Original Article

Evaluation of Position of Occlusal Plane Relative to Parotid Papilla as an Aid in Complete Denture Fabrication

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ABSTRACT

Objective: To evaluate the reliability of the parotid papilla as a guide for orientation of occlusal plane in the Pakistani population.

Study Design: Cross-sectional, hospital-based study

Place and Duration of Study: This study was conducted at the Department of Prosthodontics of Islamic International Dental Hospital, Riphah International University, over a period of six months start from 01-12-2022 to 31-05-2023.

Methods: A total of 100 patients were examined. The subjects were examined and the vertical distance between the inferior border of parotid papilla and the mesiobuccal cusp tip of maxillary second molar on the right and left sides was measured using a periodontal probe. The measurements were recorded in a written performa, and mean values were calculated. Descriptive statistical analysis were used for qualitative and quantitative variables.

Results: Mean age of the participants was 33.23±7.20 years. The gender distribution of the patients reveals a higher proportion of males, with 57 (57.0%) participants, compared to females, who constituted 43 (43.0%). The mean position of the parotid papilla in relation to the maxillary occlusal plane was calculated as 3.66±0.50 mm.

Conclusion: The findings of this study conclude that the parotid papilla is present above the maxillary occlusal plane. This anatomical relationship was quantified by measuring the mean vertical distance, which was determined to be 3.69 mm.

Key Words: Occlusal plane, Parotid papilla, Complete denture

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INTRODUCTION

Upon replacing the lost teeth with artificial prosthesis, dentists not only aim to restore the esthetics and smile characteristics, but also regain the lost masticatory and functional stimuli. When it comes to restoration, it is imperative to enhance the esthetic features of a smile by making sure that the occlusal plane is correctly oriented.[1]

The GPT (Glossary of Prosthodontic Terms) defines "occlusal plane" as "the average plane established by the incisal and occlusal surfaces of the teeth".[2] A "consonant" smile should be achieved in the denture to establish proper esthetics.[3]

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The correct orientation of occlusal plane is associated with masticatory efficiency and neuromuscular coordination.[1] Moreover, it revealed a neutralised relation of the denture flanges with the soft tissues of the oral cavity.[3] This augments the resultant stability and retentive characteristics of the final denture which, in turn, provides a psychological uplift to the patient when the he is able to talk and bite on food without any hindrance from soft tissues and muscles on the denture.[3]

The parotid gland secretes saliva through the Stensen's duct, which drains in the oral cavity through the parotid papilla. This papilla is located opposite the upper second molar. An accessory parotid gland may also be present, in 21-69% of individuals.[4] It is a separate nodule of salivary tissue present anterior to parotid gland,[4] usually over the masseter muscle.

Both intraoral and extraoral anatomic structures are used to construct the occlusal plane during fabrication of complete dentures.[5] The Stensen's duct (parotid papilla) is possibly the only intraoral landmark that can be used for posterior maxillary denture plane orientation.[6] Extraorally, the Camper's line (line between ala of nose and tragus of ear) is used to establish the maxillary plane of occlusion in posterior region.[5]

ln the past, several researches have been conducted on dentate patients to estimate the distance of parotid papilla with maxillary occlusal plane. ln 1970, Researcher determined a sustained relationship of the parotid papilla and occlusal plane with no significant differences among the genders and race of the subjects included. A rather recent research was conducted in 2019, where Tantray and Zargar[6] evaluated the distance in the Kashmiri population and determined it to be 3.7mm. They divided the measurement of right and left parotid papillae to be 3.2mm and 3.6mm respectively.[6]

The most recent research was carried out in Nepal when Mehta and Chhetri concluded that the parotid papilla was located superior to the maxillary occlusal plane[7] and the mean measurement of distance of parotid papilla and maxillary occlusal plane was 3.69±1.19mm.[7]

There has been only one study[7] conducted in the recent past to evaluate the average distance of parotid papillae with the maxillary occlusal plane, thus providing us with the aim to conduct this study. Therefore, the objective of this study is to determine the location of parotid papilla in relation to the maxillary plane of occlusion in dentulous individuals and to predict its reliability to reposition the occlusal level in edentulous patients of the Pakistani population. The study will help in serving as an anthropometric guide for positioning of the maxillary posteriors in complete denture fabrication.

METHODS

A cross-sectional study was conducted over a period of six months from 01-12-2022 to 31-05-2023. After obtaining clearance from the Ethical Review Committee of Islamic International Dental Hospital (Ref No. IIDC/IRC/2022/10/018), the subjects were selected after obtaining written consent from patients and dental students at the Department of Prosthodontics of Islamic International Dental Hospital, Riphah International University, Islamabad. The data was kept anonymous throughout the procedure and evaluation forms were discarded after data entry.

Sample size was calculated by using the WHO sample size calculator, which was 100 with confidence level 95%, Population mean is 3.69mm.[7] Population standard deviation (±SD) is ±1.19mm. Absolute precision is 0.25mm.

