Research Article

Morphological Diversity of Soft Palate in Nepalese Population: A Retrospective Cephalometric Study

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ABSTRACT

Introduction: Soft palate is a fibromuscular portion constituting the back of roof of the mouth which is essential for phonation, deglutition, respiration and velopharyngeal competence.

Objective: To study various morphologies of soft palate, difference in proportion of each type and their differencesamong gender and agegroups in Nepalese sample.

Materials & Method: Aretrospective study was conducted on patients seeking orthodontic treatment. 263 lateral cephalograms were classified on the basis of radiographic appearance. Analysis was done using SPSS (version 20.0). Pearson chi square and descriptive statistics were performed and level of significance was set at $p<0.05$.

Result: In the order of occurrence; rat tail type of soft palate was most prevalent followed by leaf type, butt type, straightline, crooked type and S shaped. There was no significant difference between male and female subjects (p=0.338) and through age groups (p=0.998).

Conclusion: The study highlights various types of soft palate present in Nepalese sample which will help as a reference for research pertaining to cleft palate/ velopharyngeal closure and in obstructive sleep apnoea syndrome in Nepalese population.

Key-words: digital lateral cephalometry, morphology, soft palate

INTRODUCTION

The oral cavity has various functions including respiratory, nutritional and communicative. The palate is the roof of the mouth and comprises of an anterior bony hard palate and posterior muscular portion. Soft palate is a fibromuscular portion constituting the back of roof of the mouth and does not contain bone. The hard and soft palate are easily palpable and identified by change in colour.[1] Soft palate plays an important role in phonation, deglutition, respiration and velo-pharyngeal competence.[2] The palate is formed by the fusion two palatal processes and fronto-nasal process. In later stage, the mesoderm in the palate undergoes intra-membranous ossification to form the hard palate whereas the posterior part doesnot undergo ossification and remains as soft tissue.[3-5]

Theanatomy of the soft palate plays animportant role in velopharyngeal closure which is a sphincteric mechanism constituting of velar and pharyngeal components. The movement separates the oral cavity from nasal cavity during deglutition and speech. When the velum and lateral and posterior pharyngeal walls fails to separate two cavities, velopharyngeal incompetence (VPI) occurs. It participates in many oral functions especially velopharyngeal closure which is related to normal function of sucking, swallowing, and pronunciation.[6] This incompetency can result into many malfunctions especially Obstructive Sleep Apnoea (OSA).

You M *et al* documented the variation in normal velar morphology and classified them into six different categories;[7] which have been employed in the present study. 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 in Nepalese sample.

MATERIALS AND METHOD

The retrospective study was conducted from July 2016 to February 2017. A total of 263 lateral cephalograms were collected randomly from patients who had visited Department of Orthodontics and Department of Oral

Medicine & Radiology, Dhulikhel Hospital. Patients seeking orthodontic treatment for malocclusion without any speech abnormality orany other syndromes or diseases within the age rangeof 18 to 40 years were included in the study. Among them 92 weremale and 171 were female. Participants with head & neck anomalies, intra-osseous pathologies, history of trauma or any surgery, images with positioning errors, magnification or distortion were excluded from the study. The examination and classification ofsoft palate on lateral cephalograms was done bya single trained examiner. The panoramic X Ray unit used was Planmeca ProMax, Finland with the tube potential 80-84 kV, tube current 16 mA, and exposure time 2 sec.

In this study, soft palate was classified according to You M *et al*. On the basis of radiographic appearances; categorization ofsoft palate was done into following six types[7] (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.

