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Mean Vertical Distance of Incisive Papilla with Maxillary Central Incisor in Patients Presenting at Tertiary Care Hospital Lahore

Zahira Nawaz[1], Marleen Mahlaqa[2], Aqeel Ibrahim[3], Danish Azeem Khan[4], Muhammad Afzal[5]

[1,2,4,5] 28 Military Dental Centre CMH Lahore, Pakistan
[3] 4 Military Dental Centre, CMH Bahawalpur, Pakistan

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Correspondence to: Zahira Nawaz, Department of Dentistry 28 Military Dental Centre Lahore, Pakistan.
Email: nawaz.zehra135@gmail.com

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ABSTRACT

Background: The incisive papilla is a reliable anatomical landmark widely used in prosthodontics to position maxillary central incisors during complete denture fabrication. Accurate placement of anterior teeth is crucial for aesthetics, speech, and oral function. **Objectives:** To determine the mean vertical distance between the incisive papilla and maxillary central incisor in adult patients presenting at a tertiary care hospital in Lahore. **Study Design and Setting:** A cross-sectional study was conducted at the Department of Dentistry, 28 Military Dental Center Lahore over six months 15 October 2024 to 15 April 2025. **Methodology:** Sixty adult dentate patients aged 20 to 40 years with normal maxillary anterior teeth alignment were enrolled through consecutive sampling. Demographic data including age, sex, smoking, pan chewing, and dental arch form were recorded. Impressions were taken and stone casts fabricated. The vertical distance from the center of the incisive papilla to the mesial incisal edge of maxillary central incisors was measured using a digital vernier caliper. Data were analyzed using SPSS version 25. Independent t-tests were applied to assess differences in mean distances across stratified groups. **Results:** The mean vertical distance was 7.05 ± 0.25 mm (range 6.50–7.60 mm). No statistically significant differences were observed based on age, sex, smoking history, pan chewing, or arch form ($p > 0.05$). **Conclusion:** This study provides local reference values for the vertical distance between the incisive papilla and maxillary central incisors, which may aid in accurate anterior tooth positioning in denture fabrication. Demographic and behavioral factors did not significantly affect this measurement.

INTRODUCTION

In the fabrication of complete dentures, the prosthetic maxillary anterior teeth should be positioned as close as possible to the natural teeth's original locations to achieve a natural appearance and proper function.1 To accomplish this, reliable anatomical landmarks are essential. The incisive papilla, a small pear-shaped eminence consisting of fibrous connective tissue overlying the bony exit of the nasopalatine nerve and blood vessels, serves as a significant anatomical reference for locating the maxillary central incisors during denture fabrication.[2]

Harper demonstrated the stability of the incisive papilla by caliper measurements on pre-extraction and post-resorption models of the same patients over seven years.[3] Similarly, McGeea noted that the incisive papilla maintains a consistent position after tooth loss.[4] Despite variations in shape and location, the center of the incisive papilla is commonly used as a reference point in denture construction and related studies.[5] Proper positioning of artificial teeth relative to the incisive papilla provides a foundation for natural speech, pleasing esthetics, and normal oral function.[6]

Accurate determination of the anterior incisal tooth position is crucial in complete denture fabrication. The incisive papilla is a firm, immovable, and reliable landmark that guides the midline, labiolingual, and inciso-cervical placement of the maxillary central incisors.[7,8] Rizvi et al.[10] found the vertical distance between the mesial incisal edge of the maxillary central incisors and the incisive papilla ranged from 6.89 mm to 7.03 mm, with a mean vertical distance of 7.00 ± 0.026 mm.

Although many studies have examined the horizontal relationship between the incisive papilla and maxillary central incisors, there is limited information on their vertical relationship. Furthermore, local data on this vertical distance are scarce. Establishing this relationship in the local population will provide valuable baseline data to assist clinicians in accurate inciso-cervical positioning of anterior teeth tailored to the individual needs of edentulous patients. The objective of this study is to determine the mean vertical distance between the incisive papilla and the maxillary central incisor in adults presenting at a tertiary care hospital in Lahore.

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MATERIALS AND METHODS

Permission from the institutional ethical review committee was obtained prior to conducting the study (ERC/2023/RAD/05). A cross-sectional study was conducted at the Department of Dentistry, 28 Military Dental Center Lahore over six months 15 October 2024 to 15 April 2025. Total 60 patients meeting the inclusion and exclusion criteria were enrolled from the Dental OPD of 28 Military Dental Center Lahore and written informed consent was obtained. Demographic information including name, age, sex, history of smoking, pan chewing, and dental arch form (ovoid, tapered, or square) was recorded at the time of inclusion. The required sample size was calculated to be 60 patients, based on a mean vertical distance of the incisive papilla to the maxillary central incisor of 7.00 ± 0.026 mm, with a margin of error of 0.01 and a confidence level of 95%. Non-probability consecutive sampling was used for sample selection.

