

HEARING LOSS EVALUATION IN ORAL SUBMUCOUS FIBROSIS PATIENTS, PREOPERATIVELY AND POSTOPERATIVELY

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ABSTRACT

Objective: To evaluate hearing sensitivity and Eustachian tube function in oral sub mucous fibrosis patients preoperatively and following surgical intervention.

Materials and Methods: This is observational prospective study in which 40 patients (80 ears) suffering from biopsy proven OSMF (Group 2 & 3) were tested for Eustachian tube dysfunction and hearing sensitivity using Tympanometry & Audiometry.

Results: On Tympanometry, Type A curve was obtained in 58 ears, Type B curve in 15 ears and Type C curve in 7 ears preoperatively. Immediate postoperatively TYPE A curve was obtained in 54 ears, TYPE B curve in 19 ears and Type C curve in 7 ears. After 1 month and 3 month Type B and Type C curve was not obtained in any ear. On Audiometry, 56 ears showed normal hearing and 24 ears showed minimal conductive hearing loss preoperatively and Immediate postoperatively. Tests after 1 month and 3 months showed all 80 ears having normal hearing.). One way ANOVA test was done and the results were found statistically significant in both tests .Pearson correlation test shows that both test methods (Tympanometry and audiometry) are highly co related.

Conclusion: The results indicate an association between stages of OSF and hearing loss. OSMF causes fibrotic changes in Tensor veli palatani and Levator veli palatani muscles which in addition with restricted mouth opening restricts proper Eustachian tube functioning in turn causing changes in Middle ear function. This feature if found can be dealt effectively with surgical intervention.

INTRODUCTION

Oral Submucus Fibrosis (OSMF) is a chronic, gradually progressive, scarring precancerous condition, widespread in South East Asian population. Chronic placement of betel quid in the mouth is main

etiology.1–4 Also, many other factors such as chewing tobacco, smoking ,consuming chilies, hypersensitivity, , genetic predisposition, autoimmunity ,vitamin B-complex and chronic iron deficiency have been thought to be contributory.5,6

Although sometimes preceded by and/or associated with vesicle formation, it is always associated with juxtaepithelial inflammatory reaction followed by lamina propria fibroelastic changes , with epithelial atrophy leading to the oral mucosa and causing trismus and inability to eat.8

Incidence of OSMF in India is 0.2% to 1.2%and it is seen more in males compared to females.7Clinical features include inadequate mouth opening, stomatopyrosis, blanching of oral mucosa, xerostomia, dysphagia. Progressive inability to open the mouth is due to development of vertical fibrous bands and loss of elasticity in labial and buccal tissues. This disease is commonly seen in adults & adolescents mainly in the ages between 16 and 35 years. It may be associated with other precancerous conditions and lesions.1–4

In advanced cases, It may also involve the paratubal muscles and the pharyngeal orifice of the eustachian tube (ET), thereby affecting its functions and causing symptoms along with other pathological changes in the middle ear mucosa that eventually lead to hearing impairment.

Several past studies have investigated the association of OSMF with Eustachian tube dysfunction. Mostly included patients suffering from OSMF – Khanna and Andrade Group 4. However, in this study we have talked about prevalence of ET dysfunction in patients suffering from biopsy proven Oral Submucous fibrosis (Khanna and Andrade Group 2 & 3). Also, very few studies appears to have compared the changes of Eustachian tube functioning following surgical intervention of OSMF with that of pre surgical Eustachian tube functioning. Hence, the second objective of this study was to detect whether the surgical intervention is of any help to treat hearing problems in such patients.

MATERIALS AND METHODS

2.1. Study design

This was an observational prospective study conducted at Mahatma Gandhi medical college and hospital , Jaipur by Department of ENT , between Jan 2021 to Jan 2022 on 40 OSMF patients , systematically healthy after obtaining ethical clearance from the Institutional ethical committee. Therefore, the sample size included 80 ears.

2.2. Participant selection criteria

Inclusion Criteria:

- All patients with biopsy proven OSMF & reduced mouth opening .
- Patients in Group 2 & Group 3 according to Khanna JN, Andrade NN (1995) classification – with the 15–35 mm mouth opening .

