Application of Pont's Index on Indian Population : A Dimorphic Study

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ABSTRACT

Purpose: To verify the accuracy of Pont's index on male and female Indian population.

Materials and method : The study was done on two hundred samples (100 males and 100 females) by fabricating the study models. Then, maxillary incisor mesiodistal width, premolar arch width and molar arch width were measured on the cast using Digital Vernier calipers, which was followed by statistical analysis of the data using the software Package (version 11.5 SPSS).

Results : Both premolar and molar arch widths and mesiodistal width of four maxillary incisors are greater in males than in females. Significant difference were found between observed and predicted arch widths according to Pont's index.

Conclusion: Applicability of Pont's index is questionable in Indian population as per the results of this study.

Introduction

Orthodontic problems commonly result from disharmony between tooth size and dental arch size. Many indices and methods have been suggested to guide clinicians in predicting the ideal arch width required to alleviate dental crowding to produce more stable final results.[1,2]

One of the commonly used Index was described by Pont (1909), who found that the ideal arch width necessary to accommodate the dentition and relieve crowding can be determined by assuming a constant relationship between the sum of the mesiodistal widths of the permanent maxillary incisors (SI) and the interpremolar or intermolar arch widths, which he expressed by the following formulae:

Interpremolar arch width = Sum Of Incisors / 0.80
&
Intermolar arch width = Sum Of Incisors / 0.64.

The advantage of Pont's Index lies in ease of application and the valuable information it provides to aid treatment planning. Nevertheless, using this index remains highly controversial with some investigators supporting its use to predict arch widths[3,4] and others believing it to be unreliable and advocating not to be used for clinical purposes.[5-8]

Studies done on Indian population have found a significant relationship between sum of the incisor widths and arch widths[4], while studies done on Navajo-Indians and Americans have found lesser significance.[6]

Most of the previously mentioned studies[3,4] concluded that Pont's Index was unlikely to be a useful clinical predictor of dental arch width, but these investigations had their drawbacks in terms of adequacy of sample size and randomization. Furthermore, no study has been undertaken to assess application of Pont's Index on different sex on Indian population. Therefore, this dimorphic study has been undertaken to assess applicability of this index on Indian population.

Materials & Methods

Collection of data and sample size

For this study 200 subjects with normal occlusion (100 males & 100 females) in the age group of 16-25 years were selected based on the required selection criteria after taking proper consent from the subject. Maxillary study models were prepared after selection of the samples based upon the ideal selection criteria.

Selection Criteria

Full set of erupted permanent dentition till first molars on both jaws.

- No clinically visible dental caries or restorations
- No clinically visible dental attrition
- No history of previous orthodontic treatment
- Angle Class I molar relation
- Normal occlusion

Measurements

The measurements were carried out using a digital vernier caliper with an accuracy of 0.01 mm. The following landmarks were used for measurements :(fig-1, 2, 3)

Mesiodistal widths of four maxillary incisors: measured one by one from anatomic contact point from mesial to distal side.

Width of arch in the premolar region: measured from the distal pit of one upper first premolar to the distal pit of the opposite first premolar.

Width of arch in the molar region: measured from the mesial pit of one upper first molar to the mesial pit of the opposite first molar.
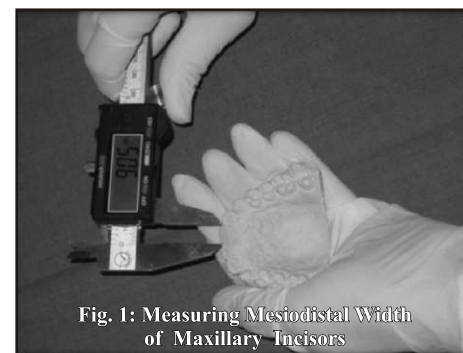

Fig. 1: Measuring Mesiodistal Width of Maxillary Incisors

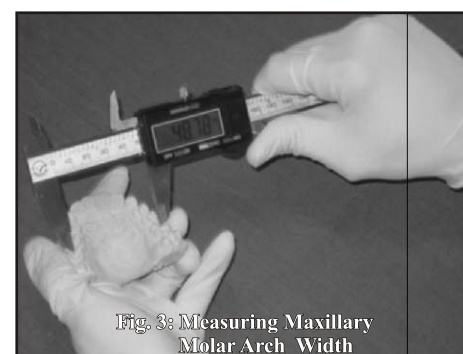Fig. 2 : Measuring Maxillary Premolar Arch Width

Fig. 3: Measuring Maxillary Molar Arch Width

Observation And Results

Statistical analysis was performed with a software Package (version 11.5 SPSS) to analyze the data. Descriptive analysis of all the seven parameters (i.e. The mesiodistal width of the maxillary incisors, true premolar and molar arch width, and estimated premolar and molar arch width

according to the Pont's formula) for both males and females was done separately and together.(table1A,1B,1C)

According to the results obtained the sum of maxillary incisors mesiodistal widths ranged between 27.86 mm to 34.96 mm for males and 26.02 mm to 33.73 mm for females with a mean of 31.61 mm and 29.75 mm respectively for males and females.

