Estimation of the Crown Widths of Unerupted Canine and Premolars by Using Vistibulo-oral Crown Dimensions of Permanent Teeth

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الخلاصة

الأهداف: تهدف الدراسة إلى تحديد طريقة التحليل الانحداري المتعدد على (88) شخصا (48 أنثى و 40 ذكرا) وذلك للتنبؤ بأبعاد تاج الناب والضواحك غير الظاهرة للفكين العلوي والسفلي ولكلا الجنسين ويمتلك الأشخاص الصنف الأول من الإطباق الطبيعي والتسنين ألدائمي الكامل. المواد وطرائق العمل: أخذت قوالب الأسنان لــ 88 شخصا (48 أنثى و40 ذكرا). تم قياس البعد الإنسي الوحشي والبعد ألدهليزي الفموي لتاج القواطع، الناب، الضواحك والطاحن الأول ألدائمي لكلا الجانبين والفكين. وقد تم تحديد معادلة تحليل الانحدار المتعدد ومعامل الارتباط بين الأسنان المتنبئة (القواطع والطاحن الأول) والأسنان المطلوب التنبؤ بها (الناب والضواحك). وقد حللت البيانات باستخدام البرنامج الإحصائي SPSS. النتائج: استخرجت معادلات الانحدار المتعددة من قواعد القياسات الناتجة باستخدام (3 إلى 5) متنبئين للتنبؤ بمجموع عرض تاج الناب والضواحك غير الظاهرة باستخدام معادلات مفصولة لكلا الفكين والجنسين (و يمكن القول أن 4 معادلات للانحدار المتعدد)، ومعامل الارتباط حسب الجنس والفك تراوح بين 0.70 –0.79. الاستنتاجات: إنشاء معادلة تحليل الانحدار المتعدد التي أعطت معامل ارتباط معقول حسب الجنس والفك تراوح من 0.70 —0.97.

ABSTRACT

Aims: To estimate multiple regression equation on (88) subjects (48 females and 40 males),for predicting the widths of crowns of unerupted canine and premolar for both jaws and both genders. The subjects had normal class I molar relationship with full permanent dentition. **Materials and methods:** Plaster models of (88) subjects (48 females and 40 males).Mesiodistal diameter (MMD) and vestibulooral diameter (VOD) of the crown of cental incisor, lateral incisor,canine,premolars and first molar(I1,I2,C both P1 and P2, and M1) on both sides in both jaws were measured. Multiple regression equations and correlation coefficients between the predictors(central incisor,lateral incisor and first molar) and the criteria variables (canine and premolars) were calculated. The data were analyzed by computerized statistical program SPSS. **Results:** Gradual regression equations were derived on the basis of measurement result ,by using three to five predictors to predict the sums of width of crown of unerupted canine and premolars using separated equations for both jaws and both genders (i.e four multiple regression equations were prepared).The coefficients of multiple correlations regarding gender and jaws ranged between 0.70-0.79.**Conclusions:** Establish regression equations, which would give satisfactory correlation coefficient regarding the gender and the jaw varied from 0.70-0.79.
Key Words: Unerupted canine and premolars , Regression equation.

INTRODUCTION

Ideal occlusion is impossible in the presence of tooth size discrepancy[1,2] Several methods have appeared for analyzing the mixed dentition to determine what discrepancy will be present when the permanent teeth erupt[3,4] and for determine the discrepancy between the available and required space in each dental arch,[5] because it affect the final result of orthodontic treatment.[6,7] So, space analysis should be done accurately before any orthodontic treatment,[8] based on these calculation,

therapeutic procedures can be introduced ranging from resolving slight incisor crowding by simple methods to more complex mechanisms of space regaining or even serial extractions.[9,10] It has been established that the degree of tooth size – arch length discrepancy increase from the deciduous dentition to the mixed dentition and from the mixed dentition to the permanent dentition.[11] Predicting the size of unerupted teeth during the mixed dentition period is a critical factor in managing the developing occlusion of a growing

child.[12] The widely used Tanaka and Johnston space analysis is a simple method to predict the sizes of unerupted canine and premolars in mixed dentition but it over estimates the sizes of these teeth.[13] Other method are based on measurements taken directly from radiograph.[14] Some methods based on tooth size averages use established tables of average tooth sizes.[15] Still other methods used regression equations and devoted a separate equation to each jaw and gender.[16,17] The aim of this study was to estimate multiple regression equations, which would give the greatest correlation coefficient for the sum of the mesiodistal diameter of canine and premolars for both jaws by measuring mesiodistal diameter(MDD) and vestibulooral diameters (VOD) of crowns of permanent central and lateral incisors (I1,I2) and the first permanent molar (M1).

