

# An Analysis of Malocclusion and Occlusal Characteristics in Nepalese Orthodontic Patients

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## ABSTRACT

**Objective:** To analyze the prevalence of malocclusion and occlusal characteristics in referred Nepalese orthodontic patients with respect to age, gender, Angle's classification.

**Materials & Method:** Study models of 464 orthodontic patients (165 male and 299 female) of the age ranging from 11 to 30 years were studied to evaluate the prevalence of malocclusion using Angle's classification and occlusal characteristics of overjet, overbite, open bite, cross bite, displacement, and hypodontia according to the method of Dental Health Component of Index of Orthodontic Treatment Need. The association between DHC grades and Angle's classification and gender were assessed using chi-square test ( $p < 0.01$ ).

**Result:** The malocclusion status among the Nepalese seeking orthodontic treatment was 54.7% Class I, 36.9% Class II, and 8.4% Class III. The occurrence of occlusal discrepancies were overjet in 43.8%, increased overbite in 20.7%, open bite in 8.2%, cross bite in 23.3%, displacement in 65.7% and hypodontia in 11.3%.

**Conclusion:** 16.2% required no/little treatment need, 20.4% required borderline treatment need, and 63.4% required great/severe treatment need according to DHC scale. There was statistically significant association between DHC grades and distribution of malocclusion and gender of the Nepalese subjects.

**Key words:** Angle's classification, dental health component, malocclusion, orthodontic patients

## INTRODUCTION

Facial esthetics and perfect smile are important determinants for individual's self-esteem and social acceptance. World Health Organization defines health as "a state of complete physical, mental and social well-being and not merely the absence of disease or infirmity". Consequently, a person cannot be considered completely healthy if malocclusion prevents him/her from attaining this state of complete well-being, whether for physical (functional impairment) or psycho-social (serious impairment of self-esteem or dentofacial esthetics) reasons. In fact malocclusion is not an illness but an occlusal condition that lies within the boundaries of all possible occlusal discrepancies.

In recent years, much attention has been focused on assessment and measurement of severity and

prevalence of malocclusion. Several epidemiological studies use indices or clinical assessment methods to assess prevalence and occlusal characteristics of malocclusions among the population with respect to age, gender, ethnic groups etc. Some authors measured single/multiple occlusal traits<sup>1,2,3</sup> and others studied malocclusion using Angle's classification system.<sup>4</sup> Consequently, orthodontic indices such as Dental Aesthetic Index,<sup>5</sup> Treatment Priority Index,<sup>6</sup> Index of Complexity Outcome and Need,<sup>7</sup> and Index of Orthodontic Treatment Need (IOTN)<sup>8</sup> were introduced.

IOTN was first developed in Britain as a system for grading malocclusion. The IOTN is based on Dental Health Component (DHC) and Aesthetic Component (AC).<sup>8,9</sup> Lunn *et al*<sup>10</sup> made IOTN easier to use by reducing the DHC grades from five to three scales. Burden *et al*<sup>11</sup> further proposed a modification specifically

for epidemiological studies to reduce the number of grades to two. They used the acronym MOCDO (Missing teeth, Overjet, Cross bite, Displacement of contact points, Over bite) to speed up the process and to select the patients that need treatment.

The objective of the present study was to analyze the prevalence of malocclusion and occlusal characteristics such as overjet, overbite, open bite, cross bite, displacement, and hypodontia in referred Nepalese orthodontic patients with respect to age, gender and Angle's classification.

## MATERIALS AND METHOD

A total of 464 patients with 165 male and 299 female of the age ranging from 11 to 30 years were included in the study. The study was conducted among the patients of Department of Orthodontics, Kantipur Dental College Teaching Hospital & Research Center (KDCH), Kathmandu who were seeking orthodontic treatment during May 2008 to May 2013. The subjects were evaluated using dental stone study models from the patient record. The study models were examined and graded by a specialist orthodontist; the co-author of the present study.

