



## Morphological types of Soft palate and influence of age and gender on it: A Lateral Cephalometric Study

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### Abstract

**Aim-**To study various morphologies of soft palate, difference in proportion of each type and their differences among gender and age groups .**Material and methods-**A Prospective study was conducted on 150 Subjects out of which 75 are males and 75 are females aged 4-79 years. Subjects are divided age into three groups that were 05 to 20 yrs, 21 to 40 yrs and 41yrs.150 lateral cephalograms were classified onto six types on the basis of radiographic appearance. Analysis was done using SPSS (version 20.0). Chi-square statistical test was applied to the results and level of significance was set at  $p < 0.05$ .**Results-**Among various types of soft palate, maximum number of participants had Type 2(26.0%), followed by Type 3 (20 %), Type 6 (18.67%) ,Type 1 (14.66 %)and and type 5 (11.34 %) Type 4 (9.33 %). There is a highly significant association between age and soft palate morphology types (i.e.  $p < 0.01$ ). There was also significant difference between the three age groups. There is a significant association between gender and soft palate morphology types (i.e.  $p < 0.05$ ). **Conclusion-**The Type 2 (rat-tail) soft palate was the most frequent type, while the type 4 (straight line) shape was the least common among all the 6 types. Type 2 soft palate (rat-tail) is most commonly found in first age group, type 6 (crook shape) most commonly found in second age group and type 3 (butt-like) most commonly found in third age group. Type 2 (rat-tail) is most common in females and type 6 (crook shape) most commonly found in males.

**Keywords:** soft palate., morphology, lateral cephalogram, prospective study

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## Introduction

The soft palate is the posterior fibromuscular part of the palate that is attached to the posterior edge of the hard palate. The palate is formed by the fusion of three components; they are two palatal processes and the primitive palate is formed from the frontonasal process. At a later stage, the mesoderm in the palate undergoes intramembraneous ossification to form the hard palate. However, the ossification does not extend into the most posterior portion which remains as the soft palate<sup>1,2,3</sup>. It participates in most oral functions, especially velopharyngeal closure which is related to the normal functions of sucking, swallowing and pronunciation. The soft palate is responsible for breathing, speech, coughing, sneezing, closure of the pharyngeal isthmus hence the quality of voice can be modified.

You M et al documented the variation in normal velar morphology and classified them into six different categories<sup>4</sup> which have been employed in the present study. Pepin et al<sup>5</sup> found the ‘‘hooked’’ appearance of the soft palate also known as (‘S’ type) in awake patients, which indicated a high risk for obstructive sleep apnoea syndrome (OSAS). 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.<sup>1,6</sup>

By observing the image of the soft palate on lateral cephalometry, we noticed that the configuration of the soft palate presented variously in normal individuals. Several methods using advanced technologies (e.g CT, MRI and Videoendoscopy) have been used to evaluate the anatomical characteristics of upper airway and craniofacial structures that may predict Obstructive sleep apnoea and or to determine the sites of obstruction. However the traditional cephalometric method has been the most practical. Cephalometric analysis is one of the most commonly accepted techniques for evaluating the soft palate. Cephalometry is a relatively inexpensive method and it permits a good assessment of the soft tissue elements that define the soft palate and its surrounding structures. Although the continued efforts toward the dimensional analysis of the soft palate and its surrounding structures have been made, little attention has been paid to the variety of soft palate morphology and configuration. The objective of this study is to classify various morphologies of soft palate, difference in proportion of each type and also the difference between gender and age groups on lateral cephalogram.

## MATERIAL AND METHODS-

This prospective study was conducted in the Department of Oral Medicine & Radiology. Subjects for the study were selected randomly from the outpatient department of Oral Medicine & Radiology and the patients referred from Department of Orthodontics at DY Patil dental college, Pune, Maharashtra.

**Study Duration:** January 2011 to December 2012.

**Sample size:** 150 patients

### Inclusion Criteria-

- Subjects with age range starting from 5 years to 79 years.

