

# Horizontal Distance between WALA Ridge and Mandibular Teeth with Normal Occlusion

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## ABSTRACT

**Introduction:** Maintenance of mandibular pretreatment arch shape and size is important for long term orthodontic treatment stability. Will Andrews and Lawrence Andrews (WALA) ridge was proposed by Andrews as a clinical guide for the bucco-lingual position of mandibular teeth in the arch.

**Objective:** To determine the horizontal distance between WALA ridge and mandibular posterior teeth in individuals with normal occlusion.

**Materials and Method:** An analytical cross-sectional study was conducted from May to July 2020 at Kathmandu Medical College after getting ethical approval. The sample consisted of 130 dental casts of Nepali individuals (46 males and 84 females) with normal occlusion. WALA ridge and FA (facial axis) points of each mandibular posterior tooth except third molars were identified. FA to WALA ridge horizontal distance was determined using a modified digital Vernier caliper. Values were compared by arch side and gender using Student's t-test in SPSS software v.20..

**Result:** Values for FA to WALA horizontal distance showed statistically significant gender variation for all teeth except for the first molar. Whereas, for arch side, there were no statistically significant differences for all teeth in both males and females. The mean FA to WALA ridge distance in males was 0.6 mm for first premolars, 1.16 mm for second premolars, 1.71 mm for first molars, and 2.41 mm for second molars. In females, it was 0.4 mm for first premolars, 0.88 mm for second premolars, 1.72 mm for first molars, and 2.1 mm for second molars.

**Conclusion:** In present study, mandibular posterior teeth showed progressively increasing horizontal distance to WALA ridge from anterior to posterior.

**Keywords:** Mandibular posterior teeth; normal occlusion; WALA ridge.

## INTRODUCTION

Long term stability of tooth position after orthodontic treatment has always been a matter of concern for orthodontists. Maintaining the pretreatment arch form for better post-treatment stability has been suggested because arch shape is different for different individuals.<sup>1-3</sup> For correction of mild crowding, expansion of arch is preferred over extraction of teeth. However, it requires consideration to the basal bone width. Andrews and Andrews<sup>4</sup> have suggested to use soft tissue band immediately superior to mucogingival

junction termed as Will Andrews and Lawrence Andrews (WALA) ridge as a clinical reference for buccal position of mandibular posterior teeth. This landmark has been proven to be significantly

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correlated with tooth position in dental arch.<sup>5</sup> Cone-beam computed tomography (CBCT) study has shown that it is located vertically at or near the centre of resistance for all posterior teeth.<sup>6</sup>

Arch form is unique to individual and no single arch form can be utilised to treat all individuals.<sup>2</sup> WALA ridge horizontal norms has been provided by Andrews for white Caucasians and similar studies were done to establish norms for other populations.<sup>7-9</sup> This study aims to determine the horizontal distance between WALA ridge and the mandibular posterior teeth in individuals of Nepali nationality visiting Kathmandu Medical College, with normal occlusion.

## MATERIALS AND METHOD

An observational, analytical cross-sectional study was conducted in the Department of Orthodontics and Dentofacial Orthopaedics of Kathmandu Medical College both at Duwakot and Sinamangal Teaching Hospitals on mandibular study models of 130 Nepali individuals with natural normal occlusion. The study was conducted between May 2020 to July 2020 after getting ethical clearance from the Institutional Review Committee (Ref. 2003202004) of Kathmandu Medical College.

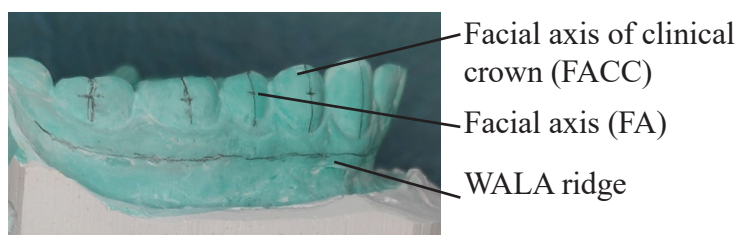
Alginate impression was made and study cast was obtained for the lower jaw of 46 (35.38%) male and 84 (64.62%) female participants aged 19 to 30 years after getting informed consent. A convenience sampling technique was used for the study. Sample size was calculated with reference to study done on Himachali population<sup>8</sup> using the formula:

