

## Morphological study of soft palate in skeletal class I and class II patients using cone beam computed tomography

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### Abstract

**Aim:** To investigate the association between various morphological types of soft palate and skeletal Class I and Class II malocclusions using cone beam computed tomography.

**Materials and Method:** Pre-treatment CBCT of the 80 patients are taken, they are categorized into two groups: Skeletal Class I (ANB 0°–4°), Skeletal Class II (ANB > 4°). The Morphological variants of soft palate were assessed and were allotted to one of the six patterns described by You et al using NNT software.

**Results:** Comparison between the type of malocclusion and the frequency of shapes of soft Palate revealed that Type I (leaf-shaped) soft palate (40%), was observed more significantly (P < 0.05) among Skeletal Class I malocclusion, Type II (rat tail shaped) soft palate (67.5%), was most frequently found in Skeletal Class II malocclusion.

**Conclusion:** Type 2 Rat tail shaped soft palate is the most common shape of soft palate. There is a significant correlation between the variants of soft palate and the type of Skeletal Malocclusion.

**Keywords:** Soft Palate, CBCT, Skeletal Malocclusion

### 1. Introduction

The soft palate is a mobile flap suspended from the posterior border of the hard palate, sloping down and back between the oral and nasal parts of the pharynx. It is a thick fold of mucosa enclosing an aponeurosis, muscular tissue, vessels, nerves, lymphoid tissue, and mucus glands [1]. It participates in most of the oral functions, especially velopharyngeal closure which is related to the normal functions of sucking, swallowing, blowing, and pronunciation. Soft palate dysfunctions are frequently seen in cleft lip and palate patients, enlarged adenoids, obstructive sleep apnea syndrome (OSAS), snoring, poorly retained maxillary denture, and skeletal craniofacial malocclusion [2-4]. The palate is formed by the fusion of three components, namely, two palatal processes and the primitive palate, which is formed by the frontonasal process. The intramembranous ossification occurs in the mesoderm of palate to form the hard palate, whereas the soft palate is formed in the posterior region where the ossification does not occur [3]. Often the normal anatomy and any other anomaly of soft palate help in diagnosis and successful treatment of many intricate Cases.

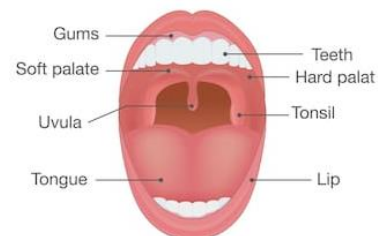


Fig 1

Numerous studies have been done in the past toward the dimensional analysis of soft palate and its surrounding structures, but little attention has been paid toward the morphological variants of soft palate. The soft palate can be studied on lateral cephalogram and sagittal section of Cone beam computed tomography (CBCT). CBCT permits a good assessment of the soft tissue elements that define the soft palate. The existing literature reveals numerous studies on soft palate using lateral cephalogram but only one study till date using CBCT. However, the skeletal malocclusion was not considered despite that the shape of soft palate depends on the jaw and posterior teeth positioning. The present study was designed to evaluate the morphology of soft palate through computed tomography in skeletal Class I and Class II malocclusion.

### Materials and Method

A sample of 80 patients clinically diagnosed with Skeletal

Class I and Class II malocclusion are taken. The pre-treatment CBCT will be taken.

**Inclusion criteria**

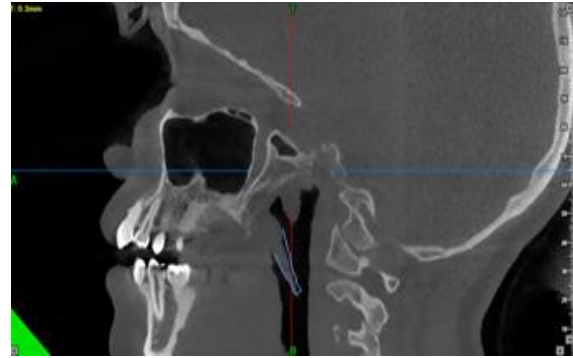
- Patients with skeletal Class I and Class II malocclusion.
- Acceptable quality of CBCT head scans.
- Age Group -15 to 30 years.

**Exclusion criteria**

- Individuals with cleft lip and palate
- A history of chronic mouth breathing or snoring
- A history of tonsillectomy or adenoidectomy.

**Methodology**

- 80 patients will be selected in this study and based on sagittal skeletal pattern, they were categorized into two groups: skeletal Class I (ANB 0°–4°), skeletal Class II (ANB >4°)
- The pre treatment CBCT of the patient will be obtained with natural head posture and maximal dental intercuspatation.
- The CBCT is taken using new tom machine.
- The exposure parameters included tube voltage of 110 KVP, tube current of 5 mA.
- The data obtained will be taken as digital imaging and communication in medicine (DICOM) format files.
- The DICOM files were reconstructed using NNT software.
- The morphological variants of soft palate were assessed and were allotted to one of the six patterns (Figure 1) described by You et al [5].



