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Morphometric Evaluation of Soft Palate Among Men and Women- A Digital Cephalometric Study

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1. Abstract

Objectives: The soft palate is known as velum or muscular palate, a posterior fibromuscular part of palate that is attached to posterior edge of hard palate. Functions of soft palate are sucking, swallowing and pronunciation. The classification system of soft palate can be important for the assessment of velopharyngeal closure and in diagnosing obstructive sleep apnea individuals. Considering this, the present study was done to investigate the variation in the morphology of the soft palate. **Materials and Methods:** A total of 200 patients belonging to both the genders, in the age group 18-50 years, were selected from the outpatients visiting the Department of Oral Medicine and Radiology. All the study samples were subjected to lateral cephalogram and the morphology of the soft palate was categorized as described by **You et al.** The data obtained were tabulated and subjected to statistical analysis. **Results:** The morphology of soft palate was categorized into six types. Type 2 was the commonest type observed. The relationship between the different types of soft palate in various age groups was

found to be non-significant. 2% of the subjects were having type 5 or 's' shaped soft palate can have high risk of obstructive sleep apnea. **Conclusion:** This radiographic classification of morphologic variants of soft palate can be used as reference for the research in individuals with obstructive sleep apnea syndrome

2. Keywords: Lateral Cephalogram • Obstructive Sleep Apnea • Soft Palate.

3. Introduction

Soft palate which is also known as velum or muscular palate situated posterior to the hard palate. This muscular fold separates the nasopharynx from the oropharynx. It performs important functional role in oropharyngeal region and it helps in palatopharyngeal opening and closure which is associated with normal functions like sucking, deglutition, respiration, pronunciation, and phonation. The morphology of soft palate varies for different diseases therefore, it is necessary to access and determine the different shapes of the muscular palate in normal patients. Examples of such conditions are cleft patients, enlarged adenoids, obstructive sleep apnoea (OSA), ill-fitting maxillary dentures, oral submucous fibrosis (OSMF), and skeletal malocclusions commonly presents with the palatopharyngeal deficit. [1-8].

The classification of various types of velar morphologies was given by You *et al.*, in 2008, which was followed in this study [6]. The following study was carried out in The Department Of Oral Medicine and Radiology, Maratha Mandal N.G.H. Institute of Dental Sciences and Research Centre , Belgaum, Karnataka, India. Before carrying out the study ethical clearance was taken from the institutional review board and informed consent was obtained from the patients. In this study retrospective digital data was used. The aim of this study was to assess and compare the morphology of soft palate through lateral cephalogram in men and women of 18-50yrs.

4. Materials and Methodology

Patients without any bony pathology were included in the study. Patients with major systemic disease, OSMF, cleft lip, cleft palate, post-operated head and neck surgery patients were excluded from study as the morphometric changes seen with respect to soft palate is gradual increase in its width, decrease in its length and angle of inclination is associated with these disease conditions.

A total of 200 Digital Lateral Cephalograms of 100 Men and 100 Women were selected for the study. All lateral cephalograms was taken from KODAC 8000 C OPG machine of 73KVp tube potential, 10.3mA tube current and total infiltration of 2.5mm, focal spot of 0.5 and time 13.9s. All of the radiographs were observed and categorized into six types by two oral radiologists who did the assignment separately.

5.1 Statistical Analysis Data were entered in Microsoft Excel and analyzed using SPSS (Statistical Package for Social Science) One-way analysis of variance (ANOVA) to test the difference between

groups and Student's 't'-test used to determine whether there was a statistical variation in male and female subjects in the parameters measured. In the above test, $P < 0.05$ was accepted and indicated statistical significance.

5. Results & Discussion

Morphological variants of soft palate play a crucial role especially in condition like cleft palate and obstructive sleep disorder and some functionally compromised cases among varied morphology of soft palate can be assessed [1-8].

The shape analysis was overlooked in past but its diverse morphology has been now given importance. For morphological analysis of soft tissue like soft palate, Cephalometry is comparatively economical method. [1-9].

