

Does Oral Submucous Fibrosis Affect the Hearing Ability of an Individual? A Cross-Sectional Study in North Indian Population

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Academic Editors: Alessandro Leite Cavalcanti and Wilton Wilney Nascimento Padilha

Received: 06 March 2019 / Accepted: 27 July 2019 / Published: 15 August 2019

Abstract

Objective: To evaluate the hearing efficiency of Oral Submucous Fibrosis (OSF) patients using Pure Tone Audiometry (PTA) and to correlate between the hearing efficiency and clinical stage of OSF. **Material and Methods:** Twenty-five patients clinically diagnosed as OSF were evaluated for hearing loss using 'PTA'. Patients were grouped as mild cases and severe cases. Mild cases comprised of Group A and B, and severe cases comprised of Group C and D. Patients suffering from the previous hearing were excluded from the study. The data were submitted to statistical evaluation using the Chi-square test. The level of significance was set at 5%. **Results:** Out of the total patients, 52.4% were diagnosed as mild cases (Group M) OSF and 47.6% as severe cases (Group S). The analysis of the data of mild cases and severe cases revealed a significant association between advancing stages of OSF and hearing loss ($p = 0.026$). The cases in Group M after otoscopic evaluation demonstrated no visible ear defect. However, 30% of cases in Group S showed retraction of the tympanic membrane. **Conclusion:** The results indicate an association between stages of OSF and hearing loss. With advancing stages of OSF, there may be involvement of muscles of soft palate namely the levator veli palatine or tensor veli palatine, which may lead to the narrowing of the Eustachian tube leading to a decrease in air conduction demonstrating it as hearing loss of varying degrees depending upon the involvement.

Keywords: Hearing Tests; Audiometry; Hearing Loss; Oral Submucous Fibrosis.

Introduction

Oral submucous fibrosis (OSF) is a progressive disease of the oral cavity, which was named “vidari” by the Sushruta in 600 B.C [1]. It was first described in 1952 by Schwartz, who called it “atrophia idiopathica mucosae oris” [2]. Since then, its understanding along clinical and molecular levels have increased considerably.

OSF is attributed to a variety of factors like betel nut alkaloids, capsaicin, hypersensitivity, autoimmunity, genetic predisposition, and chronic iron and vitamin B-complex deficiency, the major factor being areca nut [3]. Areca nut chewing is a common practice in the Indian subcontinent and retains its popularity as a masticatory even today.

Pindborg defined OSF as “a chronic insidious disease, affecting any part of the oral cavity and sometimes the pharynx. Although occasionally preceded by and/or associated with vesicle formation, 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” [4].

OSF is regarded as a collagen disorder causing fibrosis, and these fibroelastic changes can extend posteriorly into soft palate and nasopharynx, causing difficulty in speech. It may also involve the pharyngeal orifice of the Eustachian tube and paratubal muscles, thereby affecting its functions and causing pain along with other pathological changes in the middle ear, which can eventually lead to hearing impairment.

Pure Tone Audiometry (PTA) is an electronic device that produces pure tones and is the most common technique used for hearing assessment. It helps in identifying hearing threshold levels and also determines the type, degree, and configuration of hearing impairment [5-7]. The present study aimed to evaluate the hearing efficiency of OSF patients using PTA.

Material and Methods

Study Design and Sample

A clinical cross-sectional study was undertaken in the authors’ institute after obtaining the institutional ethical clearance. Twenty-five clinically confirmed cases of OSF (ears) were evaluated and graded according to the Lai DR classification [8]. All patients were tested for air and bone conduction hearing loss. Four cases were excluded from the study as the patients had OSF with middle ear defects or sensorineural hearing deficit. Informed written consent was obtained from all participating patients.

Data Collection

The patients were then divided into two groups, Mild cases (Group M) which included the Group A and B and; Severe cases (Group S) which included Group C and D [8] (Figure 1). The patients were then subjected to middle ear evaluation using otoscopy and hearing function evaluation

using PTA. Apure tone audio was delivered to the ear through the headphone for assessing air conduction impairment while bone vibrator was used to evaluate bone conduction loss.



Figure 1. Lai classification for OSF based on the inter-incisal distance [8]. (A) Group A: >35 mm inter-incisal distance, (B) Group B: 30-35 mm inter-incisal distance, (C) Group C: 20-30 mm inter-incisal distance, and (D) Group D: <20 mm inter-incisal distance.

The hearing loss is graded into several categories by air conduction threshold as; 10-15dB – normal hearing, 16-25 dB – minimal hearing loss, 26-40 dB – mild hearing loss, 41-55 dB – moderate hearing loss, 56-70 dB – moderate to severe hearing loss, 71-90 dB – severe hearing loss, and >90 dB – profound deafness [9]. The patients were scored depending on their hearing loss and ear involvement assessment and were interpreted as: 0: No hearing loss; 1: Mild hearing loss unilateral; 2: Mild hearing loss bilateral; 3: Moderate hearing loss unilateral; 4: Moderate hearing loss bilateral; 5: Moderate to severe hearing loss unilateral; 6: Moderate to severe hearing loss bilateral; 7: Severe hearing loss unilateral; 8: Severe hearing loss bilateral; and 9: Profound deafness.

