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Evaluation of Eustachian Tube Dysfunction in Oral Submucous Fibrosis: A Case Control Study

Dr. B. Jaya Lakshmi[*1], Dr. Avinash Tejasvi.M.L[2], Dr. Srinath Jadhav[3], Dr. Desavali Sindhoori[4], Dr. Thakur Kshatri Shyamilee[5], Dr. R Tharshik Kumar[6], Tanjela Bushra[7], Fariha Haseen[8]

[*1]Senior lecturer, Department of Oral medicine and Radiology, Malla Reddy Dental college for women, suraram, Hyderabad

[2] Professor and HOD, Department of Oral medicine and Radiology, Kamineni Institute of Dental Sciences, Sreepuram, Narketpally. Nalgonda – 508254

[3]Private practitioner, Srikanth Multispeciality, Hyderabad

[4] Senior lecturer, Department of Oral medicine and Radiology, SVS Institute of Dental Sciences

[5] Private Practitioner, Dr Shyamilee's Fab Dental Clinic, Hyderabad.

[6] Intern, Department of Oral medicine and Radiology, Kamineni Institute of Dental Sciences, Sreepuram, Narketpally. Nalgonda - 508254

***Corresponding Author:**

Dr. B Jaya lakshmi

ABSTRACT

Introduction: Oral Sub mucous fibrosis (OSMF) is a chronic, progressive, irreversible, insidious disease of oral mucosa that occurs due to areca-nut chewing, consumption of chillies, genetic predisposition and autoimmunity. It is a potentially malignant lesion and can transform into oral carcinoma. The disease starts with burning sensation with gradual reduction in mouth opening due to fibrosis of the oral mucosa. It mainly effects oral cavity which includes buccal mucosa, tongue, lips, soft palate but may also extend to pharynx, oesophagus and even to larynx The extension of fibrosis into the nasopharynx leads to reduction in hearing efficiency.

Aim-To evaluate the effect of oral sub mucous fibrosis on the Eustachian tube function and its correlation with various grades of OSMF and control group.

Materials and methods- This was a case-control study with total of 45 patients (90 ears), which included 15 stage IV OSMF (30 ears), 15 stage III OSMF (30 ears) and 15 normal controls.

Results: on audiometry ,83.3% in control group showed no loss hearing impairment 66.6% ,53.3% in stage III and IV OSMF respectively, mild loss was higher in both stages of OSMF and least in control group, moderate loss hearing impairment was higher in stage IV, less in stage III absent in control group. on tympanometry type A pattern was noticed in 17 ears in stage IV OSMF,16 and 30 in stage III OSMF and control group respectively, Type b pattern in stage IV and III was 9and 11 respectively and absent in control group. Type C pattern found IV and III was 4and 3 respectively and absent in control group. Eustachian tube dysfunction in stage IV and III was 70% and 46.6% respectively and absent in control group.

Conclusion: From this study, it is observed that the subjective functions of Eustachian tube were affected by disease process.

Keywords: *Audiometry, Tympanometry, Eustachian tube dysfunction test*

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1. INTRODUCTION

In the year 1952 schwartz described oral sub mucous fibrosis as chronic, progressive, irreversible disease of oral cavity with an unknown etiology.[1]pindborg described oral sub mucous fibrosis as chronic insidious process characterized by juxtra-epithelial deposition of followed by fibro elastic changes in the lamina propria causing stiffness of oral mucosa leading to trismus and difficulty in chewing.[2]it mainly effects oral cavity which includes buccal mucosa, tongue, lips, soft palate,pharynx,larynx.[3] Overall prevalence rate in India varies from 0.3% to 5% and is more prevalent in males with 0.2% to 5% and 2- 4.5% in females.[4] various authors, have been suggested a variety of etiological factors including betel nut, capsaicin and the most common of which is chewing areca nut other factors include autoimmunity, hypersensitivity, genetic predisposition and vitamin deficiency like chronic iron and vitamin B-complex also plays a role.[5]

Oral sub mucous fibrosis shows degenerative changes in the deeper tissue with muscle fibers.[6] Any changes in these muscles which are attached to soft palate and auditory tube leads to changes in the middle ear pressure affects the functions of eustachian tube resulting in the impairment in hearing.7 Atmospheric pressure in the middle ear is maintained by normal opening of the eustachian tube ,closing of the eustachian tube protects the middle ear from loud sounds and unwanted pressure fluctuations. Abnormal functions in the eustachian tube (i.e., impaired closing or opening) may cause pathological changes in the middle ear. This in turn can lead to hearing impairment.[8]

However there are few studies available correlating the eustachian tube dysfunction in OSMF patients and thereby decreasing the hearing capacity. Therefore, present study was conducted to evaluate whether any association between OSMF and Eustachian tube function actually present or not.