We divided their age into 3 groups-

- 1) 05 to 20 years
- 2) 21 to 40 years
- 3) 41 and above

### **Exclusion Criteria -**

- Subjects having speech dysfunction
- Subjects having or any history of cleft palate
- Subjects having fracture of the head and neck

Each patient was fully informed and explained about the lateral cephalometry procedure and consent form were signed. A detailed history of each patient was recorded at the time of diagnosis to rule out any speech dysfunction, cleft palate or fracture of the head and neck.

### **Digital lateral cephalogram technique-**

Lateral cephalogram was taken for each individual included in the study. The subjects stood with the sagittal plane parallel to the film and the bilateral ear rods gently inserted into the external auditory meatus to stabilize the head position during exposure. The head was adjusted so that the Frankfort horizontal plane was parallel to the floor. The tube potential is adjusted to optimize the contrast of both hard and soft tissues. The digital radiographs were processed by Planmeca Dimax Pro Version 4.2.0 software.

The parameters were kept same for every patient.

(Kvp-66 mv, mA-7, Time -18secs, filtration-2.5mm)

In this study, soft palate was classified according to You M et al <sup>4</sup> On the basis of radiographic appearances; categorization of soft palate was done into following six types (figure 1)

Type 1: Leaf / Lanceolate shaped: The middle portion of the soft palate elevated to both nasal and oral sides.

Type 2: Rat-tail shaped: The soft palate showing inflated anterior portion and free margin with an obvious coarctation.

Type 3: Butt-like: The soft palate showing a shorter and fatter velum appearance with no distinct difference of width of the anterior portion to the free margin.

Type 4: Straight line shaped.

Type 5: S-shaped/distorted soft palate.

Type 6: Crooked appearance: The soft palate with posterior portion crooks antero-superiorly.

### **Statistical Analysis-**

Chi-square statistical test was applied to the results obtained from the study; value of significance (p value) was calculated.

## **RESULTS-**

The obtained data was compiled systematically and coded in MS Excel sheet and subjected to statistical analysis with the consult of a statistician.

Statistical procedures were carried out in 2 steps:

1. Data compilation and presentation

2. Statistical analysis

Descriptive and inferential statistical analyses were carried out in the present study. The Statistical software IBM SPSS statistics 22.0 (IBM Corporation, Armonk, NY, USA) was

used for the analyses of the data and Microsoft word and Excel were used to generate graphs etc. Chi-square statistical test was applied to the results obtained from the study; value of significance (p value) was calculated.

Among various types of soft palate, maximum number of participants had rat tail type (Type 2) of soft palate (26.0%), followed by butt type (20%), crooked type (18.67%), leaf type (14.66%) and S shaped (11.34%) straight line (9.33%), (Table 1)(Graph 1)

There is a highly significant association between age and soft palate morphology types (i.e.  $p < 0.01$ ). There was also significant difference between the three age groups. Type 2 (Rat tail type) is most common (26%) followed by butt type, crooked type, leaf type, S shaped and straight line among all age groups (Table 2, Graph 2)

There is a significant association between gender and soft palate morphology types (i.e.  $p < 0.05$ ). Type 2 (rat-tail) is most common in females and type 6 (crook shape) most commonly found in males. (Table 3, Graph 3)

## DISCUSSION-

It was found that the Type 2 (rat-tail) soft palate was the most frequent type, while the type 4 (straight line) shape was the least common among all the 6 types. Type 2 soft palate (rat-tail) is most commonly found in 1<sup>st</sup> age group, type 6 (crook shape) most commonly found in 2<sup>nd</sup> age group and type 3 (butt-like) most commonly found in 3<sup>rd</sup> age group. Type 2 (rat-tail) is most common in females and type 6 (crook shape) most commonly found in males.