Data Analysis

Data were tabulated and evaluated statistically using the Statistical Package for Social Service (SPSS) software for Microsoft Windows, version 17. The Pearson Chi-Square test was used to assess the association between hearing loss and different grades of OSF. The level of significance was set at 5%.

Results

Out of the total patients, 52.4% were diagnosed as mild cases (Group M) OSF and 47.6% as severe cases (Group S) of OSF, as shown in Table 1. In Group M OSF cases, 100% showed no hearing loss; whereas in Group S 40% cases showed no hearing loss, 20% showed mild hearing loss unilaterally, 30% showed mild hearing loss bilaterally, and 10% showed moderate hearing loss unilaterally.

There was a significant association between OSF groups and hearing loss ($p = 0.026$). The cases in Group M after otoscopic evaluation demonstrated no visible ear defect. However, 30% of cases in Group S showed retraction of the tympanic membrane.

Table 1. Inter-group comparison between the hearing loss score and OSF groups.

Score	Stage Mild (A+B)		Stage Severe (C+D)		Total	
	N	%	N	%	N	%
0	11	73.3	4	26.7	15	71.4
1	0	0.0	2	100.0	2	9.5
2	0	0.0	3	100.0	3	14.3
3	0	0.0	1	100.0	1	4.8
Total	11	52.4	10	47.6	21	100.0

In Figure 2, the inter-group comparison of hearing loss was interpreted. It showed that as the mouth opening reduced, the hearing efficiency also decreased, concluding a significant Pearson's Rank correlations on comparison of the degree of mouth opening with hearing loss.

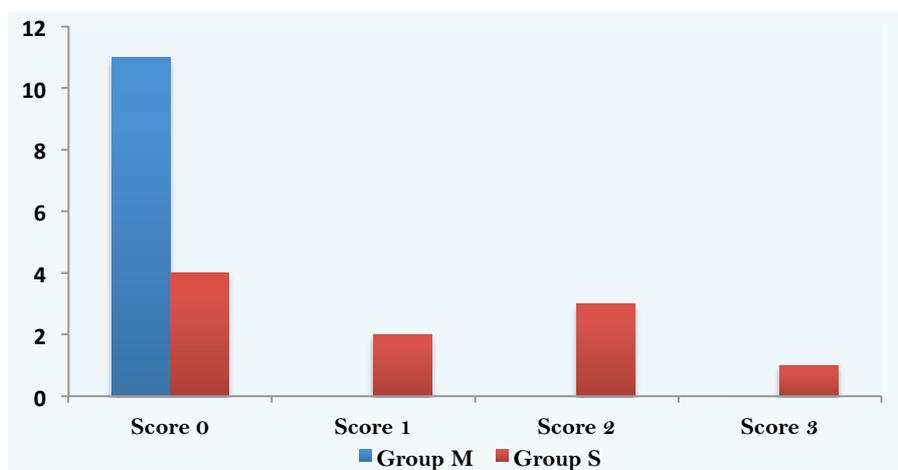


Figure 2. Inter-group comparison of hearing loss.

Discussion

Oral Submucous Fibrosis is classified under Group 1 of potentially malignant disorders; suggestive of morphologically altered tissue in which external factor is responsible for etiology and malignant transformation [10,11]. It is a chronic, an insidious disabling disease involving oral mucosa, the oropharynx, and rarely larynx [3]. Various histopathological studies have established that OSF can affect the muscular tissue in advancing stages.

The Eustachian tube is approximately 3 mm in diameter and can be divided into two parts: cartilaginous part (first two-thirds), bony part (last third, the part closest to the middle ear space). Narrowing of the pharyngeal orifice of the Eustachian tube might be seen in OSF, leading to the failure of the Eustachian tubes to regulate air pressure effectively [12-15]. This might cause sensations of popping, clicking, and ear fullness and occasionally moderate to severe ear pain. As Eustachian tube function worsens, air pressure in the middle ear falls, and the ear feels full, and sounds are perceived as muffled [9].

The present study revealed a positive association between the advancing grade of OSF and the Eustachian tube function defect. The results obtained were in accordance with previous studies

[6,9,16]. From the present study, it is evident that the subjective function of the Eustachian tube may be affected by the disease process.

The limitations of this study were that the sample size was small; another limitation was that the present study design is a cross-sectional one, which makes it difficult to comment on any change in hearing status.

Conclusion

Oral Submucous Fibrosis is a potentially malignant disorder, affecting structures adjacent to the oral cavity. Hearing deficit is rarely noticed but might play the role of being an important factor for patient education for an explanation of the prognostic outcome of the condition. The management for the hearing deficit in cases of OSF should primarily involve the management of the condition, which requires habit cessation to prevent the further progression of the disease along with supportive care. The present study was on smaller sample size but can be further justified by studies involving a larger sample size and patients with severe OSF.