Patients of both genders, with age range of 20 to 50 years with an Angles Class I molar relationship and unrestored, intact maxillary molars. Samples that were excluded from our study included those with missing maxillary molars or patients demonstrating wear facets and those with restorations in maxillary arch. Furthermore, patients with a history of orthodontic treatment and those with supraeruption, rotation or any malalignment of maxillary molars were also excluded.

The vertical distance of parotid papilla from the maxillary occlusal plane in dentate patients was measured. (Figure-1) Subjects reporting to the Department of Prosthodontics in IIDH filling the inclusion criteria were selected for the study. Before selection, each patient was directed and informed about the study and an informed written consent was taken for participation in the study. The subjects were examined. The distance between inferior border of parotid papilla and the mesiobuccal cusp tip of maxillary second molar on the right and left sides was determined. It was verified clinically that the teeth are in maximum intercuspation so that the parotid papilla remains in its unchanged form. Instrument that was used to measure the distance is William's Probe (Hu Friedy, Chicago). The probe is 10mm in length, with color coded markings at each millimeter and readings at 1-2-3-5-7-8-9-10mm. The right and left readings were compared and evaluated for any significant variation. The readings were recorded for both sides in a written performa.

Data analysis was done using Statistical Package for Social Studies version 23 (SPSS v23). Descriptive statistics were calculated for the variables. The quantitative variables like age, distance between parotid papilla and maxillary second molar cusp tip, mean±SD (standard deviation) was calculated. For qualitative variables like gender, percentages and frequencies were calculated. Effect modifiers like age and gender were controlled by stratification. Post-stratification independent sample t-test was applied. P value ≤ 0.05 was considered significant.

RESULTS

The distribution of patients by age shows that the majority of participants 61 (61.0%) were in the age group of 20–35 years. The mean age of the participants was 33.23±7.20 years, reflecting a relatively young patient population in this study (Table-1).

The gender distribution of the patients reveals a higher proportion of males, with 57 (57.0%) participants. This indicates a male predominance in the study population. Table-2 provides an overview of the mean position of the parotid papilla in relation to the maxillary occlusal plane, along with the distances measured on the right and left sides separately. The mean position of the parotid papilla in relation with the maxillary occlusal plane was calculated as 3.66 mm with a standard deviation (SD) of 0.50 mm. This indicates a consistent positioning of the papilla with relatively low variability among the participants. When examining the sides independently, the mean distance on the right side was slightly greater at 3.73 mm (SD = 0.63 mm) compared to the left side, which had a mean distance of 3.56 mm (SD = 0.58 mm). This slight variation suggests a minor asymmetry in the positioning of the parotid papilla between the right and left sides. The relatively small

standard deviations across all measurements indicate a high degree of consistency in the positioning of the parotid papilla among the studied individuals.

The stratification of the mean location of the parotid papilla in relation with the maxillary occlusal plane by age showed minimal variation between the two groups. The mean position in individuals aged 20–35 years (N=61) was 3.68 mm with a standard deviation of 0.50 mm, while in those aged 36–50 years (N=39), it was slightly lower at 3.61 mm with the same standard deviation of 0.50 mm. The difference between these age groups was not statistically significant, as indicated by a p-value of 0.480. This suggests that age does not have a notable impact on the vertical position of the parotid papilla, supporting its reliability as an anatomical reference across different age ranges (Table-3).

Table No.1: Patient distribution by age

Age of patients	Number of patients	Percentage
20-35 years	61	61.0
36-50 years	39	39.0
Total	100	100.00
Mean±SD	33.23±7.20	

Table No.2: Average distance between the parotid papilla and maxillary plane of occlusion

	Mean	S.D
Distance between parotid papilla and maxillary molar cusp	3.66	0.50
Right side distance	3.73	0.63
Left side distance	3.56	0.58

Table No.3: Stratification for age with regard to mean of parotid papilla location with the occlusal plane

Age (Year)	N	Mean	S.D
20-35	61	3.68	0.50
36-50	39	3.61	0.50
P value	P=0.480		

Table No.4: Stratification for gender with regard to mean of parotid papilla with the occlusal plane

Gender	n	Mean	S.D
Male	57	3.68	0.52
Female	43	3.62	0.47
P value	0.581		

The stratification by gender revealed negligible differences between males and females. Among males (n=57), the mean position was 3.68 mm with a standard deviation of 0.52 mm, while in females (n=43), the mean was slightly lower at 3.62 mm with a standard deviation of 0.47 mm. p-value was 0.581 indicating that this difference is not statistically significant. These findings suggest that gender does not significantly influence the vertical position of the parotid papilla in relation with the upper occlusal plane, confirming its consistency as an anatomical reference across both genders (Table-4)

DISCUSSION

Absence of natural teeth and supporting anatomical landmarks can make it difficult to determine the precise position of the occlusal plane.[8,9] The stomatognathic system functions most efficiently and harmoniously when the occlusal plane remains in the neutral zone.[10,11] Any deviation from this position may disrupt normal oral functions, potentially leading to issues such as impaired mastication, phonation difficulties, and discomfort.[12]

