal hearing, 22% had mild hearing loss, and 11% had significant mixed hearing loss. Statistically, there was no significant difference among OSMF Grades and grade of hearing loss. (P [0.05).

In the current research, there was a significant difference in hearing loss between groups 1 and 3 (early OSMF and severe OSMF). In both the right and left ears, Group 3 was substantially related with moderate hearing loss when compared to any other group of participants. The results presented agreed with those of Chaudhary *et al*. Fibrosis of the palate muscles may cause dysfunction of the eustachian tube in OSMF. Over fifty percent of patients with fibrosis in the faucial pillars have palatal inclusion. Involvement of the palatal and paratubal muscles (levator veli palatini, tensor veli palatini, tensor tympani, and salpingopharyngeus), which regulate pharyngeal orifice patency and function. (Fig. 2) Additional narrowing of the ordinarily tiny opening of the pharyngeal orifice of the eustachian tube in OSMF leads in ineffective air pressure regulation. This causes ear pain as well as hearing loss [1, 4, 7]. Therefore, hearing loss can be linked to the degree of palate muscle fibrosis, which reduces the patency of the eustachian tube. Because fibrosis of the oropharynx causes altered sound perception, it is visible in the advanced stages of OSMF due to changes in the patency of the Eustachian tube, which may develop due to increasing fibrosis of the palatal muscles and is directly proportionate to the degree of the condition.

Table 1: Correlation of grade of OSMF with loss of hearing according to age group

Age (In Year)	Normal	Loss of Hearing	Normal Loss of Hearing	Normal	Loss of Hearing
	(Total =5) [100%]	(Total = 0) [0%]	(Total = 8) [61.53%] (Total = 5)	(Total = 7)	(Total = 5)
			[38.46%]	[58.33%]	[41.67%]
15–30	4[80%]	0	3[37.5%] 2[40%]	2[28.57%]	0
(Total = 11)					
31–45	1[20%]	0	5[62.5%] 3[60%]	3[42.85%]	2[40%]
(Total = 14) 46–60	0[0%]	0	0[0%] 0	2[28.57%]	3[60%]
(Total = 5)					

P Value B 0.05 Significant

(Level of Significance P B 0.05, Pearson Chi Square test)

Table 2: Categories of hearing loss association with grades of OSMF

OSMF Grade (Total Ears = 60) [100%]	Normal H (Total = 42) [70%]	Minimal HL (Total = 5) [8.33%]	Mild HL (Total = 6) [10%]	Moderate HL (Total = 7) [11.66%]
Early OSMF	10 [23.80%]	0	0	0
Moderate OSMF	17[40.47%]	4[80%]	2[33.33%]	3[42.85%]
Severe OSMF	15[35.71%]	1[20%]	4[66.67%]	4[57.14%]

P Value B 0.05 Significant
(Level of Significance P B 0.05, Pearson Chi Square test)

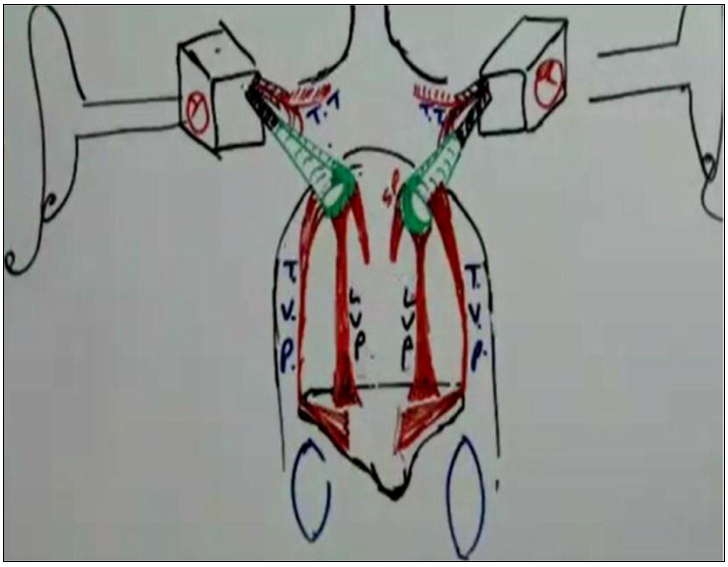

Fig 2: Schematic diagram of relationship of eustachian tube and palatal muscles (levator veli palatine (LVP), tensor veli palatini, (TVP) tensor tympani (TT) and salpingopharyngeus (SP)

Table 3 categorises hearing loss based on age group. Hearing loss was found in three ears in the 15-30 age range, with little hearing loss in two ears and moderate hearing loss in one. The 46-60 year old age group had moderate hearing loss in 6 ears. Out of six, four had moderate hearing loss and two had mild hearing loss. There was no statistically significant difference between age groups and types of hearing loss. (P [0.05. Hearing efficiency declines with ageing. As a result, it could also be a contributing factor. success rate of treatment.

Table 3: Shows category of hearing loss according to age group

Age (In Year) (Total Ears = 18)	Minimum Hearing Loss (Total=5)		Mild Hearing Loss (Total = 6)		Moderate Hearing Loss (Total = 7)	
	Right Ear (Total = 2) [40%]	Left Ear (Total = 3) [60%]	Right Ear (Total = 3) [50%]	Left Ear (Total = 3) [50%]	Right Ear (Total = 4) [57.14%]	Left Ear (Total = 3) [42.85%]
15–30	1[50%]	1[33.33%]	0	0	0	1[33.33%]
(Total = 3)						
31–45	1[50%]	2[66.67%]	3[100%]	1[33.33%]	1[25%]	1[33.33%]
(Total = 9) 46–60	0	0	0	2[66.67%]	3[75%]	1[33.33%]
(Total = 6)						

P Value B 0.05 Significant (Level of Significance P B 0.05, Pearson Chi Square test)

Conclusion

Inclusion of the palate muscles in OSMF may reduce Eustachian tube patency, resulting in conductive hearing loss. As a result, because the test is non-invasive, painless, and takes less time, it can be implemented efficiently for instructing the patient, which may be useful in assessing morbidity and determining the prognosis as a whole so as to find more appropriate therapeutic interventions for hearing deficit in order to increase the success rate of treatment.

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