



## Cephalometric Evaluation of Pharyngeal Airway in Oral Submucous Fibrosis - A Preliminary Study

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### Abstract

**Background:** Oral Submucous fibrosis (OSMF) is a chronic progressive disease causing macro and micro damage of oral structures and occasionally involve the pharynx leading to blanching, ulcerations and fibrosis of the oral mucosa. Patients with a severe form of this disease will have severely restricted mouth opening. Intubation remains a challenge when mouth opening is compromised. The Oral radiologist could give vital information of airway assessment to the anaesthetist and the operating surgeon treating these patients.

**Aims:** To assess the dimensions of the oropharynx in patients with Oral Submucous fibrosis as compared to disease free patients using Cephalometric data.

**Settings and Design:** This is a cross sectional analytical study using the collected lateral cephalograms of OSMF and normal individuals.

**Methods and Materials:** Lateral cephalogram of 90 OSMF patients and 90 disease free individuals were taken. The upper and Lower Pharyngeal Airway space evaluation was done using McNamara's airway analysis.

**Statistical Analysis Used:** Data was analysed using the Student's paired t test and Chi square test with  $P < 0.05$  was considered to be statistically significant.

**Results:** Statistically significant narrow upper and lower pharyngeal width in OSMF patients when compared to normal patient and marginal reduction in lower pharyngeal space in females with OSMF.

**Conclusion:** The data provides preliminary details of significant reduction in upper and lower airway space in individuals with oral submucous fibrosis

**Keywords:** Oral Submucous Fibrosis; Oropharynx; Cephalometry

## Introduction

Oral submucous fibrosis (OSMF) is one among the potentially malignant disorders of oral cavity and pharynx, characterized by combined inflammation and progressive fibrosis of sub mucosal tissues leading to progressive inability to open the mouth [1]. Pindborg and his associates defined the condition as “an insidious chronic disease affecting any part of the oral cavity and sometimes pharynx. Although occasionally preceded by and/or associated with vesicle formation, it is always associated with juxtaepithelial inflammatory reaction followed by fibroelastic changes in the lamina propria, with epithelial atrophy leading to stiffness of the oral mucosa causing trismus and difficulty in eating” [2].

Cephalometry can be considered as an appropriate aid for the analysis of the dental and craniofacial anomalies as well as pharyngeal airway space. Over the past several decades, various advanced sophisticated techniques used for assessment of pharyngeal space with drawbacks of expense and access.

This study aims to gain measurements of upper and lower airway space through lateral Cephalometric analysis in young Indian subjects with OSMF and to compare the obtained dimensions with the disease-free subjects. It represents the preliminary data in assessing airway dimensions assessment in OSMF patients of both sexes.

## Methods and Materials

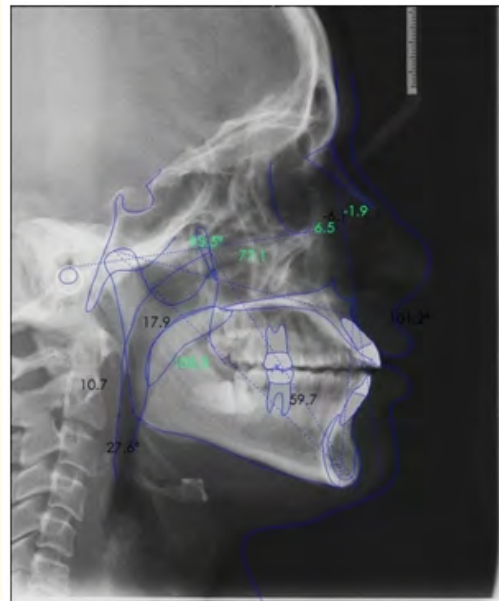
This cross-sectional analytical study was conducted using data from 180 lateral Cephalometric radiographs of patients (90 OSMF and 90 normal) who reported to our Department of Oral medicine and radiology over the last 1 year. Lateral Cephalometric radiographs taken with the teeth occluded in centric relation, and lips in closed relaxed position using standardized parameters (KVP = 70 and mA = 10) in Planmeca digital x ray machine. All subjects are positioned in an upright position with the Frankfort horizontal plane of patients parallel to the floor. Instructions to refrain swallowing and head as well as tongue movement was given to the patient.

The primary inclusion criteria were patients more than 18years and clinically diagnosed as having stage C OSMF based on Haider, *et al.* functional staging

- Stage A: Mouth opening, 13-20 mm
- Stage B: Mouth opening, 10-12 mm
- Stage C: Mouth opening, <10 mm

Patients with craniofacial deformities and systemic diseases were excluded.

