Assessment ofClinical Significance of Soft Palate Morphology in Oral Submucous Fibrosis

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Abstract

Background: Oral Submucous Fibrosis (OSMF) is a chronic, progressive, and potentially malignant disorder of the oral cavity, primarily associated with areca nut and tobacco consumption. The condition leads to fibrosis of the submucosal tissues, affecting oral functions such as speech and swallowing. One of the critical anatomical structures impacted in OSMF is the soft palate, which plays a vital role in velopharyngeal function.

Objective: This study aims to evaluate the morphological variations of the soft palate in OSMF patients using lateral cephalometric imaging, correlating these changes with disease progression and severity.

Methods: A total of 200 clinically diagnosed OSMF patients were enrolled in this observational study. Lateral cephalometric radiographs were obtained under standardized conditions, and soft palate morphology was classified into six types: Leaf, Rat-tail, Butt, Straight, S-shaped, and Crook-shaped. Measurements of soft palate length and width were recorded and analyzed using Image Plus software. Statistical analysis was performed using SPSS (Version 15.0), with significance set at $p < 0.05$.

Results: The most common soft palate morphology in OSMF patients was Leaf-shaped (44%), followed by Butt-shaped (22%) and Rat-tail (15%). A significant shift toward Butt and Crook-shaped palates was observed with increasing disease severity ($p < 0.001$). The mean soft palate length in the study group (28.38 ± 2.98 mm) was significantly shorter than in controls (37.28 ± 4.52 mm) ($p < 0.001$), while velum width was significantly greater in OSMF patients (10.28 ± 1.62 mm vs. 9.31 ± 2.25 mm, $p < 0.001$). The severity of OSMF correlated with progressive soft palate shortening and altered morphology.

Conclusion: Morphological changes in the soft palate in OSMF patients reflect disease progression and its impact on oral function. Lateral cephalometry serves as a valuable diagnostic tool for early detection and classification of soft palate alterations, aiding in disease management and treatment planning.

Keywords: Oral Submucous Fibrosis, Soft Palate, Morphology, Lateral Cephalometry, Fibrosis, Disease Progression

Introduction

Oral Submucous Fibrosis (OSMF) is a chronic, progressive, and potentially malignant disorder of the oral cavity that primarily affects individuals with a history of areca nut and tobacco consumption. The condition is characterized by excessive fibrosis of the submucosal tissues, leading to restricted mouth opening, burning sensations, and alterations in oral functions such as speech and swallowing. Over time, the progressive fibrosis results in stiffness and atrophy of oral tissues, significantly impairing patients' quality of life. One of the key anatomical structures affected in OSMF is the soft palate, which plays a crucial role in speech resonance, swallowing, and airway patency.[1,2]

Lateral cephalometry, a widely used radiographic technique in craniofacial analysis, offers a non-invasive method to evaluate structural changes in the soft palate. The present study aims to investigate the morphological variations of the soft palate in OSMF patients using lateral cephalometric imaging. Since the severity of fibrosis in OSMF can impact the mobility and contour of the soft palate, radiographic evaluation can provide valuable insights into disease progression and functional impairment.[2,3]

The objectives of this study include observing the different radiographic appearances of the soft palate in various functional stages of OSMF. Understanding these morphological changes may aid in the early diagnosis and classification of disease severity, ultimately contributing to better treatment planning and prognosis assessment. By correlating soft palate alterations with disease progression, this study seeks to enhance our understanding of the pathological changes occurring in OSMF and their impact on oral function.[4,5]

This research holds clinical significance in providing objective criteria for evaluating soft palate involvement in OSMF patientsusing lateral cephalometry and assess its clinical significance. The findings may help establish a more structured approach to assessing disease severity, guiding clinicians in developing tailored management strategies for affected individuals. Additionally, the study may contribute to future research exploring therapeutic interventions aimed at preserving or restoring soft palate function in OSMF patients.

Materials and method

This observational study was conducted on 200 clinically diagnosed Oral Submucous Fibrosis (OSMF) patients. A detailed case history was recorded for each subject, and lateral cephalometric radiographs were taken after obtaining written informed consent. The inclusion criteria comprised patients clinically diagnosed with OSMF, while individuals unwilling to undergo cephalometric radiography or those with congenital anomalies like cleft palate were excluded. Radiographs were acquired using the STRATO – 2000 Digital Cephalometric System (AERB India Approved) under standardized conditions. The subjects were positioned with the Frankfort horizontal plane parallel to the floor, teeth in occlusion, and facial muscles relaxed, ensuring reproducibility. The distance between the X-ray source and the mid-sagittal plane was maintained at 60 inches. The exposure parameters were set at 85 kVp anode voltage, 10 mA tube current, and 1.3 seconds exposure time. The films used for imaging were Fuji medical dry imaging films, size 8” x 10”, with a magnification ratio of 1:1. Cephalometric radiographs were analyzed using Image Plus software, ensuring accuracy by measuring the length and width of the soft palate twice. Morphological variations were categorized into six types as described by You M et al.[6]: Leaf-shaped, Rat-tail shaped, Butt-like shape, Straight-line, S-shaped (Distorted), and Crook-shaped. All radiographs were assessed under standardized viewing conditions using an illuminated view box. Statistical analysis was conducted using SPSS software (Version 15.0). Mean and standard deviation (Mean ± SD) were used for descriptive statistics, while Chi-square tests, ANOVA, and Student's t-test were applied for comparative analysis. A p-value of less than 0.05 was considered statistically significant.