$$n = \frac{Z^2_{(1-\alpha/2)} \times SD^2}{d^2} = 129.17$$

$$Z(1-\alpha/2) = 1.96$$

$$SD \text{ (standard deviation)} = 0.29$$

$$d \text{ (permissible error)} = 0.05$$



**Figure 1: FACC, FA, and WALA ridge marked on cast.**

Inclusion criteria were: Individuals of Nepali nationality, minimum of 14 years of age, Angle's Class I molar relation<sup>10</sup> bilaterally, a full complement of permanent dentition excluding third molar, well-aligned maxillary and mandibular teeth with at least four out of six keys of normal occlusion<sup>11</sup> not excluding the first key, intact mandibular permanent teeth free of caries, restoration, malformation, attrition and abrasion, no history of orthodontic treatment or trauma to jaws. Exclusion criteria were: missing, impacted, or incompletely erupted maxillary or mandibular teeth.

Facial axis of the clinical crown (FACC) and FA were marked with pencil on clinical crown of mandibular first premolar to second molar. FACC was marked at the most prominent portion of buccal surface of premolars and at mesiobuccal groove of molars. FA point was marked as midpoint of FACC. WALA ridge was drawn in the region of first premolar to second molar as shown in Figure 1.

Digital Vernier caliper was modified similar to by Kong et al.<sup>7</sup> as shown in Figure 2. Two needles of different lengths were attached to the beaks of the caliper so that the FA to WALA distance could be measured. A scale was attached on the other side of the caliper so that the measurement could be done parallel to the occlusal plane. With the help of this modified caliper, the horizontal distance between WALA ridge and FA point of mandibular first premolar, second premolar, first molar, and second molar was measured parallel to the occlusal plane (Figure 3). The measurement was done by single investigator and repeated in two weeks' interval time to check the reliability. Third measurement was done for any disagreement between the two tests. Variation of 0.02 mm or less on repeat measurements were averaged.<sup>12</sup>

Collected data were analysed in IBM SPSS Statistics for Windows, version 20 (IBM Corp., Armonk,



**Figure 2: Modification of digital Vernier caliper.**



**Figure 3: Measurement of FA to WALA distance.**

N.Y., USA). The means, standard deviations, minimum and maximum values for FA to WALA distance were calculated. A comparison was made between the right and left sides and between males and females using the Independent Sample t-test for all posterior teeth. Statistical significance was set at  $P \leq 0.05$  in all tests.

## RESULT

Values showed statistically significant gender variation for all teeth ( $P \leq 0.05$ ) except for the first molar ( $P > 0.05$ ). Whereas no statistically significant

difference was seen between the right and left side ( $P > 0.05$ ), so the measurement and analysis were done as combined for right and left.

In both males and females, mean value for FA to WALA progressively increased from first premolar to second molar. In male, average FA to WALA distance was found to be 0.6 mm for first premolar, 1.16 mm for second premolar, 1.71 mm for the first molar and 2.41 mm for second molar. Similarly, in female it was found to be 0.4 mm for first premolar, 0.87 mm for second premolar, 1.72 mm for the first molar and 2.1 mm for second molar.

**Table 1: Arch side comparison of FA to WALA in mm by Student's t-test.**

Tooth	Male				Female			
	Right side Mean±SD	Left side Mean±SD	Mean difference	P value	Right side Mean±SD	Left side Mean±SD	Mean difference	P value
FPM	0.59±0.28	0.61±0.28	0.02	0.948	0.40±0.22	0.41±0.22	0.02	0.965
SPM	1.16±0.33	1.15±0.33	0.01	0.892	0.88±0.29	0.87±0.29	0.01	0.855
FM	1.68±0.42	1.74±0.45	0.06	0.754	1.73±0.37	1.71±0.36	0.02	0.916
SM	2.40±0.27	2.42±0.27	0.02	0.793	2.11±0.54	2.10±0.53	0.01	0.906