Linear angular measurements of digital images were taken using in built software with in the machine. Identification as well as Labelling of anatomical landmark and measurement of upper and lower pharyngeal airway was done using McNamara analysis. The Upper pharyngeal width was measured from a point on the posterior outline of the soft palate to the closest point on the posterior pharyngeal wall. The Lower pharyngeal width was measured from the point of intersection of the posterior border of the tongue and inferior border of mandible to closest point on the posterior pharyngeal wall [Figure 1].



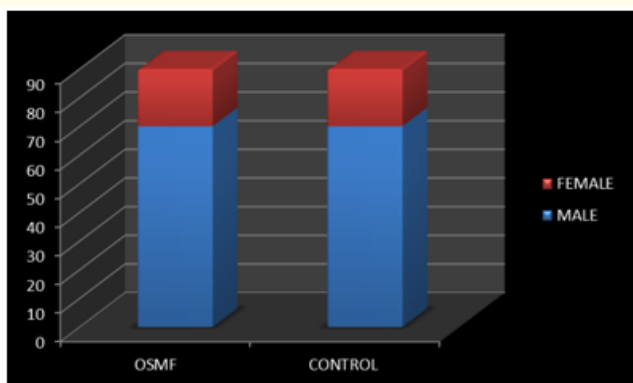
**Figure 1:** Complete linear, angular and airway measurements along with specific landmark tracing in osmf patient.

## Results

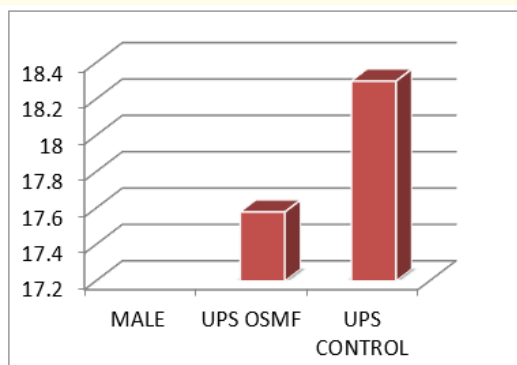
The data were statistically analysed on a computer with Statistical Package for Social Science 22 (SPSS Inc., Chicago Illinois, USA) using Student’s paired t-test and Chi square test with p value

< .05 is considered as statistically significant. Means and standard deviations for upper and lower airways were calculated in both sexes.

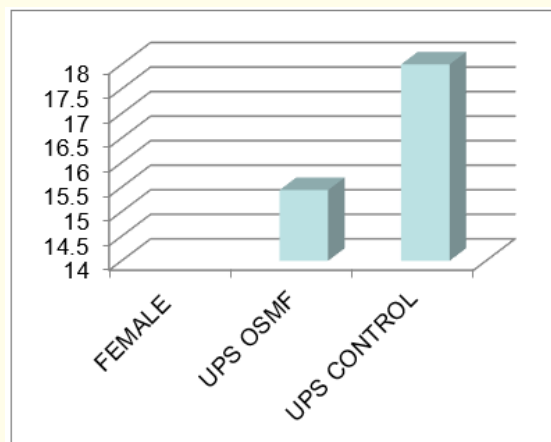
A total of 180 participants, 90 in OSMF group and 90 in disease free group consisting of 20 females and 70 males in each [Figure 2], were recruited for the study. In males the mean of upper pharyngeal space with OSMF is 17.06 and 18.24 in disease free individuals [Figure 3] while in females its 15.4 and 17.4 respectively [Figure 4]. The mean of lower pharyngeal space in males with OSMF is 26.32 and 28.8 in disease free individuals while in females it is 21.6 and 30.8 respectively [Figure 5]. The comparison was done in upper and lower pharyngeal space in female with OSMF with that of disease free females and the same for males by considering the fact of sex dimorphism in dimensions of airway spaces. The pharyngeal spaces of males are larger compared to females so error can be eliminated if same sexes are compared.