The study analyzed the prevalence of malocclusion using Angle's classification and occlusal characteristics like overjet, overbite, open bite, cross bite, displacement, and hypodontia among the patients. These occlusal traits are measurable clinical characteristics which help to assess malocclusion and are used by Dental Health Component of IOTN. All statistical analyses were performed by using SPSS 16.0 version. Descriptive statistics were calculated for the prevalence of malocclusion, occlusal characteristics and DHC grades. The association between DHC grades and Angle's classification of malocclusion, and gender were assessed using chi-square test ( $p < 0.01$ ).

### Variables used in the study:

**Molar relationship:** The relationship between upper and lower first permanent molars were used to determine Angle's Class I, Class II or Class III malocclusions.

**Overjet:** Values between 0 to 3 mm were considered normal. Increased overjet greater than 3.5 mm but less than or equal to 6 mm with competent lips was

coded as '2a'. Increased overjet greater than 3.5 mm but less than or equal to 6 mm with incompetent lips was coded as '3a'. Increased overjet greater than 6 mm but less than or equal to 9 mm was coded as '4a' and increased overjet greater than 9 mm was coded as '5a'. The categories '2a' and '3a' were combined as the lip competency could not be evaluated from the study model.

**Overbite:** Values between 0 to 3 mm were considered normal. Increased overbite greater than or equal to 3.5 mm without gingival contact were coded as '2f'. Complete overbite without gingival or palatal trauma was coded as '3f' and increased or complete overbite with gingival or palatal trauma was coded as '4f'.

**Anterior/Posterior cross bite:** Anterior or posterior cross bite was diagnosed when there was a crossover of at least one tooth in the anterior or posterior region of the dental arch. Cross bite with less than or equal to 1 mm discrepancy between retruded contact position and intercuspal position was coded as '2c'. Cross bite with greater than 1 mm but less than or equal to 2 mm discrepancy was coded as '3c'. Cross bite with greater than 2 mm discrepancy was coded as '4c'.

**Displacement:** Displacement is the distance between the natural contact points of the adjacent teeth; which is not a measure of crowding. Displacement of teeth greater than 1 mm but less than or equal to 2 mm was coded as '2d'. Displacement greater than 2 mm but less than or equal to 4 mm was coded as '3d'. Severe displacements of teeth greater than 4 mm were coded as '4d'.

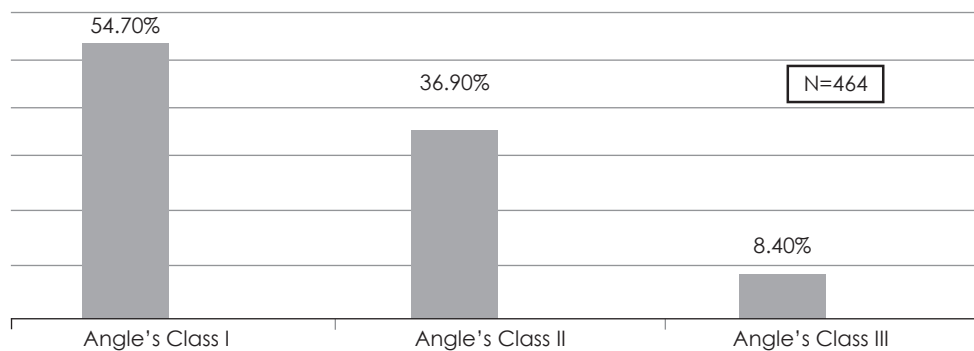
**Open bite:** Anterior or posterior/lateral open bite greater than 1 mm but less than or equal to 2 mm was coded as '2e'. Open bite greater than 2 mm but less than or equal to 4 mm was coded as '3e'. Extreme anterior or lateral open bite greater than 4 mm was coded as '4e'.

**Hypodontia (Missing):** Less extensive hypodontia requiring pre-restorative orthodontics or orthodontic space closure to obviate the need for prosthesis was coded as '4h'. Extensive hypodontia with restorative implications of more than one tooth missing in any quadrant requiring pre-restorative orthodontics was coded as '5h'.

## RESULT

In the present study, dental stone models of 464 subjects seeking orthodontic treatment including 165 (35.6%) male and 299 (64.4%) female were analyzed. The age of the subjects ranged from 11 to 30 years with mean age 17.32 years. Among 464 patients, 196 (42.2%) were of age group 11-15 years, 172 (37.1%) were 16-20 years, 65 (14%) were 21-25 years and 31 (6.7%) were 26-30 years of age.