Exclusion Criteria:

- Patients in Group 4A & 4B according to Khanna JN, Andrade NN classification (1995)

- Presence of any other etiology for trismus eg. TM Joint problems and any other oral lesions
- Patients who refuse to undergo hearing test, fail to come for follow up
- Patients with poor postoperative compliance.
- Patients with pre-existing ear infections, hearing aids

2.3. Procedure

Patients in whom mouth opening was reduced were assessed clinically and undertaken for biopsy under local anesthesia to confirm the presence of Oral Submucous fibrosis. To rule out field cancerisation, biopsy was done from multiple sites. Once biopsy confirmed the presence of Oral Submucous fibrosis, patients were explained regarding the procedure and informed consent was taken. Patients were taken up for surgery under General anesthesia (GA), for fibrotic bands release in bilateral buccal mucosa with reconstruction using buccal fat pad & collagen sheet. Following the surgery the treatment was supplemented by rigorous mouth opening exercises, intralesional steroid as per patient's requirements.

2.4. Evaluation

Tympanometry and Audiometry (Figure 1 and 2) was done in the preoperative period and in the postoperative period. A total of 3 readings were taken in the postoperative period – one day after surgery, 1month after surgery, 3months after surgery. The tests were done by the Department of Speech & Audiology, mahatma Gandhi medical college, Jaipur.



Figure 1: Audiometer



Figure2: Tympanometer

Statistical analysis.

- Window 10 Microsoft excel sheet was used for noting down recordings.
- The results were analysed using SPSS (Statistical Package for the Social Sciences) version 20.0 (Chicago, USA) software in the Department of Statistics, mahatma Gandhi medical college and hospital
- One way ANOVA and Post Hoc Test was done to determine the statistical significance of the findings.
- Pearson correlation test was done to determine the correlation between the results obtained from tympanometry and audiometry.

3. RESULT

Out of 80 ears Type A curve/normal Tympanometric curve was obtained in 58 ears (0.725), Type B curve/abnormal Tympanometric curve was obtained in rest 15 ears (0.187) and type C curve in 7 ears (0.087) preoperatively. Immediate postoperative Tympanometry test showed TYPE A curve in 54 ears

(0.675) TYPE B curve in 19 ears (0.2375) and TYPE C in 7 ears (0.087). Tympanometric test after 1 month