For true premolar arch width the range was 33.01 mm to 42.56 mm with a mean of 37.78 mm for males and for females the range was 31.99 mm to 40.10 mm with a mean of 36.13 mm. Similar values for inter molar width were found to be 42.07mm to 53.61 mm with a mean of 47.92 mm for males and for females the range was 40.20 mm to 51.60 mm with a mean of 45.67 mm.

Coefficients of correlation were also analyzed between combined maxillary incisor widths to true premolar and molar arch width for males and females, respectively. The Correlation of coefficients between the measured true arch width values and the corresponding values estimated according to Pont's index was tabulated separately for males and females. (Graph-1,2). These values were found to be highly significant as the p=<.001 level

For inter premolar arch width- Percentage sample having the true measured arch width (graph-1)

1. For males
• Below Pont's prediction 66%,
• Above Pont's prediction 15%
• And around ±1mm from Pont's prediction was 19%.

2. For females
• Below Pont's prediction 51%,
• Above Pont's prediction 16%
And around ±1mm from Pont's prediction was 33 %.

For inter molar arch width - Percentage sample having the true measured arch width (graph-2)

1. For males
• Below Pont's prediction 64%,
• Above Pont's prediction 23% and
• Around ±1mm from Pont's prediction was 13%.

2. For females
• Below Pont's prediction 52%,
• Above Pont's prediction 25% and
• Around ±1mm from Pont's prediction was 23%.

Discussion

The findings of the present study revealed that a significant and definite correlation exists between the widths of four maxillary incisors and both premolar and molar arch widths. It was consistent with results of the study conducted by Gupta et al[4] and G.Agnihotri et al[9].

But, at the same time the present pioneer study has taken the impact of gender factor into consideration, which most of the previous studies has not done.

The results of the present study indicate that the arch width's (both premolar and molar) and mesiodistal width of four maxillary incisors are greater in males than in females. The sum of maxillary incisors mesiodistal widths ranged between 27.86 mm to 34.96 mm for males and for females 26.02mm to 33.73mm respectively. For premolar arch width the range was 33.01 mm to 42.56 mm with a mean of 37.78 mm for males and for females the range was 31.99 mm to 40.10 mm with mean of 36.13 mm. Similar values for inter molar width were found to be 42.07mm to 53.61 mm with a mean of 47.92 mm for males and for females the range was 40.20 mm to 51.60 mm with mean of 45.67 mm. (Table 1A and 1B).

This is in agreement with the results obtained for North Indians[9] and for Saudi population[10], but in disagreement with the findings for (Egypt, Mexico and United State)[11] and Jordanian population[12]. This is of definite significance as the tooth morphology is known to be influenced by cultural, environmental and racial factors.

Table 1a- Descriptive Mean, Standard Deviation ,minimum & Maximum Values of (100)males

PARAMETERS	SUM OF MAXILLARY INCISORS	TRUE MEASURED PREMOLAR WIDTH	TRUE MEASURED MOLAR WIDTH	ESTIMATED PRE-MOLAR BY PONT'S FORMULA	ESTIMATED MOLAR BY PONT'S FORMULA
MEAN	31.6173	37.7871	47.9237	39.5192	49.4092
STANDARD DEVIATION	1.30722	2.15484	2.74203	1.63429	2.04078
MINIMUM	27.86	33.01	42.07	34.82	43.53
MAXIMUM	34.96	42.56	53.61	43.70	54.62

Table 1 B- Descriptive Mean, Standard Deviation, Minimum & Maximum Values of (100) Females

PARAMETERS	SUM OF MAXILLARY INCISORS	TRUE MEASURED PREMOLAR WIDTH	TRUE MEASURED MOLAR WIDTH	ESTIMATED PRE-MOLAR BY PONT'S FORMULA	ESTIMATED MOLAR BY PONT'S FORMULA
MEAN	29.7517	36.1338	45.6788	37.1849	46.3930
STANDARD DEVIATION	1.50988	1.91754	2.55658	1.88869	2.63525
MINIMUM	26.02	31.99	40.20	32.52	34.34
MAXIMUM	33.73	40.10	51.60	42.16	52.70