Inclusion criteria comprised subjects aged 20 to 40 years of either gender, having permanent anterior teeth present with normal alignment, and dentate subjects with a full complement of natural teeth along with symmetrical and acceptable alignment of maxillary dentition presenting for routine dental check-up. Exclusion criteria included non-consenting subjects, those with worn or restored anterior teeth, teeth with agenesis, crowding, rotation, periodontal disease, missing anterior teeth, or a history of trauma or surgery involving the midface (nose, maxilla, or premaxilla).

Impressions were taken and stone casts were fabricated. The vertical distance between the incisive papilla and the maxillary central incisor was measured using a vernier caliper. The center of the incisive papilla was determined by measuring the planar distance between its most anterior and posterior borders along the median palatal line, using a vernier caliper with a precision of 0.01 mm, and halving this distance. The midpoint of the incisive papilla was then marked on each stone cast.

A digital caliper fixed perpendicular to the horizontal bar of a surveyor was used for measurements. The midpoint of the flat edge plane of the depth caliper was marked with graphite. This flat edge plane was contacted to the mesial incisal edges of the maxillary central incisors, aligning the midpoint of the flat edge with the midpoint of the incisal edge. The pin of the depth caliper was then touched to the marked midpoint of the incisive papilla. The mounted casts were moved by sliding, and the first measurement was accepted as the starting point. Three readings were taken for each subject, and the mean was calculated. All findings were recorded on a pre-designed proforma.

Data were analyzed using SPSS version 25.0. The Shapiro-Wilk test was applied to check for normality of data. Mean and standard deviation were calculated for continuous variables such as age and the vertical distance between the incisive papilla and maxillary central incisor. Frequencies and percentages were calculated for categorical variables including sex, history of smoking, pan chewing, and arch form. Stratification was done based on age, sex, smoking history, pan chewing, and arch form to assess their effects on the outcome variable. Post-stratification, an independent t-test was applied to compare the mean vertical distance of the incisive papilla with maxillary central incisor among stratified groups. A p-value less than 0.05 was considered statistically significant.

RESULTS

Table 1 presents the demographic characteristics of the 60 study participants. The majority of participants (55.0%) were aged 30 years or younger, while 45.0% were older than 30 years. Male participants slightly outnumbered females, comprising 53.3% of the sample compared to 46.7% females. Most participants did not have a history of smoking (83.3%) or pan chewing (86.7%), with only 16.7% reporting smoking and 13.3% reporting pan chewing. Regarding dental arch form, 75.0% of participants had either an ovoid or tapered arch, while 25.0% had a square arch form.

Table 2 shows the descriptive statistics for the vertical distance between the incisive papilla and the maxillary central incisor among the study participants. The mean vertical distance was 7.05 mm with a standard deviation of 0.25 mm. The minimum measured distance was 6.50 mm and the maximum was 7.60 mm, indicating slight variability around the mean value in the sample.

Table 3 compares the mean vertical distance of the incisive papilla to the maxillary central incisor across different stratified groups using independent t-tests. Participants aged 30 years or younger had a mean distance of 7.06 ± 0.25 mm, while those older than 30 years had a mean of 7.04 ± 0.26 mm (p=0.562), showing no significant difference. Male participants had a slightly higher mean distance (7.08 ± 0.27 mm) compared to females (7.01 ± 0.23 mm), but this difference was not statistically significant (p=0.284). Similarly, participants with a history of smoking (7.12 ± 0.28 mm) did not differ significantly from non-smokers (7.04 ± 0.24 mm) (p=0.371). For pan chewing history, those who chewed pan had a mean distance of 7.10 ± 0.26 mm versus 7.05 ± 0.25 mm for non-chewers (p=0.467). Finally, there was no significant difference between dental arch forms, with ovoid/tapered arches showing a mean distance of 7.05 ± 0.24 mm and square arches 7.07 ± 0.28 mm (p=0.764). Overall, none of the stratified variables showed a statistically significant effect on the mean vertical distance.

