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Original Research Paper

Dental Orthodontics

APPLICABILITY OF PONT'S INDEX TO COASTAL ANDHRA POPULATION - A CROSS SECTIONAL STUDY.

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ABSTRACT

Context: The Pont's index was evaluated for its applicability and had gross geographic variability, so we had evaluated the same on coastal Andhra population to check the validity of the index as an orthodontic diagnostic tool.**Aims:** The aim of the study is to assess the applicability of Pont's Index on Coastal Andhra Population. Special consideration was given to the adequacy of the chosen sample in terms of size, selection criteria, and representation of the specific cohort. **Settings and Design:** A Cross sectional study. **Methods and Material:** A screening of 839 Indian students aged 14 to 25 years was done, out of which 130 students were selected those who had ideal class I occlusion. All measurements were taken on the study casts by a digital calliper with sharp beaks. The premolar arch width; molar arch width, the combined width of the maxillary incisors was considered. The predicted arch widths in the Inter-premolar arch width(P) and Inter-molar arch width(M) regions were estimated with the formula proposed by Pont. **Statistical analysis used:** All statistical analysis was carried out using SPSS version 20.0, MEDCALC and MS Excel-2010. Correlation coefficient was evaluated between measured and calculated arch width values according to Pont's formulae. **Results:** Pont's index overestimated the inter-premolar and inter-molar width in males and underestimated inter-premolar and inter-molar width in females. **Conclusions:** Lack of correlation exists between arch predetermination with use of Pont's index and observed arch forms, making it unsuitable for usage in costal Andhra population.

KEYWORDS : Angle's Class I Molar Relationship; Pont's Index; Interpremolar Arch Width; Intermolar Arch Width.

INTRODUCTION:

Malocclusions are a direct result of inheritance although similarities cannot always be estimated between parents and offspring due the reported frequent tooth loss in the parents. There are basically two general factors considered which can contribute to similarities between relatives: genetic factors and environmental factors.[1,2] The crowding of teeth is a result of a discrepancy between the combined width of teeth and the arch perimeter and that this depends on numerous factors such as shape, length and width.[3,4] Therefore, a great variety of indexes have been implemented for clinical orthodontic diagnosis. These indices are used to predict the size of the dental arch and help us choose the treatment plan more suited for each case.[1] Numerous indexes have been suggested as a guide for the clinician to determine the amount of expansion required to achieve an ideal arch width.[4] The importance of this evaluation method is for the maxillary orthopaedic diagnosis and treatment planning and has been overrated in the past. A variety of diagnostic indices have been proposed in clinical orthodontics to help predict dental arch growth and assist with treatment planning.

Pont, in 1909,[5] proposed a method of predicting the ideal maxillary dental arch width from sum of mesiodistal diameters of the four maxillary incisors and it is popularly known as Pont's Index. The index also helps to determine if the dental arch is narrow or normal and if expansion is possible or not.[6] The Mesiodistal tooth width has an anthropological significance because it provides valuable information on human evolution with its technological and dietary changes.[7] On a clinical level, mesiodistal tooth width is correlated to the arch alignment and large teeth are associated with crowded dental arches.[8,9,10]

From a clinical point of view, Pont's Index cannot provide reliable predictions for individual orthodontic treatment planning. Since Pont's Index was originally based on the mean value of an unspecified French population, individual variations and population differences were not covered.[6]

The present study was initiated to provide estimates of Pont's index in selected samples and do assess the applicability of the same in Indian population.

Material and Methods:

The cross-sectional study was conducted among the Coastal Andhra Pradesh, population, India. The Ethical clearance was obtained from Institutional Ethical Committee before start of study and written informed consent was obtained from all the subjects before commencement of study. A hospital based screening was conducted in XXX, XXX, southern India for 839 subjects aged 14 to 25 years, out of which 130 were selected on meeting the inclusion criteria. The criteria for inclusion was subjects with presence of all permanent teeth erupted except third molars, subjects processing Angle's class I molar relationship, with < 4 mm Overbite; <3 mm Overjet, with no/minimal total arch crowding or spacing (< 3 mm), with no supernumerary teeth; with no crossbite, with no/minimal attrition, with no history of past orthodontic treatment. Those subjects with missing teeth/partial anodontia, with any cleft lip/palate and craniofacial Syndromes or those who were unwilling were excluded.

Sampling technique:

The required sample was attained by stratified random sampling procedure taking age into considerations after which the subjects were selected randomly.

Study duration:

The study was done for a period of 6 months i.e., from 31-04-2018 to 31-10-2018.

