A radiographic assessment of morphologies of soft palate: A retrospective study

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Abstract

Background: Soft palate morphologies vary among individuals, which may sometimes help in diagnosing various conditions such as cleft palate, oral submucous fibrosis (OSMF), and obstructive sleep apnea (OSA).

Aims and Objectives: To assess the shape of the soft palate in normal individuals, classify the soft palate and investigate the differences in the size and shape of velar morphology in both the genders and age groups.

Materials and Methodology: The study was conducted using 200 lateral cephalograms which were taken with digital orthophos XG machine. Radiographs were collected and soft palate morphologies were analyzed using Sirona software. Soft palate length and thickness were also calculated.

Results: Increase in soft palate length was observed till the age of 30 years and showed a decrease thereafter. Velar width was more in males and showed variation in different age groups. Three additional morphological variants of soft palate were found. The soft palate length and width was significantly higher in males than females.

Conclusion: Soft palate morphologies are variable. Type 1 variant was observed most commonly followed by Types 2 and 3. Thus, it will be beneficial for diagnosis and management of OSA and also will be helpful in assessing the changes in the morphologies in OSMF patients.

Introduction

Soft palate is the movable portion, muscular fold situated posterior to the hard palate. It separates the nasopharynx from the oropharynx. It has an important role in different crucial functions of the oropharyngeal region. It has various morphologies in different diseases, so it is necessary to access and determine the different shapes of the palatal velum in normal patients. 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.

The classification of various types of velar morphologies was given by You et al., in 2008, were followed in this study. The aim of this study was to estimate the shape and forms of the soft palate in normal individuals, classify the soft palate and investigate the differences in the size and shape of velar morphology in both the genders and age groups.

Materials and Methodology

This study was conducted during a period of 3-month, from November 2014 to January 2015. The sample consisted of Lateral cephalograms of 200 individuals with an equal number of males and females (hundred males and hundred females) in the age group of 8 to 35 years who attended the dental hospital. Two hundred digital lateral cephalograms of these normal subjects were evaluated in the Department of Oral Radiology. Digital lateral cephalograms were taken with orthophos XG machine with a tube voltage of 73 kV, tube current of 15 mA, and exposure time of 9.4 s. The velar length was determined by measuring the straight distance from the posterior nasal spine to the lower end of uvula of the resting soft palate. The distances were measured using Sidexis Programs (Sirona) software. It was measured in millimeters.
Inclusion criteria

Lateral cephalograms of all patients between the age range of 8-35 years (Mean: 19.46 ± 5.941 years) having normal speech function were added in the study.

Exclusion criteria

Radiographs of patients with developmental anomalies such as cleft palate or any systemic diseases and any disease or fractures of the maxillofacial complex were not included in the study.

Statistical analysis

Data were entered in Microsoft Excel and analyzed using SPSS (Statistical Package for Social Science).
1. One-way analysis of variance (ANOVA)
   One-way ANOVA were used to test the difference between groups.
2. Student t-test
   The student t-test was 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.

Results

Six basic types of basic shapes of the soft palate were seen. This was in accordance with the classification given by You et al., viz.

- Type 1: Leaf shaped/lanceolate shaped - the middle portion of the soft palate was slightly elevated to than the nasal and the oral ends.
- Type 2: Rat-tail shaped - the soft palate with bulged anterior portion and constricted free margin.
- Type 3: Butt-like soft palate which showed a shorter and fatter appearance with no distinct difference in width from anterior portion to the free margin.
- Type 4: Linear shaped.
- Type 5: S-shaped/twisted/distorted soft palate.
- Type 6: Crooked appearance - the soft palate in which the posterior most portion of the soft palate hooked up anterior superiorly.

According to Guttal et al.[3] study (2012), there were two additional variants of soft palate was found, viz.

- Type 7: U-shaped soft palate - variety of Type 2, with blunt end.
- Type 8: Variants which did not fit into either of the above-mentioned categories.

In addition to the above-mentioned types, three different types were found in this study. They are, viz., Types 9-11.

- Type 9: Cone Shaped.
- Type 10: Triangular shape.
- Type 11: V shaped.

The distribution and proportion of various types of palatal velum of our study group are shown in Table 1. Around 39% of the cases (36 females and 42 males) showed Type 1 [Figure 1a] variety of soft palate, 33.5% (36 females and 31 males) had Type 2 [Figure 1b] soft palates, 10% (5 female and 15 males) showed Type 3 [Figure 1c] variety, 3% (3 females and 3 males) showed Type 4 [Figure 1d] patterns. 3.5% cases (4 female and 3 male) had Type 5 [Figure 1e] soft palates and 4.5% (7 female and 2 males) showed Type 6 [Figure 1f]. 2% (3 females and 1 male) showed Type 7 [Figure 2a], 1% (1 female and 1 male) showed Type 8 [Figure 2b], 1% (1 female, 1 male) showed Type 9 [Figure 2c], 1.5% (3 females, 0 male) showed Type 10 [Figure 2d], and 1% (1 female and 1 male) showed Type 11 [Figure 2e] which were the new shapes seen in this study. Type 1 soft palate was more prevalent followed by Types 2 and 3. Significant increase in velar length was found till 30 years, following which there was a decrease. Furthermore, the velar length and width was greater in males than in females, which was significant [Tables 2 and 3].

