ORIGINAL ARTICLE

CORRELATION AND CONSISTENCY OF MELGACO EQUATION TO DETERMINE THE MESIODISTAL WIDTH OF UNERUPTED MANDIBULAR CANINE AND PREMOLARS IN CLASS II DIVISION 1 OCCLUSAL RELATIONS

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ABSTRACT

Prediction of mesiodistal width of unerupted buccal segment teeth is crucial for treatment planning in mix dentition. The aim of this study was to validate the applicability of a regression equation proposed by Melgaco for prediction of mesiodistal width of unerupted canine and premolars in mandibular arch (PSCP) in class II division 1 occlusal relations.

The study was conducted on one hundred dental casts of class II division 1 patients that were collected after sample size calculation. Actual mesiodistal widths of the mandibular permanent canines and premolars (ASCP) was measured with the help of Vernier calipers. Mesiodistal width of erupted first molar and incisor was also measured. The predicted mesiodistal width of unerupted canine and premolars were determined by Melgaco equation. Descriptive statistics were generated for age, gender, predicted (PSCP) and the actual size of canine and premolars (ASCP). Pearson correlation was used to check the correlation coefficient (r value) and test whether significant correlation exist between the predicted and actual mesiodistal dimensions. A p-value < 0.05 was taken as significant.

The study consisted of 37 males and 63 females with mean age of 17.74 ± 2. 14 years. Significant correlation, p-value <0.001 was found between predicted and actual mesiodistal width of canine and premolars in the entire sample along with terms of gender stratification.

In conclusion, Melgaco equation shows positive correlation with actual mesiodistal width of the teeth in both genders having class II div I malocclusion with females having higher correlation coefficient.

Keywords: *Melgaco equation, Class II division1, Mesiodistal width prediction, Space analysis, Mix dentition*

INTRODUCTION

Evaluation of mesiodistal width of unerupted canines and premolars in mix dentition is an integral part of the orthodontic assessment.[1] It helps in predicting future crowding or spacing and the availability of leeway space. This, in turn helps in deciding treatment modalities like space regaining, space maintenance, space supervision or some extraction pattern like serial extraction.[2-4] Mostly the size of primary buccal segment teeth is larger than their succedaneous teeth and is called leeway space.[5,6] If not utilized, this space is most commonly lost in mesial drift of the molars.[7]

Different methods are employed to measure the size difference of primary and permanent teeth. These include a combination of dental casts and regression equations[8, 9], dental cast with two-dimensional x rays and cone beam computed tomography (CBCT). The problem with the radiographic method is that these are associated with radiation dose especially CBCT

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Received for Publication: May 25, 2018
Revised: Sep 29, 2018
Approved: Sep 30, 2018

and have ethical concerns if radiographs are done solely for this purpose.[10, 11] On the other hand, regression equations are developed for specific populations and it is a well established fact that there are racial differences in mesiodistal width of teeth.[12, 13] So, the validity of regression equations should be tested on other populations or new regression equations should be formulated for each specific population.

Class II malocclusion is a frequent problem in clinical orthodontics with Class II division 1 malocclusion reported as the most frequent occlusal trait in the adolescent having prevalence of 8.7 % to 40 % in orthodontic patients.[14-16] Regression equations for tooth size difference are mostly developed and tested for all types of occlusal relations rather than for a specific occlusal trait. However, the difference in tooth sizes have been reported in the literature in different occlusal relations.[17, 18] Limited literature is avaliable on using regression equations for tooth size difference in specific occlusal triat.

Melgaço developed a regression equation for the Brazilian population with the highest reported value of correlation and determination coefficient.[19] The method was found to have a higher predictive value than other popular methods.[20] The rationale of this study is to test the Melgaço regression equation in the mandibular arch in class II division 1 malocclusion.

MATERIALS AND METHODS

Patients between the age of 13 to 21 years with class II division 1 occlusal relations having erupted permanent mandibular teeth up to first molars were selected for the study. Patients with a previous history of orthodontic treatment, extractions, proximal caries, restorations, proximal or occlusal abrasion and bruxism were excluded from the sample. Sample size calculation was done by taking a 5% type 1 error and 10% type 2 error. The expected correlation coefficient of r= 0.6735 between predicted mesiodistal width of unerupted canine and premolars (PSCP) calculated through Melgaco's equation to the actual mesiodistal width of unerupted canine and premolars (ASCP) were also taken for sample size calculation. 100 patients were eventually selected for the study. The study was reviewed and approved by the ethical committee.

Dental casts of the patients were obtained. The mesiodistal widths of the permanent incisors, canines, premolars and molars were measured in millimeters (mm) by Hunter and Priest Method[21] by using a digital vernier caliper (Mitutoyo, Japan) having accuracy and reproducibility in the range of 0.01mm (Figure 1). PSCP was calculated through Melgaco's equation. Melgaco equation is given as follows:

PSCP = 0.975X (male patients),

PSCP = 0.971X (female patients),

PSCP = 0.973X (both genders).