MATERIALS AND METHODS

Eighty eight plaster casts (48 females and 40 males) were selected from records of Orthodontic Department in College of Dentistry at Mosul University. The children with out syndrome disease and all casts met the following criteria: permanent dentition in both jaws (age ranged from 14 to 18 years); teeth with out anomalies in size , form, number; no proximal caries or fillings and intact mesiodistal and vestibulooral surface of the crowns of the teeth I1,I2,C,P1,P2 and M1.A pointed venier caliper (Dental Vernier , Dentarum) with accuracy of 0.01 mm was used to measure the MDD and VOD of I1,I2,C,P1,P2 and

M1 according to the method described by Moorees et al.[18] In each case , one experienced examiner took two separate measurements of each tooth and the mean value was used for further data analysis .The data were analyzed using statistical package for social statistics (SPSS).The variables were divided into groups of predictor variables (MDD and VOD of I1,I2 and M1) and criteria variables (sum of MDD of C,P1 and P2) in all four segments. The consistency in measurement was determined by person's correlation coefficients. The discrepancies in MDD and VOD of teeth between males and females were verified by the t-test procedure, a separate optimal linear combination for each gender. Correlation coefficients and β -ponders for three to five predictors, MDD and VOD of I1,I2 and M1, in all segments were determined by the linear regression analysis [19] The criteria of excluding the predictors from the gradual regression analysis was determined in advance to be 10%.

RESULTS

It can be seen from Table (1) that there is a statistical significant gender discrepancy, which necessitates division of the subjects according to gender when determining optimal linear combinations of predictors and criteria variables. Table (2) illustrates the coefficients of multiple correlations resulting from gradual regression analysis by a backward method for both subsamples.

Table (1): Mesiodistal diameter of sums of crowns of C, P1 and P2 for both geners.

Variables	Females		Males		F ratio	*P*
	AM	SD	AM	SD		
MDDUC,P1,P2	20.95	0.969	21.63	0.996	0.012	0.002
MDDLC,P1,P2	22.483	1.565	21.277	1.226	3.508	0.000

AM: Arithmetic Means; SD: Standard Deviation; MDD: Mesiodistal Diameter; U: Upper and
L: Lower. *P*<0.01.

Table (2): Gradual regression analysis for the sum of predictable mesiodis-
tal diameters of crowns of C, P1, and P2 for both genders.

		Female	Male
Maxilla	**r**	0.736	0.742
	F	9.9	10.718
	P	0.00	0.00
	SEE	0.694	0.705
Mandible	**r**	0.70	0.792
	F	8.1	14.755
	P	0.00	0.00
	SEE	0.82	0.789

Tables (3) to (6) show the result of gradual regression analysis for the prediction of sum of MDD of C, P1 and P2 with regard to the jaw and gender. Tables 3 and 4 shows regression equations for the prediction of sum of MDD of C, P1 and P2 for females, each jaw separately.

Table (3): Gradual regression equation for the prediction of the sum of me-
siodistal diameters of crowns of C, P1 and P2 in upper jaw for the females.

Predictors	Beta	SEE	β- Ponder	t	*P*
MDDL2	1.563	0.314	0.633	4.972	0.00
MDDL6	0.34	0.216	0.186	1.576	0.123
VODL1	0.452	0.297	0.188	1.521	0.136
VODL2	-0.485	0.289	-0.225	-1.677	0.101
VODU6	0.2	0.202	0.112	0.993	0.326

MDD: Mesiodistal diameter, VOD:Vistibulooral diameter, L:Lower, U: Upper. Constant= 6.109.
MDDUC, P1, P2=1.563 (MDDL2)+0.34(MDDL6)+0.452(MDDL1)-
0.485(VODL2)+0.2(VODU6)+6.109.

Table (4): Gradual regression equation for the prediction of the sum of mesi odistal
diameters of crowns of C, P1 and P2 in lower jaw for the females.

Predictors	Beta	SEE	β- Ponder	t	P
MDDL2	1.095	0.694	0.27	1.577	0.122
MDDL6	-0.005	0.472	-0.002	-0.01	0.992
VODU6	0.588	0.515	0.175	1.143	0.259

MDD: Mesiodistal diameter, VOD:Vistibulooral diameter, L:Lower, U: Upper. Constant= 6.28.
MDDLC, P1, P2=1.095(MDDL2)-0.005(MDDL6) +0.588(VODU6) +6.28.

