Original Article

Evaluation and Assessment of the Anatomic Variations of Retromolar Pad in Edentulous Patients

Gohar Ali, Muhammad Aamir Ghafoor Chaudhary, Hira Riaz, Hadee Aziz, Noor Fatima and Hania Noor

ABSTRACT

Objective: To evaluate mandibular casts in order to classify and assess morphologic differences of the retromolar pad within a selected age group of completely edentulous patients. Also to highlight the significance of retromolar pad in the field of prosthodontics and its clinical relevance in complete denture fabrication.

Study Design: Cross-sectional observational study

Place and Duration of Study: This study was conducted at the Department of Prosthodontics, Islamic International Dental Hospital, Islamabad over a period of six months from January 1st to June 30th in the year 2024.

Methods: A cross-sectional observational study was conducted, including a sample of one hundred and twenty completely edentulous patients. Functional impressions were taken by a prosthodontist to fabricate mandibular casts. The shapes of the retromolar pad were determined with the help of diagnostic markings and were classified as; pear-shaped, triangular shaped, and round shaped. Chi-square and One-Way ANOVA test was performed to review data in relation to gender and age, respectively.

Results: Results suggested that pear-shaped retromolar pad was most frequently observed (54.2%), followed by the triangular shape (29.2%), while the round shape was the least common observed (16.7%). Moreover, the gender and age had no significant influence on the variation in shapes of the retromolar pad ($p < 0.05$).

Conclusion: The present study concluded that the pear-shaped retromolar pad is the most prevalent morphological type among completely edentulous patients. There was no statistically significant difference in the shape of retromolar pads with age, side and gender.

Key Words: Mandibular, Edentulous, Resorption, Occlusion, Impressions, Gender

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INTRODUCTION

The retromolar pad, also known as the piriformis papilla, is a key anatomical feature in the oral cavity, particularly in edentulous patients. [1,2] It acts as a significant intraoral landmark in complete denture prosthodontics, aiding in the restoration of a completely edentulous mouth. Retromolar pad functions as both a supporting and limiting area of the mandibular arch.[3] Located distal to the mandibular third molar, it is a mass of elevated soft tissue with glandular elements, covering the retromolar triangle.[2,4,5] The surface epithelium of the retromolar pad can be divided into two parts; anterior keratinized epithelium and posterior non-keratinized epithelium.[6]

Anatomically, the retromolar pad is bound by several muscles and tendinous structures.[2] Bordered posteriorly by the terminal ends of the temporalis tendon, laterally by the buccinator muscle, medially by the pterygomandibular raphe as well as the superior constrictor muscle of pharynx, and anteriorly it is bound by the masseter muscle.[1,7,8] Following the loss of molar, resorption and remodelling of the alveolar bone and soft tissues is observed especially in the mandibular ridge.[1,9] Residual ridge resorption results in blending of the resorbed tissues with the retromolar pad. In the mandibular arch, bone resorption does not extend beyond the buccal shelf, mylohyoid ridge, and their associated muscles, because these help limit chronic bone resorption.[6] The retromolar pad itself resists resorption due to underlying dense cortical bone, serving as a stable landmark for posterior denture extension.[1,5,6,9] The retromolar pad also protects lingual nerve from iatrogenic injury.[10]

Ensuring adequate coverage of the retromolar pad and buccal shelf areas is necessary for primary support in complete dentures. Since these regions contain

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muscular elements, it is important to avoid excessive pressure during denture fitting.[1] Shape and size of retromolar pad critically influences the posterior marginal seal of the mandibular denture, preventing food accumulation beneath the denture and enhancing comfort and fit.[1,6] A reduction in peripheral seal significantly reduces mandibular denture stability.[11]

Shah observed that in majority cases, the retromolar pad's bottom third and mandibular posterior occlusal plane correspond consistently.[6] Since anatomically the retromolar pad is divided into anterior two-third and posterior one-third, it is generally recommended that the posterior occlusal plane should be aligned with the anterior two-third of retromolar pad which is firm and fibrous.[2,9,12,13] According to Khan NM and colleagues, the interpupillary line along with the retromolar pad area serves as a reliable anatomical reference in establishing the occlusal plane in complete denture fabrication.[14] Proper occlusal plane alignment ensures good function, while misalignment may compromise the denture stability and accelerate bone resorption.

Despite its importance, limited research exists on the morphological and dimensional variations of the retromolar pad.[8] Previous studies[1], were based on observation and categorized retromolar pad as pear, triangular and round shaped. Understanding these variations is crucial, as they can significantly influence the stability, peripheral seal, and overall mandibular dentures' fit. The prime objective of current study was to determine prosthetic significance of various shapes of the retromolar pad following molar loss, providing valuable insights that aid prosthodontists in designing and fabricating dentures that enhance retention, support, and stability for edentulous patients.

METHODS

A cross-sectional observational study was conducted at the Department of Prosthodontics, Islamic International Dental Hospital, Islamabad, Pakistan. The study spanned over a period of six months, from January 1st, 2024, to June 30th, 2024, with a sample size of one hundred and twenty completely edentulous participants including both males and females.