2. MATERIALS AND METHODS

A prospective, case control study was done in the department of oral medicine and radiology Kamineni institute of dental sciences in collaboration with Department of ENT, Kamineni institute of medical sciences. Patient diagnosed with stage III and IV OSMF, were included in the study based on the clinical examination. Total samples of 45 patients belonging to both genders were taken and were divided into 3 groups of 15 each. Group A consisted of 15 grade III OSMF. Group B consisted of 15 grade IV OSMF, and group C consisted of 15 healthy persons without OSMF). After obtaining institutional ethical clearance and informed consent from patients, both the ears were examined in all the three groups with total of 90 ears.

Exclusion criteria-Previous ear surgery, initial stages of OSMF, congenital deafness, developmental anomalies of ear, chronic ear infections, middle ear infections, tympanic membrane perforations, cholesteatoma were excluded. **Inclusion criteria**- clinically diagnosed stage III and stage IV oral sub mucous fibrosis patients.

Audiometry -Audiometer is an electronic oscillator which produces pure tones with range. Auditory sensitivity was best ascertained with the use of an audiometer, model number-1classic with input power of 200V-250V/50HZ A.C shown in [Figure 1]. Audiometry was performed in a noise proof chamber. The examiner was seated in a noise proof chamber and fitted with earphones set to the patient to measure her/his threshold for pure tone. Patient is instructed to raise hand. Signal intensity was slowly decreased to 10dB steps until no response was obtained. Pure tones were delivered in to the ear through headphone for air conduction and for bone conduction through bone vibrator. In audiometry procedure, initially air conduction was performed followed by bone conduction. The hearing loss was measured in decibels (dB), various frequencies were selected and the dB's varied until the examiner reports s/he can hear sound. Air conduction and Bone conduction tones were measured at 250 Hz(50dB), 500 Hz(70dB), 750 Hzv(70dB), 2000 Hz and 4000 Hz. The threshold for each frequency was recorded and entire range of audible pitches was plotted on graph known as audiogram.Both the ears of the subjects from study and control group were subjected to this analysis.

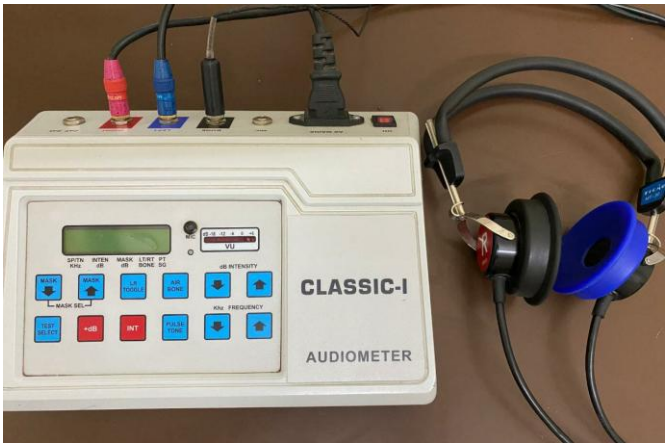


FIGURE 1- Audiometer

Interpretation [9]-Based on the AC-BC Gap values, hearing impairment was quantitatively graded into following categories:

1) Normal hearing 0-25 dB,
2) Mild deafness26-40 dB,
3) Moderate deafness 41-55 dB.

Tympanometry

sTympanometric analysis was done with AT 235 Inter acoustic impedence equipment. A small probe was inserted in to the ear which emits a of low frequency sound (226Hz) via a tube into the auditory canal produces continuous positive pressure and negative pressure by the pump in the external auditory canal in front of the tympanic membrane. The compliance was measured and shown on a graph known as tympanogram. Graphs obtained are Type A, Type B and type C

Interpretation [9]

1. Type A- Normal
2. Type B - Abnormal tympanograms.
3. Type C- Abnormal tympanograms.

Eustachian Tube Function Test

Eustachian tube function test was performed same as that of tympanometry. In Eustachian tube function test multiple tympanograms was done to obtain different middle ear pressures at normal, positive and negative pressures in three different conditions. Initially patient was asked to swallow with nose and mouth closed and finally after performing Valsalva method, middle ear pressure was recorded. The pressure values at maximum compliance were recorded from all the tympanograms and the shift in the compliance peaks at normal, negative pressures and positive pressures was calculated.

