The Morphological Variation of the Soft Palate in Hospital Visiting Patients

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ABSTRACT

Background: The soft palate anatomy of individuals can have a range of morphologies. Cephalometric analysis is a low-cost approach to analyze the soft palate in patients with or without developmental abnormalities.

Methods: The lateral cephalogram of the patients visiting Tribhuvan University Teaching Hospital, Institute of Medicine for various dental treatment purposes was evaluated. The soft palate was delineated on the radiographs by sketching the soft palate's contour along its radiolucent outline using the curve lines and connectors of Microsoft PowerPoint. The soft palate was then categorized according to the study by You M et al.

Results: The different types of soft palate morphology observed in the study were rat tail (42.4%), leaf-like (40.8%), butt-like shape (8.9%), straight-line (4.7%), s-shaped (1.9%), and crooked (0.9%). The males had rat-tail (44.4%), leaf-like (41.1%), butt-like shape (8.4%), straight-line (3.9%), s-shaped (1.3%), and crooked (0.6%), whereas the females had rat-tail like (40.6%), leaf-like (40.6%), butt-like shape (9.5%), straight-line (5.6%), s-shaped (2.5%), and crooked (1.2%) types of soft palate.

Conclusions: The rat-tail form of the soft palate was the most prevalent, followed by the leaf-like in both sexes. The least common type was the crooked form. This study found no evidence of sexual dimorphism.

Keywords: Cephalogram; morphology; Nepalese population; soft palate.

INTRODUCTION

The soft palate is the fibromuscular portion of the palate that connects to the hard palate's posterior margin.[1] Soft palate dysfunction is caused by a variety of factors, including cleft lip and palate, enlarged adenoids, obstructive sleep apnea syndrome (OSAS), snoring, improperly maintained maxillary dentures, and skeletal craniofacial malocclusion.[2,3] The knowledge of the normal anatomy of the soft palate and its morphological variance aids in the diagnosis and successful treatment of these intricate cases.[4]

Cephalometry is a low-cost technology that allows a thorough examination of the soft palate.[4] The heterogeneity in the soft palate morphology is quite valuable during soft palate surgeries.[5,6] A successful outcome is primarily dependent on normal anatomy of the soft palate and other associated structures.[7,8]

The present study aimed to assess the morphology of the soft palate among patients visiting tertiary level hospital in Nepal. The findings of this study may support the use of soft palate morphology in successful soft palate functional and structural rehabilitation.

METHODS

The lateral cephalograms from the archives of the patients' records aged 7 to 28 years visiting Tribhuvan University Teaching Hospital for various dental treatments were used in this cross-sectional descriptive

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study. This study was conducted in the Department of Oral Pathology & Forensic Dentistry from November 25, 2021, until December 25, 2021.

The protocol of the study was approved by Institutional Review Committee, Institute of Medicine, Kathmandu, Nepal with Reference No 182 (6-11) 078/079. Only participants with normal speech function were considered, with no history of cleft palate, systemic disorders, or diseases or fractures in the head and neck region. Individuals with a history of cleft palate and trauma in the maxillofacial region were excluded from this study.

The radiographs were first examined with the built-in magnifying lens on the MacBook Pro, which can be accessed by clicking tools. After that, the X-rays were taken on a screenshot and transferred into Microsoft PowerPoint. The radiographs were then used to sketch the soft palate's contour along its radiolucent outline using curved lines and connectors, which can be accessed by clicking shapes in Microsoft Power Point's home. The morphology of the soft palate was categorized into 6 types based on radiographic appearances given by You M et al.[2]

Type 1: Leaf shaped/Lanceolate shaped
Type 2: Rat-tail shaped
Type 3: Butt-like
Type 4: Straight line
Type 5: S-shaped/distorted soft palate.
Type 6: Crooked appearance

The sample size was calculated using the prevalence of s-shaped soft palate from a study conducted by You M et al.[2] The minimum desired sample size was estimated to be 52. Thus 52 in each group was calculated for a total of 312.

The data was verified and imported into a Microsoft Excel spreadsheet and analyzed using the Statistical Package for Social Sciences (SPSS) Version 21. Descriptive statistics using frequency, percentage, mean, and standard deviation were calculated. The Chi-square test was used to compare the significance among the sexes. The level of significance was set at $p<0.05$ at a 95% confidence interval.

