

## Comparison of Palatal Morphology in Angle's Class I and Class II Division 1

### Malocclusions

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### ABSTRACT

**Introduction:** Palatal morphology plays an important role in defining the skeletal and facial patterns of an individual. Different individual presents with different height, width, and length of the palate. Orthodontic treatment also causes change in palatal dimensions. Thus, understanding the variation in palatal morphology in various malocclusions is important.

**Objective:** To compare palatal morphology between Angle's Class I and Class II division 1 malocclusions.

**Materials and Method:** The study was done on 110 study models belonging to 38 (34.55%) male and 72 (65.45%) female comprising of 55 Class I and 55 Class II division 1 malocclusions meeting the inclusion criteria. The samples were collected from the pretreatment records of the Department of Orthodontics. Measurements of palatal height, palatal width, and palatal height index as defined by Korkhaus were done using digital Vernier caliper. Mean values of each variable were calculated and compared between the two malocclusion groups. Independent sample t-test was performed to analyse the significant difference at  $P \leq 0.05$ .

**Result:** Korkhaus Palatal Index was found to be significantly larger in Class II division 1 malocclusion  $45.06 \pm 4.94$  (%) as compared to Class I malocclusion  $42.58 \pm 3.21$  (%). This was because of the deficient transverse development of maxillary arch in Class II division 1 malocclusion in relation to palatal vault development.

**Conclusion:** Palatal morphology varies between Angle's Class I and Class II division 1 malocclusions in Nepalese adults. This variation could be an important factor in diagnosis, treatment planning, and long-term stability of the orthodontic treatment.

**Keywords:** Angle's classification of malocclusion; korkhaus index; palatal morphology.

### INTRODUCTION

Palatal morphology plays important role in defining the skeletal and facial pattern of an individual.<sup>1</sup> A balanced face with proper occlusion has an excellent relationship between its dental and osseous elements.<sup>2,3</sup> Evaluating and recognising the osseous or dental configuration of an arch is useful while planning treatment needs in any individual case. Palatal morphology can even be influenced by orthodontic treatment.<sup>4</sup> Hence, analysis of

osseous or dental arch dimensions is fundamental in orthodontic treatment planning.<sup>5</sup>

Buschang et al. (1994) found greater palatal height and narrower maxillary dental arch in subjects with Class II division 1 malocclusion compared to Class II division 2 malocclusion.<sup>6</sup> Nahidh et al. (2012) found that Class I samples had larger palatal width and palatal depth compared to Class II and Class III, while Class II samples had larger palatal length.<sup>4</sup>

There are several literatures related to arch length and arch width on Nepalese subjects,<sup>7-10</sup> however the investigations on palatal morphology (width, height and palatal index) are not readily available. Hence, the purpose of this study was to evaluate the palatal morphology in most common malocclusion groups namely Angle's Class I and Class II division 1 malocclusions in adult Nepalese samples.

## MATERIALS AND METHOD

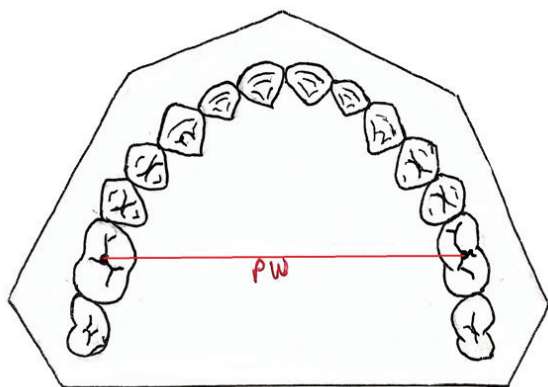
The present study is an observational, descriptive, cross-sectional study carried out on pre-treatment study models of patients who reported to Department of Orthodontics, Kantipur Dental College. The ethical approval was taken from Institutional Review Committee of the college. The study was carried out during January and February 2020.

Sampling technique was non-probability convenient sampling. Sample size was calculated in reference to the study done by Acharya et al.<sup>11</sup> using the following formula:

$$\text{Sample Size (n)} = \frac{\frac{z^2pq}{e^2}}{1 + \frac{z^2pq}{e^2 \cdot N}}$$

Where,  $z = 1.96$ ,  $p = 27.33\%$ ,<sup>11</sup>  $q = 72.67\%$ ,  $e = 0.05$ , and  $N =$  number of patients visiting the department with Angle's Class II div 1 malocclusion in a period of six months = 65.

Sample size was calculated to be 55 in each class of malocclusion. Inclusion criteria were:



**Figure 1: Palatal width (PW):** measured between left and right first molar at the point of intersection of transverse fissure with the buccal fissure.

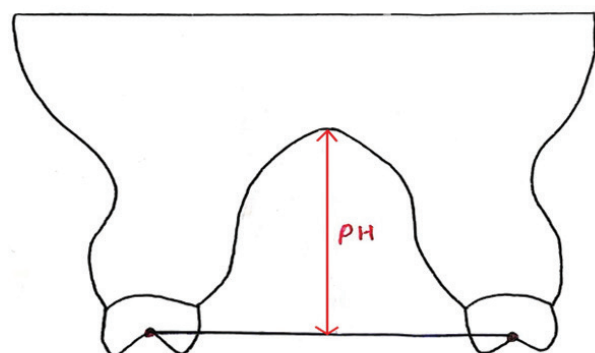
pretreatment cast with Angle's Class I or Class II div 1 malocclusion with the subjects of age group 16-30 years.<sup>12,13</sup> Poor quality study model, cases with cleft palate, missing or malformed permanent first molar were excluded. The sample consisted of study models of 38 males and 72 females.

