

Morphology of Soft Palate – Analysis by Digital Cephalometric Study

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Abstract: Objective of our study was to investigate the variation in the morphology of soft palate in normal individuals.- The study was conducted in 200 (100 males and 100 females) individuals requiring orthodontic treatment and who require lateral cephalogram for the purpose of treatment. The age range of the individual was between 9-40years .Velar shape was classified into 6 patterns as described by Youet .al. The difference in pattern and as well as difference between gender were studied.Results of study were as follows.: - Type 1(Leaf shape) was the most common shape of the soft palate (42%) found followed by type 2(32%), type 3(10%), type 4(9%), type5 (5%) and type 6 (2%). Type 1 was the commonest seen in males (55%) and type 2 was more commonly seen in females (40%).Conclusion: - Knowledge of variation of soft palate morphology will be helpful in the field of research related to cleft palate, sleep apnoea disorders and other disorders.

Key Words:soft palate, cephalogram, pharynx

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I. Introduction

The soft palate plays a vital role in velopharyngeal closure and thus aids in normal physiologic functions like sucking,swallowing and pronunciation.(1) The velopharyngeal adequacy is strongly dependant on a close co-ordination of the anatomic parts- soft palate and the contiguous pharyngeal structures, so it is reasonable to hypothesize that the contiguous pharyngeal structures may have different characteristics to match up to different velar morphologies.(2)

Many studies have evaluated the dimensional analysis of the soft palate, but few have shed knowledge on the variations of soft palate morphology and configuration. (3-5)

Clinically accessibility to the velopharyngeal region is difficult; hence have to depend largely on diagnostic methods. Radiographic examination of soft palate can be done with the help of anterioposterior view, lateral skull view but they do not help in complete evaluation due to superimposition of various structures. (6)Therefore lateral cephalogram, being one of the screening radiographs and relatively inexpensive can be used for evaluation of soft palate in the sagittal plane. (2)

Thus aim of the study was to investigate the various shapes of soft palate on digital lateral cephalograms in normal individuals.

II. Material And Methods

The study consisted of 200 patients requiring orthodontic treatment. A total of 100 (Males) and 100 (females) with age range of 9-40 yrs were considered for the study. Informed consent was taken from all the subjects. The importance and the need for the study was explained to each individual. Any dental appliance and metal objects present on the individual were asked to be removed prior to radiographic exposure.

Digital lateral cephalogram were obtained usingCarestream (CS 8000 C). Patients with normal speech function were considered for the study. Patients with any developmental anomalies of maxilla,palate,(soft

palate) any head and neck fractures, any history of surgery in the oropharyngeal and nasopharyngeal region, any history of systemic diseases and local diseases affecting this region such as OSMF were excluded.

The radiographs were viewed using the available software and classified according to You Met al⁽⁷⁾ as follows

1. Type 1- “Leaf –shape” (lanceolate)- the middle portion of the soft palate is elevated to both naso- and orosides; (figure 1)
2. Type 2- “rat-tail shaped,” the anterior portion is inflated and the free margin has an obvious coarctation; (figure 2)
3. Type 3- “butt-like shaped,” shorter and fatter velum appearance and the width has almost no distinct difference from the anterior portion to the free margin; (figure 3)
4. Type 4- “straight line shaped;” (figure 4)
5. Type 5- distorted soft palate, which presents the “S shape;” (figure 5)
6. Type 6- “crook-shaped” appearance, in which the posterior portion of the soft palate crooks anterosuperiorly. (figure 6)

III. Figures and Legends.



1. Type 1- “Leaf –shape” (lanceolate)-

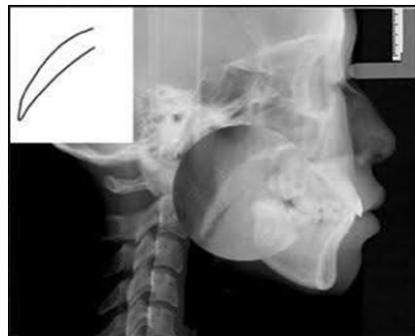


Fig 2. Type 2- “rat-tail shaped

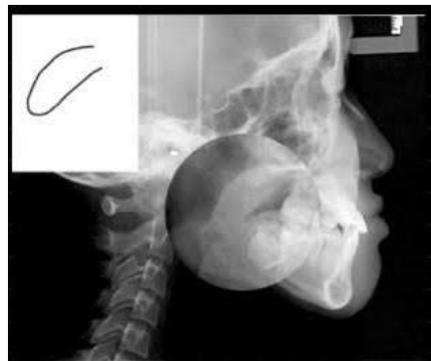


Fig 3- Type 3- “butt-like shaped,”