Discussion

Cephalometric estimation is a commonly used radiographic method for assessing the soft palate in normal patients. This

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<th>Table 2: Comparison of velar length between males and females</th>
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*P<0.005 (highly significant), SD: Standard deviation

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<th>Table 3: Comparison of velar width between males and females</th>
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| Total  | 200 | 9.644±1.6474 | 9.675 | 4.6 | 14.5 | *

**P<0.001 (very highly significant), SD: Standard deviation
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In this study, the change in the dimension of soft palate, especially the changes in the length and the width has been studied. Soft palate classification given by You et al. was employed.

The important functions of soft palate, especially in maintaining the velopharyngeal closure and the dimensional changes of the soft palate and its surrounding structures, especially in the length and width, have been previously studied by some investigators.

Satoh et al. studied and analyzed the difference in the growth changes in the nasopharyngeal region among unilateral cleft lip and palate and in non-cleft individuals with lateral cephalograms, and found that the velar length was significantly less in cleft patients when compared to patients without clefts.

According to Mohan et al., in OSMF, Types 1 and 2 are commonly observed. As the disease advances, they are replaced by Types 3 and 6 variants. In OSMF patients, there was reduction in the anteroposterior dimension of the soft palate.

According to the study done by Guttal et al., a significant increase in soft palate length was observed as age increased. In this study, we found that there was a significant increase in velar length as age increased, till the age of 30 years, following which there was a decrease in length.

Kollias and Krogstad compared the dimensional changes of velar morphology between male and female subjects and concluded that increase in velar length, thickness and sagittal area of soft palate was equal among males and females. However, in this study, it was noted that velar length and width was significantly greater in males than in females which was in accordance with study done by Guttal et al.

OSA is a medical disorder which is associated with significant morbidity and it is being recognized and diagnosed easily but sometimes it goes undiagnosed. It is characterized

Figure 1: Various morphologies of soft palate. (a) Type 1 or lanceolate pattern, (b) Type 2 rat-tail shape, (c) Type 3 butt-like, (d) Type 4 straight line shaped, (e) Type 5 S-shaped, (f) Type 6 crooked appearance

Figure 2: Various morphologies of soft palate (Continuation) (a) Type 7 U-shaped, (b) Type 8 bifid, (c) Type 9 cone shaped, (d) Type 10 triangular shaped, (e) Type 11 V shaped

(Continued on the next page)
by the repeated blockade of the upper airways due to the falling back of pharyngeal walls during sleep especially in the inspiratory phase. The causes of OSA are still debated. In general, OSA patients are overweight, with habit of snoring and moderate to excessive sleepiness during the day.[11] Patients in their middle age are more prone for OSA.[12] It was found that pharyngeal morphology is not unalterably established during childhood and adolescence; both size and shape changes throughout adult life. Usually, length and width increases with age. During adulthood a longer, thicker soft palate and narrower oropharynx are formed. This explains the possibility of increased incidence of OSA and related disorders occurring later in life.[10] In the studies done by Pépin et al.,[13] and You et al.,[14] the authors found that curving of the soft palate results in a sudden and major reduction in dimensions of oropharynx which increases the resistance of the upper airway and with increased transthypharyngeal pressure gradient leading to airway collapse. A hooked appearance of palatal velum on radiographic images in awake patients indicates the possibility of OSA. According to the studies done by Lyberg et al., in 1989, elongation of the palatal velum was also observed.[14] In this study, the Type 5: Distorted soft palate was identified in 7 cases (3.5%) and three new morphologies of soft palate were noticed. Future studies with larger sample sizes are required to assess if the new morphology is associated with any obstructive conditions or malocclusion.

Conclusion

This study was done to assess the variations in the size and shape of soft palate and to classify them in accordance with the classification of You et al. and Guttal et al. Type 1 variant of palatal velum was the most common form followed by Types 2 and 3. Three supplementary morphological variations which did not fit into any other classification in the literature were also observed and were grouped as Types 9-11. The length and width soft palate was significantly greater in males than in females. There was no significant relation between the different age groups and the types of soft palate.

Clinical significance

Thus, it will be beneficial for diagnosis and management of OSA and also will be helpful in assessing the changes in the morphologies in OSMF and cleft palate patients.

References