Interpretation [9]

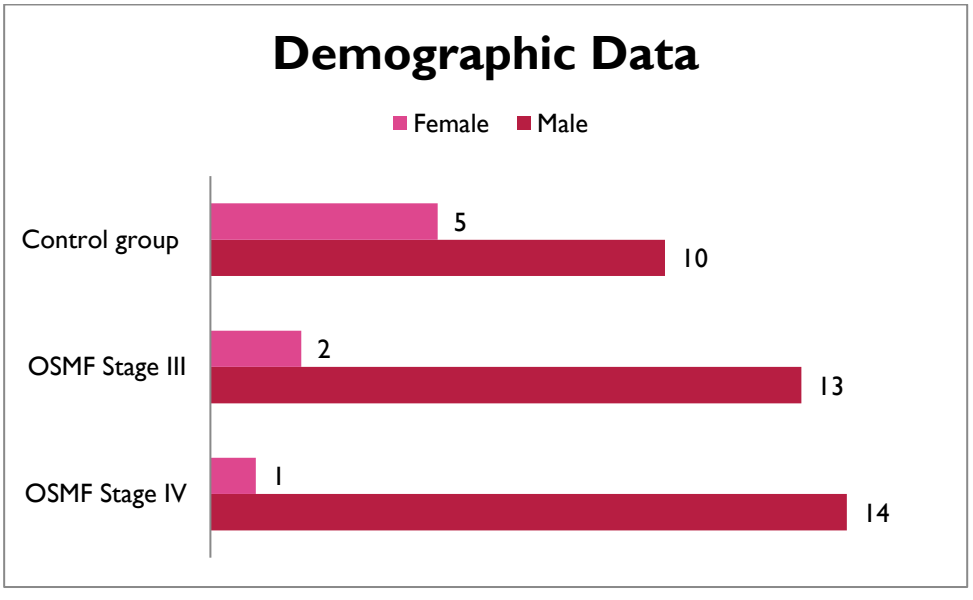
1) Good functioning-Shift in the compliance peaks showed good functioning of eustachian tube
2) Poor functioning-No shift in the compliance peaks showed poorly functioning of eustachian tube.

Audiometry, tympanometry and esutachian tube function test were done in all the groups by ENT surgeon and the data so obtained was tabulated

3. RESULTS

Demographic data:-

Study group comprised of 27 males and 3 females age ranged between 20 to 50 years which were divided into stage III and stage IV. Control group comprised of 10 males and 5 females age ranged between 20 to 50 years shown in Table 1 and graph 1.

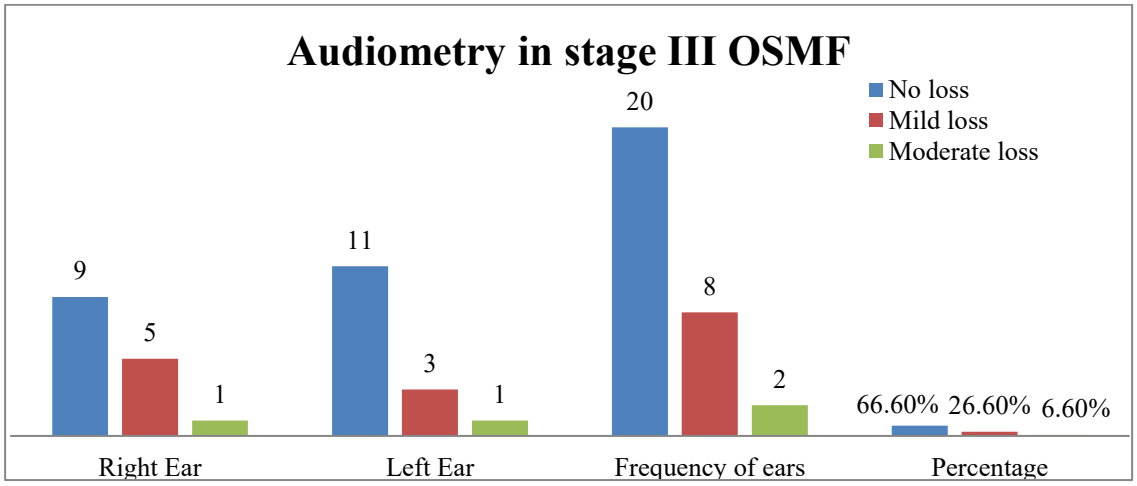


Graph 1- Demographic data

Audiometry in stage III OSMF showed no hearing loss 9 in right and 11 in left ears with 66.6%, mild hearing loss seen in 5 and 3 in right and left ears respectively with 26.6% and moderate loss 1 and 1 in right and left ear respectively with 6.6% shown in table 2 and graph 2