According to Angle's classification; the patients' malocclusion status were 254 (54.7%) Class I, 171 (36.9%) Class II, and 39 (8.4%) Class III (Figure 1). Table 1 and Table 2 represent frequency distribution of Angle's classification according to gender and age groups respectively.



**Figure 1: Distribution of subjects according to Angle's classification of malocclusion**

**Table 1: Distribution of malocclusion according to gender**

Angle's classification	Gender		Total
	Male	Female	
Class I	80 (31.50 %)	174 (68.50 %)	254 (54.70 %)
Class II	69 (40.35 %)	102 (59.65 %)	171 (36.90 %)
Class III	16 (41.03 %)	23 (58.97 %)	39 (8.40 %)
Total	165 (35.60 %)	299 (64.40 %)	464 (100 %)

**Table 2: Distribution of malocclusion according to age group**

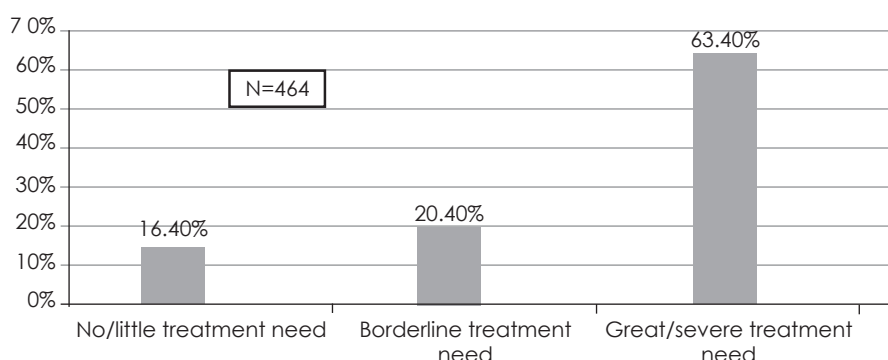
Angle's classification	Age Group				Total
	11-15 years	16-20 years	21-25 years	26-30 years	
Class I	100 (39.37 %)	95 (37.40 %)	41 (16.14 %)	18 (7.09 %)	254
Class II	75 (43.86 %)	70 (40.94 %)	18 (10.52 %)	8 (4.68 %)	171
Class III	21 (53.85 %)	7 (17.95 %)	6 (15.38 %)	5 (12.82 %)	39
Total	196 (42.2 %)	172 (37.1 %)	65 (14.0 %)	31 (6.7 %)	464

The present study showed increased overjet in 43.8% subjects with 6.9% showing overjet more than 9 mm. Similarly, increased overbite was seen 20.7% with 19.2% subjects showing complete overbite. Varying levels of open bite was found in 8.2% subjects and cross bite was found in 23.3%. Displacement was found in 65.7% with 37.1% showing displacement more than 4 mm. Hypodontia was seen in 11.3% with 2.2% requiring pre-restorative orthodontic treatment for more than one tooth missing among the Nepalese seeking orthodontic treatment (Table 3).