Materials used In the Study:

Alginate irreversible hydrocolloid impression material (Zelganplus,Dentsply), Orthodontic Impression trays (Dentsply), Mixing bowl and spatula, Dental stone (Orthostone, Dentsply)

Methodology:

Alginate impressions were taken and poured immediately with hard orthodontic stone material (Figure 1). The dental

cast will not be soaped/waxed to prevent the occlusion slippage. Power calculation was undertaken to determine the sample size. Taking the sum of mesiodistal crown diameters of the four maxillary incisors width comparison between males and females, power of the study is found to be 97% indicating the sample size taken in the study is sufficient. Software used for estimating the power of the study: G power software version 3.1.9.2. All measurements were taken on the study casts by a digital calliper with sharp beaks (Figure 2, having an accuracy of 0.01 mm). The premolar arch width was taken from the first premolar of the left side to the right side at the distal end of its occlusal groove. The molar arch width was taken from the maxillary left permanent molar to the same of the right at its mesial pit on the occlusal surface. The combined width of the maxillary incisors was taken at the distal contact points with the canines on either side. The predicted arch widths in the Interpremolar arch width(P) and Intermolar arch width(M) regions were estimated with the formula proposed by Pont.

Interpremolar arch width(P)= SI × 100/80
Intermolar arch width(M)= SI × 100/64

Where, 'SI' = sum of mesiodistal crown diameters of the four maxillary incisors; 'P' width = transverse distance between maxillary first premolars measured at the distal pit; and 'M' width = transverse distance between maxillary first molars measured at the central fossa. All the examination was carried out by the investigator herself and 10% of the recording was duplicated every day.

Statistical analysis:

All statistical analysis was carried out using SPSS version 20.0, MEDCALC trail version and MS Excel-2010. Incisor and arch widths will be recorded for each subject to the nearest 0.01mm and described in term of average values, standard deviations and coefficients of variation for males and females separately. Arch widths will be calculated according to Pont's formulae and correlation coefficients will be calculated between the measured and the calculated arch width values. Correlations will also be determined between individual and combined incisor widths and measured arch widths.

RESULTS:

Table 1: Represents the correlation coefficient(r) and coefficient of determination(r2) between measured and calculated arch width values according to Pont's formulae.

ARCH WIDTH	Coefficients	Males(39)	Females(91)
INTERPREMOLAR	r	0.231	0.247
	r2	0.053	0.06
INTERMOLAR	R	0.148	-0.055
	r2	0.021	0.0025

- Table 1 showing correlation coefficient(r) and coefficient of determination (r^2) between measured and calculated arch width values where r value for inter-premolar archwidth for males is 0.231 and females is 0.247 and (r^2) value for males is 0.053 and for females 0.06.
- In inter-molar archwidth the r value for males is 0.148 and for females is -0.055 whereas the (r^2) value for males is 0.021 and females is 0.0025.

Table 2: Represents the percentage of individuals having an observed arch width values under, over, and ±1 mm around Pont's prediction.

	Under Pont's prediction(%)	Over Pont's prediction(%)	Pont's prediction ±1 mm(%)
Interpremolar Males (n = 39)	48.71	51.28	46.15
Females (n = 91)	36.26	63.73	38.46
Intermolar Males (n = 39)	38.46	61.53	41.02
Females (n = 91)	49.45	50.54	28.57

- The percentage of individuals having observed arch width values around the predicted values (with α ±1 mm difference) were generally low among males and females, ranging from (46.15 to 38.46%) inter-premolar region.
- The percentage of individuals having observed arch width values around the predicted values (with α ±1 mm difference) were generally low among males and females, ranging from (41.02 to 28.57%) intermolar region.

Table 3: Represents the largest differences under and over Pont's prediction for males and females in millimetres.

	Largest difference under Pont's prediction(mm)	Largest difference over Pont's prediction(mm)
Interpremolar Males (n = 39)	-3.57	4.61
Females (n = 91)	-6.15	5.86
Intermolar Males (n = 39)	-4.7	6.53
Females (n = 91)	-6.91	5.84

- The differences between the actual and predicted arch width values for each subject were large, for the interpremolar widths which ranged from −3.57 to +4.61 mm for males and from −6.15 to +5.86 mm for females. Pont's index overestimated the interpremolar width in males and underestimated interpremolar width in females.

- The differences between the actual and predicted arch width values for each subject were large, for the intermolar widths which ranged from −4.7 to +6.53 mm for males and from −6.91 to +5.84 mm for females. Pont's index overestimated the intermolar width in males and underestimated intermolar width in females.

