ISSN: 2581-5989
PubMed - National Library of Medicine - ID: 101738774

International Journal of Dental Science and Innovative Research (IJDSIR)
IJDSIR : Dental Publication Service
Available Online at: www.ijdsir.com
Volume – 6, Issue – 1, January - 2023, Page No. : 238 - 242

Numerology for Arch Perimeter Prediction

[1]Dr. Rahul Paul**,** Professor & HOD**,** Department of Orthodontics & Dentofacial Orthopaedics, Inderprastha Dental College Sahibabad, Ghaziabad, Uttar Pradesh.

[2]Dr. Dipesh Grover, Post Graduate Student IIIrd year, Department of Orthodontics & Dentofacial Orthopedics, Inderprastha Dental College Sahibabad, Ghaziabad, Uttar Pradesh.

[3]Dr. Deepti Yadav, Professor, Department of Orthodontics & Dentofacial Orthopaedics, Inderprastha Dental College Sahibabad, Ghaziabad, Uttar Pradesh.

[4]Dr.Mudita Gupta, Associate Professor, Department of Orthodontics & Dentofacial Orthopaedics, Inderprastha Dental College Sahibabad, Ghaziabad, Uttar Pradesh.

Corresponding Author: Dr. Dipesh Grover, Post Graduate Student IIIrd year, Department of Orthodontics & Dentofacial Orthopedics, Inderprastha Dental College Sahibabad, Ghaziabad, Uttar Pradesh.

Citation of this Article: Dr. Rahul Paul**,** Dr. Dipesh Grover, Dr. Deepti Yadav, Dr. Mudita Gupta, "Numerology for Arch Perimeter Prediction", IJDSIR- January - 2023, Volume –6, Issue - 1, P. No.238– 242.

Type of Publication: Original Research Article

Conflicts of Interest: Nil

Abstract

Introduction: Model analysis is an integral part of orthodontic diagnosis, which helps to study the occlusion & dentition from all three dimensions & analyze the degree & severity of malocclusion and hence help in treatment planning. The models whether plaster or digital provide a vital piece of information about the overall arch perimeter, length, teeth size, inter-canine and inter-molar width and shape of the arch. The use of brass wire to measure the arch perimeter has been practiced for long in the field of dentistry and orthodontics. This method carries some amount of discrepancy and is a tedious process to allow the wire follow the line of occlusion. Over the time various numerical methods have been proposed by various authors to predict the arch perimeter. The current study proposes a new regression equation to predict the arch perimeter in the North Indian population which is simple, accurate and less tiring.

Aim & objectives: To evaluate and compare the reliability of the new regression equation for predicting the arch perimeter.

Material & method: 25 students were selected for the study having molar and canine Class I relation for the study at Inderprastha Dental College & Hospital.

Result: The mean and standard deviation for the measured arch perimeter was 80.64 ± 4.06 mm, calculated arch perimeter using the new regression equation was 81.140 ± 5.57mm, measured whole arch perimeter was 112.10 ± 7.40mm and calculated whole

arch perimeter using Sannin's equation was 105.95 ± 7.20mm. The width of central incisors, inter premolar width and inter molar width showed a significant co-relation with the arch perimeter obtained using the Regression Equation as each figure had a value greater than 0.5.

Conclusion: The new Regression equation is reliable in predicting the dental arch perimeter.

Keywords: Arch perimeter, arch length, numerical method, regression equation, model analysis

Introduction

The field of orthodontics requires an accurate analysis of records before reaching a final diagnosis. Model analysis is an integral part of orthodontic diagnosis, which helps to study the occlusion & dentition from all three dimensions & analyze the degree & severity of malocclusion and hence help in treatment planning. [1,2] The major uses of models whether plaster or digital include studying and calculating the arch shape, total tooth material (TTM), arch perimeter, and arch length, inter canine width, inter pre molar width and inter molar width.[3]

The prediction of arch perimeter is helpful in planning the treatment of patients who need expansion which can facilitate non extraction orthodontic treatment. [4]Dental arch perimeter is considered as one of the important parameters for the diagnosis of orthodontic cases and treatment planning. It is defined as the distance from the mesial surface of the first permanent molar around the dental arch to the same point in the opposite side. Daskalogiannakis defined this space as the space available in the dental arch for the alignment of the teeth. [4, 5]