Result

The study analyzed the morphology of the soft palate in 200 subjects using digital lateral cephalometry. The gender distribution included 157 males (78.5%) and 43 females (21.5%), with no statistically significant difference between the control and study groups (p=0.863). The age distribution revealed that the majority of participants belonged to the 31-40 age group (43.5%), followed by the 21-30 age group (29.5%) and the 41-50 age group (21.5%), with no significant variation between groups (p=0.733).

Soft palate morphology was categorized into six types: Leaf, Rat-tail, Butt, Straight, S-shaped, and Crook-shaped. The most prevalent shape in the control group was the Leaf type (64%), followed by Rat-tail (26%) and Butt (4%). In the study group, the Leaf type was also the most common (44%), but the Butt type (22%) and Rat-tail type (15%) were more prominent compared to controls. The difference in soft palate morphology between groups was statistically significant (p<0.001).

Regarding velum dimensions, the mean length in the study group (28.38 ± 2.98 mm) was significantly smaller than in the control group (37.28 ± 4.52 mm) (p<0.001). Conversely, the velum width was significantly larger in the study group (10.28 ± 1.62 mm) compared to the control group (9.31 ± 2.25 mm) (p<0.001).

The severity of OSMF was categorized into three stages: Stage I (14%), Stage II (61%), and Stage III (25%). A significant trend was observed in gender distribution across stages, with the proportion of females decreasing as the severity increased (p<0.001). Similarly, younger participants were more prevalent in earlier stages, while older participants were more common in advanced stages (p<0.001). Soft palate morphology varied with disease progression, with an increasing prevalence of Butt and Crook-shaped palates in later stages (p<0.001). The length of the velum progressively decreased with disease severity, while width remained relatively stable.

Comparative analysis of velum dimensions across different OSMF stages revealed statistically significant differences in length (p<0.001) and width (p=0.008). Pairwise comparisons showed significant differences in velum length between controls and all OSMF stages (p<0.001), whereas velum width showed significant differences only between controls and Stage II (p=0.002).

Discussion

The soft palate, a fibromuscular structure, plays a critical role in velopharyngeal closure, which is essential for functions such as swallowing, speech, and sucking. In Oral Submucous Fibrosis (OSMF), a chronic, progressive disorder characterized by fibrosis of the oral mucosa, the soft palate undergoes significant morphological changes. These changes are not only clinically significant but also provide insights into the progression and severity of the disease.[7,8]

The study revealed that the soft palate in OSMF patients exhibits six distinct morphological types: leaf-shaped, rat-tail shaped, butt-like, straight-line, S-shaped, and crook-shaped. The most common type in both OSMF patients and normal controls was the leaf-shaped soft palate (64% in controls and 44% in OSMF patients). However, as OSMF progressed, there was a significant increase in butt-shaped and crook-shaped soft palates,

particularly in advanced stages of the disease. This shift in morphology is clinically significant as it reflects the progressive fibrosis and structural changes in the soft palate, which can lead to functional impairments such as trismus, difficulty in swallowing, and altered speech.[8,9]

Several studies support these findings. Shankar et al., reported a gradual reduction in the length of the soft palate and an increase in width with advancing OSMF stages, attributing these changes to differential fibrosis between the oral and pharyngeal surfaces of the uvula. A study by Hasan S et al. further highlighted that soft palate shortening is a key feature in OSMF, correlating with disease severity and functional limitations. Additionally, Johnston C D et al. observed a higher prevalence of rat-tail and butt-shaped soft palates in advanced OSMF cases, indicating a significant alteration in velopharyngeal structure and function.[10,11,12]

The reduction in the length of the soft palate and the increase in its width, as observed in the study, are indicative of the fibrotic changes that occur in OSMF. The shortening of the soft palate in the anteroposterior direction is more pronounced than changes in the superoinferior direction. This differential fibrosis between the oral and pharyngeal surfaces of the uvula likely contributes to the characteristic abnormalities seen in OSMF, such as forward-pointing or vanishing uvula. These changes are clinically significant as they can lead to velopharyngeal incompetence, affecting speech and swallowing.