Tables 5 and 6 shows regression equations for the prediction of sum of MDD of C,P1 and P2 for females, each jaw separately. In gradual regression analysis, only three to five predictors were maintained. Betas and β - ponders are given in those tables, as well as the constant for determining MDD of C, P1 and P2.

Table (5): Gradual regression equation for the prediction of the sum of mesiodistal diameters
of crowns of C, P1 and P2 in upper jaw for the males.

Predictors	Beta	SEE	β- Ponder	t	P
MDDL2	0.306	0.316	0.132	0.968	0.34
MDDU2	0.806	0.232	0.465	3.481	0.001
MDDU6	0.348	0.254	0.193	1.369	0.18
VODU6	0.253	0.247	0.149	1.022	0.314

MDD: Mesiodistal diameter, VOD: Vistibulooral diameter, L:Lower, U: Upper. Constant= 7.759.
MDDUC,P1,P2=0.306(MDDL2)+0.806(MDDU2)+0.348(MDDU6)+0.253(VODU6)+7.759.

Table (6): Gradual regression equation for the prediction of the sum of mesiodistal diameters of crowns of C,P1 and P2 in lower jaw for the males.

Predictors	Beta	SEE	β- Ponder	t	P
MDDL2	0.218	0.367	0.071	0.594	0.556
MDDL6	0.599	0.311	0.254	1.926	0.062
VODL2	0.476	0.408	0.14	1.166	0.252
MDDU2	1.163	0.29	0.519	4.006	0.00

MDD: Mesiodistal diameter, VOD:Vistibulooral diameter, L:Lower, U: Upper. Constant= 2.402.
MDDLC, P1, P2=0.218(MDDL2) +0.599(MDDL6) +0.476(UODL2) +1.163(MDDU2) +2.402.

DISCUSSION

The purpose of this study was to establish regression equations by the use of the predictors MDD and VOD of I1, I2 and M1, so the sum of MDD of C, P1 and P2 in both jaws would be predicted. Out of all the proposed methods so far for prediction of the sum of MDD of C,P1 and P2 , Moyer's method and Tanaka and Johnston method are most frequently applied, where as many others have indicated that the predicated values were too high when these methods are used with different population because it fit the racial and ethnic group to which it belong .(20-23) In this study , using three to five predictors, MDD and VOD of I1,I2 and M1,correlation coefficients with the sum of MDD of C,P1 and P2 amounted to : for the females , 0.73 in the maxilla and 0.70 in the mandible; and for the males 0.74 in the maxilla and 0.79 in the mandible. Sums of MDD of C, P1 and P2 in both jaws predicted by this method were more precise in males this agreed with Legovic et al.[16] (Correlation coefficient for males 0.84 in the maxilla and 0.85 in the mandible ,and for female 0.79 in the maxilla and 0.78 in the mandible) and with Staley et al.[24] which made similar observations.

According to Staley et al.[24] the prediction of the width of the crowns of teeth is more reliable on the left than on the right side of the jaw, while in our study the side is not important because there is no significant difference in the MDD of teeth between right and left sides of the jaws for both males and females .This agreed with Awni [13] and legovic et al.[16] The VOD of the M1 crown is used as a predictor in this study. According to Potter [25] the VOD of the teeth in the maxilla more strongly controlled than the genetic system of MDD. Their use showed greater correlation with C, P1 and P2 than the use of MDD. Legovic et al.[16] Gross and Hasund [26] and Ingerwaland and Lennartsson[27] they used VOD of M1 in their prediction methods, While in the study of Nourallah et al.[12] that used the MDD only,the correlation coefficients between groups of teeth are (0.67 in the maxilla and 0.68 in the mandible).According to Staley et al.[24] combinations of three predictors, two of which are determined by measuring MDD of crowns on radiographs and the third by measuring MDD of crowns on the plaster cast , give the greatest correlation coefficient (0.89-0.93).While in Legovic et al.[16] study regarding the gender and the jaw varied from 0.79-0.85.The study elaborates regression equations separately for each gender. Other authors have also pointed at gender dimorphism of dimensions of MDD of C, P1 and P2.All of them found that the methods of determining the sums of MDD of C, P1 and P2 have to be different according to gender (28-30).

CONCLUSSION

The sums of MDD of C,P1 and P2 can be predicted by modifications on regression equation with the use of three to five predictors which represented by MDD and VOD of I1,I2 and M1 with correlation coefficients from 0.70-0.73 in the females and 0.74-0.79 in males.

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