Morphologic Variation of Retromolar Pad in Nepalese Population: A Cross-Sectional Study

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ABSTRACT

Introduction: Retromolar pad is considered a stable reference area of the mandibular edentulous ridge as it undergoes limited resorption due to the presence of cortical bone and insertion of muscle fibers. It acts as a fixed intraoral landmark for determining posterior occlusal plane and also contributes to peripheral seal, retention and stability of lower denture. Various shapes and sizes of retromolar pad have been described in the literature. The objective of the study was to find the prevalence of different shapes of the retromolar pad among the people of eastern Nepal.

Methods: The study was conducted on 92 completely edentulous patients who came for the replacement of their missing teeth. The retromolar pads were marked on the master cast and their longitudinal and transverse diameter measured. The t-test was used for comparison between left and the right side and ANOVA for comparison of diameter between the various shapes of retromolar pads.

Results: The study identified four shapes of retromolar pad: pear (41.3%), oval (40.7%), round (13.6%) and triangular (4.1%). The variation in shapes of retromolar pad on right and left side was not significant. The study showed no significant difference between longitudinal and transverse diameter according to shape of retromolar pad.

Conclusion: Pear shaped retromolar pad is the most prevalent type of retromolar pad followed by oval, round and triangular with no significant differences among the shapes in terms of the longitudinal and transverse diameter in Nepalese population.

Key words: Morphologic variation; Pear-shaped pad; Retromolar pad

INTRODUCTION

The retromolar pad is a non-keratinized pad of tissues located at the distal end of mandibular residual ridge.[1]It contains fibers of the pterygomandibular raphae, superior constrictor and buccinator muscles, fibers of temporal tendon and glandular tissue.[2] The underlying bone is dense cortical and resistant to resorption due to the muscle attachments.[3]

The retromolar pad provides a standard landmark for the extension of lower denture distally.[4]A properly constructed lower denture should cover the retromolar pad.[2,4]The retromolar pad adds another plane to resist the movement of the denture base and aids in the stability of lower denture.[2]Extending the denture borders to include the retromolar pad completes the soft tissue border seal.[5,6]While making impression, tray should be selected in such a way that it should be long enough to cover the retromolar pad.[7]

Conflict of Interest: None

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Retromolar pad is a prominent and stable landmark for establishment of mandibular posterior occlusal plane.[3-5,8-11] It may also be a useful landmark for arranging posterior teeth.[12] The retromolar pad may be used as an alternative entry site for anesthesia of the inferior alveolar nerve, for patients who are carriers of blood dyscrasias.[13]It can also be used as a new landmark for avoiding iatrogenic lingual nerve injury.[14]

Various sizes and shapes of the retromolar pad have been documented in literature[15-19]but such type of information is not available in the Nepalese population. A study concluded that pear and triangular shaped retromolar pad provides greater stability because of increased surface area and provides better peripheral seal of lower denture as compared to patients with round shaped retromolar pad.[15]

Determining different shapes and sizes of retromolar pad helps for prediction of quality of dentures regarding retention, stability and support. Therefore, this study was conducted to obtain baseline data about prevalence of various shapes and sizes of retromolar pad in Nepalese population.

METHODS

This cross-sectional study was conducted at the Department of Prosthodontics, BPKIHS, Dharan, Nepal on 92 completely edentulous patients (48 female, 44 male) who visited the department for the replacement of their missing teeth. The sample size was calculated based on previous literature[15] in which the proportion of retromolar pas was 51.3%. The total sample size in our study was 92. The ethical approval was obtained from Institutional Review Committee of BPKIHS (IRC: 213/077/078) and informed verbal and written consent had been taken from participants prior to the enrollment.
The inclusion criteria were as follows:

- Patients with complete edentulous upper and lower arch.
- Patient having well-formed mandibular ridge and retromolar pad with distinguishable margin.
- Cases in which retromolar pad is properly recorded in impression.

The following were excluded from the study

- Severely atrophic mandibular ridge.
- Cases where retromolar pad and its margin are not well demarcated.
- Participants with congenital or acquired defect of mandible ridge and retromolar area.
- Patients who have neuromuscular and temporomandibular joint disorder.