OSMF Grade III	Right Ear	Left Ear	Frequency of ears	Percentage
No loss	9	11	20	66.6%
Mild loss	5	3	8	26.6%
Moderate loss	1	1	2	6.6%
Total	15	15	30	100%

Table 2- Audiometry in stage III OSMF

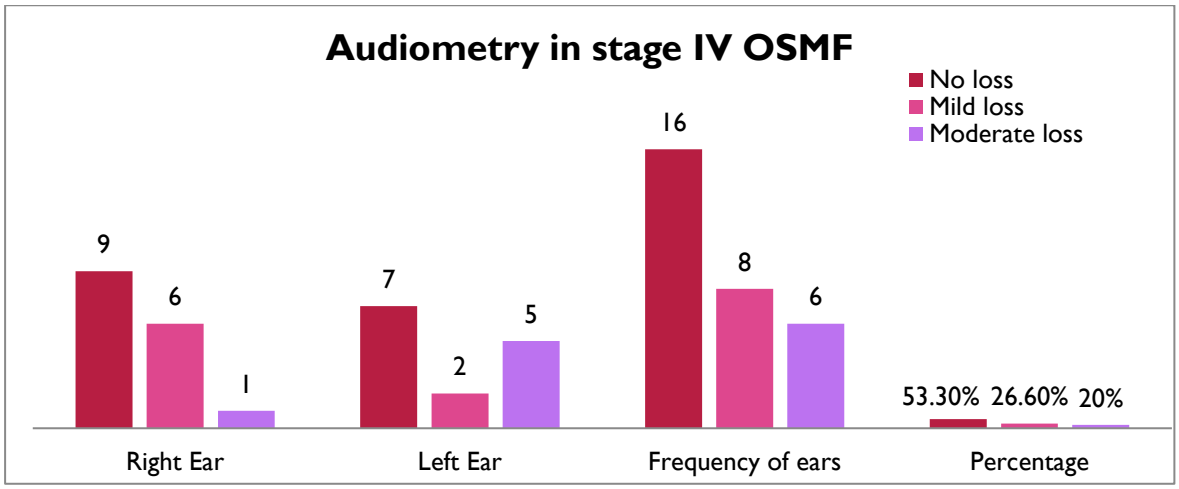


Graph -2 Audiometry in stage III OSMF

Audiometry in stage IV OSMF showed no hearing loss 9 in right and7 in left ears with 53.3%, mild hearing loss seen in 6 and 2 in right and left ears respectively with 26.6% and moderate loss 1 and 5 in right and left ear with 20%shown in table 3 and graph 3.

OSMF Grade IV	Right Ear	Left Ear	Frequency of ears	Percentage
No loss	9	7	16	53.3%
Mild loss	6	2	8	26.6%
Moderate loss	1	5	6	20-%
Total	15	15	30	100%

Table 3- Audiometry in stage IV OSMF



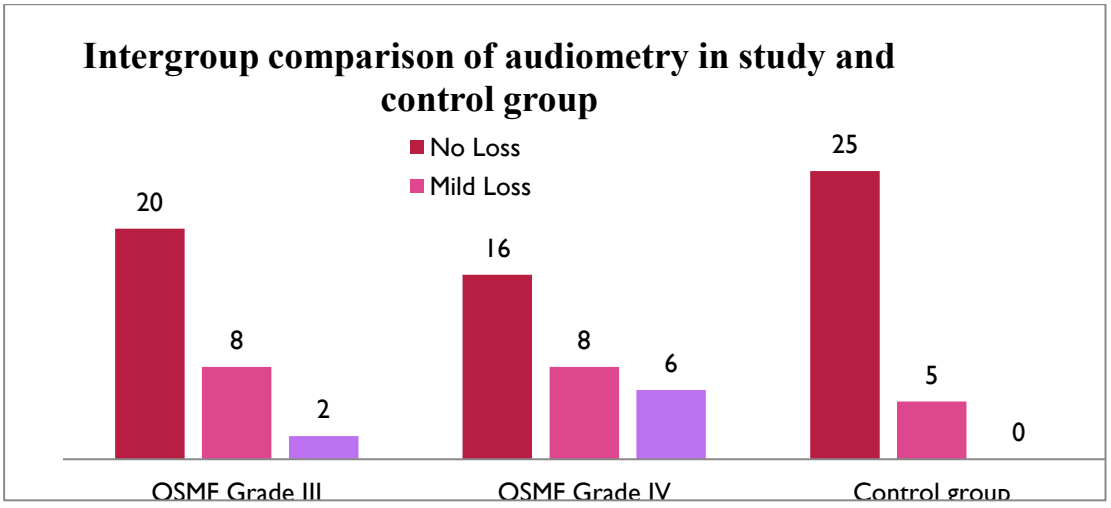
Graph 3- Audiometry in stage IV OSMF

Control group- showed no hearing loss 13 in right and12 in left ears with 83.3%, mild hearing loss seen in 3 and 2 in right and left ears respectively with 16.6% and moderate loss was 0% shown in table 4 and graph 4.

