

PAPILLO-INCISAL DISTANCE

INCISIVE PAPILLA MAXILLARY INCISOR DISTANCE IN SUBJECTS OF VARIOUS ARCH FORMS

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DR. TAYYABA SALEEM

Assistant Professor
Department of Prosthodontics
University College of Dentistry
The University of Lahore

PROF. TARIQ ZAMAN AHMAD

Associate Dean
University College of Medicine and Dentistry
The University of Lahore

ABSTRACT... Objectives: To compare the influence of various arch forms on papillo-incisal distance PID (distance between posterior limit of the incisive papilla and the most prominent contour of the labial surface of maxillary central incisors). **Study design:** Descriptive study. **Place and duration of study:** Department of Prosthodontics, Lahore Medical and Dental College, Lahore, Pakistan, from October 2004-December 2005 & May 2010-September 2010. **Methodology:** A total of 250 subjects, 125 male and 125 female were included. Theme of evaluation was incisive papilla maxillary central incisor distance and arch form. Normal healthy subjects with symmetrical arches and all teeth present except third molars were included. Subjects with malformed teeth, periodontal problems, orthodontic treatment or restorations on the labial tooth surfaces were excluded. Data was analyzed in SPSS 16 package by applying t test and ANOVA, with $p \leq 0.05$ as cut off point for statistical significance. **Results:** The mean PID was 12.02mm SD \pm 1.5. Among the subjects 82% had ovoid, 7% had tapering and 11% had squarish arches. **Conclusions:** Mean PID 12.02mm SD \pm 1.5 is suggested for artificial central incisors replacement. There is higher presentation of ovoid arches with a strong influence of arch forms (p -value < 0.02) and a weak influence of gender (p -value < 0.489) on PID.

Keywords: Dentures, Artificial tooth, Esthetics

INTRODUCTION

Suitable positioning of replacement teeth poses challenges¹. Best position for artificial teeth is the one occupied by the natural predecessors². When pre-extraction records are available the task is simpler. Several methods have been developed for their accurate placement, various operators have employed certain anatomic landmarks as useful guidelines for placement in positions of natural predecessors³.

Frequently used landmarks are maxillary labial vestibule⁴, incisive papilla,^{1,2,4,5,6} retromolar pad, palatal gingival vestigial remnants, midpalatal suture,⁴ and palatal rugae.

Incisive papilla (IP) is a noticeable land mark which appears to have survived from the dentate to edentulous condition¹. It serves as a guide to determine midline,⁴ labiopalatal position of artificial incisors and canines, as a starting point for occlusal rim fabrication at the central incisor region⁷ and for determination of parallelism of occlusal plane, when used in conjunction with hamular notch⁸.

The distance of IP from the central incisors has been measured from center,⁶ or posterior border of the papilla^{1,2,5,6,9}. This distance also varies in the squarish,

tapering and ovoid arch forms².

Studies have been conducted for Caucasian,^{1,2,4} Chinese⁶ Thai,⁵ Korean⁹ and Taiwanese¹⁰ populations.

Oral health awareness and status in our society is far below the WHO standards. Pre-extraction records are either not available or lost due to negligence. The prosthodontist may have to rely only on the anatomic landmarks for tooth arrangement. There is scant data on this subject from the local population. This study aims to find the PID and its association with arch forms in local population.

METHODOLOGY

A descriptive study was carried out over a period of 19 months from October 2004 to December 2005 & May 2010 to September 2010 at Lahore Medical and Dental College. A convenient sampling technique was used to recruit 250 subjects (125males, 125females). The subjects were 16-40 years of age who had normal healthy dentition, well aligned arches with all incisors, canines, first and second premolars and molars present. Patients with malformed and malposed teeth, periodontal disease, restored anterior teeth, history of orthodontic treatment, congenital and/or acquired maxillary defects, orthognathic/ reconstructive surgical procedures were excluded.