Pearson chi square test was used to compare the groups and descriptive statistics was portrayed for frequency distribution. Level of significance was set at $p<0.05$. All Analyses were done using SPSS (version 20.0).
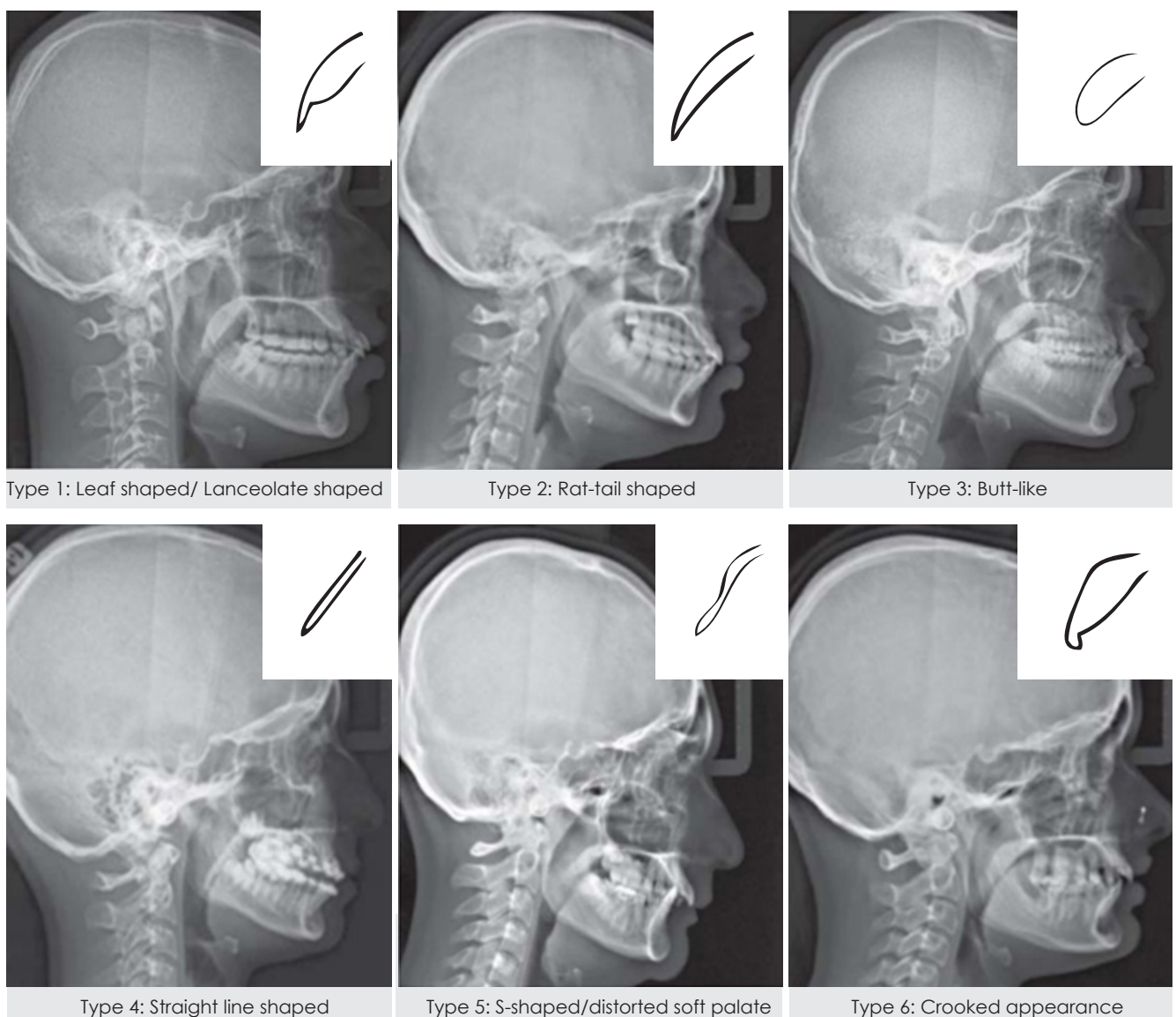

Type 1: Leaf shaped/ Lanceolate shaped

Type 2: Rat-tail shaped

Type 3: Butt-like

Type 4: Straight line shaped

Type 5: S-shaped/distorted soft palate

Type 6: Crooked appearance

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

RESULT

In the present study, the age group of patient ranged from 18-40 years with the mean age of 27.70 years. Among various types of soft palate, maximum number of participants had rat tail type of soft palate (35.0%),followed by leaf type (20.2%), butt type (14.4%) and straight line (13.7%), crooked type (10.3%) and S shaped (6.5%) (Table 1).

The gender comparison showed almost equal proportion of male and female in each type of soft palate with no significant difference between the groups (*p*=0.338) (Table 2).

The age-wise comparison (<20 years, 21-30 years and 31-40 years) showed almost equal proportions in each type of soft palate with no significant differences among the groups (*p*=0.988) (Table 3).