Intergroup comparison of audiometry in study and control group- 83.3% in control group showed no loss hearing impairment 66.6% and 53.3% in stage III OSMF and stage IV OSMF respectively, mild loss was higher in both stages of OSMF and least in control group, moderate loss hearing impairment was higher in stage IV, less in stage III absent in control group shown in table 4 and graph 4.

Type of hearing impairment	OSMF Grade III	Percentage	OSMF Grade IV	Percentage	Control group	Percentage
No Loss	20	66.6%	16	53.3%	25	83.3%
Mild Loss	8	26.6%	8	26.6%	5	16.6%
Moderate Loss	2	6.6%	6	20%	0	0
Total	30	100%	30	100%	30	100%

Table 4 Intergroup comparison of audiometry in study and control group



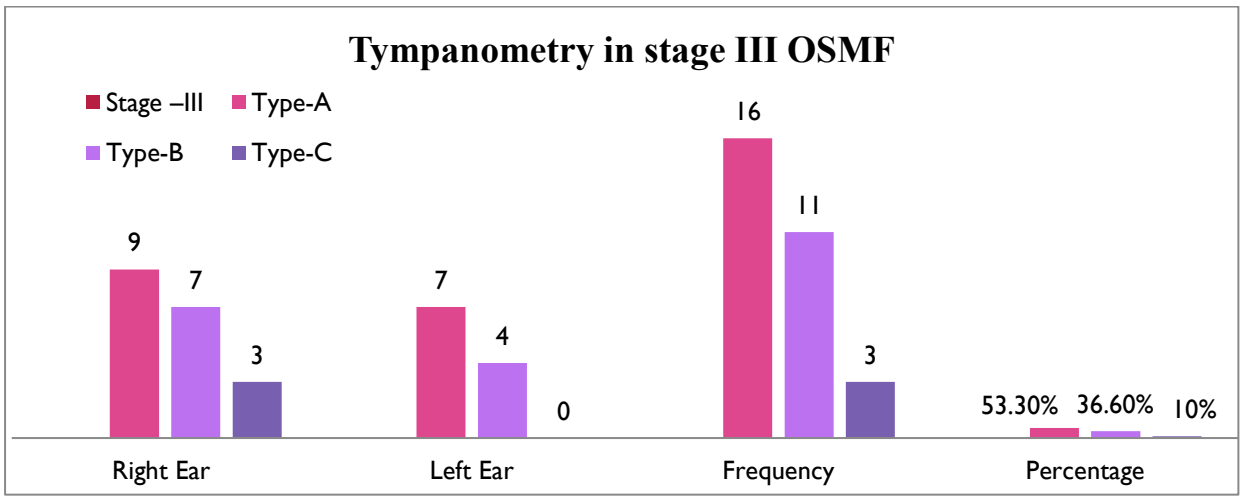
Graph- 4 Intergroup comparison of audiometry in study and control group

Tympanometry in Stage –III OSMF

On tympanometry out of 30 ears in Osmf (stage III) normal tympanogram type-A was recorded 9 in right ear and 7 in left ear with frequency of 16 ears (53.3%), while abnormal tympanogram type B in right and left ear was 7 and 4 with frequency of 11 ears (36.6%), tympanogram type c was 3 in right ear and 0 in left ear with frequency of 3 ears (10%) shown in table 5 and graph 5.

Grade of OSMF Stage –III	Right Ear	Left Ear	Frequency No of Ears	Percentage
Type-A(n=16)	9	7	16	53.3%
Type-B(n=11)	7	4	11	36.6%
Type-C(n=03)	3	0	03	10%
Total			30	100%