**Table 3: Frequency distribution of Angle's classification according to occlusal characteristics**

Malocclusion		DHC notation	Class I (N=254)	Class II (N=171)	Class III (N=39)	Total (N=464)
Overjet	Normal	-	175 (68.9 %)	47 (27.49 %)	39 (100 %)	261 (56.2%)
	≥ 3.5 mm (without gingival contact)	2f	6 (2.36 %)	1 (0.58 %)	0	7 (1.5 %)
	Complete (w/o gingival trauma)	3f	13 (5.12 %)	13 (7.60 %)	0	26 (5.6 %)
	Complete (w/ gingival trauma)	4f	19 (7.48 %)	43 (25.15 %)	1 (2.56 %)	63 (13.6 %)
Over-bite	Normal	-	231 (90.94 %)	166 (97.08 %)	29 (74.36 %)	426 (91.8 %)
	> 1 mm to ≤ 2 mm	2e	3 (1.18 %)	0	0	3 (0.6 %)
	> 2 mm to ≤ 4 mm	3e	7 (2.76 %)	0	3 (7.69 %)	10 (2.2 %)
	> 4 mm	4e	13 (5.12 %)	5 (2.92 %)	7 (17.95 %)	25 (5.4 %)
Open bite (Antr/ Postr)	Normal	-	188 (74.02 %)	153 (89.47 %)	15 (38.46 %)	356 (76.7 %)
	≤ 1 mm	2c	6 (2.36 %)	0	1 (2.56 %)	7 (1.5 %)
	1 mm to ≤ 2mm	3c	19 (7.48 %)	4 (2.34 %)	9 (23.08 %)	32 (6.9 %)
	> 2mm	4c	41 (16.14 %)	14 (8.14 %)	14 (35.90 %)	69 (14.9 %)
Cross bite (Antr/ Postr)	Normal	-	188 (74.02 %)	153 (89.47 %)	15 (38.46 %)	356 (76.7 %)
	≤ 1 mm	2c	6 (2.36 %)	0	1 (2.56 %)	7 (1.5 %)
	1 mm to ≤ 2mm	3c	19 (7.48 %)	4 (2.34 %)	9 (23.08 %)	32 (6.9 %)
	> 2mm	4c	41 (16.14 %)	14 (8.14 %)	14 (35.90 %)	69 (14.9 %)
Dis-plac-ement	Normal	-	88 (34.65 %)	53 (30.99 %)	18 (46.15 %)	159 (34.3 %)
	> 1 mm to ≤ 2 mm	2d	47 (18.50%)	6 (3.51%)	0	53 (11.4 %)
	> 2 mm to ≤ 4 mm	3d	42 (16.54 %)	30 (17.54 %)	8 (20.52 %)	80 (17.2 %)
	> 4 mm	4d	77 (30.31 %)	82 (47.95 %)	13 (33.33 %)	172 (37.1 %)
Hypo-dontia	Normal	-	222 (87.40 %)	153 (89.47 %)	37 (94.88 %)	412 (88.8 %)
	Less extensive	4h	27 (10.63 %)	14 (8.19 %)	1 (2.56 %)	42 (9.1 %)
	Extensive	5h	5 (1.97 %)	4 (2.34 %)	1 (2.56 %)	10 (2.2 %)

Among 464 patients examined; the distribution of DHC scale was 75 (16.2%) for no/little treatment need, 95 (20.4%) for borderline treatment need, and 294 (63.4%) for great/severe treatment need (Figure 2).



**Figure 2: Distribution of Dental Health Component**

The study depicted statistically significant association between DHC grades and distribution of malocclusion according to Angle's classification and gender groups among Nepalese orthodontic patients ( $p < 0.01$ ) (Table 4, 5).

**Table 4: Frequency distribution and test of association between DHC grade and Gender**

Gender	DHC grade			Total	p-value
	No/little treatment need	Borderline treatment need	Great/severe treatment need		
Male	15 (9.09%)	31 (18.79%)	119 (72.12%)	165	0.003*
Female	60 (20.41%)	64 (21.77%)	175 (59.52%)	294	
<b>Total</b>	<b>75 (16.2 %)</b>	<b>95 (20.4 %)</b>	<b>294 (63.4 %)</b>	<b>464</b>	

**Table 5: Frequency distribution and test of association between DHC grade and malocclusion**

Angle's classification of malocclusion	DHC grade			Total	p-value
	No/little treatment need	Borderline treatment need	Great/severe treatment need		
Class I	68 (26.77 %)	52 (20.47 %)	134 (52.76 %)	254	0.000*
Class II	6 (3.51 %)	31 (18.13 %)	134 (78.36 %)	171	
Class III	1 (2.56 %)	12 (30.78 %)	26 (66.66 %)	39	
<b>Total</b>	<b>75 (16.2 %)</b>	<b>95 (20.4 %)</b>	<b>294 (63.4 %)</b>	<b>464</b>	

$p < 0.01$  \*Statistically significant

## DISCUSSION

Various malocclusion features have been found to vary with different population, age, gender and ethnicity. The result of our study showed the prevalence of 54.7 % Class I, 36.9 % Class II, 8.4 % Class III malocclusion among referred Nepalese orthodontic patients. These findings serve as reference data for the epidemiology of malocclusion. Table 6 illustrates the malocclusion data of various studies on Nepalese population.

