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RELATIONSHIP OF FOVEA PALATINI TO VIBRATING LINE IN PATIENTS AT A TERTIARY CARE HOSPITAL

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ABSTRACT

Background: The posterior palatal seal is essential for the retention and stability of maxillary complete dentures. The fovea palatini and the vibrating line are critical anatomical landmarks used to determine the denture's posterior extent. However, variability in their spatial relationship across populations may affect the accuracy of denture border placement. Limited data exist from South Asian populations, particularly in clinical settings, regarding this anatomical relationship.

Objective: To evaluate the positional relationship between the fovea palatini and the vibrating line in a sample of patients at a tertiary care dental hospital and to assess its association with age and gender.

Methods: A descriptive cross-sectional study was conducted over six months at the Department of Prosthodontics, Bacha Khan College of Dentistry, Mardan. A total of 151 patients aged 20–80 years with visible fovea palatini and normal palatal mucosa were included using consecutive non-probability sampling. The vibrating line was identified using the phonation method and recorded relative to the fovea palatini as anterior, coinciding, or posterior. Associations with age and gender were analyzed using Chi-square tests. Data were processed using SPSS version 25, and a p-value of <0.05 was considered statistically significant.

Results: The vibrating line was located anterior to the fovea palatini in 104 participants (68.8%), at the fovea in 29 (19.2%), and posterior in 18 (11.9%). No significant associations were found between vibrating line position and gender ($p = 0.96$) or age group ($p = 0.81$).

Conclusion: The vibrating line most frequently lies anterior to the fovea palatini, indicating that sole reliance on the foveal landmark may result in underextension

	of maxillary dentures. Functional assessment using phonation should be employed alongside anatomical guidance to ensure optimal posterior palatal seal and denture retention. Future studies should incorporate broader populations and palatal morphology to refine prosthodontic protocols.

Introduction

Edentulism, or the loss of all natural teeth, remains a significant public health concern, particularly among older populations. It compromises essential functions such as mastication, speech, and esthetics, thereby adversely affecting the overall quality of life. Complete dentures are among the most common and cost-effective methods for rehabilitating edentulous patients. The success of maxillary complete dentures largely depends on three key biomechanical factors: retention, stability, and support. Among these, achieving an effective posterior palatal seal is crucial for maintaining denture retention and preventing dislodgement during functional movements such as speaking and swallowing.

The **fovea palatini**—a pair of small mucosal depressions located on either side of the midline near the junction of the hard and soft palate—serve as a clinically significant anatomical landmark in the fabrication of maxillary complete dentures. They are often used in conjunction with the **vibrating line**, an imaginary line marking the division between the movable and immovable parts of the soft palate, to guide the placement of the denture's posterior border. Accurate identification of this border is essential, as overextension may lead to discomfort, gag reflex, and poor retention, while underextension may compromise the seal and function of the prosthesis.

Several methods have been described in the literature to locate the vibrating line, including the phonation method, Valsalva maneuver, and palpation with instruments. However, studies examining the precise anatomical relationship between the fovea palatini and the vibrating line have yielded inconsistent results. For instance, some research indicates that the vibrating line is anterior to the fovea palatini in the majority of patients, while other studies suggest it coincides with or lies posterior to the fovea. Reported incidence rates vary across populations, with anterior occurrence ranging from approximately 58% to 69%, and posterior occurrence being the least common. Furthermore, the impact of demographic factors such as age and gender on this anatomical relationship remains unclear.

Despite its clinical significance, limited data exist from the South Asian region, particularly Pakistan, on this anatomical relationship. The few studies conducted internationally often involve population groups with different ethnic and anatomical characteristics, limiting the generalizability of their findings to local clinical practice. This represents a notable gap in the literature, highlighting the need for regional studies that evaluate these anatomical landmarks in local populations.

The objective of this study is to assess the positional relationship between the fovea palatini and the vibrating line in patients attending a tertiary care dental hospital. The study also aims to investigate any potential associations between this relationship and demographic factors such as age and gender.