FPM = first premolar, SPM = second premolar, FM = first molar, SM = second molar, SD = standard deviation

**Table 2: Comparison of FA to WALA ridge distance (mm) by gender using Student's t-test.**

Tooth							Mean difference	P value
	Min	Max	Mean±SD	Min	Max	Mean±SD		
FPM	0.12	0.99	0.60±0.28	0.11	0.89	0.40±0.22	0.20	<0.001
SPM	0.49	1.64	1.16±0.33	0.31	1.71	0.88±0.29	0.28	<0.001
FM	0.87	2.64	1.71±0.44	0.97	2.93	1.72±0.36	0.01	0.812
SM	2.01	2.90	2.41±0.27	1.29	3.21	2.10±0.53	0.31	<0.001

FPM = first premolar, SPM = second premolar, FM = first molar, SM = second molar, SD = standard deviation, Min = minimum value, Max = maximum value

**Table 3: Comparison of FA to WALA horizontal distance (mm) with different studies.**

Study population	First premolar	Second premolar	First molar	Second molar
American <sup>4</sup>	0.8	1.3	2	2.2
Peruvian <sup>7</sup>	0.96	1.45	2.12	2.55
Himanchali <sup>8</sup>	1.17	1.53	2.04	2.46
Brazilian <sup>9</sup>	0.88	1.55	2.21	2.49
Nepali male (present study)	0.6	1.16	1.71	2.41
Nepali female (present study)	0.4	0.88	1.72	2.1

## DISCUSSION

The main aim of orthodontists is to align all teeth aesthetically in smile line while keeping roots within the alveolar bone. To let teeth to remain in neutral position various factors like periodontium, muscular force, tooth inclination and occlusion have important roles to play.<sup>1,13,14</sup> Commercially available arch wires eliminate the need for shaping wire individually which is beneficial as it reduces the chairside time. However, arch shape and size varies widely from individual to individual. Individualisation of arch wire shape for treatment stability has been suggested by previous studies.<sup>2,3</sup>

Orthodontic correction of crowding requires space which can be achieved either by arch expansion or by bicuspid extraction. There are different views regarding extraction and arch expansion for resolution of crowding among orthodontists. For moderate to severe crowding extraction can be absolute choice<sup>15</sup> but for borderline cases, there is argument whether to extract teeth or to expand the arch width.<sup>16,17</sup> While expanding arch width it is important to keep roots of teeth within alveolar bone and little is known about the amount of buccal expansion that can be done without destroying the periodontium of teeth.<sup>18</sup> WALA ridge helps orthodontist to determine the lateral border of the alveolar bone as it is clinically visible.

The horizontal distance between FA point of mandibular posterior teeth to WALA ridge in this study followed progressive pattern, increasing from first premolar to second molar as seen in previous studies in various population.<sup>7-9</sup> This study showed statistically significant gender variation in distance between FA to WALA for all teeth except for first molar with female showing more buccal positioning

of teeth which was not seen in previous studies in other populations.<sup>7-9</sup> This might be due to racial variation, as size of teeth varies among races<sup>19</sup> there is possibility that position of teeth also varies among races and this requires further studies. As summarised in Table 3, this study has shown that mandibular posterior teeth among individuals visiting Kathmandu Medical College Teaching Hospital are more buccally positioned than in other population. This may suggest that buccal muscular force on teeth is comparatively less in this population.

WALA ridge is proven to be a good clinical guide for the amount of buccal expansion of arch and a study has shown good post treatment stability in cases treated by individualisation of arch using WALA method.<sup>20</sup> Thus the values obtained in this study can be valuable for orthodontists to individualise dental arch of Nepali. However, this study has some limitations. Since the study was done in a single dental hospital, the results cannot be generalised to the whole Nepali population and further research needs to be done to provide FA to WALA norms for Nepali.

## CONCLUSION

In this study, mandibular posterior teeth in females were more buccally positioned than in males. However, in both males and females, the mean horizontal distance between WALA ridge and FA point of mandibular posterior teeth increased from anterior to posterior. WALA ridge can be valuable for determining buccal position of teeth.