Kumar et al in 2012 analyzed, 100 normal subjects between 15-35yrs, they found a significant difference in the morphology of soft palate and also between male and female groups in proportion to velar types. Smriti K et al in 2015 analyzed, 100 healthy subjects 50 male and 50 females between 15-45yrs, they found rat tail shape as most common in 30%, and there was no significant difference in morphology of soft palate among men and women. D Samdani et al in 2015, analyzed 250 healthy subjects between 14-28yrs, they too found rat tail shaped was most common 37.2%. Present study also shows similar results out of 200 subjects most common type of soft palate was found to be rat tail shaped in 36% and there was no significant difference in shape of soft palate among men and women. [10-14,19,20] [Figure 2 and Figure 7] [Table 1].

The variations in the soft palate morphology were analyzed over many years by many authors. After a long research on it, they have made effort to categorize them into different types. Pepin *et al.* (1992) found hooking of the soft palate which have angulation of 30° or greater between the longitudinal axis of the soft palate and the distal part of the uvula. [1-8,10-15].

After few years authors found a correlation of hooked shape appearing soft palate in patients with habit of snoring with or without obstructive sleep apnea syndrome (OSAS), on computed tomography (CT) & on cephalometric radiographs. In a study where 9 of 96 patients showed hooked shape soft palate in both CT and cephalometric radiographs. [10,13-17].

According to, Niu *et al.* the static images of soft palate was divided into six shapes: Shuttle shaped, crescent-shaped, strip-shaped, S-shaped, hamulus-shaped, and anomalous-shaped, and the dynamic image was described as knee-shaped among 106 normal patients. Similar to this study Guo *et al.* found knee shaped morphology in all the individual's palate when pronouncing the high vowel of "i" and You *et al.* categorized the morphology of the soft palate into six different types. Additional two types along with the six types had been described by Guttal *et al.* as Type 7- U-shaped soft palate as the possible variant of the rat-tail shape and type 8- bifid-shaped soft palate. The present study followed Niu et al static images of soft palate and divided as mentioned in it. [11-13,20].

D Samdani et al in 2015, analyzed 250 healthy subjects between 14-28yrs, they too found rat tail shaped was most common 37.2%. This was also in agreement with other studies done by Kumar and Gopal and Guttal *et al.* The finding of the present study was also in concordance with the above study where type 2 rat tail among men and women. However, our results were contrary to the study conducted by Praveen *et al.* (2011) who observed type 2, i.e., rat-tail shaped soft palate, as the most common type (55%) as the maximum dominant morphological soft palate variant.

Morphological soft palate variant type 1, type 3, and type 6 soft palate were the next common types seen in the present study as compare to other studies. These results were in agreement with the results of studies done by You *et al.* and Kumar *et al.* The hooked appearance of the soft palate found by Pepin *et al.* (1992) was described as distorted shape (S-shape or type 5) by You *et al.* [1,5,6,9,13-15] [Figure1, Figure3, and Figure 6] [Table1].

Type 5 or distorted s -shaped soft palate was observed in only some individuals (1.5%). This variant was present in only 3 (1.5%) cases in the present study. This was also in accordance with the study results of You *et al.* (1.5%), Kumar *et al.* (3%), and Guttal *et al.* (6.5%). [6,13,14] [Figure 5] [Table 1]

In addition to the six types mentioned by You *et al.*, two more variants were noted in the study and were differentiated as types 7 and 8. Types 7 were described as triangular-shaped soft palate and type 8 as bifid shaped soft palate, and were observed in 4 cases (2%). [6,13,14,20,21].

According to the current study, overall, 2% of the subjects were having type 5 or s shaped soft palate. The s shape or type 5 which is described as a hooked shape or distorted s shaped soft palate by Pepin et al was found in 3% of the subjects of their study. According to Pepin et al hooking of soft palate can be defined as their angulation about 30 degrees between the distal part of uvula and longitudinal axis of soft palate. Subjects who are having type 5 or s shaped soft palate have high risk of having obstructive sleep apnea as the hypothesis given by pepin et al states that s shape soft palate causes increased pharyngeal collapse, sudden major reduction in oropharyngeal dimension which leads to increased upper airway resistance and trans pharyngeal pressure gradient. [10,15,17-20] [Figures1-7] [Table1].

6. Conclusion

Cephalometry was most economical method for studying the morphology of soft palate. There was no significant difference found between the soft palate morphology among men and women. This radiographic classification of morphologic variants of soft palate can be used as reference for the research in individuals with obstructive sleep apnea syndrome.

7. Conflict of Interest: None

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