Understanding this relationship is essential for enhancing the accuracy of maxillary complete denture fabrication and, ultimately, improving patient outcomes. This study may contribute to the standardization of clinical protocols used to identify the posterior palatal seal area, thereby minimizing variability and improving treatment predictability.

Materials and Methods

Study Design

This was a descriptive, cross-sectional observational study conducted at the Department of Prosthodontics, Bacha Khan College of Dentistry, Mardan. The study duration spanned six months, from November 2024 to April 2025.

Study Population and Participants

The study population consisted of individuals visiting the Prosthodontics outpatient department during the study period. A non-probability consecutive sampling technique was employed to recruit participants. The sample size was calculated to be 151 using OpenEpi software, based on a 95% confidence interval and prevalence values derived from prior literature.

Inclusion criteria were:

- Patients aged between 20 and 80 years
- Presence of clinically visible fovea palatini
- Normal, healthy pink palatal mucosa
- Adequate mouth opening to allow posterior palatal examination

Exclusion criteria included:

- History of maxillofacial trauma or surgery
- Congenital or acquired craniofacial anomalies
- Presence of palatal lesions or pathological conditions
- Limited mouth opening or inability to phonate adequately

Data Collection and Instruments

The anatomical relationship between the fovea palatini and the vibrating line was assessed using the **phonation method**, a commonly accepted clinical technique in prosthodontics. The phonation of the "Ah" sound was practiced and standardized across participants to avoid exaggeration and variability. A sterile gauze (2x2 cm) was used to dry the palatal mucosa, and an indelible marker pencil was employed to identify and mark both the vibrating line and fovea palatini. The process was repeated twice for each participant to enhance measurement consistency and reduce observational error. The location of the vibrating line relative to the fovea palatini was recorded as either anterior to, coinciding with, or posterior to the fovea.

Ethical Considerations

The study protocol was reviewed and approved by the Institutional Ethical Review Committee of Bacha Khan College of Dentistry and the College of Physicians and Surgeons Pakistan (CPSP). All participants were informed about the purpose, procedures, and voluntary nature of the study. Written informed consent was obtained before inclusion. Participant anonymity and data confidentiality were strictly maintained throughout the study.

Variables

The **primary variable** was the location of the vibrating line in relation to the fovea palatini (categorized as anterior, coinciding, or posterior). **Secondary variables** included demographic characteristics such as age and gender. Age was measured in years and analyzed as a categorical variable (<50 years, ≥50 years).

Data Analysis

All data were entered and analyzed using **SPSS version 25.0**. Descriptive statistics (means, standard deviations, frequencies, and percentages) were computed for demographic variables. The Chi-square test was used to assess the association between the location of the vibrating line and demographic factors (age and gender). A p-value of <0.05 was considered statistically

significant. In cases of non-normal distribution, appropriate non-parametric measures such as interquartile range (IQR) were applied.

Results

Overview of Findings

A total of 151 participants were evaluated to determine the anatomical relationship between the fovea palatini and the vibrating line. The majority of participants demonstrated the vibrating line anterior to the fovea palatini. No statistically significant association was observed between the location of the vibrating line and demographic variables such as age or gender.

Participant Characteristics

The study sample comprised 75 males (49.7%) and 76 females (50.3%). Participants' ages ranged from 20 to 80 years, with a mean age of 45.0 ± 17.0 years. Age was stratified into two categories: individuals aged below 50 years and those aged 50 years or above. Baseline demographic characteristics are summarized in **Table 1**.

Table 1: *Baseline Characteristics of Study Participants (N = 151)*

Variable	Category	Frequency (n)	Percentage (%)
Gender	Male	75	49.7
	Female	76	50.3
Age Group	<50 years	71	47.0
	≥50 years	80	53.0
Mean Age	—	45.0 ± 17.0	—

Primary Outcome: Location of Vibrating Line Relative to Fovea Palatini

Among all participants, the vibrating line was located:

- **Anterior to the fovea palatini** in 104 individuals (68.8%)
- **At the level of the fovea palatini** in 29 individuals (19.2%)
- **Posterior to the fovea palatini** in 18 individuals (11.9%)

These findings are illustrated in **Figure 1**.