The most commonly used method to measure the arch perimeter is by using a brass wire. The wire passes along the buccal cusps of premolars and incisal edges of the anterior teeth. In crowded arches, the wire should pass according to the arch form that reflects the majority of the teeth. The wire should pass along the cingulum of anterior teeth if they are Proclined and along their labial surfaces if they are retroclined. The wire is then straightened to measure the space available. [5]

Several other methods are also available to measure the arch perimeter which includes the use of segments in the arch to measure the arch perimeter. The type of method that is the focus of this study is a mathematical one that uses multiple regression analysis to develop an equation for estimating arch perimeter. Different equations have been derived for over the time by Sanin et al [7], Paulino et al [8] and Al-Khatieeb et al [9]. These methods involve the analysis of the relationship between arch lengths, widths, and perimeters. Through studies, Ricketts et al found that the arch length to be increased by 1 and 0.25 mm for each 1 mm increase in the inter-canine and inter-molar distances, respectively. [10]

Material & method

The study was undertaken at Inderprastha Dental College & Hospital where the dental occlusion was examined. 25 students were selected all having ideal class I molar and canine relation. The sample selected for the study were above the age group of 14 years where all the permanent teeth up to second molar was present.

Impressions were taken using alginate impression material and poured using Kalabai orthokal dental plaster. The arch perimeter using brass wire from mesial side of first molar on the left side to mesial side of first molar on the right side was measured. The Inter-canine width (ICW), width of the two central incisors (IIW) and width of canine and lateral incisor on the right side (RIC) were measured

The arch perimeter was calculated using the new derived regression equation using the above-mentioned parameters.-22.5+ (-1) * ICW+8.25* IIW+ (-0.625) *RIC = Calculated arch perimeter.

The arch width and arch length were measured to calculate the arch perimeter using the Sanin et al regression equation. Dental arch perimeter= (dental arch width × 0.504) + (dental arch length × 1.525) + 14.856

The values obtained using the Sannin's equation and the whole arch perimeter was compared. Similarly, the values for arch perimeter and the new regression equation were also compared. The mean, standard error and Paired T Test were done to check for the efficacy.

Result

Table 1

	Measured arch perimeter (mm)	Calculated arch perimeter (regression equation)(mm)	Measured Whole arch perimeter (mm)	Calculated arch perimeter (sannin's equation) (mm)
Minimum	72	73.93	100.50	96.46
Maximum	92	96.87	129	132.96
Mean	80.6400	81.1400	112.1000	105.9535
Standard deviation	4.06848	5.57952	7.40214	7.20270
Std. Error of mean	0.81370	1.11590	1.48043	1.44054

Data subjected to two tailed T – test

The mean and standard deviation for the measured arch perimeter was 80.64 ±4.06 mm, calculated arch perimeter using the new regression equation was 81.140 ± 5.57mm, measured whole arch perimeter was 112.10 ± 7.40mm and calculated whole arch perimeter using Sannin's equation was 105.95 ± 7.20mm as shown in Table 1.

Table 2

	Pair 1 Arch perimeter--- Regression Equation	Pair 2 Whole arch perimeter--- Sannin's Equation
Mean	0.500	6.14648
Std. deviation	3.40630	5.33828
Std. error of mean	0.68106	1.06766
T value	0.734	5.757
P value (Two Tailed)	0.470	0,.000

Data subjected to two tailed T – test

Table 3

Width of central incisors	Inter canine width	Inter premolar width	Inter molar width
0.727	0.377	0.543	0.522

Pearson's co-relation with respect to Arch Perimeter

The data was subjected to Two Tailed T-Test, as shown in Table 2 to check the significant difference between measured and calculated values. The Pair 1 show the difference in the means with the value of 0.50 and the P-

value of 0.47 showing no statistical difference between the measured and calculated arch perimeter with the new Regression equation. In Pair 2, the difference in the means came out to be 6.14 with the P-value of 0.00 depicting a greater statistical difference between the measured whole arch perimeter and Sannin's equation.