Where X= Actual mesiodistal width of mandibular four incisors and first molar. Right side first permanent molar was taken in all the cases.

The data obtained was entered and analyzed through SPSS version 21. Quantitative data like age, PSCP and ASCP were presented in the form of mean ± SD. Qualitative data like gender was presented in the form of frequencies and percentages. Pearson's correlation coefficient was calculated to determine the relationship between PSCP to ASCP. A p-value ≤ 0.05 was considered as significant.

Data were stratified for gender to address the effect modifiers. Post-stratification Pearson's correlation test was applied to check the significance with p-value ≤ 0.05 as significant and to measure the correlation coefficient =r.

RESULTS

The study consisted of 37 males and 63 females with mean age of 17.74 ± 2.14 years (Table1). The mean value of X was 45.48 ± 3.38 mm with minimum and maximum value as 37 mm and 58 mm respectively. The mean value of PSCP and ASCP was 44.21 ± 3.10mm and 43.46 ± 2.79 mm (Table 2).

Pearson's correlation of actual versus the predicted value of mandibular canines and premolars (PSCP vs. ASCP) is given in Table 3. The Pearson's correlation or correlation coefficient was r= 0.706 and p-value was <0.001. This shows a significant correlation between the actual size of teeth and size measured by Melgaco equation with a p-value <0.05 taken as significant.

Pearson's correlation test was also done to evaluate gender dimorphism Table 3. In gender evaluation, a statistically significant correlation was found between ASCP and PSCP. However, females show a higher correlation coefficient r=0.757 than males r= 0.599.

DISCUSION

More leeway space is present in the mandibular arch as compared with the maxillary arch because of a significant size difference between primary buccal segment teeth and their permanent successors. However, this size difference is not always positive.[22] Also, secular reduction in mandibular leeway space have been reported.[6] Due to the radiation dose associated with the radiographic method, many parents are reluctant to have their children undergo x-ray exposure. This leaves the orthodontist's job challenging to asses and manage tooth size-arch length discrepancies. Regression equation along with dental cast is the only solution in such cases if these have a reasonable degree of validity.

Fig 1: Digital vernier calliper

TABLE 1: GENDER DISTRIBUTION OF THE SAMPLE

		Frequency	Percent
Gender	Male	37	37.0
	Female	63	63.0
	Total	100	100.0

TABLE 2: DESCRIPTIVE STATISTICS OF MESIODISTAL WIDTH IN MILLIMETERS OF DIFFERENT TEETH

	tX	PSCP	ASCP
Mean	45.48	44.21	43.46
Standard Deviation	3.38	3.10	2.79
Range	21.00	17.51	15.00
Minimum	37.00	36.00	37.00
Maximum	58.00	53.51	52.00

TABLE 3: CORRELATION BETWEEN PREDICTED AND ACTUAL SIZE OF CANINE AND PREMOLARS

	Pearson Correlation (r)	p-value
PSCP versus ASCP	0.706	<0.001
Male	0.599	<0.001
Females	0.757	<0.001

High correlation coefficient r= 0.706 was found between ASCP and PSCP in the present study. Similar correlation coefficient r= 0.70 was reported by Tikku[23] when Melgaco equation was applied to the northern Indian population. The correlation coefficient reported in the present study is lower than reported by Melgaco r=0.81 in his study. This can be explained by the fact that racial variations are present in the mesiodistal size of the teeth.[12] In a study by Rasool [24] on Pakistani poupluation using Melgaco equation, a lower coefficient r=0.673 was reported. In contrast to the present study where only class II division 1 patients were taken, Rasool's study did not stratify occlusal relations. The present study also reported higher correlation coefficient than many other studies done with different regression equations on other populations.[25-27]

Gender stratification reveals greater correlation coefficient of females than males. The correlation coefficient r = 0.757 of females was higher than the correlation coefficient r=0.624 reported by Rasool[24] in Pakistani population and almost close to correlation coefficient r=0.774 in Brazilian population19 using the same regression equation. Male correlation coefficient r=0.599 was much lower than previously reported in Pakistani r=0.710 and Brazilian population r=0.795.[19,24] Mean difference of 0.75mm was reported between ASCP and PSCP with Melgaco equation overestimating the size. This difference was reported in the range of 0.49 to 1.28 mm in other studies.[23,28,29]

The p-value in each variable tested in the present study ($p<0.001$) showed significant correlations between the actual sum of teeth and sum derived from Melgaco equation. So, this equation can be used in Pakistani population. However, the effort should be made to develop Pakistani population-specific regression equation in different occlusal relations so that greater correlation and determination coefficient could be generated.

CONCLUSION

Significant correlation of Pakistani population in both genders with Melgaco equation was found in class II division 1 occlusal relations. Females show a higher correlation coefficient for Melgaco equation than males.

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