Table 5 Tympanometry in Stage –III OSMF



Graph-5 Tympanometry in stage III OSMF

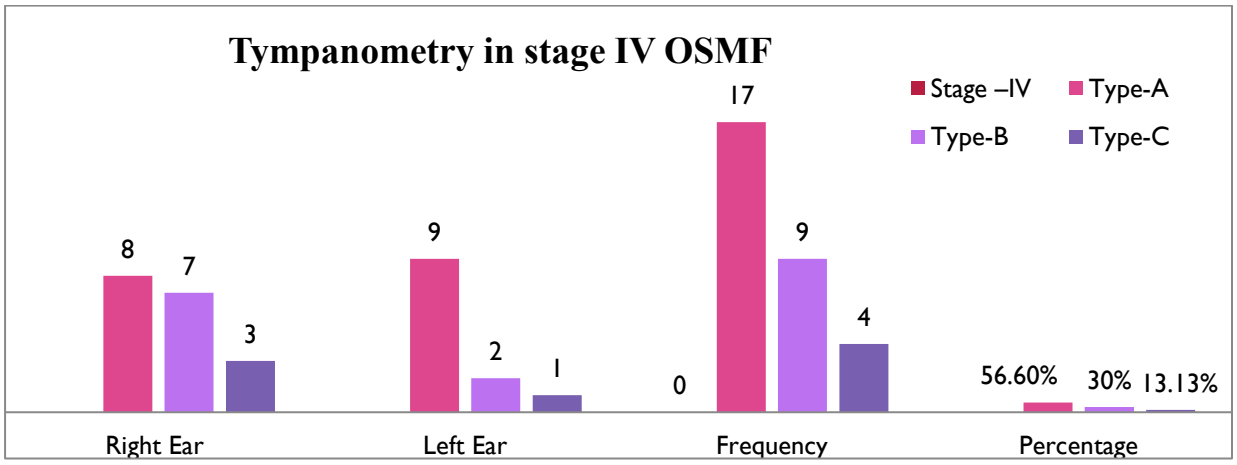
Tympanometry in Stage –IV OSMF

On tympanometry out of 30 ears in Osmf (stage IV) normal tympanogram type-A was recorded 8 in right ear and 9 in left ear with frequency of 17 ears (56.6%), while abnormal tympanogram type B in right and left ear was 7 and 2 with frequency of 9 ears (30%), tympanogram type c was 3 in right ear and 1 in left ear with frequency of 4 ears (13.13%) shown in table 6 and graph 6.

Grade of OSMF Stage –IV	Right Ear	Left Ear	Frequency No of Ears	Percentage
Type-A(n=17)	8	9	17	56.6%
Type-B(n=09)	7	2	09	30%

Type-C(n=04)	3	1	04	13.13%
Total			30	100%

Table 6 Tympanometry in Stage –IV OSMF



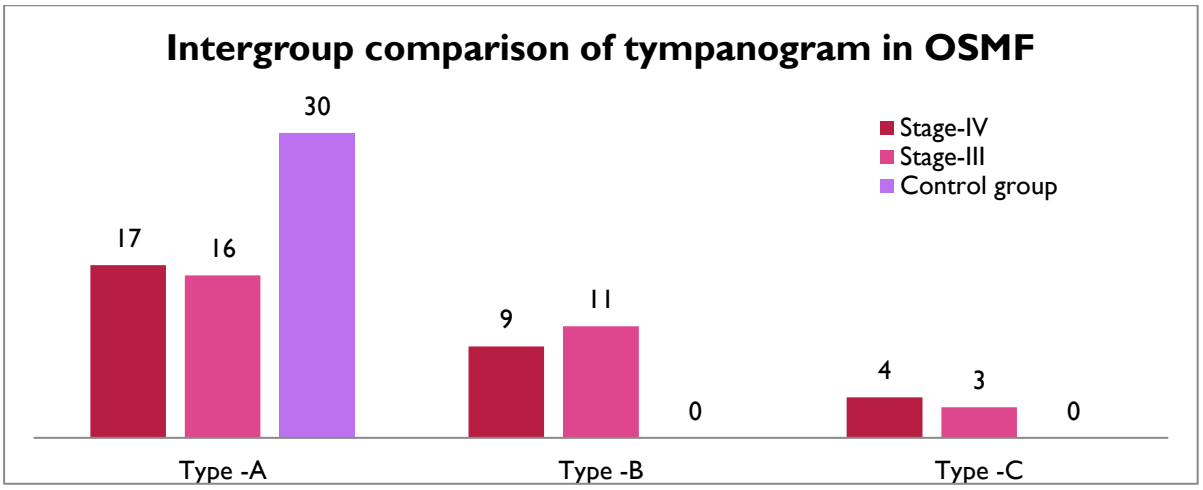
Graph -6 Tympanometry in stage IV OSMF

Intergroup comparison of tympanogram in OSMF -on tympanometry out of 30 ears in control group normal tympanogram type-A was recorded in 30 ears with (100%), type B and type C was absent shown in table 7. Intergroup comparison of tympanogram showed type A and type B more in stage IV and type C pattern more in stage III OSMF shown in table 7 and graph 7

Control group- Control group showed 100% type A pattern shown in table 7 and graph 7.

