ABSTRACT

Background: Soft palate is a tissue mass that hangs behind the hard palate mainly to seal the pharyngeal airway. The length of the soft palate should be adequate to close the pharyngeal depth. Failure to completely seal leads to velopharyngeal insufficiency while longer palatal length leads to obstructive sleep apnea. This study aimed to find the need’s ratio among the general Nepalese population.

Methods: Lateral cephalograms of 591 of 17 years and above cases without any history of palatal surgery, orthodontic treatment or congenital defect were studied. The length of the soft palate, pharyngeal depth and thickness of the palatal tissue was measured using VLX computer program in lateral cephalograms obtained from gendex orthoralix 9200. The ratio of palatal length pharyngeal depth was calculated as Need’s ratio.

Results: Soft palate length was 33.27 + 7.74 and 24.82 + 4.53 respectively. The Need’s ratio calculated is 0.75. The rat tail shape of soft palate was highly prevalent 173 (28.3%) while S shape was least 51 (8.6%) . Crook type of soft palate has highest Need’s ratio.

Conclusions: The mean Need’s ratio of Nepalese population is 0.75. Need’s ratio also varies from shape of the soft palate.

INTRODUCTION

Fibromuscular structure attached posterior to the hard palate is soft palate. Soft palate, also known as velum, moves and closes pharyngeal wall for different purposes like swallowing, speech and sucking. When soft palate fails to close the pharyngeal wall, these normal activities get hampered and such condition is termed as velopharyngeal insufficiency. The length of soft palate (PL) and pharyngeal depth (PD) can be measured using lateral cephalometric and the ratio of these measurements is termed as Need’s ratio.

Need’s ratio in normal population is 0.6 to 0.7 was first shown by Subtenly. If the ratio is over 0.7 then we consider it to be the case of velopharyngeal insufficiency. Though morphological variation of soft palate has been studied in Nepalese population need’s ratio was not found.

This study aimed to find the need’s ratio among the general Nepalese population.

METHODS

This retrospective study was conducted at the Department of oral and maxillofacial Surgery, College of Medical Sciences, Chitwan, Nepal. The duration of study was 12 months from October 2021 to September 2022. The study was approved by the Ethics Committee of College of Medical Sciences, Bharatpur, Chitwan, Nepal (Ref No: COMSTH-IRC/2022-023).

Based on the previous study, and using formula \( n = Z^2 \sigma^2/e^2 \) Where \( Z = 1.96 \), \( \sigma = 0.11 \), \( e = 0.1 \% \) of 0.73 = 0.00073 (allowable error)

Correcting the sample size \( n = 295.3 \), however, in the present study 591 cephalograms were studied.

All lateral cephalometric radiographs recorded with gendex orthoralix 9200, with standard exposure factors recommended by the manufacturer was taken in the study. Principal investigators studied the radiograph of pre-treatment cases of orthodontics from 17 to 40 years with permanent dentition.
Cases with history of palatine or pharyngeal surgery, previous orthodontic treatment, any kind of extraction and patient with craniofacial abnormalities like cleft lip and palate or trauma surgery and unclear cephalogram were excluded.

Using the computer program VLX at 1.1 magnification a linear distance from the posterior nasal spine (PNS) to the tip of the uvula of the resting soft palate was measured as soft palate length (SPL) (blue line in figure 1). A linear measurement from the posterior nasal spine to the posterior pharyngeal wall along the palatal plane (yellow line in figure 1) was palatal depth (PD) while thickest section of the velum was velar width (VW) (red line in Figure 1). To avoid the biasness three recordings were done and mean was calculated in presence of two investigators. And if there was confusion among the investigators third investigator was present to clear the dispute. Need’s ratio was calculated as the ratio obtained by dividing the pharyngeal depth with length of soft palate. All the records were prepared in the MS excel. Total 1344 cases were measured. Then using randomly computer-generated number 591 cases were selected and analysed using SPSS software package for Windows version 20.0. To describe about the descriptive statistics, frequency was used. For categorical variables, percentage was used and for continuous variables, mean & S.D were used after checking the skewedness.

![Figure 1: Measurement of Soft palate length (Blue line), Palatal thickness (red line) and Pharyngeal depth (yellow line)](image)

**RESULTS**

Of 591 lateral cephalograms were included in this study out of which 219 (37.1%) were of male and 372 (62.9%) were female. The mean age of the patient in study was 22.97 + 2.86 years.

The mean length of Soft Palate and Pharyngeal depth was 33.27 + 7.74 and 24.82 + 4.53 respectively. The Need’s ratio calculated was 0.75 + 0.15 (Table 1).