The analysis of shapes of retromolar pad was done indirectly on the master casts obtained during fabrication of complete denture. The retromolar pad was marked on the master cast carefully determining its border with a pencil by a single operator. Different shapes of retromolar pad were noted on right and left side and four groups were formed based on the shape – pear shape, oval shape, round shape & triangular shape.

Antero-posterior (AP) line was drawn on the master cast along the crest of the ridge. Longitudinal diameter (LD) was measured by taking point of intersection of AP line and border of retromolar pad anteriorly and posteriorly. Transverse diameter (TD) was measured by taking mid-point of AP line and drawing a line from that point buccally and lingually to intersect at respective border of retromolar pad. All measurements were made by placing thread on the point of intersection of line and retromolar border (Figure 1)and with the use of digital vernier caliper (Figure 2).

Statistical analysis was done using SPSS version 20. Retromolar pads of both the left and

right side were analyzed and percentages were obtained for descriptive variable like shapes of retromolar pad. The quantitative variables like longitudinal and transverse diameters were shown in mean and standard deviation. Paired t-test was used to compare the longitudinal and transverse diameters and one-way ANOVA was used for the comparison of longitudinal and transverse diameter between various shapes of retromolar pad.

RESULTS

Shape of retromolar pad

Pear shape and oval shape were highly prevalent shapes and triangular shape was the least prevalent shape of retromolar pad. On right side, 44.4% subjects had pear shaped and 41.3% had oval shaped retromolar pad. On, left side, the proportion of pear and oval shaped retromolar pad was equal i.e. 40.2%. In 79.35% subjects, the shape of retromolar pad was same on the right and left side. The morphologic distribution of retromolar pad is presented in Table 1.

Diameter of retromolar pad

The longitudinal diameter of retromolar pad on right side was not significantly different with that of left side (p=0.623). However, the transverse diameter of the retromolar pad on right side was statistically higher than that of the left side. (p=0.001).

Relationship between shapes and diameter of retromolar pad

The triangular shaped retromolar pad showed largest longitudinal diameter (15.76±1.36 mm) and pear shaped retromolar pad showed largest transverse diameter (14.18±2.74 mm) on the right side (Table 2). On the left side (Table 3), oval retromolar pad showed largest longitudinal diameter (15.05±2.43 mm) and, triangular shaped retromolar pad showed largest transverse diameter (13.88±2.12 mm). ANOVA test showed no statistical difference (p≥0.05) between longitudinal and transverse diameter according to shape of retromolar pad.

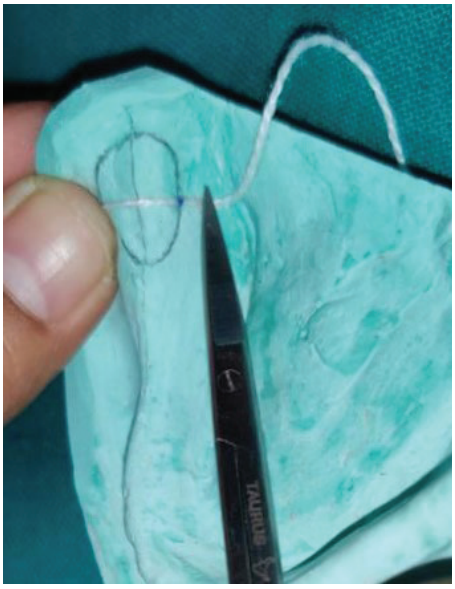

Figure 1: *Transverse diameter measured on Master cast*

Figure 2: *Measurement with vernier caliper*

Table 1: Morphologic distribution of retromolar pad

Shapes	Right		Left	
	Number (N)	Percentage (%)	Number (N)	Percentage (%)
Pear	39	42.4	37	40.2
Oval	38	41.3	37	40.2
Round	11	12	14	15.2
Triangular	4	4.3	4	4.3
Total	92	100	92	100

Table 2: Relationship of shapes of right retromolar pad with its longitudinal and transverse diameter