RESULTS

The mean age of the patients was 17.07±8.015 years. Out of 312 patients, 153 (48.8%) were males and 160 (51.1%) were females. The various forms of the soft palate observed on the lateral cephalogram in the study are shown in Figure 1.
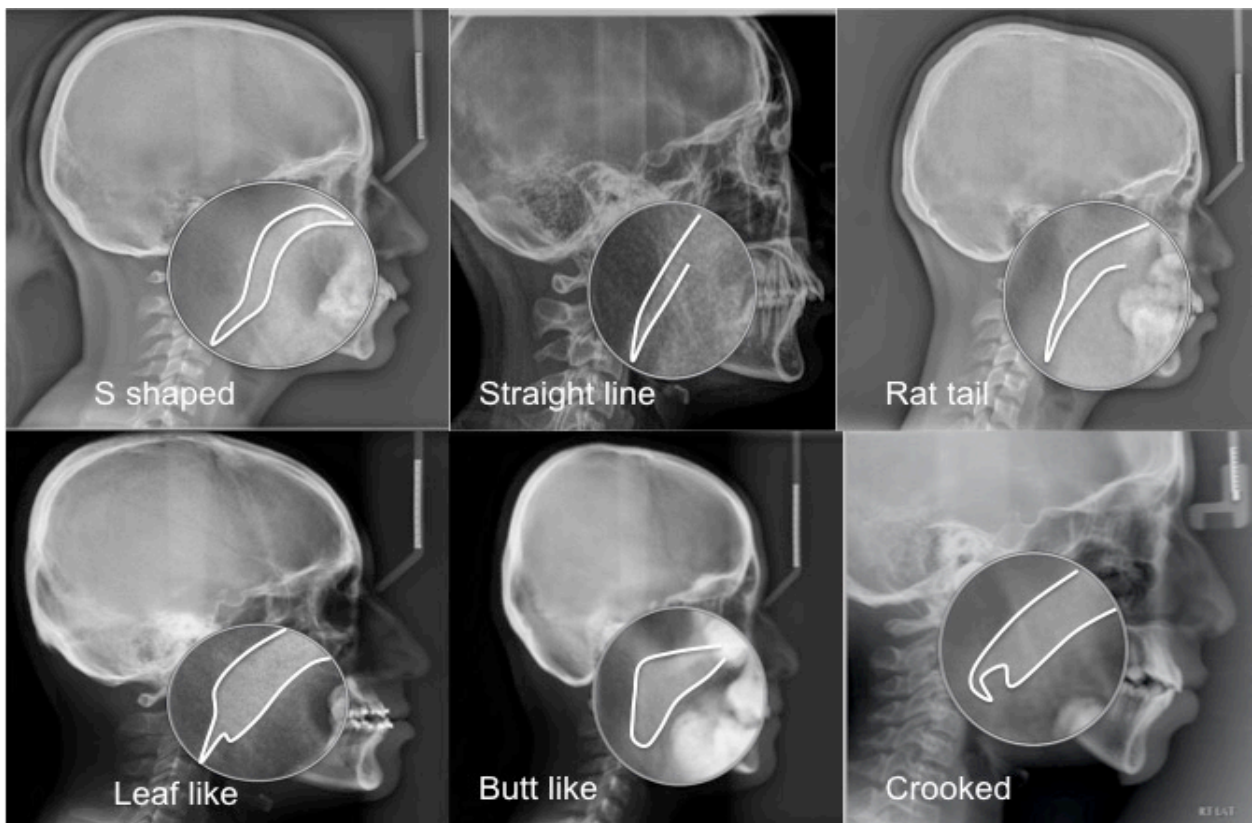

Figure 1. The various types of the soft palate in the Nepalese population observed on lateral cephalogram Xray with an inbuilt magnifying glass in Macbook Pro.

The total prevalence of various types of the soft palate was 8.9% in the butt-like shape, 0.9% in crooked, 40.8% in a leaf-like, 42.4% in rat-tail, 1.9% in s-shaped, and 4.7% in a straight-line. The prevalence in males was 8.4% in butt-like shape, 0.6% in crooked, 41.1% in leaf-like, 44.4% in rat-tail, 1.3% in s-shaped, and 3.9% in straight-line. The prevalence in females was 9.5% in the butt-like shape, 1.2% in crooked, 40.6% in leaf-like, 40.6% in rat-tail, 2.5% in s-shaped, and 5.6% in a straight-line as shown in Figure 2.
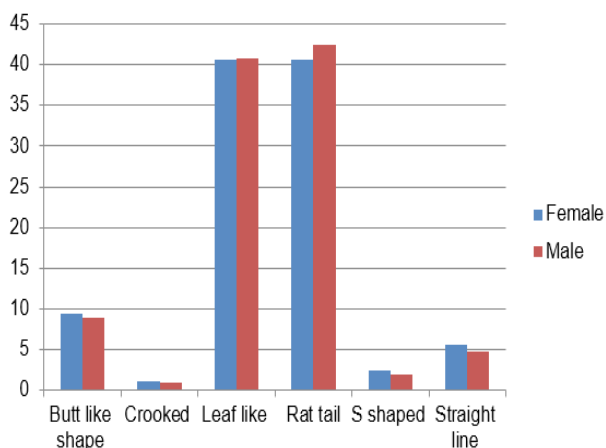

Figure 2. Distribution of the soft palate forms among both the sexes.

There was no significant difference in the proportion between the sexes. (p= 0.781) as shown in Table 1.

Table 1. Pearson Chi-Square to compare the genders.

