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Comparative Study of Tweed Triangle in Angle Class II Division 1 Malocclusion between Nepalese and Chinese Students

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ABSTRACT

Introductions: The establishment of specific cephalometric norms for specific race or ethnic group has been documented in literatures. The aim of the present study was to compare the Tweed triangle for Nepalese and Chinese subjects with Angle Class II division 1 malocclusion.

Methods: The cephalometric radiographs of 52 Nepalese and 52 Chinese students age between 14 to 18 years, Class II division 1 malocclusion with Point A-Nasion-Point B angle larger than 4 degrees were analyzed for 9 parameters.

Results: Mean age of Nepalese participants was 14.28 years and that of Chinese 14.09. The comparative variables of Nepalese and Chinese population were: Y axis (61.39 and 67.52), Sella Nasion Point A angle (83.69 and 81.14), Sella Nasion Point B angle (76.87 and 74.62), Occlusal plane angle (19.0 and 23.12), Frankfort Mandibular plane angle (28.13 and 32.87) and Lower Incisior to Frankfort Horizontal plane Angle (54.77 and 48.23).

Conclusions: The Class II skeletal pattern, well positioned maxillas and retrusive mandibles were present in both samples. The Chinese showed more protruded maxilla, more buccal inclination of lower incisors and longer face than Nepalese.

Keywords: angle class II division 1, cephalometry, tweed triangle

> ### Plain Language Summary
>
> The study was done to identify the Tweed triangle for a sample of Nepalese and Chinese subjects with Angle Class II division 1 malocclusion . The study found that the both samples showed Class II skeletal pattern, well positioned maxillas and retrusive mandibles but the Chinese had more protruded maxilla, more buccal inclination of lower incisors and longer face than Nepalese. It showed the importance of ethnic role as Nepalese have distinct cephalometric features, which should be used as a reference while treating the Nepalese orthodontic patients.

INTRODUCTIONS

Angle Class II Division 1 malocclusion is characterized by a distal relation of the lower teeth to the upper. The extension of lower teeth being more than one-half the width of one cusp and the protusive maxillary incisors.[1] This can be related to a retrognathic mandible, prognathic maxilla, or a combination of both.[2,3] The most common characteristics are the retrognathic mandible, maxillary prognathism and reduce vertical skeletal jaw relationship.[4]

Tweed analysis[5] consists of the Tweed triangle formed by 'Frankfort horizontal plane, the mandibular plane and the long axis of lower incisor'. In 1954 Tweed[6] stated that "The lower incisor to Frankfort horizontal plane angle (FMIA) of 65 degree works beautifully but occasional patients require 75 degree."

The purpose of the present study was to compare tweed triangle of Nepalese and Chinese subjects with Angle Class II division 1 malocclusion.

METHODS

This cross sectional descriptive study was done in the Department of Orthodontics, B.P. Koirala Institute of Health Sciences, Nepal and the Department of Orthodontics, Dalian Medical University, China. The purposive sampling done with standardized lateral cephalometric radiographs of 52 Nepalese and 52 Chinese students with equal number of male and female in both groups (Male=26 and Female=26). Written consent was obtained from all participants after explaining the nature and purpose of the radiograph.

The inclusion criteria were natural-born ethnic Nepalese and Chinese, age 12 to 18 years. Angle class II division 1 malocclusion, A-Nasion-Point B (ANB) angle larger than 4 degrees, no craniofacial deformities, no previous orthodontic treatment or maxillofacial surgery or plastic surgery.

The descriptive analysis and independent student t-test were performed using Statistical Package for the Social Sciences (SPSS version 11.5). Results were considered to be statistically significant when p≤0.05.