This study was in accordance with study done by Praveen BN et al<sup>7</sup> who found that Type 2 – rat tail shape was most common in both the genders. Present study was inconsistent with one of findings of this study that there was no significant difference in proportion of various shapes of soft palate between genders. This study was also in accordance with M You et al<sup>4</sup> who found there was a significant difference between the pre adult and adult groups and also between male and female groups in proportion to soft palate type. These results were in accordance with study done by Samdani et al<sup>8</sup> who found out the frequency of rat tail (37.2%) type of soft palate was seen in highest proportion, whereas the frequency of distorted S-shape (6.80%) was least in both the genders. This study was in accordance with Kumar kalyan and Gopal Saraswati<sup>11</sup> who found that there was a significant difference in the morphology of soft palate and also between male and female groups in proportion to velar type.

This study was inconsistent with the study done by Pradhuman Verma et al<sup>9</sup> who investigated that the most frequent type of soft palate was leaf shaped (48.7%) and least common was crook shaped. Our study was inconsistent with the study done by Tejavathi Nagaraj et al<sup>10</sup> who found out that leaf shaped variant is the most commonly observed type of palate. This study was inconsistent with the study done by C. Vani et al<sup>12</sup> who found that there was no significant correlation between the different age groups and the type of soft palate. These findings were inconsistent with the study done by Smriti K et al<sup>13</sup> who found that there was no significant difference in morphology of soft palate among men and women.

## **CONCLUSION-**

Following conclusions can be drawn from this study-

1. The Type 2 (rat-tail) soft palate was the most frequent type, while the type 4 (straight line) shape was the least common among all the 6 types.
2. Type 2 soft palate (rat-tail) is most commonly found in 1<sup>st</sup> age group, type 6 (crook shape) most commonly found in 2<sup>nd</sup> age group and type 3 (butt-like) most commonly found in 3<sup>rd</sup> age group.
3. Type 2 (rat-tail) is most common in females and type 6 (crook shape) most commonly found in males.

## **CLINICAL SIGNIFICANCE-**

Thus, it will be beneficial for diagnosis and management of Obstructive sleep apnea and also will be helpful in assessing the changes in the morphologies in Oral Submucous fibrosis and cleft palate patients.

## **LIMITATIONS OF THE STUDY-**

This study involved a small sample size; therefore similar studies of larger population would hopefully strengthen our result.

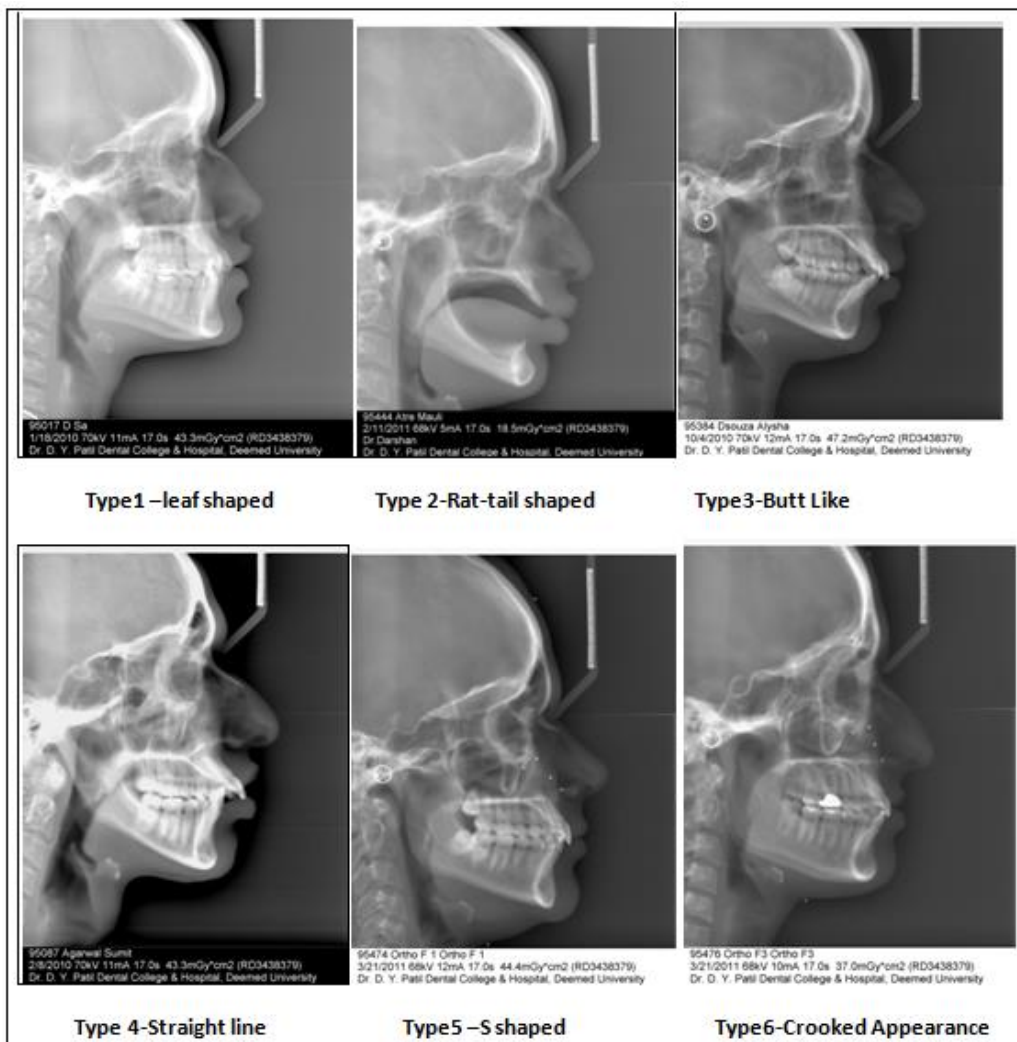
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**Figure 1: Various types of soft palate according to You M et al**