DISCUSSION

The lateral cephalogram is the most common diagnostic radiograph used in clinical orthodontics. Cephalometric analysis is a commonly accepted technique for the evaluationof soft palate in both normal individuals and in cleft palate and Obstructive sleep apnea (OSA) cases. It is used because of its easy availability and cost effectiveness. The morphology of soft tissues like soft palate can be clearly observed on lateral cephalogram.[8]

The diagnosis of a plethora of neurologic, inflammatory, and neoplastic disorders of the adult soft palate can be assessed by radiographic methods. The dimensional analysis of the soft palate and it surrounding structures (velar length and width) has been studied extensively in the past; but the types of velar morphology which is the most obvious reason of the different dimensions on the

Table 1: Distribution of various types of soft palate

Types of soft palate	Frequency (n)	Percent (%)
Rat tail	92	35.0
Leaf	53	20.2
Butt type	38	14.4
Straight line	36	13.7
Crooked	27	10.3
S shaped	17	6.5
Total	263	100.0

Table 2: Comparison of type of soft palate with gender

Gender		Type of Soft palate						Total	p-Value (2 sided)
		Leaf	Rat tail	Butt type	Straight line	S shaped	Crooked		
Male	N	20	27	11	14	6	14	92	0.338 (NS)
	%	21.7%	29.3%	12.0%	15.2%	6.5%	15.2%	100.0%	
Female	N	33	65	27	22	11	13	171	
	%	19.3%	38.0%	15.8%	12.9%	6.4%	7.6%	100.0%	
Total	N	53	92	38	36	17	27	263	
	%	20.2%	35.0%	14.4%	13.7%	6.5%	10.3%	100.0%	

Table 3: Comparison of type of soft palate with age group

Gender		Type of Soft palate						Total	p-Value (2 sided)
		Leaf	Rat tail	Butt type	Straight line	S shaped	Crooked		
>20 yrs	N	10	21	9	9	5	5	59	0.988 (NS)
	%	16.9%	35.6%	15.3%	15.3%	8.5%	8.5%	100.0%	
21-30 yrs	N	22	34	15	12	7	9	99	
	%	22.2%	34.3%	15.2%	12.1%	7.1%	9.1%	100.0%	
31-40 yrs	N	21	37	14	15	5	13	105	
	%	20.0%	35.2%	13.3%	14.3%	4.8%	12.4%	100.0%	
Total	N	53	92	38	36	17	27	263	
	%	20.2%	35.0%	14.4%	13.7%	6.5%	10.3%	100.0%	

NS: Not significant

soft palate has frequently been left unexplored. Even after closure of the soft tissue defect in cleft patients, normal function of the softpalate is frequently not achieved and velopharyngeal insufficiency (VPI) with hypernasal speech follows thereafter in more than 30% patients.[9-12] One of the several hypotheses proposed by Cohen *et al* suggested that; this surgically successful yet functionally compromised repair may be the difference in morphology of the soft palate and other associated structures in these patients from that of the normal subjects. Hence, presurgical evaluation of soft palate morphology aid in the success ofsurgery.[13-16]

In the present study, Type 2 rat tail shape was most frequent type (35.0%), which is similar to study done by Samdani *et al*.[17] This was followed bythe prevalence of Type 1 Leaf shaped (20.2%). However in many studies; most common type of soft palate reported was Leaf type.[18,19,4] The leaf shape which is found as second common in our study was previously described as classic velar morphology in literature. This variation could be due to the fact that most of our study cases had malocclusions requiring orthodontic treatment.

In other studies; the most common type of morphological variant of soft palate was reported to be butt-shape and S shaped.[20,21] These variations in types of soft palate could be population related trait. Probably, there are not many studies done in Nepali population that evaluate the types of soft palate.

The recurrent occlusion of the upper airways resulting from the inspiratory collapse of the pharyngeal walls during sleep results in Obstructive sleep apnea (OSA). Etiological or predisposing factors for OSA are still not clearly known. Incidence of OSA is higher in middle-aged adults. Studies have reported that the pharyngealmorphology is not completely established duringchildhood and adolescence, which changes throughout the adult life. There is a tendency towards longer and thickersoft palate and narrower oropharynx during adulthood, which may explain the possible increased incidence of OSA and related disorders occurring later in life. The S shape which was described as hooked appearance of soft palate by Pepin *et al* was found in 6.5%of our cases. They found the "hooked" appearance of soft palate in patients who were awake and this appearance of soft palate is associated with high risk of obstructive sleep apnea syndrome (OSAS).[22]

The difference among age and gender groups with different shapes of soft palate was not statistically significant in the present study, conforming to other studies as well.[19,18,23]

CONCLUSION

Soft palate is an important structure in velopharyngeal closure and provides information for diagnosis, prognosis and treatment in individuals with cleft palate and in obstructive sleep apnoea syndrome. The present study helps as a reference for research pertaining to cleft palate/ velopharyngeal closure and in obstructive sleep apnoea syndrome in Nepali population.

OJN

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