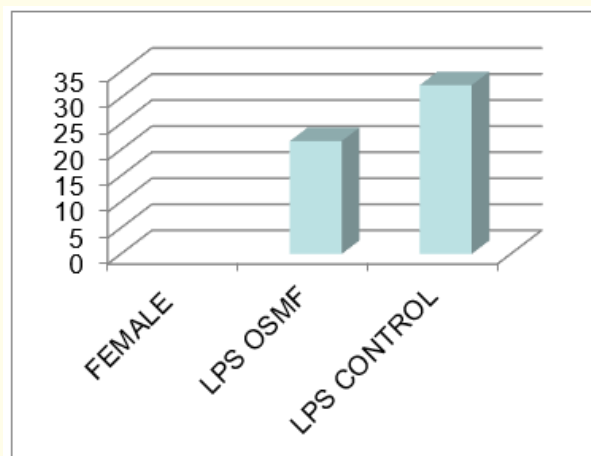
**Figure 2:** Bar graph analysis of Gender Distribution in case and control group.



**Figure 3:** Bar graph analysis of upper Pharyngeal Space – Males which illustrates marked reduction in size of upper airway space in osmf patients compared to disease free.



**Figure 4:** Bar graph analysis of upper Pharyngeal Space – females which illustrates marked reduction in size of upper airway space in osmf patients compared to disease free.



**Figure 5:** Bar graph analysis of lower Pharyngeal Space – females which illustrates marginal reduction in size of lower airway space in osmf patients compared to disease free.

The dimensions of upper and lower pharyngeal space is considerably reduced in male patients with OSMF compared ( $p = 0.000$ ) to disease free individuals while in case of females the results are significant with respect to upper pharyngeal space ( $0.000$ ) and marginal significance in case of lower pharyngeal space ( $p = 0.054$ ).

**Discussion**

Standard airway space dimensions can be considered as one of the prime factor that determines the normal growth of the

craniofacial structures. Normal upper pharyngeal airway space measurement is about 15–20 mm while lower pharyngeal airway (LPA) space measures about 11–14 mm. Maltais, *et al.* [4] have stated that the use of cephalometric radiographs to assess the upper airway anatomy is helpful because it is simpler than other methods for measuring airway patency.

The lateral cephalogram is gold standard radiographic aid for orthodontic pre and post treatment purposes which depicts the two-dimensional sagittal representation of head and neck region. Because of its simple technique, cost effectiveness, reliability, reproducibility and availability cephalometric radiograph are the most reliable source for assessing the upper airway anatomy.

Parkkinen, *et al.* stated in their study that the lateral cephalogram is a relatively reliable and valid method for the nasopharyngeal and retro palatal region dimensional evaluation [5]. Due to ease of availability of Cephalometric radiographic data a retrospective analysis was done to airway analysis in diseased and disease-free subjects. Malkoc, *et al.* noted that cephalometric films were significantly reliable and reproducible in determining the pharyngeal airway dimensions [6].

Cameron, *et al.* compared computed tomography and cephalometric radiograph for nasopharyngeal airway dimensional assessment in skeletal malocclusion subjects and given an inference of significantly positive correlation in teenagers [7].

Oropharyngeal space has paramount importance in head and neck region which varies considerably according to ethnic group and sex [8].

Tsai, *et al.* [9] have investigated the pharyngeal airway structural changes seen during development from the early mixed dentition into adulthood in untreated normal Taiwanese persons and also to compare the same among males and females.

Allergies, environmental irritants, infections, mouth breathing, obstructive sleep apnoea (OSA), skeletal features such as maxillary and mandibular deficit and vertical maxillary excess have relevant unfavourable impact on anteroposterior dimensions of the airway giving rise to pharyngeal airway obstruction [10]. Gois, *et al.* reported that the association of vertical growth patterns with pharyngeal airway obstruction concomitantly with mouth breathing [11].

Variations in pharyngeal airway have also been described with some sleep disorders like obstructive sleep apnea (OSA) [12]. Turnbull and Battagel proved significant decrease in retro lingual airway dimension after mandibular setback surgery and a significant increase after mandibular advancement [13]. Battagel, *et al.* demonstrated that an increase in oropharyngeal dimension was associated with mandibular advancement [14].

This is a 1<sup>st</sup> attempt to compare size of Oropharyngeal space using lateral cephalogram in the most potent premalignant disorder that is Oral Submucous Fibrosis and the study showed statistically significant p value in relation to upper pharyngeal space in patients with OSMF of both the genders while lower airway space is slightly significant in cases of females with OSMF.

## Conclusion

Data proven in this study conducted in Hyderabad Karnataka region can be considered as the most beneficiary eye opener to all oral and maxillofacial physicians and radiologists for not to neglect the evaluation of pharyngeal space in routine examination of oral submucous fibrosis patients and can be even considered as a diagnostic tool for the same. A further study involving a larger group would be ideal in arriving at definite conclusions and studies for Co-relating the stage of the disease and measurement of pharyngeal spaces should be carried out.

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