OSMF group	Type –A	Percentage	Type -B	Percentage	Type -C	Percentage
Stage-IV(n=30)	17	56.6%	09	30%	04	13.13%
Stage-III(n=30)	16	53.3%	11	36.6%	03	10%
Control group (n=30)	30	100%	0	-	0	-

Table 7 Intergroup comparison of tympanogram in OSMF

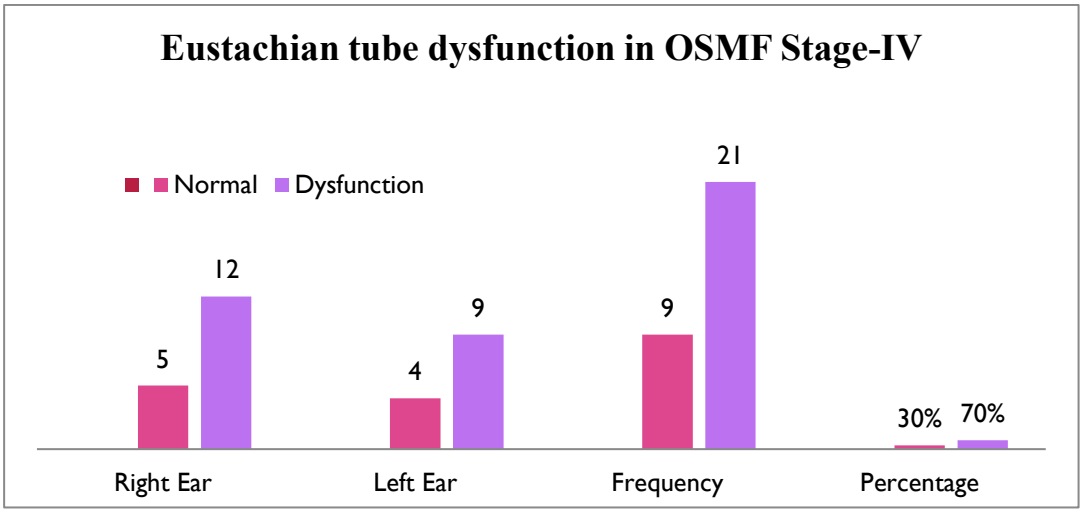


Graph -7 Inter group comparison of tympanogram in study and control group

Eustachian tube dysfunction in OSMF Stage III- total of 30 ears in which eustachian tube was normal 9 in right and 7 in left ear with 53.3% and dysfunction was present 6 in right and 8 in left ear with 46.6% shown in table 8 and graph 8.

OSMF Stage-III	Right Ear	Left Ear	Frequency No of Ears	Percentage
Normal	9	7	16	53.3%
Dysfunction	6	8	14	46.6%
Total			30	100%

Table 8 Eustachian tube dysfunction in OSMF Stage-III



Graph-9 Eustachian tube dysfunction in OSMF Stage-IV

Eustachian tube dysfunction in OSMF Stage IV- total of 30 ears in which eustachian tube was normal 5 in right and 4 in left ear with 30% and dysfunction was present 12 in right and 9 in left ear with 70% shown in table 9 and graph 9.

OSMF Stage-IV	Right Ear	Left Ear	Frequency No of Ears	Percentage
Normal	5	4	9	30%
Dysfunction	12	9	21	70%
Total			30	100%

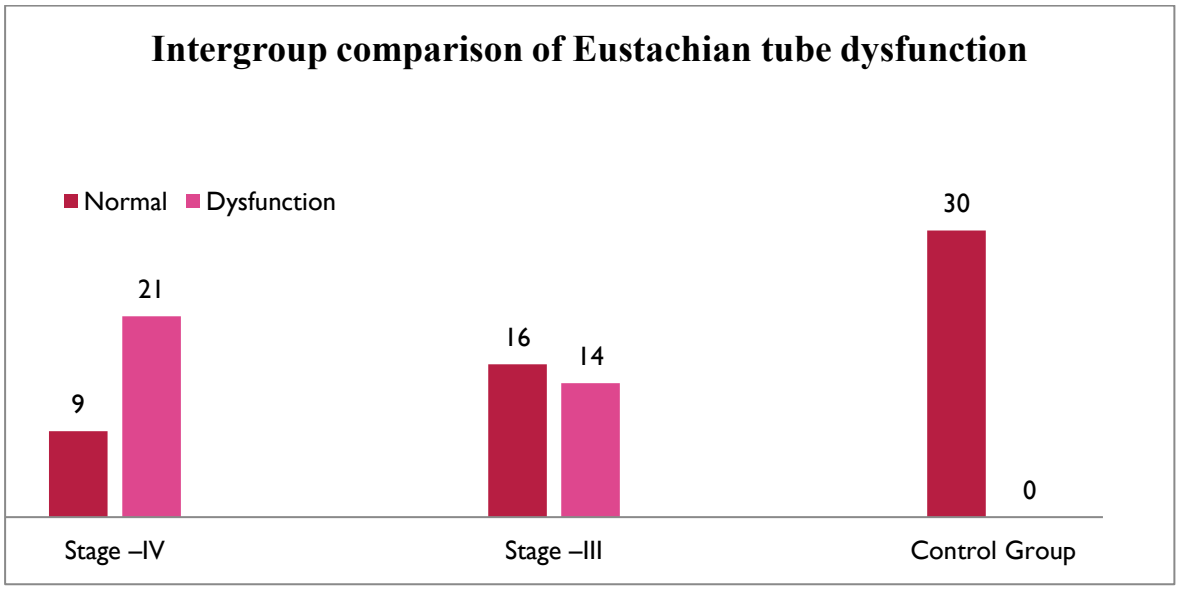
Table 9 Eustachian tube dysfunction in OSMF Stage-IV

