The buccal groove of the lower first molar: Comparing odontometric position with anatomic nomenclature

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Abstract

Background: The buccal groove of the lower first molar (LM1) is the reference point in the clinical classification of malocclusion based on Edward Angle's criteria, a classification of great value in orthodontic practice. The groove has been popularly named as the mid-buccal, anterior buccal, or simply as the buccal groove. This variation in nomenclature suggests that the location of the buccal groove differs in different populations.

Aim: This study aimed to ascertain the exact location of the buccal groove on mandibular first molars as well as its morphological variations and possible clinical implications in this environment.

Methods: The study casts were retrieved from the orthodontic units of University College Hospital, Ibadan, and Military Hospital, Lagos. Sociodemographic variables, the mesiodistal width of the LM1, number of buccal grooves, and location of the buccal groove along the mesiodistal width of the LM1 were ascertained. Data were analysed using the SPSS software version 22. Paired t-test was used to assess the relationships between quantitative variables while the Chi-square test assessed qualitative variables and the level of significance was set at $P < 0.05$.

Results: The mean age of the patients was 15.50 ± 7.09 years. The mean mesiodistal widths of the lower right and left molars were 11.27 ± 0.78 mm and 11.41 ± 0.86 mm, respectively. Paired t-test showed that the left buccal groves were more anteriorly located than the right buccal grooves ($P < 0.001$). The buccal grooves were more anteriorly placed irrespective of the number of grooves present on the LM1, both left and right ($P < 0.001$).

Conclusion: The most appropriate nomenclature for the buccal groove of the LM1 is the anterior buccal groove. Caution must be exercised in classifying individuals with uncommon buccal groove location in clinical orthodontic practice.

Keywords: Buccal groove, dental anatomy, first molar, molar relationship, odontometry, orthodontics

INTRODUCTION

The human dentition consists of twenty deciduous teeth and 32 teeth in the permanent series. The morphological types of permanent teeth include the incisors, canines, premolars, and molars, while the deciduous dentition excludes the premolars. Odontometric studies have

reported the mandibular first permanent molars as having the largest occlusal surface area with an average mesiodistal diameter of 10.6 ± 0.7 mm in females and 11.1 ± 0.7 mm in Nigerian males.[1] Similar size was observed in a Dominican Republic study with males exhibiting larger lower first molars (LM1) than females.[2] The morphology of the mandibular first permanent molar, also known as the 6th year molar teeth, has also been described in literature and consists typically of either 4 or 5 cusps, one or two buccal grooves, and a lingual groove.[3] The buccal groove of the mandibular first permanent molar runs from the more mesial of the two central pits of the central groove towards the buccal surface between the mesiobuccal and distobuccal cusps and terminating in the buccal pit.[4] The buccal groove is typically more mesial than the lingual groove in a parallel fashion.

The buccal groove is a very important morphological feature of the mandibular first molar as far as orthodontics is concerned, as it is the index landmark by which Edward H. Angle in 1899 classified the human occlusion. In this globally versatile Angle's classification, the mesiobuccal cusps of the upper first maxillary permanent molars and the buccal groove of the mandibular first permanent molars are the signposts for classification. The buccal groove has been popularly named in literature as the mid-buccal groove,[5] anterior buccal/mesiobuccal groove,[6,7] or just as the buccal groove.[8,9] This variation in nomenclature suggests that the location of the buccal groove differs in different populations. Variations in occlusal configuration of all teeth including the mandibular first molar have been thoroughly elucidated in literature.[10,11] However, studies verifying the precise location and basis for the various nomenclatures of the buccal groove of the LM1 based on objective measurements are scarce in documented literature.

This study aimed to ascertain the exact location of the buccal groove on mandibular first molars as well as its morphological variations and possible clinical implications in the Nigerian environment.

METHODS

This cross-sectional study was carried out over a 6-week period between July and August 2015 using dental study models from individuals who attended the orthodontic clinics at University College Hospital, Ibadan, and Military Hospital, Lagos. Data were collected in conformity with the ethical principles of the Helsinki Declaration. Defective models, models with orthodontic bands *in situ,* or those with any form of tooth tissue loss or restorations relating to the mandibular first molars were excluded from the study. Sociodemographic variables of the individuals whose study casts were selected were obtained from the clinic's daily attendance register.

Measurements were obtained using an electronic digital calliper (Digimatic Caliper, Mitutoyo, UK). The orientation of the vertical limbs of the calliper was parallel to the long axis of the tooth while the horizontal bridge was parallel to the occlusal plane as shown in Figure 1.

The following variables were determined and recorded: the number of buccal grooves on each LM1, the mesial contact points to distal contact point width of the LM1 which is its mesiodistal width; the mesial contact point to buccal groove width as well as the distal contact point to buccal groove width of the LM1 was also recorded.

The buccal groove was classified as anterior if found mesial to the midpoint of the mesiodistal width of the LM1. It was classified as Mid buccal groove if found exactly at the midpoint of the mesiodistal width of the LM1 and posterior if found distal to the midpoint of the mesiodistal width of the LM1.

To limit errors due to fatigue, only a total of twenty casts were measured by each examiner in a day. All measurements were carried out by two examiners (TOT and KKK), and a pilot analysis of the casts was done twice within 2 weeks using twenty casts so as to assess intra- and inter-examiner reproducibility. Using Pearson's bivariate correlation, it was found that there was a high correlation between the two measurements taken by examiner 1 (rho value [ρ] = 0.99) and examiner 2 (ρ = 1.00). Interexaminer reproducibility for the first reading (ρ = 0.99) and the second reading (ρ = 0.99) was high. All values were obtained at $P < 0.01$.