In the present study, the palatal width was measured between left and right first molars at the point of intersection of transverse fissure with the buccal fissure using digital Vernier caliper (Measuring range: 0-150 mm; Accuracy: 0.01 mm).<sup>14</sup> The vertical distance between depth of palate and occlusal surface at first molar region was measured using metallic scale and depth rod of digital Vernier caliper. The vertical distance between depth of first molar fissure and height of palatal cusp of first molar was subtracted from this distance to obtain the palatal height as described by Korkhaus (Figure 1, 2).<sup>14</sup>

Palatal height index (PHI) was calculated as:

$$\text{PHI} = \frac{\text{PH} \times 100}{\text{PW}}$$

Intra-observer variation was checked for korkhaus palatal height index on randomly selected 22 casts (20% of sample) after seven days from the initial measurement. Kappa test showed substantial intra-observer agreement for measurements as the value was above 0.75. Statistical analysis was done using IBM SPSS Statistics for Windows, version 21 (IBM Corp., Armonk, N.Y., USA). Independent sample t-test was performed as the data was normally distributed as checked by Shapiro-Wilk test. Statistical level of significance was set at  $P \leq 0.05$ .



**Figure 2: Palatal height (PH):** measured as the distance of the perpendicular line from the connecting line between midpoints of the fissures of upper first molars to the surface of the palate.

**Table 1: Comparison of palatal dimensions between the gender groups.**

Parameter	Gender	N	Mean±SD	P value
Palatal Width (mm)	Male	38	48.11±3.24	0.003
	Female	72	46.35±2.70	
Palatal Height (mm)	Male	38	21.29±2.06	0.005
	Female	72	20.15±1.93	
Palatal Height Index (%)	Male	38	44.34±4.22	0.368
	Female	72	43.55±4.39	

**Table 2: Comparison of palatal dimensions between two malocclusion groups.**

Parameter	Malocclusion	N	Mean±SD	P value
Palatal Width (mm)	Class I	55	48.24±2.49	<0.001
	Class II div 1	55	45.68±2.94	
Palatal Height (mm)	Class I	55	20.53±1.79	0.977
	Class II div 1	55	20.55±2.28	
Palatal Height Index (%)	Class I	55	42.59±3.21	0.002
	Class II div 1	55	45.06±4.94	

## RESULT

Table 1 shows the comparison of palatal width, height and palatal height index between the gender groups and Table 2 shows the comparison between Angle's Class I and Class II division 1 malocclusions.

The mean values of palatal width in male and female were 48.11 mm and 46.35 mm respectively and the mean values of palatal height in male and female were 21.29 mm and 20.15 mm respectively; the differences were statistically significant. Palatal height index in male and female were 44.34 (%) and 43.55 (%) respectively; the difference was not significant.

Mean values of palatal width in Class I and Class II division 1 malocclusion were 48.24±2.49 mm and 45.68±2.94 mm respectively; the difference was statistically significant. Mean values of palatal height in Class I and Class II division 1 malocclusions were 20.53±1.79 mm and 20.55±2.28 mm respectively; the difference was not significant. Palatal height index in Class I and Class II division 1 malocclusions were 42.59±3.21 (%) and 45.06±4.94 (%), respectively; the difference was significant.

## DISCUSSION

In the present study, palatal width was found to be greater in male compared to female with a significant difference. Similarly, palatal width was lesser in Class II division 1 compared to Class I

with a significant difference. These findings are in accordance with the study of Buschang et al.,<sup>6</sup> Patel et al.<sup>15</sup> and Islam et al.<sup>16</sup> This result can be explained by the fact that the aetiology of Class II malocclusion is related to mandibular retrognathism, maxillary prognathism or the combination.<sup>17,18</sup> Nasal obstruction, lower tongue position, finger sucking, tongue thrusting, abnormal sucking or swallowing habits are also considered to be the reason for narrow arch in Class II division 1 malocclusion.<sup>15</sup>

Palatal height was lesser in female compared to male with a significant difference. Palatal height was lesser in Class II division 1 malocclusion with no significant difference. These findings were in accordance with the study done by Nahidh et al.<sup>4</sup> Many factors like heredity, growth, eruption pattern, teeth inclination, external environmental influence and ethnicity affect size of the dental arches.<sup>19</sup> Assessment of arch dimensions is significant in diagnosis and treatment planning, and predicting the treatment outcome. Hence, it is essential for an orthodontist to be acquainted with usual growth and development of the dentition and dental arch.<sup>15</sup>

In the present study, the palatal height index was 42.58±3.21 (%) in Class I and 45.06±4.94 (%) in Class II division 1 malocclusion. The average index value for Caucasian is 42 (%).<sup>14</sup> The present value for Class I malocclusion is in accordance with the Caucasian norms. Palatal height index is increased in Class II division 1 malocclusion due to the diminished transverse arch development with respect to the palatal height (Table 2). A study on

Iranian population found the average value of palatal height index to be 36.44 (%).<sup>5</sup> This difference in the value could be because of the variation in reference points, methodology, and race.

## CONCLUSION

Palatal width in Nepalese adults is significantly narrower in Class II division 1 malocclusion when compared to Class I malocclusion. Similarly, palatal width is lesser in female than the male samples. Palatal height is lesser in Class II division 1 malocclusion compared to Class I malocclusion but the difference is not statistically significant. Palatal height index as defined by Korkhaus was found to be significantly greater in Class II division 1 malocclusion compared to Class I malocclusion. Palatal morphology should be considered in

diagnosis and treatment planning of different malocclusions as it can affect the treatment outcome and its stability.

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**Conflict of Interest:** None.

JNDA

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