Additionally, the occlusal plane plays a pivotal role in enhancing the overall aesthetic appearance by maintaining facial symmetry and proportions, which are particularly important in edentulous patients[9] who may already experience facial sagging due to tooth loss. Reconstructing the occlusal plane involves careful consideration of various mechanical, aesthetic, and phonetic factors. By achieving an appropriate balance among these elements, clinicians can provide edentulous patients with prostheses that serve to have long-term patient satisfaction.[13]

The occlusal plane is represented as the average planar curvature formed by the incisal edges of anterior teeth and the occlusal surfaces of posterior teeth. However, when a patient experiences complete tooth loss, this occlusal plane is also lost,[9] posing a significant challenge for the restorative dentist. Several intraoral anatomical landmarks are utilized to aid in the reorientation of the lost occlusal plane. These landmarks include the incisive papilla[14,15], the retromolar pad[16], the ala-tragus line[17] and parotid papilla.[7] According to Sicher and DuBrul (20), the parotid papilla is an important anatomical feature that typically aligns near the maxillary second molar, though its exact position may vary. Researcher noted that it is located superior to the buccal cusp tips of the maxillary molars. These observations highlight the potential of the parotid papilla as a reference point in reconstructing the occlusal plane, although its variability emphasizes the need for individualized assessment and careful consideration in clinical practice.[6]

The present study holds significant clinical relevance as it provides insights into the location of parotid papilla in relation to the plane of occlusion in dentulous individuals. The findings of the study revealed that the distance of the parotid papilla from the occlusal plane was 3.73 ± 0.63 mm on the right side and 3.56 ± 0.58 mm on the left side. This measured distance of approximately 3.6 mm serves as a practical guideline for clinicians in establishing the occlusal plane during the fabrication of complete dentures. These findings align closely with a study conducted by Mehta and

Chhetri (9), who also reported that the parotid papilla is positioned superior to the maxillary occlusal plane. In this research, the average distance between the parotid papilla and the maxillary occlusal plane was concluded to be 3.69 ± 1.19 mm. This consistency across studies reinforces the reliability of the parotid papilla as a reference point, providing valuable guidance in prosthetic dentistry.

Another study conducted by Tantray and Zargar[6] evaluated the location of the plane of occlusion and parotid papilla in the Kashmiri population. Their findings revealed that the parotid papilla was located approximately 3.7 mm above the occlusal plane on average. When analyzed separately, the distance of the right papilla from the occlusal plane was 3.2 mm, while the left papilla was positioned at a slightly greater distance of 3.6 mm.[6] These results further support the variability in the position of the parotid papilla and its potential utility to be a reference landmark for re-establishing the plane of occlusion, particularly in region-specific populations.

The study carried out by a researcher measured the distance of parotid papilla from the cusp tip of maxillary molars. In comparison to this study, where the distance was 4 mm, the present study demonstrates a notable variation. This highlights the variability in anatomical measurements and underscores the importance of understanding findings within specific study populations and methodologies.

In our study, there can be certain biases including a selection bias. Although the sample size is 100 but if it's not randomly selected, this could affect the reliability of the results. Furthermore, human error, inconsistent techniques, or instrument calibration issues might result in inaccurate or unreliable data. These biases were accounted for by implementing random sampling techniques and it was ensured that measurements are taken by the same trained individual with standardized protocols and consistent methods. A clear exclusion and inclusion criteria were decided, so that the study population was as homogenous as possible.

Limitations: One of the limitations of is our reliance on a cross-sectional design, which only provides a snapshot of the relationship between the parotid papilla and the maxillary occlusal plane at a single point in time. As a result, causal inferences cannot be made, and the study does not account for any potential changes in the anatomical relationship over time. Furthermore, the gender distribution in the sample shows a higher proportion of males, which may introduce gender bias and affect the outcomes.

Recommendations: Based on the results of this study, it is advised that the parotid papilla be further explored as a reliable anatomical guide for occlusal plane determination. Additionally, future studies should consider expanding the sample size and including participants from diverse ethnic backgrounds to validate the generalizability of these. It would also be beneficial to conduct longitudinal studies to assess the stability of this anatomical relationship over time, providing more robust evidence for its use in prosthodontics. Furthermore, future research could explore the influence of other factors, such as age, gender, or systemic conditions, on the positioning of the parotid papilla.

CONCLUSION

In conclusion, the findings of this study highlight that the parotid papilla is positioned superior to the maxillary occlusal plane. This anatomical relationship was quantified by measuring the mean vertical distance, which was determined to be 3.69 mm. This result provides valuable insight into the spatial orientation of the parotid papilla relative to dental structures in the oral cavity.

Author's Contribution:

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Final Approval of version:	All the above authors
Agreement to accountable for all aspects of work:	All the above authors

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