Figure 1: Orientation of the digital calliper for measurements

Data were analysed using the SPSS software version 22 (IBM SPSS, Armonk, New York, USA). The Chi-square test was used to analyse qualitative variables while the paired sample *t*-test was used to ascertain association between quantitative variables. Level of significance was set at $P < 0.05$.

RESULTS

A total of 269 study casts were assessed. The mean age of individuals from whom the models were obtained was 15.50 ± 7.09 years. One hundred and twenty-four casts (46.1%) were from males, while 145 casts (53.9%) were from females. The mean mesiodistal width of the right and left lower molars was 11.27 ± 0.78 mm and 11.41 ± 0.86 mm, respectively, with the left lower molars being significantly wider than the right lower molars ($P < 0.001$). There was no significant gender difference in the width of the right and left LM1 ($P = 0.20$ and 0.19, respectively).

The number of buccal grooves present on the LM1 as well as their location as obtained from odontometric measurement is shown in Table 1. With regard to symmetry in the number of buccal grooves, 12 (4.5%) of our study patients presented with single buccal grooves bilaterally, 254 (94.4%) had double grooves bilaterally, while the remaining 3 (1.1%) had asymmetric number of grooves. There is no significant variation in the symmetry of grooves with respect to gender ($P = 0.16$). The left buccal grooves were more anteriorly positioned than the right buccal grooves ($P < 0.001$). As shown in Table 2, there was no significant difference in buccal groove position in relation to gender for the left and right sides ($P = 0.39$ and 0.84, respectively). Whether the patients presented with single or double buccal grooves on their LM1, the anterior position was favoured and this was true on both the left and right molars ($P < 0.001$ and <0.005, respectively).

DISCUSSION

The sizes of the LM1 assessed in this study are similar to that reported in a previous Nigerian study.[1] Similarly, the present study corroborates the existence of asymmetry in molar sizes as well as number and odontometric location of the buccal grooves of the LM1 which have been previously reported.[3,10] However, the researchers did not observe any significant gender dimorphism in the sizes of the LM1s assessed despite the larger tooth size observed in males compared to females. This is similar to a previous Nigerian study's report that upper first molars and LM1 were the least variable in size between the two genders.[12] However, significant gender dimorphism has been reported in the sizes of other teeth by previous researchers.[13,14] In a

Table 1: Number of buccal grooves and their odontometric location

Variable	Lower right first molar (%)	Lower left first molar (%)
Number of grooves		
One	14 (5.2)	13 (4.8)
Two	255 (94.8)	256 (95.2)
Total	269 (100.0)	269 (100.0)
Location of buccal grooves		
Anterior	247 (91.8)	265 (98.5)
Middle	15 (5.6)	4 (1.5)
Posterior	7 (2.6)	0
Total	269 (100.0)	269 (100.0)

Table 2: Relationship between gender and location of buccal grooves

Variable	Male (%)	Female (%)	Total (%)	P
Symmetry in the number of grooves				
One groove symmetrical	5 (41.7)	7 (58.3)	12 (100.0)	0.16
Two grooves symmetrical	116 (45.7)	138 (54.3)	254 (100.0)	
Asymmetrical	3 (100.0)	0	3 (100.0)	
Total	124 (46.1)	145 (53.9)	269 (100.0)	
Location of the left buccal groove				
Anterior	123 (46.4)	142 (53.6)	265 (100.0)	0.39
Middle	1 (25.0)	3 (75.0)	4 (100.0)	
Total	124 (46.1)	145 (53.9)	269 (100.0)	
Location of the right buccal groove				
Anterior	113 (45.7)	134 (54.3)	247 (100.0)	0.84
Middle	8 (53.3)	7 (46.7)	15 (100.0)	
Posterior	3 (42.9)	4 (57.1)	7 (100.0)	
Total	124 (46.1)	145 (53.9)	269 (100.0)	

similar trend, there was no gender variation in the locations of the buccal groove of LM1 assessed in this study, a further attestation to the relative lack of variability in the odontometric characteristics of the LM1 between males and females.

This study observed that a significant number of individuals presented with the buccal grooves located in the anterior position of the LM1 on both sides of the jaw irrespective of the number of grooves present; hence, the name anterior or mesial buccal groove as found in some literatures[6,7] is the most appropriate nomenclature for this anatomical feature. The mid-buccal groove which is another common synonym for this index landmark was only present in <15% of the population studied, and for this reason, it may be an inappropriate nomenclature for our population of patients.

Angle's classification of 1894 has over the years undergone many criticisms and is still being criticised today by many clinicians.[15] This study found that a minority of individuals have posteriorly located buccal grooves on their lower molars. These individuals are at a risk of being wrongly classified as having 'class II malocclusion or class II subdivision left/right' on the basis of the unusual posterior

location of the buccal grooves on their LM1. This is yet another challenge in the use of Angle's classification in clinical practice and should be kept in perspective by the dentist so as to manage the patient appropriately.

This was a hospital-based study carried out in two clinics and as such it presents limited data. The authors recommend a multicentre study which will present more data that can allow for generalisation among Nigerian orthodontic patients.

CONCLUSION

The most appropriate nomenclature for the buccal groove of the LM1 on the basis of its odontometric location is the anterior buccal or mesiobuccal groove. However, the clinician must be on the lookout for individuals with posterior or 'distobuccal' grooves when using the Angle's molar classification for orthodontic diagnosis and treatment planning.

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Conflicts of interest
There are no conflicts of interest.

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