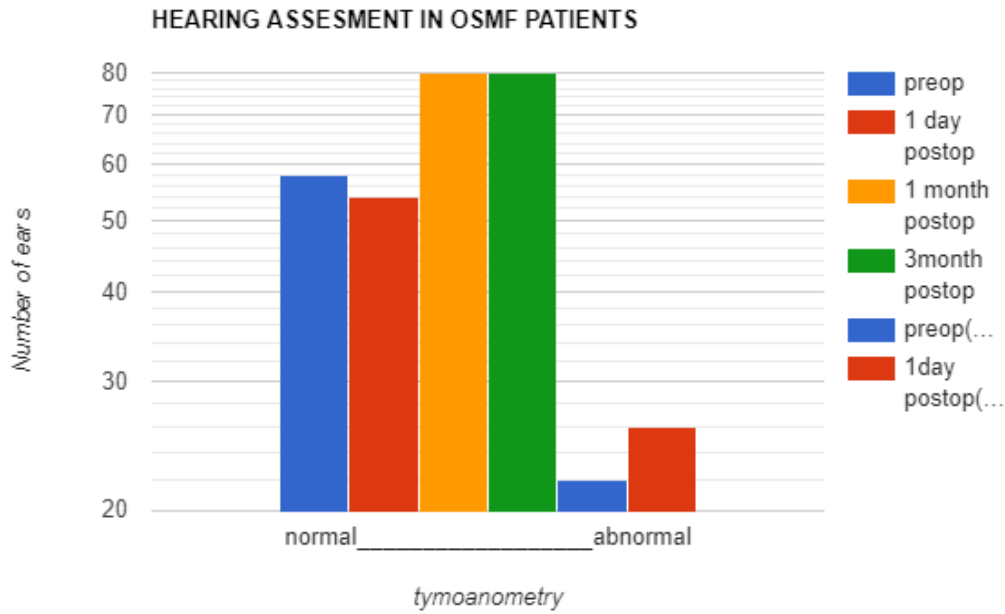


Figure 3

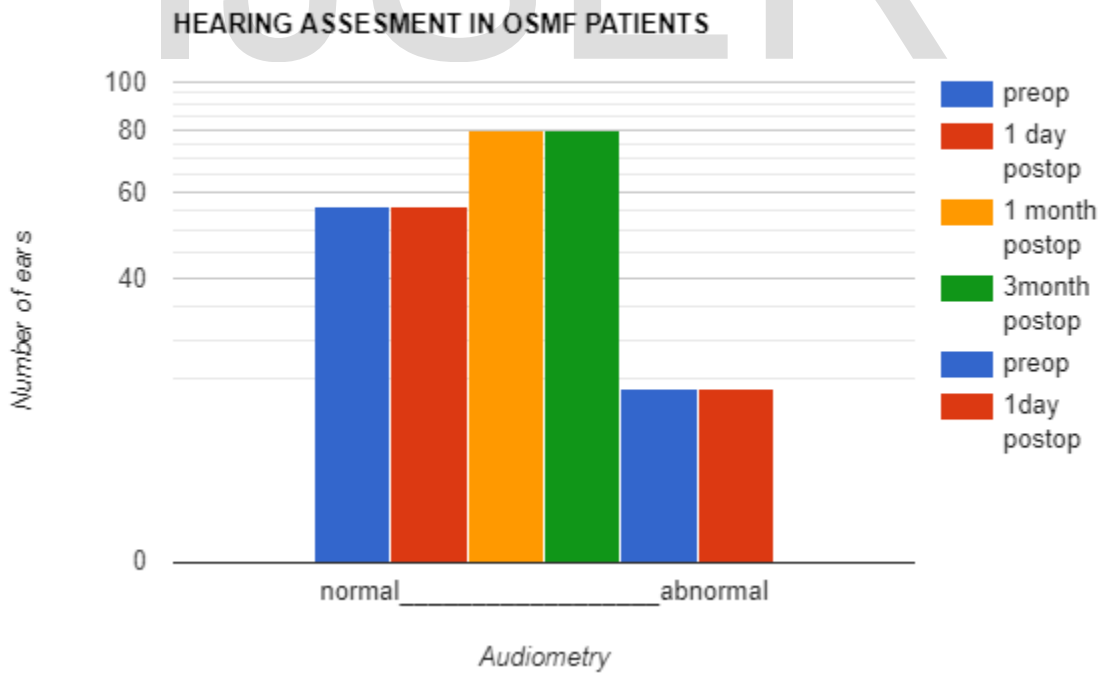


Figure 4

and 3 months revealed that Type B curve was not obtained in any ear and all 80 ears showed Type A curve. (Results are depicted in Fig. 3) Post Hoc test revealed that increase in Type B curve on tympanometry in the immediate postoperative period in 4 ears in relation to the preoperative period is statistically not significant.

On Audiometric Test, out of 80 ears, 56 ears (0.7) showed normal hearing and 24 (0.3) ears showed minimal conductive hearing loss preoperatively. Audiometric test were same when done on the immediate postoperative day. The test was done after 1 month and 3 month, showed all 80 ears having normal hearing. (Results are depicted in Fig. 4). One way ANOVA test was done and the results were found statistically significant in both tests. Pearson correlation test shows that both test methods (Tympanometry and audiometry) are highly co related.

4. DISCUSSION

4.1. Proposed pathophysiology

ET connects oral cavity and middle ear. ET physiologically has negative pressure and is collapsed at rest. It equilibrates pressure of the middle ear with that of atmospheric pressure. By active contraction of the tubal & paratubal muscles especially tensor veli palate, repeated intermittent opening of the Eustachian tube takes place when we are swallowing to maintain the pressure.^{9,10}

It is proposed that atrophic & degenerative changes of these muscles hamper ET patency and alters middle ear properties. Mainly there is a loss of elasticity of these muscles due to scarring and fibrotic changes, as a result of which negative pressure increases, tympanic membrane is sucked inwards and its shape changes. This collectively hampers sound conduction and hence hearing impairment.^{9,10}

On the other hand, since mandibular movements are constricted in OSMF it restricts patient to open mouth or swallow properly. As a result, the active opening of ET does not takes place.

4.2. The Tympanometer and the audiometer

Tympanometer /Middle ear analyser assesses middle ear functioning and measures the compliance, of the tympanic membrane as air pressure is increased or decreased in the ear canal.¹⁹ Results are plotted on a graph called a tympanogram and plotted as either a Type A, B, or C (Fig. 5B). Type A refers to normal eardrum movement. Type B indicates limited or no eardrum movement due to middle ear effusion. Type C refers to Eustachian tube dysfunction. Such a tympanogram occurs either by retraction of the eardrum or blockage of the Eustachian tube. Presence of 'C' type tympanogram is the strong indicator of Eustachian tube obstruction or blockage leading to negative pressure in the middle ear successively causing 'B' type Tympanogram⁹⁻¹¹