Maxillary impressions were made with irreversible hydrocolloid (fast setting alginate Phase Plus: Chromatic by Zhermack Spa). The models were made by making the model base parallel to the occlusal plane¹.

The casts were mounted on the horizontal table of a dental surveyor (Maraton 103 by Sae Yang Machinery Co). The distance from the posterior surface of IP to maximum convexity of central incisor, the papillo-incisal distance (PID) was measured with a modified vernier caliper¹. (0-150mm by Jing Gong). Posterior limit of IP was marked on models with a mechanical lead pencil with a 0.05mm refined lead tip and PID to the most prominent contour of the right central incisor recorded.

The arch form was calculated by using the formula of arch width and depth¹¹. The arch width was bilaterally measured at two reference points with a standard unmodified vernier caliper (0-150mm by Jing Gong). All models were photocopied with 1x1 magnifications¹² and were used to measure arch depth. The formula was applied to find the numerical value for arch form. All readings were taken at three different occasions by the author and mean values were calculated for verification and noted. Verbal consent was obtained from the study participants for publication of results.

The collected data was entered, cleaned and analyzed using SPSS program version 16. The study variables included "gender", "PID" and "Arch Form". For statistical significance "t" test was used for continuous variables and ANOVA was applied for categorical variables. "P value" ≤ 0.05 was considered the cutoff point for statistical significance.

RESULTS

Among 250 subjects, 68 (27%) were between 16-20 years of age 163 (65%) were 21-30 years old and 19 (8%) were in the age group of 31-40 years. Mean recorded PID was 12.02mm with SD=1.5. The smallest recorded reading was 8.38mm and the highest was 16.47mm. Average PID in males was 11.96 ± 1.5 (S.D) and in females was 12.09 ± 1.5 (S.D).

The PID difference in males and females was insignificant with a p-value >0.05 (0.489) and t-value of 0.693.

The distribution of various arch forms was as follows, ovoid arch form was found in 206 (82.4%), squarish in 28 (11.2%) and tapering arch form in 16 (6.4%). Table 1 shows the distribution of PID in different arch forms. The PID differences in various arch forms was significant with a p-value of <0.05 (0.02). Figure 1 shows the plot of mean PID in with arch forms.

DISCUSSION

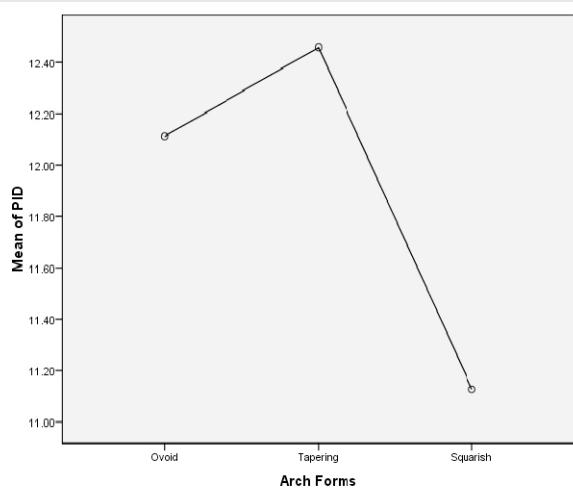
Arranging artificial teeth according to the anatomic landmarks help in positioning of teeth in relation to the general arch form and one another. The pre-maxilla may be referred to as "esthetic zone" because of its high visibility and influence on facial appearance. Improper positioning of the maxillary central incisors may result in distorted appearance and may affect speech¹³.

Many geometric arch forms and mathematical functions have been proposed to describe dental arches over the years^{11,14}. Some authors^{2,15,16} prefer to classify dental arches into ovoid, tapering and squarish, this classification of arch forms was used in the present study.