Diameter	Shapes (right)	N	Mean	SD	Minimum	Maximum	P value
LD	Pear	39	14.50	2.59	8.79	20.36	0.49
	Oval	38	14.88	2.68	9.68	20.50	
	Round	11	13.80	2.06	10.50	18.08	
	Triangular	4	15.76	1.36	14.10	16.88	
	Total	92	14.63	2.53	8.79	20.50	
TD	Pear	39	14.18	2.74	9.08	22.82	0.72
	Oval	38	13.51	2.39	8.94	19.34	
	Round	11	13.83	2.58	9.88	17.97	
	Triangular	4	13.55	2.37	10.00	14.85	
	Total	92	13.84	2.54	8.94	22.82	

Table 3: Relationship of shapes of left retromolar pad with its longitudinal and transverse diameter

Diameter	Shapes (left)	N	Mean	Std. Deviation	Minimum	Maximum	p value
LD	Pear	37	14.80	3.01	8.85	23.8	0.60
	Oval	37	15.05	2.43	9.88	21.12	
	Round	14	13.87	3.09	8.2	20.12	
	Triangular	4	14.77	0.29	14.34	14.96	
	Total	92	14.76	2.73	8.2	23.8	
TD	Pear	37	12.64	2.09	9.3	17.72	0.35
	Oval	37	12.89	2.70	8.35	19.38	
	Round	14	13.86	1.99	10.4	16.64	
	Triangular	4	13.88	2.12	11.55	15.7	
	Total	**92**	**12.98**	**2.35**	**8.35**	**19.38**	

DISCUSSION

The result of our study identified four different shapes of retromolar pad i.e. pear, oval, round and triangular among which pear shaped retromolar pad showed highest prevalence (41.3%) followed by oval shaped retromolar pad (40.7%).

This is in agreement with Sharma et al.[15], Naeem et al.[16], Fayaz et al.[17], and Cha et al.[18] who also classified the shapes of retromolar pad as pear-shaped, round, or triangular and showed the highest prevalence for pear shaped retromolar pad. Farias et al.[19] classified retromolar pad as oval, rounded and triangular in shape with the ovular shape accounting for over half of the cases, followed by round and triangular shapes.

Our study showed the least prevalence for triangular shaped retromolar pad (4.1%). A similar finding was reported by Cha et al.[18] and Farias et al[19]. However, the study by Sharma et al.[15], Naeem et al.[16], and Fayaz et al.[17]showed the least prevalence of round shaped retromolar pad.

According to our study, 73 (79.35%) subjects, had same shape of retromolar pad on the right and left side and 19 (20.65%) subjects had different shapes of retromolar pad on right and left side. However, this variation of retromolar pad on right and left side was not statistically significant. A similar finding was reported by Fayaz et al.[17], Cha et al.[18] and Farias et al.[19] in their studies. But the study by Naeem et al.[16] showed significant difference between right and left side with respect to the shape of retromolar pad.

The data of this study suggest that there was no effect of age on longitudinal and transverse diameter of the retromolar pad which is in accordance with the study by Cha et al.[18]Likewise, no significant correlation was found between gender and diameters (longitudinal and transverse) of retromolar pad. However, longitudinal diameter was slightly higher in females and transverse diameter higher in males. The study by Cha et al.[18] also showed no sex difference in longitudinal diameter of retromolar pad but males had significantly higher transverse diameter of retromolar pad than females.

Pietrokovski et al.[9] mentioned that muscles that surround and are attached to the bone surfaces of retromolar region limits the chronic and irreversible residual bone resorption in those area. So, the retromolar pad would remain relatively constant and similar in size throughout the life of an individual. This might be the reason that the diameter of retromolar pad showed no significant correlation with age. The lack of the positive correlation between male and the female with dimension of retromolar pad may also be due to the limited resorption at those area as mentioned above. This could be a potential trend for further research.