Chi-Square Tests

	Value	p-value
Pearson Chi-Square	4.776	0.781

*P<0.05= Statistically significant

DISCUSSION

A proper assessment of the soft palate anatomy is essential for effective treatment planning. For years, random methods were used to determine soft palate type of patients in the chairside. Despite several studies recommending specific clinical examinations, diagnostic casts, radiographic methods, and various combinations, accurate soft palate morphology evaluation remains elusive. Radiographic technologies offer an advantage over other procedures when it comes to accurately identifying the anatomy of the soft palate.[9]

The various types of soft palate observed in our study were rat-tail, leaf-like, crooked, straight-line, butt, and s-shaped. The rat-tail type of soft palate is shaped like a rat's tail, with an enlarged anterior section and a free margin with a visible coarctation, which was the most prevalent type in our study. Upadhyay et al.[10] and Agrawal et al.[11] also reported it to be the most prevalent, with a prevalence of 28-37%.[12,13] Kotlarek et al. reported that only children were found to have the rat-tail type, while adults had none.[13] However, Nagaraj et al. reported it to be the second most prevalent (33.5%) in their study.[14]

A leaf-type soft palate has its central half raised on both the nasal and oral sides. This shape of the soft palate is very common and thus recognized by many dentists, which in the past was referred to as classic velar morphology.[15,16] Verma et al.[15] reported it to be the most prevalent type with the prevalence of 48.7%, similar to the study done by You et al.[2] and Niu et al.[17] However, in our study, it was the second most prevalent type. This variation may be because our sample had malocclusion patients, which may have resulted in the morphological variance of the soft palate. However, Kotlarek et al. reported leaf type to be present only in adults and not in children.[13] Our study sample only had patients in the age range of 7-28 years, so the age-dependent changes couldn't be evaluated.

Butt-like shaped soft palate is shorter and fatter with no discernible variation in breadth between the anterior and free margins. In our study, it was less common in contrast to other studies reported by various investigators, with a prevalence of 32.2%-41.2%[7,9] and 57.6% respectively in adults and children.[13]

A straight line is thin in size and in a straight line. It was less common in our study. According to a few studies, the researchers couldn't even find a single case.[11,13] However, Verma et al. reported a prevalence of 8.7%.[15]

S-shaped contains two bends from the hard palate to the uvula, which is a less common variant similar to other studies. Crooked-shaped contains crooks that hang anteriorly and superiorly. It is less common as reported by other studies 3-3.3%.[11,14,16]

The most prevalent type of soft palate in our study was the rat tail type in both sexes. This coincides with the study done by Agrawal et al.[11] Domir[16] and Samdani[18] However Tripathi et al.[19] and Guttal[20] reported leaf type (30-38%) to be the most common followed by rat tail (20-27%) in healthy individuals.

Our study showed crook-shape as the least prevalent type, similar to other studies.[11] Furthermore, statistical analysis revealed that sexual dimorphism was non-significant in soft palate forms. Thus, the sex of an individual can't be determined based on soft palate

shape variance which coincides with the study done by Agrawal et al.[11] and Samdani.[18]

Various studies have correlated malocclusion with the shape of the soft palate. The Type I angle's malocclusion has shown more correlation compared to others.[18] Future research should also take into account the soft palate examination of healthy people who do not have a malocclusion. Clinically, soft palate dimensions, especially the vertical length have been associated with snoring and higher obstructive sleep apnoea (OSA) scores.[21,22] This finding may also be correlated with the shape of the soft palate, specifically the s-shaped and vertical shapes with narrow anteroposterior dimensions, which hypothetically may predispose individuals with these morphologies to OSA.[23-25] The morphology of the soft palate affects pronunciation, phonetics, speech development, and resonance disorders.[26,27] Thus, the identification of any clinical association between velar shape and its effect on the development of speech, language, and phonetics in general, may provide a path towards correction of such disorders. Multiple studies have analyzed anthropological features of the soft palate in diverse age-groups using a plethora of radiological devices, from computed tomography to MRI.[28-30] Although three-dimensional imaging like CT, CBCT, and MRI may provide better dimensional accuracy, cephalometric analysis remains a feasible and effective modality for analysis of soft tissue in the neck and has shown correlation with more advanced imaging.[31,32]

More research is needed to understand the therapeutic implications of the velar form and whether anatomical variables influence the velar shape. Future research should explore the relationship between velar morphology and velopharyngeal closure pattern. Also, more research with a larger sample size is needed to evaluate if the soft palate pattern reveals sexual dimorphism.

CONCLUSIONS

The rat-tail shape was the most common of the numerous shapes observed, whereas the crooked shape was the least common. The knowledge of soft palate morphological variances aids in a better understanding of velopharyngeal closure, as well as successful functional and structural repair in cases of cleft palate and the etiological investigation of obstructive sleep apnea syndrome, snoring, and other diseases.

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CONFLICT OF INTEREST

None

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