Table-I. Papillo incisal distance in various arch forms

Arch form	PID				
	Number	Mean	SD	Minimum	Maximum
Ovoid	206	12.1116	1.51475	8.38	16.47
Tapering	16	12.4581	1.35638	10.35	15.07
Squarish	28	11.1268	1.12555	9.25	13.45
Total	250	12.0235	1.49874	8.38	16.47

Fig-1. Plot of means of PID in various arch forms



The majority of the subjects 82.4% had an ovoid arch form, whereas 6.4% tapering and 11.2% had squarish arch forms. Females had 83% ovoid, 10% squarish and 7% tapering arches, whereas males had 81% ovoid, 13% squarish and 6% tapering arches. Ovoid arch form was prevalent in both genders. Zia¹⁷ also reported ovoid arch form to be most common in males and females, 57.3% and 68% respectively. However, he used subjective method to determine the arch forms and described five shapes. In a comparison of Japanese and Caucasian mandibular dental arches¹⁵ the Japanese group had 46% squarish arches, 42% ovoid and 12% tapering arches. The Caucasian group had 18% squarish arches, 38% ovoid and 44% tapering. The author reported that there were ethnic differences in arch forms. This explanation may also be relevant to the Pakistani samples.

PID is an important biometric guide for positioning of maxillary occlusal rim and central incisors¹⁸. Mean PID measured in this study sample was 12.02mm SD±1.5. In Grave's¹ study with the same landmarks the mean PID was 13.1mm on dentate subjects in Caucasians. The mean distance was 12.45mm in another Caucasian sample¹⁹. In a Thai sample it was 11.093mm and 12.269mm from incisive papilla to incisal edge of the central incisor and the most convex labial surface respectively⁵. In a study on Southern Chinese population the posterior limit as well as center of the incisive papilla

to the most labial contour of the central incisor was used⁶. Mean value for the distances were 12.71mm and 9.17mm respectively. A Jordanian study recorded 12.93mm from incisal tangent to the posterior limit of the incisive papilla using computer scanner and software program²⁰. In a 3D orthographic study on Korean sample the PID from the posterior border of the incisive papilla to a vector drawn in the midpoint of mesio-incisal tips of both maxillary incisors was 11.96mm⁹. The PID in studies using posterior limit of the incisive papilla as the reference point for measurement is comparable to this study.

The comparison of gender with PID and arch forms suggested no association between these variables. The *t* value calculated was 0.693 with a *p*-value of 0.489. This weak association between gender and arch forms was also reported by Grave¹ and Park⁹.

In a study² of 150 models, 50 each of ovoid, squarish and tapering forms, PID was measured from posterior limit of incisive papilla with the mesial corner of the central incisor. Mean distance was 9.65mm in ovoid and squarish arch forms and 10.29mm in tapering arches. These distances were less in comparison to present study. This may be explained on the basis of selection of area of measurement, as mesial corner of the central incisor was used as a reference point to measure the PID.

The influence of arch form on PID was determined in this study. The *p*-value of 0.02 shows a significant association of PID to arch shape of a person. This is in contrast to Mersel and Ehrlieh's study, and could be explained on the basis that their sample consisted of equal numbers of three arch forms.

The present study was designed to discover various arch forms in the collected sample and to find relation of PID in these arch forms. The ovoid arches were dominant i.e 82.4%, the other two arch forms combined were only 17.8% which may have affected the final outcome. This could be a limitation of present study and use of equal number of the three arch forms may be explored in future research projects. In addition arch forms were mathematically determined by the formula suggested by

Noorzi,¹¹ more studies may need to be done to explore the reliability for this method.

CONCLUSIONS

The mean PID in this study was 12.02mm SD±1.5; this distance is recommended for placing the central incisors in artificial tooth replacement in Pakistani population. The most common arch form was ovoid 82.4% followed by squarish 11.2% and tapering 6.4%. There is a strong relationship of PID with arch form, but a weak relation of PID with gender of a person.

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Correspondence Address:
Dr. Tayyaba Saleem
203A, Shalimar Lane, Street 5,
Cavalry Ground, Lahore.
tayyabasaleem@hotmail.com

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