A prosthodontist took the functional impressions of the patients' lower arches with impression compound, cake form. Diagnostic casts were prepared using the dental plaster material (type 3). Retromolar pads of both right and left sides were traced with indelible pencil on the mandibular casts. Upon further analysis three shapes of retromolar pad were observed: pear-shape, triangular shape and round shape.

Selection criteria: In order to ensure eligibility of the participants, the research population was selected based on a specified inclusion and exclusion criteria. The inclusion criteria consisted of male and female patients aged 55 to 70 years who had well-formed mandibular ridges, patients with intact neuromuscular coordination, and those with properly extended impression covering the retromolar pad. To enhance result reliability, specific exclusion criteria were implemented. Patients not falling in mentioned age range were excluded. Additionally, the impressions with inadequate extension over the retromolar pad and patients with history of mandibular hemi mandibulectomy were also not included in the study.

Ethical issues: The permission to collect data and conduct research was approved by the Riphah International University Ethical Committee (Ref. No. IIDC/IRC/2023/12/065 Dated 16th December 2023). Informed verbal consent was obtained prior to the study, and personal information of participants was kept confidential. The study followed the national and ethical guidelines of the institute.

Statistical analysis: Statistical analysis was conducted using IBM SPSS version 22 for windows. Categorical variables: retromolar pad shapes and gender were expressed as frequencies and percentages The Chi-Square test was applied to assess the relationship between gender, and the shape of the retromolar pad. One-Way ANOVA test was performed for comparing the mean age among individuals and the different shapes of retromolar pads. Graphs and tables were created using Microsoft Excel.

RESULTS

Descriptive analysis of the study group and their graphic representation was performed using MS Excel, while complex statistical tests were performed using SPSS version 22 for windows. A confidence interval was 95% and a margin of error was 5%. Table 1 presents the number and percentages of male and female participants in this study.

Table No.1: Participants Demographics

Gender	Number of Participants	Percentage (%)
Male	59	49.2%
Female	61	50.8%
Total	**120**	**100%**

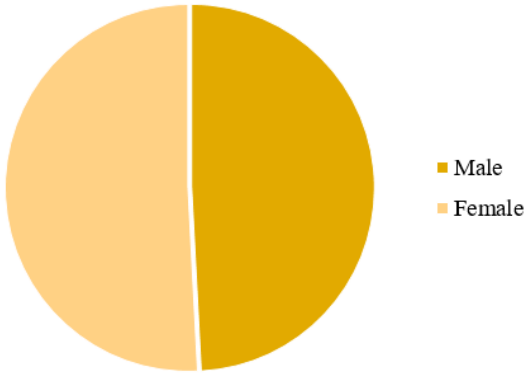

Figure No.1: Participants Demographics

Figure 1 shows that the overall distribution of shapes between genders was relatively balanced with a total of 59 males and 61 females across all shapes. Table 2 and Figure 2 present the frequency and correlation of the identified shapes among edentulous patients. The frequencies were balanced across genders and consistent on both sides of the mandibular ridge.

Table No.2: Frequency Distribution of Retromolar Pad shape in Edentulous Patients

Shape of Retromolar Pad	Frequency (n)	Percentage (%)
Pear	65	54.2%
Triangular	35	29.2%
Round	20	16.7%

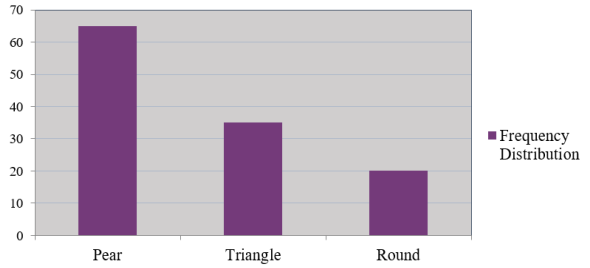

Figure No.2: Frequency distribution of various shape of retromolar pad

Table 3 indicates the distribution of the shapes of the retromolar pad among the population under study with respect to gender.

Table No.3: Gender-wise distribution of shape of retromolar pad

	Shape of Retromolar Pad			Total
	Pear	Triangular	Round	
Male	32	20	7	59
Female	33	15	13	61

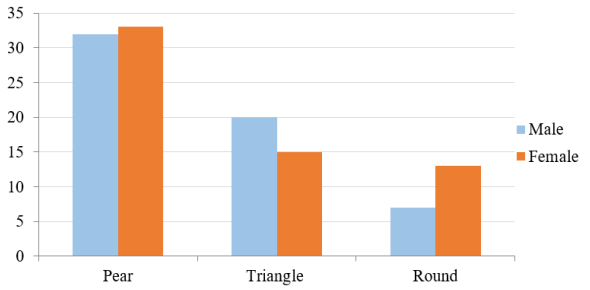

Figure No.3: Distribution of shape of retromolar pad gender wise.