**Fig 2:** CBCT image

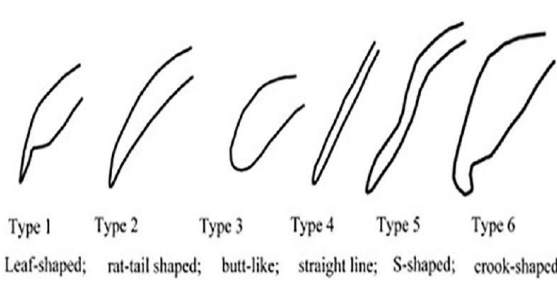
**Statistical Analysis**

All the collected data were analyzed using the SPSS Statistics 16.0. A cross-tab was composed by dividing the individuals based on (1) the type of skeletal malocclusion and (2) the morphology of soft palate. Chi –square test was used to evaluate the relationship among the variables in the cross-tab.

**Results**

The Cone Beam Computed Tomography were divided into two categories: skeletal Class I malocclusion, and Class II malocclusion. Of all the types of soft palates in the sample, rat tail shaped soft palate constituted around (50) % followed by leaf shaped (25%). Only 1% had S-shaped soft palate while butt-shaped, straight and crook shaped were around 6.25%, and 11.25%, respectively. Comparison between the type of malocclusion and the frequency of shapes of soft palate revealed that Type I (leaf- shaped) soft palate (40%), was observed more significantly (P<0.05) among skeletal Class I malocclusion, Type II, (rat tail shaped) soft palate (67.5%), was most frequently found in skeletal Class II malocclusion (Table 1).

TYPE	SHAPE	
I	leaf shaped	lanceolate shaped in which the middle portion of soft palate elevated to both naso and oro side
II	Rat tail shaped	when soft palate anterior portion is bulged and free margin has coarction
III	Butt like	shows shorter and flatter appearance and width has no distinct demarcation from anterior portion to free margin
IV	Straight line shaped	soft palate shows straight line
V	S-shaped	distortion of soft palate showing S shape
VI	Crook shaped	crook appearance revealed crook appearance in which posterior portion crook shaped anterosuperiorly



**Fig 1:** Morphological variants of soft palate described by You et al

**Table 1:** Distribution of SOFT Palate in Skeletal Class I and Class II Malocclusion

Type of Soft Palate	Malocclusion		Total	Frequency (%)	x <sup>2</sup> value	P value
	Class I	Class II				
Leaf Shaped	40 (16)	10 (4)	20	25	14.5	0.013*
Rat Tail Shaped	32.5 (13)	67.5 (27)	40	50		
Butt Shaped	7.5 (3)	5 (2)	5	6.25		
Straight Line Shaped	5 (2)	7.5 (3)	5	6.25		
S Shaped	0	2.5 (1)	1	1.25		
Crook Shaped	15 (6)	7.5 (3)	9	11.25		
Total	40	40	80	100		

Level of significance at P<0.05; %- Percentage \*Statistically significant

**Discussion**

In the present study, Type 2, that is rat tail type was the most frequent velar morphology, which was in accordance with Samdani [6], Agrawal et al [7] and Praveen et al [13]. But You et al [5] and Kumar et al [10] in their studies on lateral cephalogram found leaf shape soft palate as the most commonest. Bhambri et al [8] in his study found that patients with skeletal Class I malocclusion were most frequently found to be associated with leaf- like morphology of soft palate and Class II with rat tail- shaped soft palate. In a previous study conducted by Samdani [6] and Subramaniam [9] in dental malocclusions’ sample, Leaf shape was found to

be the most frequent to be the most frequent in Class I and rat tail type in Class II malocclusions. Study done by Pepin et al <sup>[14]</sup>, showed S-shaped morphology of velum indicated the highest risk for obstructive sleep apnea. Hook-shaped soft palate contributes an abrupt and major reduction in the oropharyngeal dimension. In the present study, only one subject has S-shaped. The results of this study demonstrated variable radiographic appearances of the soft palate using CBCT in different skeletal malocclusions. The soft palate dimensions and their functional relationships with the surrounding structures should be examined in the diagnosis and treatment planning of various skeletal problems in order to avoid post treatment speech problems.

Therefore, treatment planning involving an increase in pharyngeal space should be considered. Clinicians should be vigilant when using orthopedic or surgical methods that may involve maxillary advancement.

**Conclusion**

Type 2 Rat tail shaped soft palate is the most common shape of soft palate. There is a significant correlation between the variants of soft palate and the type of skeletal malocclusion.

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