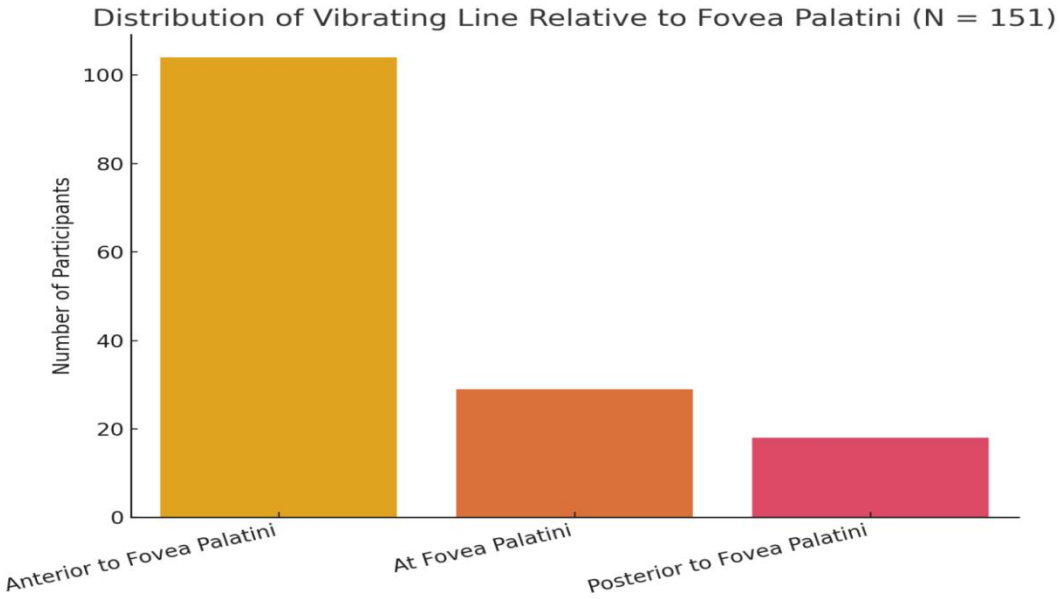

Figure 1: *Distribution of Vibrating Line Relative to Fovea Palatini (N = 151)*
(Bar chart showing anterior, at, and posterior positions with respective percentages)

Association with Gender

The association between the location of the vibrating line and participant gender was assessed using the Chi-square test. No statistically significant difference was found between males and females (p = 0.96). Results are presented in **Table 2**.

Table 2: *Distribution of Vibrating Line Position by Gender*

Vibrating Line Position	Male (n = 75)	Female (n = 76)	Total (N = 151)
Anterior	48 (64.0%)	47 (61.8%)	95 (62.9%)
At Fovea Palatini	17 (22.7%)	18 (23.6%)	35 (23.2%)
Posterior	10 (13.3%)	11 (14.4%)	21 (13.9%)
p-value			**0.96**

Association with Age

Similarly, no significant association was observed between age group (<50 vs. ≥50 years) and the location of the vibrating line (p = 0.81), as detailed in **Table 3**.

Table 3: *Distribution of Vibrating Line Position by Age Group*

Vibrating Line Position	Age <50 (n = 71)	Age ≥50 (n = 80)	Total (N = 151)
Anterior	46 (64.7%)	53 (66.3%)	99 (65.6%)
At Fovea Palatini	16 (22.5%)	15 (18.8%)	31 (20.5%)
Posterior	9 (12.6%)	12 (15.0%)	21 (13.9%)
p-value			**0.81**

Discussion

This study evaluated the anatomical relationship between the fovea palatini and the vibrating line in patients at a tertiary dental care center. The findings indicate that the vibrating line is most commonly located anterior to the fovea palatini, followed by coinciding and posterior positions. Furthermore, no statistically significant association was observed between the vibrating line's position and demographic variables such as age or gender.

The results underscore the clinical relevance of accurately determining the posterior palatal seal for the success of maxillary complete dentures. When the vibrating line is misidentified—either due to over-reliance on anatomical landmarks like the fovea palatini or lack of functional assessment—it can result in suboptimal denture retention. The predominance of the vibrating line anterior to the fovea palatini in this study reinforces the importance of integrating both anatomical and functional assessments in routine clinical practice.