Previous research by Patil BM et al. also demonstrated that the severity of morphological changes in the soft palate increases with the progression of OSMF. Their study found that in stage III OSMF, butt-shaped and crook-shaped soft palates were more prevalent, indicating a more severe fibrotic process. This progression is clinically significant as it correlates with the increasing severity of symptoms such as trismus and difficulty in mouth opening. Similarly, Rathore S et al. (2020) emphasized the importance of early cephalometric assessment in detecting these changes, allowing for timely intervention to prevent further complications.[13,14]

Additionally,You et al. analyzed soft palate variations in a normal population and reported that the leaf shape was the most common, which aligns with findings in the control group of the present study. However, in OSMF patients, the increasing prevalence of non-leaf morphologies suggests a pathological remodeling due to fibrosis. The study by Lakshmi CR et al. further confirmed that fibrosis-induced changes in soft palate morphology contribute to functional limitations, necessitating a multidisciplinary approach for management.[6,15]

Furthermore, the study's findings align with research by Jha VK et al., which noted that advanced OSMF stages exhibit a stiffened soft palate due to increased collagen deposition, reducing its flexibility and leading to compromised oral functions. These findings underscore the need for early diagnosis using digital cephalometry, which provides a non-invasive, reproducible, and cost-effective method for assessing soft palate alterations in OSMF patients.[16]

Conclusion

The morphological variations of the soft palate in OSMF are clinically significant as they reflect the progressive nature of the disease and its impact on velopharyngeal function. The reduction in soft palate length and increased width, along with shape alterations, correlate with the severity of fibrosis and functional impairment. The findings from this study, supported by previous research, highlight the importance of early detection and classification of these changes for better disease management. Integrating cephalometric analysis into routine diagnostic protocols can aid in the early diagnosis of OSMF, potentially improving patient outcomes through timely intervention and rehabilitation strategies.

Reference

1. Rooban T, Rao A, Joshua E, RanganathanK..The prevalence of oral mucosal lesions in alcohol misusers in Chennai, south India. Indian J Dent Res, 2009; 20(1): 41- 46.
2. Phatak A.G. oral sub mucous fibrosis. BMJ.1995;310: 871
3. Hosein M, Mohiuddin S, Fatima N .Association Between Grading of Oral Submucous Fibrosis With Frequency and Consumption of Areca Nut and Its Derivatives in a Wide Age Group: A Multi-centric Cross Sectional Study From Karachi, Pakistan. JOURNAL OF CANCER PREVENTION 2015;20(3): 216-222.
4. Kariya P. No age predilection for a disease like OSMF. A Case Report Of 5-Year-Old Child. Journal of Oral Biology and Craniofacial Research 2020;10(2): 153-157
5. S. Anil , Beena V.T. Oral submucous fibrosis in a 12-yearold girl: case report, Pediatric Dentistry 1993; 16 (2):120-122
6. You M, Li X, Wang H, Zhang J, Wu H, Liu Y et al. Morphological Variety of The Soft Palate In Normal Individuals: A Digital Cephalometric Study. Dento maxilla facial Radiology (2008); 37: 344–349
7. Nerkar A et al. Comparative morphometric analysis of soft palate between OSMF and normal individuals: A digital cephalometric study. International Journal of Maxillofacial Imaging 2017;3(1):1-7

8. Hazarey V. K. et al Oral submucous fibrosis: study of 1000 cases from central India. J Oral Pathol Med 2007;36: 12–7.

9. Verma P. et al. Correlation of morphological variants of the soft palate and Need's ratio in normal individuals: A digital cephalometric study. Imaging Science in Dentistry 2014; 44: 193-198.

10. Shankar V N, Hegde K, Ashwini N S, Praveena V, Ravi Prakash S. M. Morphometric Evaluation of Soft Palate In Oral Submucous Fibrosis A Digital Cephalometric Study. Journal of Cranio-Maxillo-Facial Surgery (2014); 42:48-52

11. Hasan S, Sherwani O, Ahmed S, Khan M A. Oral Submucous Fibrosis Turning Into Malignancy- A Case Report And Review of Literature. Journal of Orofacial Sciences (2011); 3(2):30-36

12. Johnston C D, Richerdson A. Cephalometric Changes in Adult Pharyngeal Morphology. European Journal of Orthodontics (1999); 357-362.

13. Patil BM. Velar Morphological Variants in Oral Submucous Fibrosis: A Comparative Digital Cephalometric Study. Indian Journal of Dental Research 2017; 28(6): 623-628.

14. Rathore S et al. Morphological Evaluation of Soft Palate in Various Stages of Oral Submucous Fibrosis and Normal Individuals: A Digital Cephalometric Study. Journal of Indian Academy of Oral Medicine & Radiology 2019; 31(1): 51-56

15. Lakshmi CR. An Innovative Approach to Evaluate the Morphological Patterns of Soft Palate in Oral Submucous Fibrosis Patients:A Digital Cephalometric Study, International Journal of Chronic Diseases 2016; 16: 1-6

16. Jha VK et al.Oral Submucous Fibrosis: Correlation of Clinical Grading to Various Habit Factors, Journal of International Society of Preventive and Community Dentistry 2019; 9:363-71.