**Table 6: Malocclusion data of Nepalese population**

Study Population	Angle's Class I	Angle's Class II	Angle's Class III
Wada T, Shrestha RM <i>et al</i> <sup>12</sup> (1999) N= 1027 (urban, sub-urban samples of Kathmandu valley)	89%	7.6%	3.4%
Bhattarai P & Shrestha RM <sup>13</sup> (2008) N= 200 (Referred orthodontic patients of Kathmandu)	54.5 %	37.5 %	8 %
Sharma JN <sup>14</sup> (2009) N=134 (Dental students of Dharan)	72.38%	19.40%	5.97%
Shrestha BK, Yadav R <i>et al</i> <sup>15</sup> (2011) N=93 (Medical students of Kathmandu)	44.09 %	30.1 %	16.12 %
Shrestha BK, Yadav R <i>et al</i> <sup>16</sup> (2012) N=937 (School children of Kathmandu valley)	59 %	25 %	16 %
Shrestha S & Shrestha RM (2013) N=464 (Referred orthodontic patients of Kathmandu)	54.7 %	36.9 %	8.4 %

The present study found that 63.4% of the Nepalese orthodontic patients require great or severe treatment need according DHC. However, another study on Nepalese samples from Dharan showed the great or severe treatment need as 11.94%.<sup>14</sup>

The normal occlusal characteristics in Nepalese subjects were 56.2% normal overjet, 79.3% normal overbite, 91.8% without open bite, 76.7% without cross bite, 34.3% without displacement and 88.8% without hypodontia problems.

When the occlusal characteristics of Nepalese subjects were compared with the similar samples of Pakistani population;<sup>17</sup> severe form of overjet was present in 30.8% in Pakistanis, 6.9% in Nepalese. Open bite was present in 2.6% in Pakistani, 8.2% in Nepalese, cross bite was present in 22.4% in Pakistanis and 23.3% in Nepalese.

The occurrence of increased overjet in Nepalese subjects was 44.2% and similar study on Nigerian subjects<sup>18</sup> showed similar results with 43% overjet. Similar study on female Saudi population seeking orthodontic treatment showed 76% moderate and 73% severe overjet in adolescents, and 24% moderate and 26.3% severe overjet in adults.<sup>19</sup>

According to the present study; increased overbite was present in 20.7% whereas Nigerian subjects<sup>18</sup> had 25.2%. Albarakari *et al*<sup>19</sup> showed 78.2% moderate and 87.5% severe increased overbite in adolescent Saudi females. Souames *et al*<sup>20</sup> showed increased overbite in 15%, increased overbite with gingival contact in 45% and increased overbite with indentation of labial and palatal gingival in 10% in French samples.

The anterior or posterior cross bite in Nepalese subjects were 23.3%, however the prevalence rate

was reversed in Albarakari *et al*<sup>19</sup> with 60.5% unilateral and 74% bilateral cross bite in Saudi female subjects. In Iranian 12 years-old children 14.2% had occurrence of crossbite.<sup>21</sup> Ajayi *et al*<sup>18</sup> showed 21.4% anterior and 12.2% posterior cross bite in Nigerian subjects.

In the present study 8% Nepalese subjects and 8.4% in Nigerian subjects<sup>18</sup> had open bite ranging from 1 to 4 mm; contrarily the prevalence of open bite was higher in Saudi females having 46.7% and 53.3% in adolescent and adults respectively.<sup>19</sup> Similarly, 0.7% Iranian 12 years-old children had openbite.<sup>21</sup>

## CONCLUSION

Nepalese orthodontic patients showed increased overjet in 43.8% subjects with 6.9% showing severe form, increased overbite in 20.7% with 19.2% subjects showing complete overbite. Varying levels of open bite was found in 8.2% subjects and cross bite in 23.3%. Displacement was found in 65.7% with 37.1% showing displacement more than 4 mm. The study revealed that 2.2% orthodontic patients require pre-restorative orthodontic treatment for more than one tooth missing.

The study depicted statistically significant association between DHC grades and distribution of malocclusion and gender among Nepalese orthodontic patients.

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