Authors' Contributions: NS contributed to the conception and designed the study, performed the data collection, data analysis and interpretation, and wrote the manuscript, MTN contributed to the conception and designed the study, ZC and AN performed the data collection, data analysis, and interpretation, and reviewed the manuscript, N and MCV performed the data collection and reviewed the manuscript. All authors declare that they contributed to the critical review of intellectual content and approval of the final version to be published.

Financial Support: None.

Conflict of Interest: The authors declare no conflicts of interest.

References

- [1] Shevale VV, Kalra RD, Shevale VV, Shringarpure MD. Management of oral sub-mucous fibrosis: A review. *Indian J Dent Sci* 2012; 4(2):107-14.
- [2] Nayak MT, Singh A, Desai RS, Vanaki SS. Immunohistochemical analysis of vimentin in oral submucous fibrosis. *J Cancer Epidemiol* 2013; 2013:549041. <https://doi.org/10.1155/2013/549041>
- [3] Pindborg JJ, Sirsat SM. Oral submucous fibrosis. *Oral Surg Oral Med Oral Pathol* 1966; 22(6):764-79. [https://doi.org/10.1016/0030-4220\(66\)90367-7](https://doi.org/10.1016/0030-4220(66)90367-7)
- [4] Tilakaratne WM, Klinikowski MF, Saku T, Peters TJ, Warnakulasuriya S. Oral submucous fibrosis: Review on aetiology and pathogenesis. *Oral Oncol* 2006; 42(6):561-8. <https://doi.org/10.1016/j.oraloncology.2005.08.005>
- [5] Kitsoulis P, Marini A, Iliou K, Galani V, Zimpis A, Kanavaros P, et al. Signs and symptoms of temporomandibular joint disorders related to the degree of mouth opening and hearing loss. *BMC Ear Nose Throat Disord* 2011; 11:5. <https://doi.org/10.1186/1472-6815-11-5>
- [6] Gupta SC, Singh M, Khanna S, Jain S. Oral submucosal fibrosis with its possible effect on eustachian tube functions: A Tympanometric study. *Indian J Otolaryngol Head Neck Surg* 2004; 56(3):183-5. <https://doi.org/10.1007/BF02974346>
- [7] Chung-Hung T, Shun-Fa Y, Yu-Chao C. The upregulation of cystatin C in oral submucous fibrosis. *Oral Oncol* 2007; 43(7):680-5. <https://doi.org/10.1016/j.oraloncology.2006.08.009>
- [8] Lai DR, Chen HR, Lin LM, Huang YL, Tsai CC. Clinical evaluation of different treatment methods for oral submucous fibrosis. A 10-year experience with 150 cases. *J Oral Pathol Med* 1995; 24(9):402-6. <https://doi.org/10.1111/j.1600-0714.1995.tb01209.x>
- [9] Chaudhary MS, Mohite DP, Gupta R, Patil S, Gosavi S, Gawande M, et al. Evaluation of hearing efficiency in patients with oral submucous fibrosis. *Otolaryngol* 2013; 3(4):1000143. <https://doi.org/10.4172/2161-119X.1000143>

- [10] Sarode SC, Sarode GS, Karmarkar S, Tupkari JV. A new classification for potentially malignant disorders of the oral cavity. *Oral Oncol* 2011; 47(9):920-1. <https://doi.org/10.1016/j.oraloncology.2011.06.005>
- [11] Sarode SC, Sarode GS, Tupkari JV. Oral potentially malignant disorders: Precising the definition. *Oral Oncol* 2012; 48(9):759-60. <https://doi.org/10.1016/j.oraloncology.2012.02.025>
- [12] Ahmad MS, Ali SA, Ali AS, Chaubey KK. Epidemiological and etiological study of oral submucous fibrosis among gutkha chewers of Patna, Bihar, India. *J Indian Soc Pedod Prev Dent* 2006; 24(2):84-9. <https://doi.org/10.4103/0970-4388.26022>
- [13] Trivedy CR, Warnakulasuriya KA, Peters TJ, Senkus R, Hazarey VK, Johnson NW. Raised tissue copper levels in oral submucous fibrosis. *J Oral Pathol Med* 2000; 29(6):241-8. <https://doi.org/10.1034/j.1600-0714.2000.290601.x>
- [14] Khanna SS, Karjodkar FR. Circulating immune complexes and trace elements (Copper, Iron and Selenium) as markers in oral precancer and cancer: A randomised, controlled clinical trial. *Head Face Med* 2006; 2:33. <https://doi.org/10.1186/1746-160X-2-33>
- [15] Haque MF, Meghji S, Khitab U, Harris M. Oral submucous fibrosis patients have altered levels of cytokine production. *J Oral Pathol Med* 2000; 29(3):123-8. <https://doi.org/10.1034/j.1600-0714.2000.290304.x>
- [16] Siddiqui SN, Saawarn N, Nair PP, Singh P, Gharote HP, Hegde K. Eustachian tube dysfunction in OSF- Often present seldom discovered. *J Clin Exp Dent* 2014; 6(4):e369-73. <https://doi.org/10.4317/jced.51593>