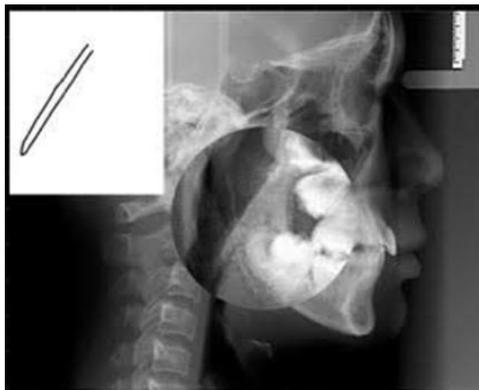
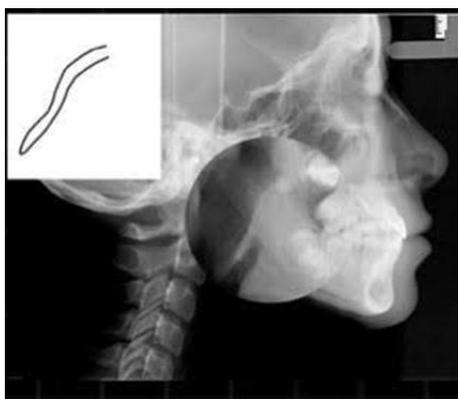


Fig 4- Type 4- “straight line shaped;”



Type 5- distorted soft palate, which presents the “S shape;”

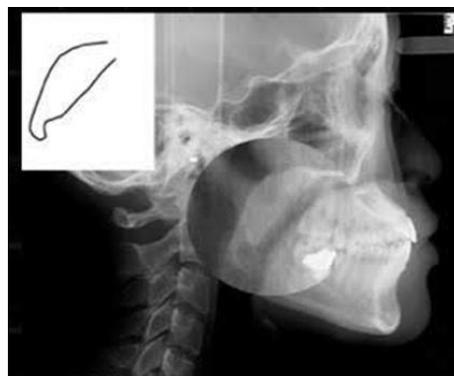


Fig 6. Type 6- “crook-shaped” appearance.

Any additional finding which does not fit in the above said types was noted and classified as type 7 and so on, if required. The radiographic images were magnified to an extent that the soft palate was clearly visualized and were observed by two radiologists independently and classified as described above.

The pattern of the soft palate on the digital lateral cephalograms was highlighted with a curve tool available in the Microsoft power point. Since there was no differences in classification between the two radiologists, reliability was considered to be acceptable. All the analysis was done using statistical package for the social sciences (SPSS) version 18. A p-value of < 0.05 was considered to be statistically significant. Comparison of variation of soft palate morphology between males and females was done using Chi-square test.

IV. Results

Overall distribution of the various types of soft palate in individuals.

Type 1 was the most common type observed in 84 cases (42%) followed by type 2 in 64 cases (32%), type 3 in 20 cases (10%) , type 4 in 18 cases (9%) ,type 5 in 10 cases (5%) ,and type 6 in 4 cases (2%) . Type 5 and type 6 were the least common types of soft palate found among the individuals. (Table 1)

Table 1

Types	Shapes	Male (100)	Female (100)	Total (200)	Percentage
1	Leaf shaped	55	29	84	42%
2	Rat Tail shaped	24	40	64	32%
3	Butt like shape	10	10	20	10%
4	Straight Lineshape	7	11	18	9%

Distribution of soft palate morphology types with respect to gender.

Statistical analysis: Chi-square test, Statistically significant if $P < 0.05$,

Chi-square test, P value = 0.490; not significant

Type 1 (42%) was seen in 55males &in 29 females, type 2 (32%) was seen in 24 males and 40 females ,type 3 (10%) was seen in 10 males and 10 females; type 4 (18%) 7 males and 11 females; type 5 (10%) was seen in 4males and 6 females and type 6 (4%) was seen in 2 males and 2 females. (Table 1)

Overall distribution of the various types of soft palate with respect to gender (figure 7)

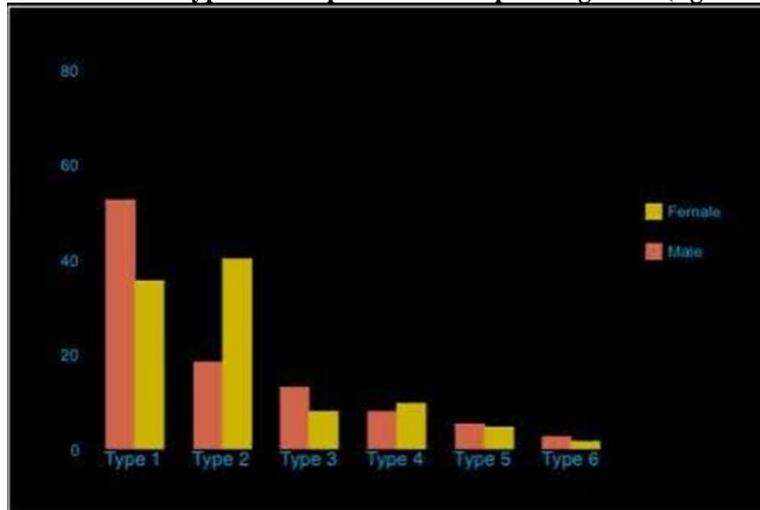


Fig 7: Graph showing Distribution of type of soft palate according to gender.