Audiometer works on principle of using air and bone conduction to determine hearing sensitivity within frequencies 250 Hz to 8 kHz (Fig. 5A). Horizontal X-axis of the graph depicts the frequency in Hertz and the vertical Y-axis depicts the intensity in Decibels.^{4,10-11}

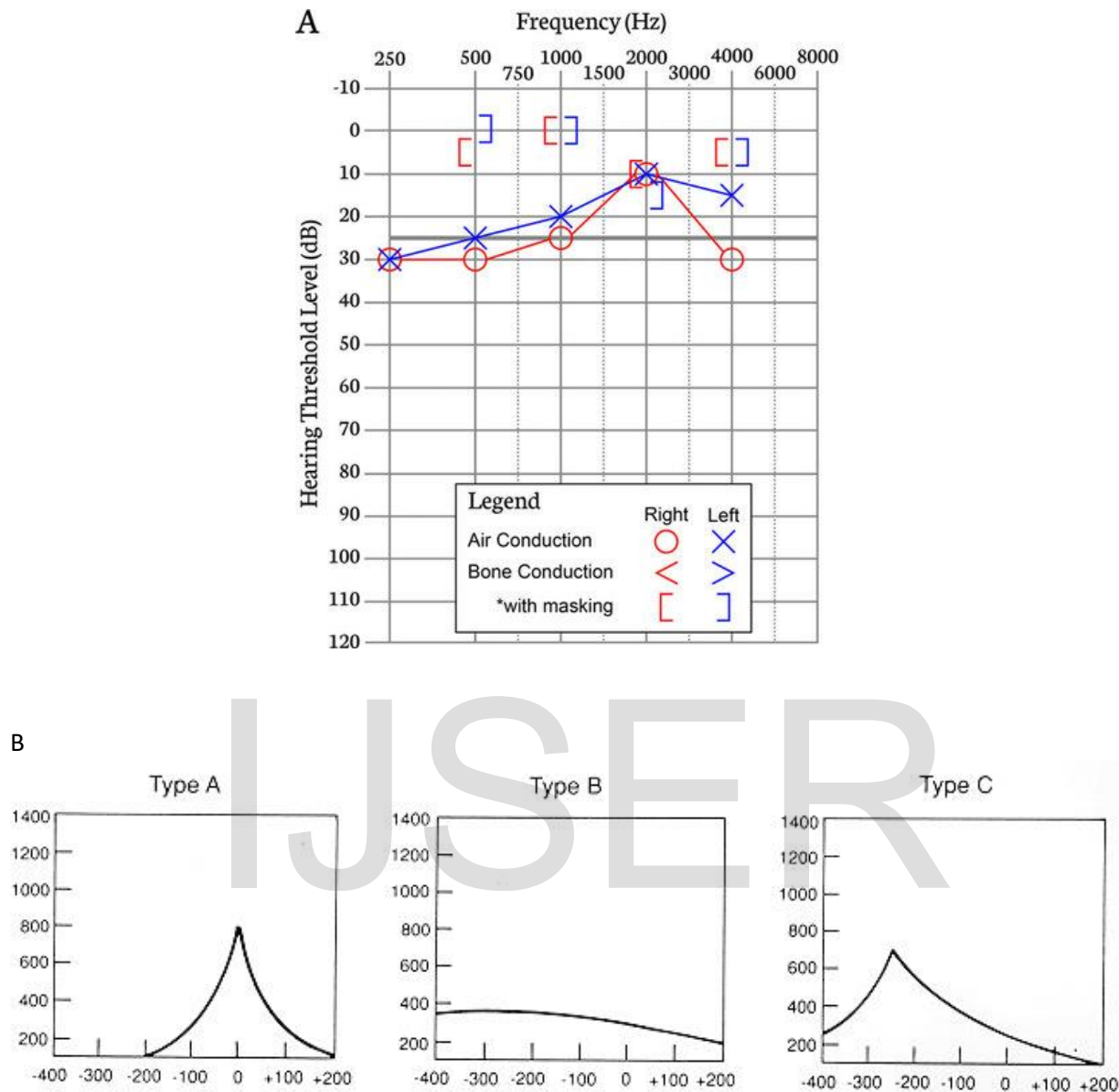


Figure5:.a Sample graph of audiometry b. Sample graphs of tympanometry (Type A – Eardrum movement in normal limits, TYPE B – Little or no eardrum movements, TYPE C – Eustachian tube dysfunction due to negative pressure)