Different points and angles described in figure are as follows:

A (Point A); ANB (Point A-Nasion-Point B Angle); B (Point B); FH (Frankfort Horizontal Plane); FMA (Frankfort Mandibular plane angle); FMIA (Lower incisor to Frankfort horizontal plane angle); Gn (Gnathion); IMPA (Lower incisor to mandibular plane angle); Ls (Labrale superius); MP (Mandibular plane); N (Nasion); NA (Nasion-Point A plane); NB (Nasion-Point B plane); OP (Occlusal plane); OP-SN (Occlusal Plane Angle); Or (Orbitale); Pg1 (Soft tissue pogonion); Po (Porion); S (Sella); SN (Sella-Nasion plane); SNA (Sella-Nasion-Point A Angle); SNB (Sella-Nasion - Point B Angle)
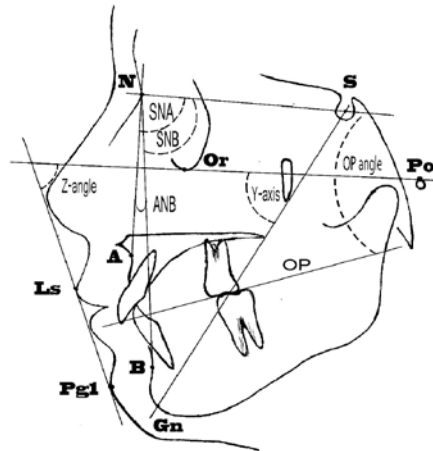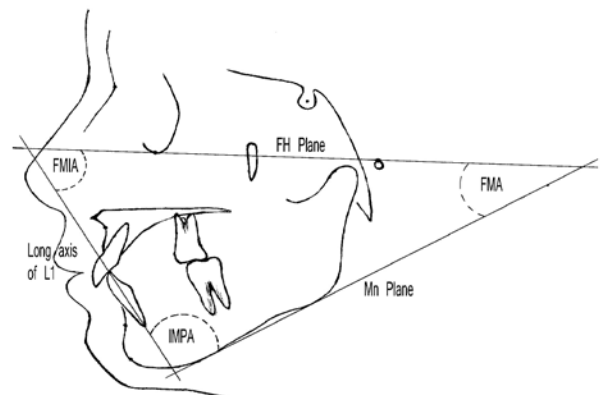

Figure 1. Points, planes and angles

Figure 2. Tweeted traingle

RESULTS

All subjects participating in the study were students. Mean age of Nepalese participants was 14.28 years and that of Chinese participants was 14.09. Craniofacial features on cephalometric parameters between Nepalese and Chinese population (Table-1) and cephalometric parameters for Nepalese and Chinese Male (Table-2) and female (Table-3) were compared. The gender difference in FMIA angle amongst Chinese population was not statistically significant. (Table 4) (Table-5).

Table 1. Comparison of mean values between Nepalese and Chinese subjects with Class II division 1 malocclusion

Variables	Nepalese (n=52)		Chinese (n=52)		t	P
	Mean	SD	Mean	SD		
Y-axis	61.39	4.866	67.52	4.336	-6.776	.000*
SNA Angle	83.69	4.820	81.14	3.637	3.043	.003*
SNB Angle	76.87	4.753	74.62	2.978	2.893	.005*
ANB Angle	6.83	2.580	6.53	1.946	.665	.507
OP-SN	19.00	7.099	23.12	4.685	-3.489	.001*
FMA	28.13	11.764	32.87	6.256	-2.560	.012*
FMIA	54.77	12.835	48.23	8.113	3.105	.002*
IMPA	99.98	11.138	98.96	6.739	.565	.574
Z Angle	61.94	5.004	63.08	6.296	-1.017	.311

Table 2. Comparison of mean values between Nepalese and Chinese Male subjects with Class II division 1 malocclusion

Variables	Nepalese Males (n=26)		Chinese Males (n=26)		t	P
	Mean	SD	Mean	SD		
Y-axis	61.13	2.830	68.85	3.728	-8.401	.000*
SNA Angle	83.88	6.049	80.94	4.208	2.036	.047*
SNB Angle	76.88	5.324	74.62	3.488	1.818	.075
ANB Angle	7.00	2.498	6.33	1.918	1.090	.281
OP-SN	20.69	8.592	24.35	4.335	-1.936	.059
FMA	29.50	14.417	35.42	6.300	-1.920	.061
FMIA	58.62	15.562	46.88	8.539	3.370	.001*
IMPA	97.65	14.727	97.73	7.805	-.024	.981
Z Angle	61.77	3.050	62.15	5.767	-.301	.765