Our findings are closely aligned with those of Al-Khateeb et al., who reported that the vibrating line was located anterior to the fovea palatini in approximately 68.5% of participants, coinciding in 19%, and posterior in 12.5% [Al-Khateeb, 2014]. Similarly, a study conducted by Sato et al. demonstrated anterior positioning in 57.85% of cases, at the fovea in 26.01%, and posterior in 16.14%, which closely resembles our observed distribution [Sato, 2016]. These similarities suggest that the anterior location is a consistent anatomical finding across different

populations and lend support to the clinical practice of not depending solely on the fovea palatini for determining the posterior palatal seal.

However, some literature contrasts with our findings. In a study by Kumar et al., the vibrating line was found to coincide with the fovea palatini in the majority of participants, suggesting a population-based variability that may reflect ethnic or anatomical differences [Kumar, 2013]. In another investigation, the posterior location of the vibrating line was reported more frequently than observed in our sample [Deshpande, 2011]. These discrepancies highlight the potential influence of anatomical morphology, soft palate classifications, or examiner-dependent techniques.

Our study also found no significant association between the vibrating line location and gender, which aligns with the findings of Alous et al., who reported no gender-based differences in the occurrence of fovea palatini in relation to the vibrating line [Alous, 2012]. Shanti et al. similarly concluded that gender had no significant impact on this anatomical relationship [Shanti, 2015]. This reinforces the notion that the relationship between these landmarks is more likely to be governed by individual anatomical characteristics rather than demographic variables.

Conversely, Bharat et al. reported a statistically significant variation in vibrating line location across age groups, suggesting that age-related changes in palatal tissue or muscle tone might influence the posterior palatal seal [Bharat, 2017]. However, our study did not replicate this association, possibly due to differences in age group stratification, sample size, or exclusion criteria.

This study has several strengths. It used a standardized phonation method, widely accepted in prosthodontic literature for its clinical reliability. The examiner conducted repeated markings to minimize intra-observer error, and participants were drawn from a real-world clinical setting, enhancing the external validity of findings. Nevertheless, the study has limitations. Being a single-center study, its generalizability is restricted. The non-probability sampling technique may introduce selection bias. Additionally, the study did not consider soft palate morphology (Class I, II, or III), which is known to influence the vibrating line position and could have offered a deeper understanding of anatomical variations. Further research is warranted to explore this relationship across various ethnic groups, using larger multicentric datasets. Future investigations should incorporate dynamic diagnostic techniques such as intraoral scanners or digital imaging, and assess how these anatomical relationships influence actual denture retention and patient satisfaction over time. In conclusion, this study contributes region-specific data to the global literature on vibrating line identification and its relationship to the fovea palatini. The finding that the vibrating line most frequently lies anterior to the fovea palatini emphasizes the need for functional assessment during maxillary denture fabrication. This work supports a more individualized and evidence-based approach to establishing the posterior palatal seal in prosthodontic treatment planning.

Conclusion:

This study aimed to assess the anatomical relationship between the fovea palatini and the vibrating line in patients presenting to a tertiary care dental hospital. The findings revealed that the vibrating line most commonly lies anterior to the fovea palatini, with fewer occurrences at or posterior to it. No significant associations were observed between the vibrating line's position and demographic variables such as age or gender.

These results have practical implications for prosthodontic practice, particularly in the accurate establishment of the posterior palatal seal during maxillary complete denture fabrication. Over-reliance on the fovea palatini as a landmark may lead to under- or over-extension of the

denture base, potentially compromising retention and patient comfort. The phonation method remains a clinically useful tool in identifying the functional extent of the soft palate.

Clinicians are encouraged to combine anatomical landmarks with dynamic functional techniques when determining the posterior denture border. Future studies involving larger, more diverse populations and incorporating soft palate morphology are warranted to enhance our understanding of this relationship and improve clinical outcomes.

This research contributes valuable regional data to the global prosthodontic literature and reinforces the importance of individualized, evidence-based approaches in complete denture design.

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