By using Goodman's classification (1952), results are plotted and categorized into different degrees of hearing loss 4,10-11

- Normal Hearing: 0dB–15dB
- Minimal Hearing Loss:16 dB- 25 dB
- Mild Hearing Loss: 26 dB-40 dB

- Moderate Hearing Loss:41 dB–55 dB
- Moderately Severe Hearing Loss:56–70 dB
- Severe Hearing Loss:71 dB-90dB
- Profound Hearing Loss: > 90 dB

Many past studies have evaluated the role of fibrotic changes in paratubal muscles in OSMF and its relationship with Eustachian tube functioning using the above-mentioned test.

Gupta et al. in the year 2000 considered histopathological changes in paratubal & tubal muscles in OSMF. In 13.2% of patients dysplasia was noticed. Degenerative changes in palatal/paratubal muscles were of two types 1. loss of cross striation in 13.2%, 2. edematous muscle fibres in 9.4% of cases. Definite involvement of palatal/paratubal muscles in OSMF was concluded by his study .12

In a study by S.C. Gupta et al abnormal hearing on audiometry were found in 21 % of total patients and TYPE B curve tympanometry was seen in 20% patients.13 Nalini Aswath , Alagiri Chandran suggested that in Grade 3 OSMF about 47% showed positive Tympanometric results. And 43% of the patients showed positive audiogram results.14 In paper by Sowbhgya et al hearing impairment on audiometry was seen in 21 % of patients, and the statistical correlation was found significant.15 Shanti Badra et al. concluded that patients with grade III OSMF had bilateral mild Conductive hearing loss.16 Maulik Shah et al. study suggested, a significant association between OSMF and Eustachian tube function.

This implies while treating OSMF, possible middle ear changes and its effect on ET functioning should be kept in mind.17

Our present study suggested a similar result. Approximately 30% of total patients suggested hearing deficit suffering from OSMF (GRADE II and III) and were positively tested by audiometry and tympanometry in preoperative period.

In a study conducted by Sana-Noor Siddiqui et al. Audiometric and Tympanometric analysis concluded no hearing impairment in OSMF patients by showing no significant differences in hearing abilities of OSMF patients and controls and between various grades of OSMF. On the other hand, the Eustachian tube function test showed statistically significant difference in Eustachian tube function in OSMF patients and controls. Further, there was increase in the severity of dysfunction with an increase in the severity of the disease which was statistically significant. This study concluded that the Eustachian tube may be affected by the disease process. But, probably the amount of defect found in Eustachian tube is non-contributing to cause a conductive hearing loss.18

None of the above mentioned studies compared the Eustachian tube functioning and middle ear status in the postoperative phase with that of preoperative findings. In this study, after the 40 patients were confirmed by biopsy, they were undertaken for bilateral surgical release of intraoral fibrous bands under General anesthesia. Post operatively there was gradual improvement in mouth opening. With increase in mouth opening, the patient was able to swallow better. This caused better opening and ventilation of Eustachian tube and hence Middle ear functioning improved, as concluded by tympanometry and audiometry findings. Since the improvement in mouth opening was gradual, Middle ear changes was also gradual and not immediately postoperatively. No statistical significance in improvement was found in immediate postoperative readings. However tympanometry and audiometry tests showed statistically

significant results in 1 month postop and 3 month postop showed 100% improvement in hearing function.

Only 2 patient (4 ears) who had normal tympanogram & audiogram reading preoperatively gave type B curve on tympanometry in immediate postoperative period. However, his audiogram continued to show normal hearing in immediate postoperative period. After 1 month and 3 month of follow up, both tympanometry & audiometry showed normal results.

This event is found to be statistically insignificant and may be due to following causes:

1. Error in recording and test procedural variations
2. The Patient might be suffering from cold & cough causing mild middle ear effusion/otitis media which could have resolved spontaneously with time.

Therefore it can be concluded that by operating it is not possible to release the fibrosis in tubal & paratubal muscles or reverse the histopathological changes that have already affected the region. However, we can at least aim to provide the patient a better mouth opening so that swallowing improves & in turn eustachian tube function improves. This improves the Middle ear function even if underlying histopathological changes are still present in paratubal muscle.

4.3. Therefore clinical implication should be

1. The Routine practice of undergoing audiological test protocol for Oral Sub mucosal fibrosis
2. Audiological test are prognostic indicators for the conducted surgical procedure.