Table 3. Comparison of mean values between Nepalese and Chinese female subjects with Class II division 1 malocclusion

Variables	Nepalese Females (n =26)		Chinese Females (n =26)		t	P
	Mean	SD	Mean	SD		
Y-axis	61.65	6.337	66.19	4.561	-2.964	.005*
SNA Angle	83.50	3.277	81.35	3.032	2.460	.017*
SNB Angle	76.85	4.211	74.62	2.434	2.338	.023*
ANB Angle	6.65	2.697	6.73	1.991	-.117	.907
OP-SN	17.31	4.798	21.88	4.778	-3.447	.001*
FMA	26.77	8.401	30.31	5.152	-1.831	.073
FMIA	50.92	7.944	49.58	7.590	.625	.535
IMPA	102.31	4.994	100.19	5.344	1.475	.147
Z Angle	62.12	6.458	64.00	6.771	-1.027	.309

Table 4. Comparison of hard and soft tissue mean values between Nepalese genders with Class II division 1 malocclusion

Variables	Nepalese Males (n =26)		Nepalese Females (n =26)		t	p
	Mean	SD	Mean	SD		
Y-axis	61.13	2.830	61.65	6.337	-.381	.704
SNA Angle	83.88	6.049	83.50	3.277	.285	.777
SNB Angle	76.88	5.324	76.85	4.211	.029	.977
ANB Angle	7.00	2.498	6.65	2.697	.480	.633
OP-SN	20.69	8.592	17.31	4.798	1.754	.086
FMA	29.50	14.417	26.77	8.401	.834	.408
FMIA	58.62	15.562	50.92	7.944	2.245	.029*
IMPA	97.65	14.727	102.31	4.994	-1.526	.133
Z Angle	61.77	3.050	62.12	6.458	-.247	.806

Table 5. Comparison of mean values between Chinese genders with Class II division 1 malocclusion

Variables	Chinese Males (n =26)		Chinese Females (n =26)		t	P
	Mean	SD	Mean	SD		
Y-axis	68.85	3.728	66.19	4.561	2.297	.026*
SNA Angle	80.94	4.208	81.35	3.032	-.397	.693
SNB Angle	74.62	3.488	74.62	2.434	.000	1.000
ANB Angle	6.33	1.918	6.73	1.991	-.745	.460
OP-SN	24.35	4.335	21.88	4.778	1.946	.057
FMA	35.42	6.300	30.31	5.152	3.205	.002*
FMIA	46.88	8.539	49.58	7.590	-1.202	.235
IMPA	97.73	7.805	100.19	5.344	-1.327	.191
Z Angle	62.15	5.767	64.00	6.771	-1.058	.295

DISCUSSIONS

We observed significant differences in cephalometric mean values of Angles Class II division 1 malocclusion of the Nepalese and Chinese subjects: Y axis (61.39 and 67.52), Sella Nasion Point A (SNA) angle (83.69 and 81.14), Sella Nasion Point B (SNB) angle (76.87 and 74.62), Occlusal plane (OP-SN) angle (19.0 and 23.12), Frankfort Mandibular plane angle (FMA) (28.13 and 32.87), Lower Incisior to Frankfort Horizontal plane Angle (FMIA) (54.77 and 48.23).

In both groups the mean value of SNA angle (Nepalese 83.69 and Chinese 81.14 degrees) for SNA angle suggests a well-positioned maxilla in relation to the cranial base like previous studies.[2,7,8] This suggests more protruded maxilla in Nepalese compared to Chinese. J.W.P. Lau and U. Hagg [9] in their study in Chinese class II division 1 found higher SNA mean value of 83.1 degree.