Table 1c- Descriptive Means, Standard Deviation, Minimum & Maximum of Two Hundred Samples (100 Males And 100 Females)

PARAMETERS	SUM OF MAXILLARY INCISORS	TRUE MEASURED PREMOLAR WIDTH	TRUE MEASURED MOLAR WIDTH	ESTIMATED PRE-MOLAR BY PONT'S FORMULA	ESTIMATED MOLAR BY PONT'S FORMULA
MEAN	30.6845	36.9605	46.8013	38.3521	47.9011
STANDARD DEVIATION	1.69078	2.19682	2.87373	2.11482	2.79509
MINIMUM	26.02	31.99	40.20	32.52	34.34
MAXIMUM	34.96	42.56	53.61	43.70	54.62

Our results are similar to the values as interpreted in the studies of Hattab et al[13] ,AL-khateeb et al[14], Qu Hong et al[15] and G.Agnihotri et al.[9]

In this study, correlation coefficient was found between the measured true arch width values and the corresponding values estimated according to Pont's index. No sample showed the values similar to the Pont's index. Most of the arch widths were either "over" or "under" the predictions (Graph 1 and Graph 2), wherein it is obvious that individual variation is large. Most of the Indian population measured arch width values are smaller than Pont's prediction which means Pont's index tends to overestimate the arch width required to relieve crowding. This indicates that Indian population have arches that are narrower than those of Pont's Estimation.

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.

Pont's Index should not be used to predetermine ideal arch width values for Indian individuals. But Pont's principal is used because findings of the present study revealed that a significant and definite correlation exists between the widths of four maxillary incisors and arch width in both (males and females) which is in apparent with the study of Gupta et al[4] and G.Agnihotri et al.[9]

Summary & Conclusion

It was summarized from the results of the present study that-

• Significant correlation exists between the combined maxillary incisor width and the maxillary interpremolar and intermolar arch widths.

• Both premolar and molar arch widths and mesiodistal width of four maxillary incisors are greater in males than in females.

• Significant difference was found between observed and predicted arch widths according to Pont's index.

• Applicability of Pont's index is questionable in local Indian population as per the results of this study.

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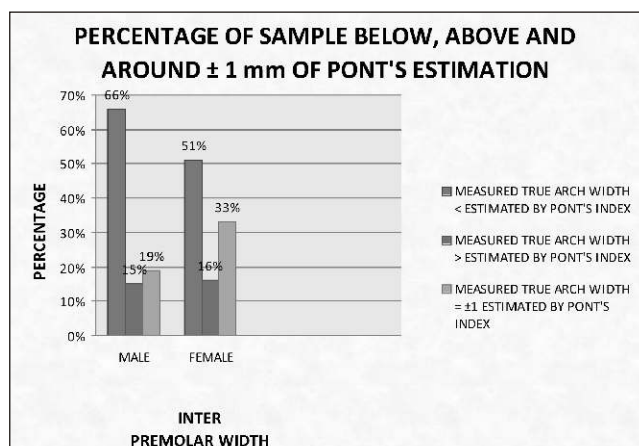
Graph -1 Depicts Difference Between Measured True Inter Premolar Arch Width & Estimated Inter Premolar Arch Width By Pont's Index
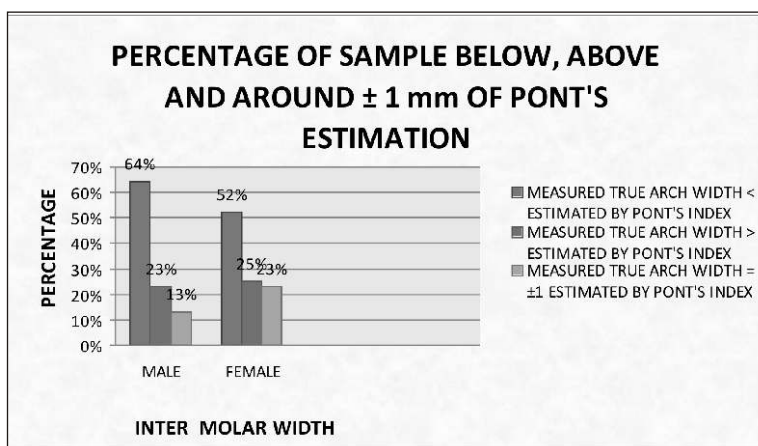
Graph -2 Depicts Difference Between Measured True Inter Molar Arch Width And Estimated Inter Molar Arch Width By Pont's Index