4.4. Drawbacks of the study

- 1 The sample size is small
- 2 Follow up period is small, i.e 3 months

4.5. Strengths of the study

1. A relation between the occurrence of ET defects and Middle ear function with OSMF

Group 2 and 3 is evaluated for which limited data is available in past.

2. Very few studies till date evaluates ET functioning and middle ear functioning in the post operative period.

Ethics statement

The study underwent ethical clearance from the Institutional Ethical Committee, Mahatma Gandhi medical college and hospital, Jaipur. The patients were informed according to the Adult Participation

information sheet and consent was duly taken on Adult Informed Consent formed as provided by the IEC.

Declaration of competing interest

We have no conflict of interest

REFERENCES:

1. Shafer WG, Hine MK, Levy BM, Rajendran R, Sivapathasundharam B. A Textbook of Oral Pathology. Philadelphia: Saunders; 1983 Sep 20.
2. Neville BW, Damm DD, Allen CM, Chi AC. Oral and Maxillofacial Pathology. Elsevier Health Sciences; 2015 May 13.
3. Ongole R. Text Book of Oral Medicine, Oral Diagnosis and Oral Radiology. Elsevier India; 2009.
4. Hebbar PB, Sheshaprasad R, Gurudath S, Pai A, Sujatha D. Oral submucous fibrosis in India: are we progressing?? Indian J Cancer. 2014 Jul 1;51(3):222.
5. Dyavanagoudar SN. Oral Submucous Fibrosis: Review on etiopathogenesis. J Cancer Sci Ther. 2009; 1(2):72-77
6. Tilakaratne WM, Klinikowski MF, Saku T, Peters TJ, Warnakulasuriya S. Oral submucous fibrosis: Review on aetiology and pathogenesis. Oral Oncology 2006; 42:561-68
7. Pindborg JJ, Sirsat SM. Oral submucous fibrosis. Oral Surg Oral Med Oral Path. 1966; 22:764-79
8. YoithapprabhunathTR, MaheswaranT, DineshshankarJ, Anusushantha, Sindhuja P, Sitra G. Pathogenesis and therapeutic intervention of oral submucous fibrosis. J Pharm Bioallied Sci 2013;5:S85-8.
9. . Bluestone MB, ed. Eustachian Tube: Structure, Function, Role in Otitis Media. PMPHUSA; 2005.
10. Dhingra PL, Dhingra S. Diseases of Ear, Nose and Throat-E-Book. Elsevier Health Sciences; 2014 Jun 5
11. Biswas A. Clinical Audio-Vestibulometry for Otologists and Neurologists. vol. 4. Mumbai: Bhalani Medical Book House; 2009:100–132
12. Gupta SC, Khanna S, Singh M, Singh PA. Histological changes to palatal and paratubal muscles in oral submucous fibrosis. J Laryngol Otol. 2000 Dec;114(12):947–950
13. Gupta SC, Singh M, Khanna S, Jain S. Oral submucous fibrosis with its possible effect on Eustachian tube functions: a tympanometric study. Indian J Otolaryngol Head Neck Surg. 2004 Jul 1;56(3):183–185.
14. Chandran A, Aswath N. Assessment of function of eustachian tube in oral submucous fibrosis–A tympanometric study. J Clin Diagn Res: JCDR. 2016 Sep;10(9):ZC13

15. Sowbhagya MB, Shivhare P, Yadav M, et al. Audiometric and tympanometric assessment in patients with oral submucous fibrosis. 2016 Jan 25:1-7 Journal of Medicine & Medical Research J Adv Med Med Res. 2016;13(6):1–7 Article no.BJMRR.23615
16. Shanti Badra Dr, Fathima Dr, Mahesh Dr. Evaluation of hearing efficiency in patients with oral Submucous fibrosis. J Pharm Sci Res. 2015;7(10):890–892.
17. Shah Maulik, Katarkar Ashish, Shah Pankaj, Alam Noorain, Modh Datt. Tympanometric study of eustachian tube function in oral submucous fibrosis. Indian J Otol. April 2011;17(Issue 2).
18. Sana-Noor Siddiqui, Saawarn Nisheeth, Preeti P, Nair, Singh Pooja, Gharote Harshkant P, Karthik Hegde. Eustachian tube dysfunction OSMF- often present seldom discovered. J Clin Exp Dent. 2014;6(4):e369–e373
19. Bluestone MB, ed. Eustachian Tube: Structure, Function, Role in Otitis Media. PMPHUSA; 2005.

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