**Conflict of Interest:** None.



## REFERENCES

1. Joondeph DR. Retention and relapse. In: Graber TM, Vanarsdall RLJ, Vig KWL, Editors. *Orthodontics current principles and techniques*. 4th ed. St. Louis, Missouri: Elsevier; 2005. p. 1123-52.
2. Sved A. The application of engineering methods to orthodontics. *Am J Orthod*. 1952;38(6):399-421.
3. Boone GN. Archwires designed for individual patients. *Angle Orthod*. 1963;33(3):178-85.
4. Andrews LF. The 6-elements orthodontic philosophy: Treatment goals, classification, and rules for treating. *Am J Orthod Dentofac Orthop*. 2015;148(6):883-7.
5. Ronay V, Miner RM, Will LA, Arai K. Mandibular arch form: The relationship between dental and basal anatomy. *Am J Orthod Dentofac Orthop*. 2008;134(3):430-8.
6. Glass TR, Tremont T, Martin CA, Ngan PW. A CBCT evaluation of root position in bone, long axis inclination and relationship to the WALA Ridge. *Semin Orthod*. 2019;25(1):24-35.
7. Kong-zárate CY, Carruitero MJ, Andrews WA. Distances between mandibular posterior teeth and the WALA ridge in Peruvians with normal occlusion. *Dental Press J Orthod*. 2017;22(6):56-60.
8. Bhandari V, Singla A, Mahajan V, Jaj HS, Seth V. Evaluation of distances between the mandibular teeth and the alveolar process in Himachali population with normal occlusion. *J Indian Orthod Soc*. 2012;46(4):10-3.
9. Triviño T, Siqueira DF, Andrews WA. Evaluation of distances between the mandibular teeth and the alveolar process in Brazilians with normal occlusion. *Am J Orthod Dentofac Orthop*. 2010;137(3):308.e1-e4.
10. Rakosi T, Jonas I, Graber TM. Classification of malposition - Nomenclature. In: Rateitschak KH, Wolf HF, Editors. *Orthodontic diagnosis*. 1st ed. New York: Thieme Medical Publishers, Inc.; 1989. p. 35-56.
11. Andrews LF. The six keys to normal occlusion. *Am J Orthod*. 1972;62(3):296-309.
12. Jaiswal AK, Paudel KR, Shrestha SL, Jaiswal S. Prediction of space available for unerupted permanent canine and premolars in a Nepalese population. *J Orthod*. 2009;36(4):253-9.
13. Strang RHW. Factors of influence in producing a stable result in the treatment of malocclusion. *Am J Orthod Oral Surg*. 1946;32(6):313-32.
14. Lear CSC, Moorrees CFA. Buccolingual muscle force and dental arch form. *Am J Orthod*. 1969;56(4):379-93.
15. Carey CW. Linear arch dimension and tooth size: An evaluation of the bone and dental structures in cases involving the possible reduction of dental units in treatment. *Am J Orthod*. 1949;35(10):762-75.
16. Konstantonis D. The impact of extraction vs nonextraction treatment on soft tissue changes in Class I borderline malocclusions. *Angle Orthod*. 2012;82(2):209-17.
17. Khanum A, Prashantha GS, Mathew S, Naidu M, Kumar A. Extraction vs non extraction controversy: A review. *J Dent Orofac Res*. 2018;14(01):41-8.
18. Garib DG, Henriques JF, Janson G, de Freitas MR, Fernandes AY. Periodontal effects of rapid maxillary expansion with tooth-tissue-borne and tooth-borne expanders: a computed tomography evaluation. *Am J Orthod Dentofacial Orthop*. 2006;129(6):749-58.
19. Shrestha RM. Measurement of mesio-distal tooth diameter of Nepalese permanent dentition. *J Nepal Dent Assoc*. 2005;7(1):55-63.
20. Conti MDF, Filho MV, Amélia S, Vedovello S. Longitudinal evaluation of dental arches individualized by the WALA ridge method. *Dental Press J Orthod*. 2011;16(2):65-74.