**Table 1: Demographic and morphometric characteristics of participants**

<table>
<thead>
<tr>
<th>Variables</th>
<th>Mean ± SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>22.97 ± 2.87</td>
</tr>
<tr>
<td>Soft palate length</td>
<td>33.27 ± 4.74</td>
</tr>
<tr>
<td>Palate width</td>
<td>8.43 ± 2.72</td>
</tr>
<tr>
<td>Pharyngeal depth</td>
<td>24.82 ± 4.53</td>
</tr>
<tr>
<td>Need’s ratio</td>
<td>0.75 ± 0.15</td>
</tr>
</tbody>
</table>

While tracing the shape the highest percentage of soft palate shape was Rat 173(28.3) while least 51 (8.6%) prevalent was S shaped type. Crook type had highest Need’s ratio. Various shape of soft palate seen in the lateral cephalograms and their Need’s ratio is tabulate in table 2.

**Table 2: Distribution of soft palate shape**

<table>
<thead>
<tr>
<th>Measurement</th>
<th>Frequency (%)</th>
<th>Need’s ratio (Mean ± SD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Leaf</td>
<td>117 (19.8)</td>
<td>0.742 ± 0.161</td>
</tr>
<tr>
<td>Rat</td>
<td>173 (28.3)</td>
<td>0.747 ± 0.144</td>
</tr>
<tr>
<td>Butt</td>
<td>103 (17.4)</td>
<td>0.791 ± 0.158</td>
</tr>
<tr>
<td>S shaped</td>
<td>51 (8.6)</td>
<td>0.724 ± 0.096</td>
</tr>
<tr>
<td>Straight</td>
<td>77 (13.0)</td>
<td>0.693 ± 0.1.1</td>
</tr>
<tr>
<td>Crook</td>
<td>70 (11.8)</td>
<td>0.836 ± 0.175</td>
</tr>
<tr>
<td>Total</td>
<td>591(100.0)</td>
<td></td>
</tr>
</tbody>
</table>

**DISCUSSION**

Soft palate or velum is a mobile fibromuscular structure. It is broad and rectangular in shape and is seen as a small mass of soft tissue in normal cephalograms behind the hard palate. It is tissue of importance as its mobile action is responsible for separating nasopharynx and oropharynx. This partition formed by mobile velum touching the posterior pharyngeal wall performs important activities like sucking, swallowing and phonetics. Failure to completely seal marks velopharyngeal insufficiency allowing escape of air and food causing nasal regurgitation and nasal resonance.

The study conducted by Deepa V. et al. observed the length of the soft palate increases with age and they measured soft palate (27.2-36.69) mm in patient of age greater than 18 years. The length of soft palate was measured to be 38.6± 6.57 by Shigeta et al in normal individual. In our study the length of the soft palate is 33.26 mm (21.97- 43.60) . Though the finding is within the limits of the studies but variations might be because of age, gender and built of the patient. Since, mobile soft palate closes the posterior pharyngeal wall elongated soft palate reduces the chances of insufficiency. However elongated palate blocks the airway during sleep, causing individual to snore. Blockage of airway causes apnea causing disturbance is night sleep resulting in day time solinance and other cardiac issues which is referred as Obstructive sleep Apnea. Shigeta et al measured the soft
The average palatal width in our study is 8.43 mm ± 0.15 which is within 0.75 to 0.80 in study conducted by Simpson & Colton and Hoopes et al.18, 19 The value is calculated to be 0.6-07 by Stanley.6 Increase in 80% in Need’s ratio is one probable risk factor for velopharyngeal insufficiency decrease in Need’s ratio is common in patient having OSA. 20, 21

In our study highest Need’s ratio is 0.836 in crooked variants and lowest in Straight 0.693. The study conducted by Agrawal et al. showed the need’s ratio ranging from 0.69- 0.81 and the Need’s ratio in their study was also highest with Crooked variants. In their study lowest Need’s ratio was of leaf and S shaped i.e 0.69 while in our study it was straight followed by leaf. 17

CONCLUSION

Lateral cephalogram radiograph is commonly used, cheap radiological investigations readily available. Using this radiograph, not only the skeletal growth pattern and malocclusion but also soft palatal shape and measurement can be studied. This measurement can be beneficial sleep medicine, ENT surgeon and oral and Maxillofacial surgeon.

CONFLICT OF INTEREST: None

FINANCIAL DISCLOSURE: None

REFERENCES: