

Evaluating vibrating line location with respect to palatine fovea in various soft palate types

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ABSTRACT

Aim: To determine the frequency of the location of vibrating line in relation to palatine fovea in Class I, II and III soft palate types among patients at Islamic International Dental College, Islamabad.

Study design: A cross-sectional observational study

Place and duration: Prosthodontic Dept of Islamic International Dental College, Riphah International University, from 2nd October 2021 till 2nd January 2022.

Methodology: A total of 200 subjects were selected and clinically examined for various locations of vibrating line with respect to palatine fovea in soft palate types (I, II, III). Phonation method 'Ah' was used to locate vibrating line location.

Results: The vibrating line location was anterior to palatine fovea in 72.7%, 64.1%, 50% of subjects with Class I, II, III soft palate. 16.5%, 25.6%, 22.7% subjects had vibrating line locating at fovea palatine in Class I, II, III soft palate types. Least observed location was the posterior location of vibrating line; 10.8%, 10.3% 27.3% in all soft palate types (class I, II, III). In-significant association with age, gender and soft palate types was seen with location of vibrating line.

Conclusion: The vibrating line was located predominantly anterior to palatine fovea in all three soft palate types.

Keywords: Dentures, Post dam area, Palatine Fovea, Retention, Soft Palate Contours, Vibrating line.

INTRODUCTION

With increasing age people tend to lose their teeth and edentulism is a condition where no tooth is left. A successful complete denture fabrication needs extra care at each step of denture construction.¹ The denture retention should be perfectly achieved as the prosthesis can only be held in the mouth with physical forces. The retention in the denture is mainly achieved by close contact of the denture with the underlying mucosa and its borders tightly sealed to prevent air, food and liquid ingress.² A seal with denture and surrounding mucosa is mandatory. The seal is hard to achieve especially at the maxillary denture posterior borders.³

In maxilla for the close contact of denture, posterior border should be extended on the hard palate to ensure posterior palatal seal. The extent to which we can extend the posterior borders is of great concern and the location of the area needs special attention and remains an important step while denture construction.⁴ Under and over extended posterior borders result into gagging, retention loss, food, air and water ingress and eventually results in loss of denture's retention, support and stability.⁵

Techniques have been suggested in many studies regarding location of maxillary denture's posterior borders.⁶ Palatine fovea are clinically visible, small pits or depression of mucosa seen at the junction of hard and soft palate.⁷ They are considered as guide for locating posterior palatal seal area.⁷ Dentist also consider the vibrating line of soft palate as a reference point. Vibrating line is where soft palate movements minimize when mucosa is in function and posterior denture border should not extend beyond this line.⁷ To evaluate vibrating line dentists commonly practice phonation method i.e., 'ah' sound, nose blowing also known as Valsalva maneuver or palpation with burnisher; a dental instrument^{8,9}.

As contours of soft palate show variation in patients therefore the position of vibrating line varies from person to person.¹⁰ Furthermore, the soft palate movements and tissue thickness at posterior palatal seal area varies¹⁰.

On the basis of angular relationship of soft and hard palate the soft palate is classified as Class I, II and III. Class I palate has minimal angle <10 degree with the hard palate as it runs a horizontal course. Class II palate 10-45 degree; has a comparative vertical direction than class I. Class III palate has sharp vertical drop and males >45degree angle to hard palate^{10,11}.

Many dental schools use the concept of locating vibration lines through phonation (ah sound) method.¹² Others adopted 1 vibrating line concept for achieving posterior palatal seal and extends denture beyond vibrating line¹². Whereas, Silverman recommended average 8.2mm distance posterior to vibrating line as a good distance to maintain denture seal¹³. Few researchers found palatine fovea and their positional relationship with vibrating line as a guide for placing posterior palatal seal of maxillary dentures.¹³ Some reported fovea at the vibrating line and other reported posterior to it. Kumar reported 2.07 mean distance of palatine fovea to vibrating line¹⁴.

The positional relation of palatine fovea with vibrating line is controversial as it was different in various studies in different part of the world.¹⁴ To the best of our knowledge, we found no study done in Pakistan to evaluate the position of palatine fovea with respect to vibrating line in soft palate types. Many dentures are unsuccessful due to improper formation of denture seal as minor attention given to the diagnostic evaluation and anatomical and physiological relationships of posterior seal. The finding of this research would help dental practitioner in easily and effectively establishing posterior border seal of maxillary dentures in different anatomical variations of palate. This study was conducted with the objective to determine the frequency of vibrating line location in relation to palatine fovea in Class I, II and III soft palate among patients at Islamic International Dental College, Islamabad.

METHODOLOGY

This Cross-sectional observational study done at Prosthodontic department of Islamic International Dental College, Riphah International University, Islamabad from 2nd October 2021 till 2nd January 2022, in 3 months duration. A total of 200 individuals of

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both genders were selected and divided into young and old age group. The younger group had age less than 50 years and the participants were the students of BDS, MBBS and supporting staff of the same college. The older group included the patients of more than 50 years age who had come for complete denture prosthesis. Non-probability purposive sampling was used. The sample size was calculated from the previous study on relationship of fovea palatine and vibrating line.¹⁴ The inclusion criteria were that all participants having healthy pink colored mucosa showing palatine fovea. Exclusion criteria had individuals with enlarged tori, acquired or congenital soft and hard palate defects. Any palatal inflammation, pathology was excluded. All with limited mouth opening and poorly visible fovea were also excluded from study. Informed consent obtained; ethical approval was obtained from institutional Dental Ethical Committee.

Examination of mouth was done with diagnostic instruments (dental mirror and probe). Palatine fovea were located on hard palate. Participants soft palate types e.g., Class I, II, III were visually inspected and findings were recorded in Performa. Angular classification of soft palate types was used to classify soft palate shapes.¹¹ After visually examining palatine fovea and types of soft palate, the gauze swab used to dry out palatal mucosa. Phonation method of 'ah' sound used to located the posterior vibrating line (imaginary line from one hamular notch to the other in posterior hard palate where the movements of soft palate begin)⁹. For this subject were asked to say 'ah' repeatedly and movement of soft palate was noted. While saying 'ah' the line was marked with indelible pencil from one hamular notch to other; where the soft palate movement were minimal. The markings were verified by repeating the procedure of marking when patient says 'ah'. Palatine fovea 'two openings of ducts of minor salivary gland' were also marked with indelible pencil. Positioning of vibrating line anterior, at and posterior to palatine fovea was recorded in the Performa.

Data analysis: The data was entered and analyzed by SPSS version 20. The mean age of subjects was calculated. Frequency and percentage were calculated with respect to age, gender and various locations of vibrating line with respect to palatine fovea in all palatal types. Age, gender and soft palate type stratification in relation to location of vibrating lines was done. Chi-square used to evaluate the significant difference. Significance level was set at $p < 0.05$

RESULTS

A total 200 subjects were evaluated for determining the location of vibrating line in 3 different soft palate types. The mean age of the subjects was 44.42 years with the age range from 22 to 75 years (SD± 17.102). Out of all the subjects 94(47%) were males and 106(53%) were females. Soft palate type I was found in 139(69.5%) subjects followed by type II; 39(19.5%) and type III; 22(11%). Anteriorly located line with respect to fovea was found in 137(68.5%) participants. Posterior location of vibrating line was 25(12.5%) and 38(19%) participants had line locating at the fovea.

Vibrating line located anterior to fovea in both genders followed by its location at the fovea. Least observed location was its posterior location; Table I. No significant gender-based association of vibrating line location was found ($p > 0.05$); Table I.

The vibrating line in Class I type was anteriorly located in 101(72.7%) subjects whereas it is 25(64.1%) in class II and 11(50.0%) in class III soft palate types. 23(16.5%) subjects with class I palate had line at the fovea palatine which was 10(25.6%) in class II and 5(22.7%) in class III soft palate. Posterior location of vibrating line was 15(10.8%) in class I, 4(10.3%) in class II and 6(27.3%) in class III soft palate. No significant association between vibrating line location and soft palatal types was found $P > 0.05$; Table II.

In both younger and old age group; anterior location of vibrating line was commonly observed 73(65.2), 64(72.7%). However, the Chi-square test showed insignificant association between age groups and vibrating line location; Table III.

Table I: Frequency of vibrating line location association with respect to gender. (N=200)

Age (years)	VB% (Anterior)	VB% (At the fovea palatine)	VB% (Posterior)
Male	69(65.1)	24(22.6)	13(12.3)
Female	68(72.3)	14(14.9)	12(12.8)
Total	137(68.5)	38(19.0)	25(12.5)

P value 0.37

Table-II: Association of vibrating line location with respect to soft palate types. (N=200)

Age (years)	VB% (Anterior)	VB% (At the fovea palatine)	VB% (Posterior)
Type I	101(72.7)	23(16.5)	15(10.8)
Type II	25(64.1)	10(25.6)	4(10.3)
Type III	11(50.0)	5(22.7)	6(27.3)
Total	137(68.5)	38(19.0)	25(12.5)

P value 0.117

Table-III: Association of vibrating line location with age. (n=200)

Age (years)	VB% (Anterior)	VB% (At the fovea palatine)	VB% (Posterior)
<50	73(65.2)	26(23.2)	13(11.6)
>50	64(72.7)	12(13.6)	12(13)
Total	137(68.5)	38(19.0)	25(12.5)

P value 0.23

DISCUSSION

In dental literature, multiple techniques have been documented to locate vibrating line like phonation method of AH, palpation method, swallowing method and Valsalva maneuver or nose blow.⁸ In the current study the ah sound of phonation method was used for locating vibrating line as it is the continent and routinely taught method worldwide including Canada and US. It is the commonly used method in dental colleges of Pakistan as well¹⁶.

Landmarks like fovea palatine and vibrating line helps in exact placement of posterior denture borders however, the different soft palatal shapes show positional variation of vibrating line.¹⁰ Research work by Baharat Kumar¹⁷ and coworkers on 197 subjects reported anteriorly located vibrating line in 64% patient whereas 34 % had line coincide with fovea. None of their subjects had posterior location. These findings are almost in accordance with the results of the current study where maximum subjects had anteriorly positioned vibrating line; 68.5% followed by vibrating line coinciding with fovea palatine; 19% and least had posterior location 12.5%. Likewise, Shanti Chhetri¹⁶ and coworkers conducted a study on 200 subjects in Nepal and studied their vibrating line location with reference to fovea palatine. They also reported maximum subjects having anteriorly located vibrating line to fovea palatine and least subjects had posterior location. Alousi¹⁸ also studied 200 patients for vibrating line location but without differentiated soft palate types. 50.9% had line at fovea, 44.5% had anterior and 6.4% posterior location. He stated fovea palatine to be an important landmark for locating seal of denture. Dipak¹⁹ and coworkers randomly selected 50 individuals and found out 46% with fovea posterior to vibrating line and only 2% subject fovea coincided with vibrating line and recommended locating vibrating line method to be the effective method while placing posterior palatal seal.

Gender based difference in locating vibrating line had been studied in different populations around the world^{16,17}. Alousi¹⁸ reported insignificant gender-based difference with vibrating line location with respect to fovea. This is in accordance with the finding of the current study. Likewise; Shanti¹⁶ and coworkers concluded insignificant gender difference. We studied the effect of age and positional relationship of vibrating line with fovea and found anterior line to be the commonest position; however; found this positional difference to be significant. Few studies in favor of the results of current study reported no age-related differences.^{14,16-18} However, in contrast Bharat¹⁴ and coworkers studied and measure the distance of fovea and line in various soft palate types and concluded wide variation between different age groups. We

believe that these contrasting results are due to change in methodology employed.

Different anatomical and physiological forms of soft palate show positional variation of vibrating line. Kumal¹⁷ et al assessed 197 subjects for the relation of line with fovea in 3 soft palate types. They reported 68%, 70 % and 50% individuals with anteriorly located line in class I, II, III, palate types. 32%, 30%, and 50% subjects had vibrating line coinciding with fovea in class I, II, III, palate. None had posteriorly located vibrating line. Their results further revealed insignificant age and gender related correlation. These results are found to be consistent with the current study where most of the subjects had anteriorly located vibrating line in all types of soft palate, i.e.; 72.2%, 64.1% and 50.0% in class I, II, III respectively. 16.5%, 25.6% and 22.7% had vibrating line at the fovea in class I, II, III palates. However, in contrast 12.5% had posterior location of vibrating line with respect to fovea palatine. Variation in results could be attributed to racial and genetical differences furthermore, different contours of soft palate with varied muscular activity may significantly affect the vibrating line location.²⁰ For instance, class I palate is horizontal so soft palate movements start more posteriorly thus exhibit less muscle activity and vibrating line extend posteriorly. Whereas in class III soft palate attachment to hard palate is at an acute angle and thus more soft palatal muscles activity results in anteriorly placed vibrating line.²⁰ Shanti Chhetri¹⁶ and coworkers in accordance with the results of current study also reported 6% subjects with posteriorly located line. Similarly, they found 70 %, 54%, and 60% subject with vibrating line anteriorly located in class I, II, III. 22%, 40% and 36% had line located at fovea in class I, II III and 23%, 5%, and 3% subjects with class I, II III soft palates. They concluded anatomical landmarks like fovea palatine as reliable guide that's helps in fabricating retentive and stable dentures. However, lack of correlation with gender and soft palate types with vibrating line location reported.¹⁶

Locating exact vibrating line in various soft palate forms is mandatory for well retentive denture fabrication as it ensures good posterior border seal^{21,22}. Anatomically stable landmarks like fovea palatine aid in its recording location of vibrating line. Inaccuracy and improper registrations of anatomical and physiological landmarks while maxillary denture fabrication attributes to denture retention failure^{22,23}. Careful examination and assessment of anatomical landmarks during diagnostic phase of treatment can alleviate denture retention problem.

CONCLUSION

The vibrating line was located predominantly anterior to palatine fovea in all three soft palate types.

Authors' contribution; MAGC: Data collection/Manuscript drafting, **SHAR:** Conceived idea/ methodology **AZ:** Statistical analysis, **FA:** Manuscript writing, **NF:** Literature review, **AF:** Manuscript final reading, **SN:** Research supervisor/designed research

Conflict of interest: Nil

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