The SNB angles (Nepalese 76.87 and Chinese 74.62 degrees) represents retracted mandible (retrognathic) in relation to the cranial base. Similarly Freitas et al[7] from Brazil found SNB mean value of 75.39 degrees, similar to other researchers among other cranial structures.[8,10-14]

The maxillomandibular relationship determined by ANB angle showed Class II skeletal pattern, similar to the findings of ANB of 6.0 degree in Chinese class II division 1 by J.W.P. Lau and U. Hagg.[9] The decrease in the ANB angle happens with the treatment.[15]

The Y-axis mean value was significantly higher in Chinese (67.52 degree) than in Nepalese (61.39 degree). This suggests the position of Chin is more down and rear ward in relation to the upper face in Chinese when compared with Nepalese.

The occlusal plane angle was higher in both the groups (Nepalese 19.00 and Chinese 23.12 degrees), suggesting long face (Chinese having longer face than Nepalese) with skeletal open bite.

Skeletal pattern of the face is represented by FMA and is considered the most important angle of Tweed triangle.[16] The FMA mean values was significantly higher in Chinese (32.87 degrees) than Nepalese (28.13 degrees) suggests long face or vertically growing in both samples. P Bhattarai et al.[17] found FMA mean value of 28 degrees in Nepalese and P.C. Tukasan et al.[16] found FMA mean value 26.66 degree on Brazilian subjects.

The FMIA angle represents a more balanced face when maintained at 65 to 75 degree.[6] The present study showed statistically significant FMIA mean value, 54.77 degrees in Nepalese and 48.23 degrees in Chinese, which shows retrusive mandible in both samples but more in Chinese. The IMPA and Z angle values also show statistically non-significant.

Comparison between genders showed the FMIA mean values were higher in Nepalese males than Nepalese females (58.62 degree v.s. 50.92 degree) suggesting more buccal inclination of lower incisors in females. However a study conducted by Bhattarai P et al[17] shows no significant difference. The FMA mean values were 35.42 degrees in Chinese males and 30.31 degrees in Chinese females, which suggests Chinese males have longer face than Chinese females. The Y-axis mean values were 68.85 degrees in Chinese males and 66.19 degrees in Chinese females, which suggests that position of the chin is more downward and rearward relation to the upper face in Chinese males when compared with Chinese females.

Comparison between same genders of Chinese and Nepalese subjects showed statistically significant difference in Y-axis, SNA angle and FMIA between Nepalese and Chinese males. The mean value of Y-axis were larger in Chinese males (68.85 degrees) than Nepalese males (61.13 degrees) suggesting the position of the chin is more downward, rearward relation to the upper face in Chinese males. The SNA angle showed Nepalese males have high mean value (83.88 degrees) than Chinese males (80.94 degrees) which suggests more protruded maxilla in Nepalese males when compared with Chinese males. The FMIA mean value were 58.62 degrees in Nepalese males and 46.88 degrees in Chinese males, suggesting more buccal inclination of the lower incisors in Chinese males than Nepalese males.

Among female gender, there was statistically significant difference between Nepalese and Chinese females in terms of Y-axis, SNA angle, SNB angle and occlusal plane angle. The mean value of Y-axis were larger in Chinese females (66.19 degrees) than Nepalese females (61.65 degrees) suggesting the position of the chin is more downward, rearward relation to the upper face in Chinese females. The higher mean value of SNA angle in Nepalese females than Chinese females (83.50 v.s. 81.35 degrees) suggests more protruded maxilla in Nepalese females. Between Nepalese and Chinese females, the higher mean value of occlusal plane angle in Chinese females (21.88 degrees) than Nepalese females (17.31 degrees) suggests longer face in Chinese females.

CONCLUSIONS

In Chinese and Nepalese students with Tweed Triangle in Angle class II, division I malocclusion both groups showed well positioned maxilla and retrusive mandible. Maxilla was more protruded in Nepalese. The Chinese showed longer face and more buccal inclination of lower incisors. The female Nepalese showed more buccal inclination of lower incisors than male. Chinese males have longer face than females.

ACKNOWLEDGEMENTS

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