**TABLE 1: DISTRIBUTION AND PROPORTION OF SOFT PALATE MORPHOLOGY TYPES**

| Type Of soft palate | 1      | 2   | 3   | 4     | 5      | 6      | Total |
|---------------------|--------|-----|-----|-------|--------|--------|-------|
| Number              | 22     | 39  | 30  | 14    | 17     | 28     | 150   |
| Proportion(%)       | 14.66% | 26% | 20% | 9.33% | 11.34% | 18.67% | 100%  |

Types: 1: leaf-shaped; 2:rat-tail shaped; 3: butt-like; 4:straightline; 5:S-shaped; 6:crook-shaped

**TABLE 2: AGE AND SOFT PALATE MORPHOLOGY TYPES**

| Age in years (Number) | 1              | 2           | 3           | 4             | 5              | 6              | Total |
|-----------------------|----------------|-------------|-------------|---------------|----------------|----------------|-------|
| 5-20                  | 7              | 18          | 4           | 6             | 7              | 8              | 50    |
| 21-40                 | 10             | 11          | 9           | 4             | 2              | 14             | 50    |
| 41 and above          | 5              | 10          | 17          | 4             | 8              | 6              | 50    |
| Total (%)             | 22<br>(14.66%) | 39<br>(26%) | 30<br>(20%) | 14<br>(9.33%) | 17<br>(11.34%) | 28<br>(18.67%) | 150   |

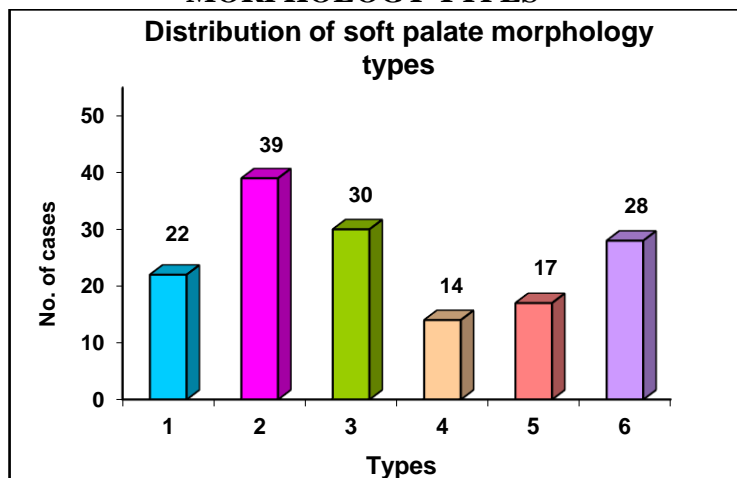
Value of  $\chi^2 = 21.19$ , d. f. = 12, highly significant, i.e.  $p < 0.01$