Table 1

Demographic Characteristics of Study Participants (n=60)

Variable	Category	Frequency, n (%)
Age (years)	Mean±SD	31.27 ± 6.45
	≤30	33 (55.0%)
	>30	27 (45.0%)
Sex	Male	32 (53.3%)
	Female	28 (46.7%)
Smoking History	Yes	10 (16.7%)
	No	50 (83.3%)
Pan Chewing History	Yes	8 (13.3%)
	No	52 (86.7%)
Dental Arch Form	Ovoid/Tapered	45 (75.0%)
	Square	15 (25.0%)

Table 2

Descriptive Statistics of Vertical Distance Between Incisive Papilla and Maxillary Central Incisor (n=60)

Variable	Mean (mm)	Standard Deviation (SD)	Minimum (mm)	Maximum (mm)
Vertical distance (Incisive papilla to incisor)	7.05	0.25	6.50	7.60

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Table 3

Comparison of Mean Vertical Distance of Incisive Papilla with Maxillary Central Incisor Among Stratified Groups Using Independent t-test (n=60)

Variable	Group	Mean Vertical Distance (mm)	p-value (t-test)
Age (years)	≤30	7.06 ± 0.25	0.562
	>30	7.04 ± 0.26	
Sex	Male	7.08 ± 0.27	0.284
	Female	7.01 ± 0.23	
Smoking History	Yes	7.12 ± 0.28	0.371
	No	7.04 ± 0.24	
Pan Chewing History	Yes	7.10 ± 0.26	0.467
	No	7.05 ± 0.25	
Dental Arch Form	Ovoid/Tapered	7.05 ± 0.24	0.764
	Square	7.07 ± 0.28	

DISCUSSION

The incisive papilla is a stable anatomical landmark used to guide the positioning of maxillary central incisors during complete denture fabrication. Accurate placement of artificial anterior teeth is essential for aesthetics, speech, and function. Vertical distance between the incisive papilla and maxillary central incisor helps determine the correct incisal height. Although horizontal relationships have been studied, limited data exist on the vertical distance, especially in the local population. Establishing this measurement locally will assist clinicians in customizing dentures. This study aims to determine the mean vertical distance in patients at a tertiary care hospital in Lahore.

The present study demonstrated a mean vertical distance between the incisive papilla and the maxillary central incisor of 7.05 ± 0.25 mm, with minimal variation across arch forms, age groups, sexes, and oral habits. These findings are in close agreement with Rizvi et al. (2021), who reported a mean papillo-incisal distance (PID) of 7.00 ± 0.026 mm, with negligible differences among ovoid, square, and tapered arches. Both studies therefore suggest that, when measured in the vertical plane from the papilla to the incisal edge, the dimension remains remarkably consistent in dentate adults.[10]

Freire et al. highlighted the incisive papilla's reliability as a landmark across facial morphologies, supporting our finding of minimal variation in vertical PID.[11] Similarly, Singh et al. (2013) stressed the need for strict exclusion criteria, which we also applied to maintain measurement accuracy.[15]

However, when comparing to studies using different anatomical reference points—particularly the posterior border of the incisive papilla—our results appear substantially lower. For example, Jatala et al. (2021) reported a mean of 11.34 mm (range: 7.58–16.45 mm)[13] and Naz et al. (2014) found 11.06 ± 1.46 mm,[16] while Shrestha et al. (2016) recorded 11.59 ± 1.3 mm.[8] These higher values are expected, as the posterior papillary border lies further palatally than our chosen landmark. Similarly, Kotwal et al. (2024) reported a mean PID of 12.09 mm,[17] and Memon et al. (2023) measured 9.20 mm to the papilla's centre and 12.47 mm to its posterior border, reinforcing the methodological impact on reported distances.[20]

Interestingly, Sapkota et al. (2021) documented slightly lower means—5.97 ± 1.03 mm (ovoid), 6.09 ± 0.98 mm (square), and 6.23 ± 0.89 mm (tapered)—which may reflect population-specific craniofacial morphology.[14] Likewise, Pachore et al. (2017) observed vertical distances ranging from 4–6 mm across arch forms, suggesting even shorter measurements in certain South Asian cohorts.[19]

Our lack of significant variation across arch forms contrasts with Jatala et al. (2021),[13] Naz et al. (2014),[16] and Ikusika et al. (2023), all of whom reported statistically significant arch-form differences.[18] In our data, ovoid/tapered arches (7.05 ± 0.24 mm) and square arches (7.07 ± 0.28 mm) were almost identical (p = 0.764), aligning more closely with Rizvi et al. (2021).[10] Overall, while the absolute numerical values reported across studies vary widely due to landmark definition, measurement technique, and population characteristics, the relative stability of the papillo-incisal relationship within a given methodology—such as in our study and that of Rizvi et al.—supports its utility as a clinical guide in prosthodontics.[10]

A key strength of this study is the use of precise measurement tools, such as vernier calipers, ensuring accuracy. The sample size of 60 provides adequate power to estimate the mean vertical distance reliably. Stratification by demographic and behavioral factors adds depth to the analysis. However, the cross-sectional design limits causal inferences. The study population from a single tertiary care hospital may reduce generalizability. Additionally, variability in dental arch forms might affect measurement consistency.

CONCLUSION

The study provides valuable local data on the mean vertical distance between the incisive papilla and maxillary central incisor. This measurement can guide more accurate anterior tooth placement in dentures. No significant demographic or behavioral factors were found to influence this distance.

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