Type 1 was more commonly seen in males in 55 individuals (55%) as compared to females,seen inonly 29 (29%) individuals.

Type 2 was more commonly seen in females in 40individuals(40%) as compared to males,seen inonly 24(24%)individuals. However this finding was not found to be statistically significant.

The other typesi.e.type 3-6 were seen similarly in both the genders.

V. Discussion

The soft palate plays a large role in velopharyngeal closure, which refers to the normal apposition of the soft palate with the posterior and lateral pharyngeal walls. It is primarily a sphincteric mechanism consisting of velar and pharyngeal components. The movement separates the oral cavity from the nasal cavity during deglutition and speech. When the velum and lateral and posterior pharyngeal walls fail to separate the two cavities, velopharyngeal incompetence (VPL) occurs. ⁽⁷⁾

Cohen et al (1993) suggestedthat one of the several explanations for the surgically successful, yet functionally compromised repair may be due to the differences in the morphology of the soft palate and other associated structures. ⁽⁸⁾ Hence, presurgical evaluation of soft palate morphology will aid in the success of surgery. Over many years, the variation in the velar morphology was analysed by many and very few have categorised them into various shapes.

In the present study, the most common type of soft palate was type 1 which was seen in 42% of cases. Type 1 soft palate was seen in 55 % of males and 29% of females. The findings of the present study was in concordance with the study by Tanya Khaitan et al⁽⁹⁾ where type 1 was seen in 47.5% of cases, which was similar as well to the other studies by Kumar & Gopal⁽¹⁰⁾ and Guttal et al.⁽¹¹⁾ However, our results were contrary to the study conducted by Praveen et al (2011) who observed type 2, rat-tail shaped soft palate as the most common type (55%).⁽¹²⁾ The next most common type was the type 2 (32%) followed by type 3 (10%) and then type 4 (9%). These results were similar to studies done by You et al and Kumar et al.^(7, 10)

The hooked appearance of the soft palate was found by Pepin et al (1992) which was described as distorted shape (S-shape or type 5) by You et al.^(7, 13) This variant was present in only 10 cases (5%) in the present study. Type 6 was seen in only 4 cases (2%). This was in accordance with studies done by Tanya K et al wherein it was present in 1.5%, You et al wherein it was seen in 1.5% , Kumar et al wherein it was seen in 3% of cases and Gutt et al seen in 6.5%.^(7, 9, 10, 11)

In addition to the above, two other types have been described as type 7 and type 8. Type 7 is described as triangular-shaped soft palate and type 8 as bifid – shaped soft palate. However in our study these two types were not present. However a new variant (or U – shape) that is triangular shaped soft palate (type 7) was seen in Tanya Khaitan et al study.⁽⁹⁾

It was found that pharyngeal morphology is not indelible established during childhood and adolescence, but changes throughout adult life. There is a tendency towards longer and thickened soft palate and narrower oropharynx during adulthood, which may explain the possible increased incidence of OSA (obstructive sleep apnea) and related disorders occurring later in life.

Studies reveal that there is an increase in length, thickness and sagittal area of soft palate with age, in both the genders but increase in soft palate area was significantly more in males. In our study type 1 was the most common found in males, that is in 55% of cases as compared to females that was present in 29% whereas type 2 was the most common type found in females in 40% of cases whereas in males only 24% of cases it was present. However these findings were in contrary to study done by BN Praveen et al (2011) where there was no significant difference between types of soft palate present between males and females.⁽¹²⁾

In our study, there was no much difference between gender in comparison to the proportion of the various morphology of soft palate that is (type 3 to type 6) present.

Tanya K et al⁽⁹⁾ analysed the dimension of soft palate in different age groups and found a weak positive correlation between age and length of soft palate, whereas studies done by Johnston and Richardson as well as Taylor et al^(14,15) found that soft palate becomes longer and thicker with advancement of age.

While lengthening of the soft palate appears to be a normal feature of aging, it may also be an important factor in individuals otherwise predisposed to OSAS. Studies carried out show a narrow hard palate with a vertically positioned soft palate and an enlarged uvula in OSAS individuals.

VI. Conclusion

It can be concluded that, there are eight types of soft palate which are normal variants identifiable on lateral cephalometric radiography. Knowledge pertaining to this varied morphology will aid in the success of soft palate surgery. More number of samples will aid in research on cleft palate, obstructive sleep apnoea and in many other conditions of the soft palate.

VII. Declarations

Acknowledgement-None

Conflicts of Interests- Authors have no conflicts of interest.

Ethical Approval- The study was started after acquiring ethical approval.

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