Discussion

The dental casts have always been used as an important basic tool in orthodontic diagnosis and treatment planning, gives precise information about the patient′s occlusion in three planes of space. The development of new regression equations over the time helped in decreasing the armamentarium and provided a scope to ease the work by decreasing tedious work. Various mathematical equations were developed over time to help in calculating the arch perimeter.

The Sannin [7] et al research using 80 adult and 80 paediatric casts showed that using two linear measurements in a simple formula gave the estimation of the arch length of the dental arch close to the estimate obtained by the fitting of a fourth-degree polynomial. Sannin was able to prove a strong co-relation of arch length and width with the calculated arch perimeter. Similarly, the new regression equation proves a significant co-relation between incisor width and combined mesio-distal width of the lateral incisor and the canine.

The data collected and subjected to statistical evaluation proved that the developed equation is more reliable and accurate in arch perimeter prediction.

Paulino [8] et al studied 197 digital models selected randomly. The arch length and inter canine width for both the arches were measured. The study concluded "For each millimetre of inter canine width increase, the arch length would increase between 1.30 and 1.41 mm". The Pearson's co-relation of 0.925 was observed between the two parameters.

On the other hand, the new developed Regression equation showed no significance of arch perimeter with inter canine width but proved a strong co-relation between the width of the central incisors, inter premolar width and inter molar width with the Pearson' co-relation of 0.727, 0.543 and 0.522 respectively. This disparity might have occurred due to the sample size and the ethnicity of the chosen population for the data collection.

Al- Khatieb [9] et al in the study used stepwise multiple linear regression analysis. The concluded that the upper inter central incisor width plays an important role in the prediction of the upper dental arch length. For the upper arch, the T-value was 4.385 and P-value of 0.000. For the lower arch, the lower inter-central incisor and inter-first premolar widths were important in the prediction of the lower dental arch length as the T-value was 3.911 and 2.259, and P-values were 0.000 and 0.026 respectively.

In the present study, the Regression equation showed a strong co-dependence and co-relation with the width of the upper central incisor for the calculation of the arch perimeter.

Conclusion

Inter canine width, the width of the upper central incisors and the combined mesio-distal dimension of the lateral incisor and canine from the right side of the maxillary arch were employed to develop new regression equation.

The developed regression equation predicted arch perimeter for the maxillary arch which did not differ significantly (P>0.05) from the measured ones. Also, the equation came to be more accurate than the Sannin's equation. Thus, these equations would be highly useful

in calculating the arch perimeter for treatment plan and diagnosis.

References

1. Callahan C; Sadowsky PL; Ferreira A. Diagnostic Value of Plaster Modelin Contemporary Orthodontics; 2005; 11(2), 94–97.
2. Al-Ansari LB et al. A new method for prediction of dental arch perimeter. Clinical, cosmetic and investigational dentistry 2019:11; 393- 397.
3. Musich DR, Ackerman JI. The catenometer: a reliable device for estimating dental arch perimeter. Am J Orthod. 1973;63(4):366–375
4. Jacobson, Alex. Glossary of orthodontic terms. American Journal of Orthodontics and Dentofacial Orthopedics. 2002; 122(3); 335
5. 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):762–775
6. Noroozi, H., Djavid, G. E., Moeinzad, H., & Teimouri, A. P. . Prediction of arch perimeter changes due to orthodontic treatment. American Journal of Orthodontics and Dentofacial Orthopedics; 2002, 122(6), 601–607.
7. Sanine C, Savara BS, Thomas DR, Clarkson QD. Arc length of the dental arch estimated by multiple regressions. J Dent Res. 1970; 49(4):885.
8. Paulino V, Paredes V, Gandia JL, Cibrian R. Prediction of arch length based on intercanine width. Eur J Orthod. 2008; 30(3):295–298.
9. Al-Khatieeb MM, Nissan LMK, Al-Janabi MF. A new calibration procedure for expectation of arch length. J Bagh Coll Dent. 2012;24(sp.Issue 1):120–126
10. Ricketts RM, Roth RH, Chacon as SJ, Schulhof RJ, Engel GA. Orthodontic diagnosis and planning: Their roles in preventive and Reha bilitative dentistry. 1982; 2(6); 741.