According to our study, mean longitudinal diameter of retromolar pad on right side was not significantly different from that on the left side whereas mean transverse diameter was statistically significant. Sharma et al.[15] also reported no significant difference in right and left mean longitudinal diameter of retromolar pad but it was statistically significant in the study by Naeem et al.[16] The right and left mean transverse diameter was also significantly different as reported by Naeem et al.[16] which is similar to our study. This finding was in contrast to the finding by Sharma et al.[15]where they reported no significant difference in mean transverse diameter on the right and left sides.

The mean longitudinal diameter in our study was relatively higher than the similar previous studies.[15,16,18] This may be due to anthropometric difference in studied subjects, variation in shape of retromolar pad and difference in the measurement techniques. We found no significant difference in mean longitudinal and transverse diameter when different shapes of retromolar pad were correlated though the triangular shaped retromolar pad showed maximum longitudinal diameter and the round shaped showed maximum transverse diameter. However, there was not much difference in the mean transverse diameter of round shaped and triangular shaped retromolar pad.

Cha et al.[18] also reported no significant difference in longitudinal diameter among the shapes of retromolar pad but the transverse diameter in their study differed significantly. But, Sharma et al.[15] and Naeem et al.[16], observed significant difference in mean longitudinal and transverse diameter with respect to different shapes of retromolar pad, and also mentioned greater diameter of triangular shaped retromolar pad, a finding similar to our study.

The variations in the results might be due to different groups of population being studied (genetic and racial factors) and differences in measurement technique. Moreover, the

examiner's subjective bias in determining boundaries of the retromolar pad might also have contributed to these discrepancies. Our study outlined the retromolar pad directly on the mandibular cast and measured the size of the pad from the mandibular cast. Therefore, this study could only measure the transverse and longitudinal diameters when classifying and comparing the shapes of retromolar pads.

According to Jacobson and Krol, retromolar pad is an important anatomical factor for providing retention to the mandibular complete denture and mandibular denture should cover retromolar pad for better peripheral seal.[20] Ichikawa advocated to extend the mandibular denture as much posteriorly as possible and at least two-third posterior to the anterior margin of retromolar pad for retention and stability.[21] Ei et al. conducted a study to evaluate the influence of mandibular denture extension to the different level of the retromolar pad and concluded that majority of the subject experienced more comfort when denture was extended only up to middle third than to posterior third of retromolar pad. When denture extension was reduced from posterior third to middle third, there was no significant change in retention. This study advocated to extend the lower removable denture only up to middle third of the retromolar pad.[22]

The role of the retromolar pad for prosthodontic rehabilitation should not be underestimated. The diameters of the retromolar pad affects the retention and hence success of the complete denture. Clinician should consider, examine and analyze the retromolar pad at the time of diagnosis and treatment planning. This helps clinician to predict the denture outcome as well as patient to have realistic expectation to the denture based on their anatomical factors.

LIMITATIONS OF STUDY

- The study was conducted in the small population so, the result may not be generalized to the larger population.
- Racial differences have not been considered in this study.
- This study included open mouth impression techniques but shapes and diameter vary when impression is made with closed mouth technique. So, further study with both impression technique is needed.

CONCLUSION

This study aimed to find the prevalence of different shapes of the retromolar pad among the people of eastern Nepal. The study showed pear shaped as most prevalent type of retromolar pad followed by oval, round and triangular as least common type with no significant differences among the shapes in terms of the longitudinal and transverse diameter. Furthermore, no significant difference was observed in diameter of retromolar pad according to age and gender.

The study was conducted on the mandibular casts obtained after functional impression during the process of denture fabrication. When making functional impressions, pressure will be applied to the retromolar pad both by muscular control and by the impression material and impression tray. The shape of the retromolar pad in this study could be considered a clinical shape accompanying a series of procedures for prosthodontic rehabilitation rather than an intact anatomical shape. Therefore, it would be more appropriate to consider that observation and measurements were performed on the clinical shape of retromolar pad rather than its anatomical shape.

This study, thus, provides a baseline data about the morphologic variation of retromolar pad in Nepalese population. However, further research is required with a larger sample including the racial differences which may give the findings that can be generalized to the larger populations of Nepal. Further studies should be conducted

to evaluate the relationship of varying shapes of retromolar pad on stability and retention of complete denture.

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