DISCUSSION:

Malocclusions commonly result from disharmony between tooth size and dental arch size, dental indices have often been related to either one or both of these variables. Pont's Index is one of the indices that still raise atavistic debate with regard to its clinical value. Pont (1909)[6] did his experiment on French population stating a need for further investigation to check the validity of his formula.. Different jaw sizes will require different amount of expansion so chances are there that the Pont's formula could be different for different population and different racial groups.[11]

The study was aimed to check the applicability of Pont's Index to south Indian population inhabiting coastal regions of Andhra. In the previous investigations, the subjects in most cases were chosen from university or hospital records. Therefore, they cannot be considered truly representative of their corresponding populations. The subjects in the present study were of a single age group selected from a random stratified sample that was collected from randomly selected schools and colleges of Coastal Andhra. For every subject selected, both parents were from Indian origin, having pure Indian ancestry. Therefore, this sample was believed to be truly representative of Coastal Andhra Pradesh population, India. Special attention was also given to the sample size. Our study had the largest sample of a single population compared with all similar previous studies conducted in India. The mesiodistal widths of the teeth were measured by two examiners in a previously conducted study. In the present investigation, only one examiner measured arch width. This

was not expected to affect the accuracy of measurements especially as error calculations were undertaken and the results showed that the measurements were highly reliable. Statistical analysis of this present study shows that the maxillary incisor widths differed significantly between males and females. The findings of the present study were supported by Jordanians[12] and Turkish[13] population and not supported by Egypt, Mexico, and the United States,[14] Jordanians[15] and Turkish population.[16]

In the present study, females had significantly smaller values for measured maxillary intercanine widths, interpremolar width and intermolar widths. This agrees with the findings of Malay,[17] Saudi,[18] Northern Indian,[19] Colombian[20] and Jordanian[15] females.

The correlations between measured arch widths and those calculated according to Pont's formulae were low, indicating that Pont's Index should not be used clinically to pre-determine arch widths for Indian individuals. Results of our study are in contrast with few previous similar studies[6,21,22,23-29] showed the same results. Few authors[30,31,32,24] were disagreed with the results achieved in the present study.

Because of variations in interpremolar and intermolar areas in different populations, researchers made modifications to the indices. Recommended index values for Northern Indians[33] was 81.66 for premolar index and 65.44 for molar index, For Indians[34] premolar index was 83.86 and Molar index was 66.36 and for Chinese premolar index was 80.27 and Molar index was 63.92, for Tibetan[35] population premolar index was 79.56 and molar index was 61.64, for Koreans[36] premolar index was 81.96 and molar index was 62.55, for Malaysians[37] premolar index was 83.34 and molar index was 67.71, for Bangladeshi[38] premolar index was 85.82 and molar index was 66.93, for Lithuanian[39] individuals were assessed to be 85.57 in premolars and 66.24 in molars area.

The differences between the actual and predicted arch width values for each subject were large, for the interpremolar widths which ranged from −3.57 to +4.61 mm for males and from −6.15 to +5.86 mm for females and for the intermolar widths which ranged from −4.7 to +6.53 mm for males and from −6.91 to +5.84 mm for females. This shows the wide range of possible error if the index were to be applied clinically. Moreover, these differences show that Pont's Index tends to overestimate the arch width required to relieve crowding in males and underestimate in females. This was supported by Navajo[40] population, three different populations: Australian Aborigines, Indonesians, and white Australians,[34] Caucasians,[41] Jordanians[1] and Malaysian[37] population.

This was particularly true for the females group in this study in which 64 %of subjects (for interpremolar widths) and 51 %of subjects (for intermolar widths) demonstrated actual values that were greater than those predicted according to Pont's Index. This indicates that Indians have arches that are broader than those of Pont's sample. The percentage of individuals having observed arch width values around the predicted values (with a ±1 mm difference) were generally low, ranging from 46.15to 38.46 percent in interpremolar areas and 41.02 to 28.57 percent in intermolar areas. This was supported by Indonesians, Aboriginals and the white sample.[41,42,43] But when compared to all other studies,[41,42,43] the present study showed the percentage of individuals having observed arch width values around the predicted values (with a ±1 mm difference) were high.

When considering the results of this research and other similar studies, it may be postulated that Pont's Index represents mean values for groups that should not be extrapolated to individuals of different ethnic origins as it does not give accurate estimates of ideal arch widths for a given individual in the majority of cases.

CONCLUSION:

The many advantages of study model analysis make it possible to detect deviations of the disgnathias (anomalies of the oral cavity and teeth that also affect the maxillary bones) in the three dimensions of space. The lack of correlation exists between arch predetermination with use of Pont's index and observed arch forms. This suggests that its use as a clinical tool for individual treatment planning is unjustified in Coastal Andhra Pradesh population, India. Mean arch forms may vary between ethnic groups and arch form varies between individuals. Differences in tooth size and average arch form may exist between genders within an ethnic group. Further studies are required to clarify the associations between tooth size and arch form (not just width) in relation to the dentofacial complex, and also to quantify the genetic influences that affect all of its components.

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