Figure 3 showed the prevalence of the different shapes of retromolar pad; pear shaped, triangular and round, among both genders. It was noted that pear shape had a similar prevalence among both genders (32 males and 33 females), triangular shape was more frequent in males (20) the round shape occurred consistently much more in females[13].

It was found that gender does not significantly influence the shape of the retromolar pad in this sample. To correlate between gender and the shape of the retromolar pad, Chi-Square test for independence was conducted. The test yielded a Chi-Square statistic (X^2) of 2.50 and a p-value of 0.29 ($p > 0.05$), demonstrating that there is no significant association between gender and the shape of the retromolar pad.

Study also implies that variations in retromolar pad shape do not appear to be influenced by age differences in the studied population. The results drawn through One-Way ANOVA revealed a p-value of 0.14, which exceeds significance threshold of 0.05. As a result, the findings indicate that the difference in mean age between the groups is statistically insignificant.

DISCUSSION

Bone resorption consequent to the third molar extraction leads to a limited remodelling in the retromolar pad area due to presence of ligaments and muscle attachments. This causes retromolar pad to remain a stable reference point, even in resorbed ridges. Factors like genetics, health, and systemic conditions can cause anatomical variations in its shape and size. In the present study, the pear shape retromolar pad appeared to be the most frequent, followed triangular and round forms. The morphology of retromolar pad may offer valuable insights into age, ridge form, and other clinical parameters in edentulous individuals.

Our ongoing investigation analysed the morphological characteristics of the retromolar pad, identifying 54.16% as pear-shaped, 29.16% as triangular, and 16.68% as round. The study aimed to assess the outcomes of a complete denture fabrication to assist prosthodontists in designing and fabricating dentures that enhance retention, support, and stability for edentulous patients.

The findings outlined in the parent article, conducted in Lahore, Pakistan suggest notable variation in the shapes of retromolar pad in completely edentulous patient.[15] The conclusion was that, among the various shapes, the triangular and pear shaped retromolar pads exhibited a larger surface area compared to the round shape.

Nazia and her team conducted a cross-sectional study on the Kashmiri population and inferred that the pear and triangular shaped retromolar pads offer improved stability for lower dentures due to their larger surface area in contrast to the round shape, which provides comparatively less support. The statistics revealed that the pear shaped retromolar pad was the most common (55%), followed by the triangular (29.4%) and the round (15.5%) shapes.[16]

In contrast, Anil Sharma and colleagues surveyed one hundred and eighty edentulous patients and identified that the triangular shaped pads were the second most common (34.30%) after pear-shaped pads (51.30%), with rounded pads being the least common (14.30%).[1]

They concluded that the pear and triangular shaped retromolar pad have an increased surface area as compared to the round shaped. Another research however concluded that area covered by the retromolar pad has little influence on force distribution during loading.[17]

According to Cha, there were no significant differences in retromolar pad shapes between the left and right sides, nor were any parameters observed to vary with age.[7] Pear shape was found to be the most prevalent, accounting for 56.5%, followed by oval or round shape 27.7%, and triangular shape 15.8%.

Based on the findings of the current study, it is evident that there are diversities in the size and shape of the retromolar pad across different populations, which impacts denture stability. A larger surface area and diameter of the retromolar pad contribute to better denture stability, as forces are more evenly distributed over an extended area. Therefore, thorough assessment of the retromolar pad is essential during the fabrication of complete dentures, and incorporating enhanced design features can improve marginal seal and overall stability of the prosthesis.

Significance: The retromolar pad serves as a consistent, stable and accessible anatomical landmark, which aligns with the mandibular posterior occlusal plane.[12] Its size and shape influence denture retention, with age-related resorption, gender differences, and genetic factors influencing its surface area. Additionally, its diameter defines the posterior extension of mandibular dentures, contributing to marginal seal and stability. These findings highlight its clinical relevance in prosthetic dentistry.

Limitations: The current study has a few shortcomings. There was a limited sample size that may not reflect the broader population, reducing the generalizability of the results. It lacks long-term follow-up to assess the impact of retromolar pad shape on denture stability over time. With increasing age, the retromolar pad tends to undergo resorption or changes in the soft tissue, reducing the effective surface area. Older patients often have a less pronounced retromolar pad, leading to challenges in denture retention. Since this research does not explore the full range of factors, such as gender, genetic predisposition, systemic conditions, tooth loss consequence, duration of edentulous time, soft tissue health, previous denture wearing experience, and many other unidentified contributors which may influence the ongoing remodelling process of the edentulous jaws. These limitations highlight the need for more comprehensive studies to better link anatomical variations with clinical outcomes.

CONCLUSION

The current study found significant variations in the shapes of the retromolar pad in completely edentulous patients. These findings underscore the importance of accounting for the anatomical features of the retromolar pad when making clinical decisions and planning prosthetic treatments. Understanding these variations can contribute to more effective prosthetic planning, ultimately improving the success of dental prostheses in edentulous patients within this specific population.

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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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