**TABLE 3: GENDER AND SOFT PALATE MORPHOLOGY TYPES**

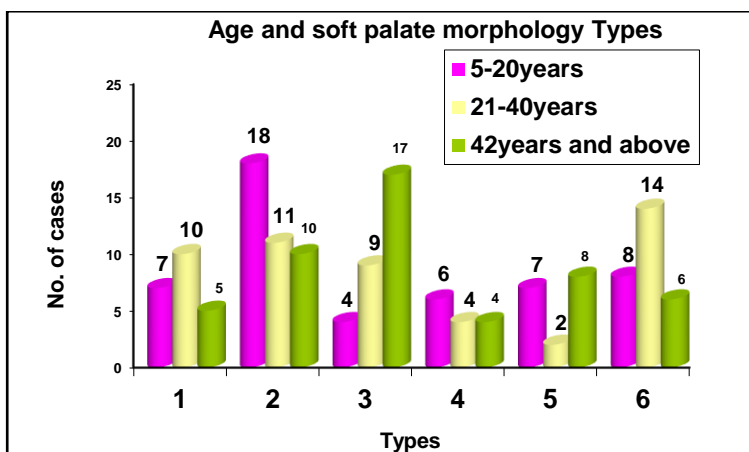
| Types of soft palate | 1   | 2   | 3   | 4   | 5   | 6   | Total |
|----------------------|-----|-----|-----|-----|-----|-----|-------|
| Sex                  | No. | No. | No. | No. | No. | No. | No.   |
| Male                 | 11  | 17  | 16  | 2   | 10  | 19  | 75    |
| Female               | 11  | 22  | 14  | 12  | 7   | 9   | 75    |
| Total                | 22  | 39  | 30  | 14  | 17  | 28  | 150   |

Value of  $\chi^2 = 12.01$ , d. f. = 5, significant, i.e.  $p < 0.05$

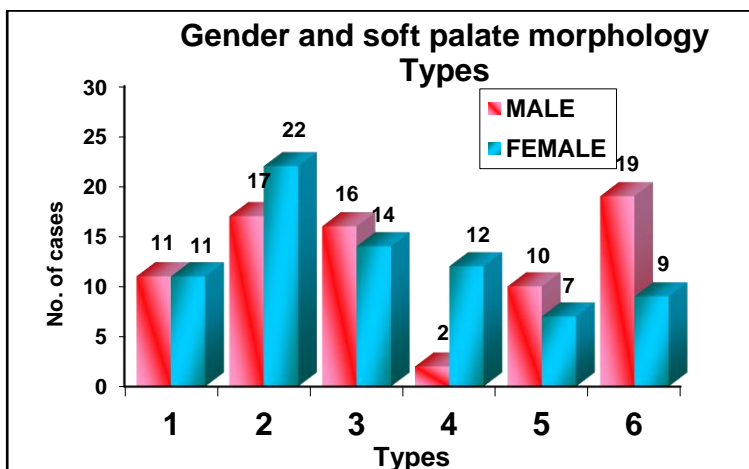
**GRAPH 1- DISTRIBUTION AND PROPORTION OF SOFT PALATE MORPHOLOGY TYPES**



**GRAPH 2 -AGE AND SOFT PALATE MORPHOLOGY TYPES**



**GRAPH 3: GENDER AND SOFT PALATE MORPHOLOGY TYPES**





### Conflict of interests

None.

### Funding :

None

### Ethical approval

The study was approved by the Institutional Ethics Committee. A written informed consent was taken.

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