Control group – Eustachian tube was normal in both ears with 100% shown in table 10.

Intergroup comparison of Eustachian tube- among both the groups dysfunction is more in stage IV than stage III shown in table 10 and graph 10.

	Normal	Percentage	Dysfunction	Percentage
Stage –IV (n=30)	09	30%	21	70%
Stage –III (n=30)	16	53.3%	14	46.6%
Control Group(n=30)	30	100%	0	0

Table10. Intergroup comparison of Eustachian tube dysfunction



Graph-10 Intergroup comparison of Eustachian tube dysfunction

4. DISCUSSION

Oral submucous fibrosis is predominantly a disease of oral cavity involving oropharynx and rarely larynx which has been studied since few decades.[10] it affects around 0.2-1.2% of the Indian population with male predominance.[11]This disease is characterized by stiffness and blanching of mucosa, burning sensation in the mouth loss of sensation, hypo mobility of tongue and soft palate occasionally mild hearing loss due to blockage of Eustachian tube.[12,13] Initially it presents with inflammation followed by hypo vascularity and fibrosis which is visible as blanching of the oral mucosa.[14] very few authors have evaluated the extent of fibrosis into the palatal and Para tubular muscles. Gupta et al have reported degenerative changes in palatal / Para tubular muscles, oedematous muscles fibres and atrophy and concluded that there was involvement of palatal and Para tubular muscles in OSMF. This could further dysfunction in Eustachian tube in OSMF.[7]

Fibrosis extends involving the nasopharynx and pharyngeal orifice of Eustachian tube and affects the functioning of Eustachian tube, normally sound waves enter auditory canal then strike eardrum causing it to vibrate. This sound waves passes from large area (Eardrum) to the inner ear. The alternate change in pressure agitate the basilar member, this results I the stimulation of sensory hair cells to send impulses to the brain along the auditory nerve.[15]

Eustachian tube in adult's measures approximately size of 3mm in diameter, first two third is supported with cartilage and last third is made by bone. It is present close to the middle ear space[16-19] .In oral sub mucous fibrosis there is further narrowing of pharyngeal orifice of Eustachian tube resulting in the failure of Eustachian tube to regulate air pressure. Partial or complete blockage of Eustachian tube causes various sensations like clicking , popping, fullness in ear, pain in ear. [10]

In a study done by **Gupta sc et al** [7] out of 106 ears tympanometric examination revealed, type A curve in 80 ears, type B curve in 17 ears, type c in 9 ears. Present study tympanometry showed similar results in a total of 60 ears in both stage III and IV, type A curve was seen in 33 ears, type B curve in 20 ears, type c in 7 ears.

In a study done by **Sana Noor et al** [9] both audiometry and tympanometry was done audiometric results stated that 28 ears were normal, 8 ears showed mild loss and moderate loss in 4 ears. Tympanometry results showed type A in 32 ears, 8 type B and type c was not recorded. Present study results were similar but type C curve was recorded.

Malik shah et al [20] compared the Eustachian tube function in 27 OSMF patients and 25 control group and found significant difference between both the groups and concluded that there was significant association between OSMF and Eustachian tube function. Present study Eustachian tube dysfunction in stage III and IV OSMF was 46.6% and 70%.

5. CONCLUSION

Present study concludes that oral sub mucous fibrosis not only involves oral mucosa but also involves Eustachian tube. As the test is non –invasive and painless, it can be effectively used to identify the prognosis and assessing the morbidity. The result can be further justifies by involving more sample size.

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