The clinical evaluation of Residual Ridge Morphology and its association with age and edentulism

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ABSTRACT

Objective: To evaluate the morphology of residual ridge of maxilla according to classification proposed by ACP (American College of Prosthodontics) and find its association with age and edentulism period.
Study Design: A cross-sectional observational study.
Place and Duration: At Prosthodontic Department of Lahore Medical and Dental College, Lahore from 1st September 2019 to 1st February 2020.
Methodology: A total of 90 completely edentulous patients above the age of 40 years were selected. The residual ridges of maxilla were clinically observed and classified using classification system proposed by ACP (American College of Prosthodontics). The association of residual ridge with age, gender, duration of edentulous period and duration of denture use was determined. Non probability purposive sampling was used for selection of both genders. Demographic data was recorded and intra-oral examination carried out after getting informed consent.
Results: Out of 90 patients, majority patients; 27.8% belonged to the age group 51-60 years. The mean edentulous period was found to be 6.10 years± SD4.702. 58.9 % of patients were complete denture wearers. The most common types observed was type A; 60.0%, type B; 28.9% followed by type C;11.0%. No patient was reported having type D morphology. Age and gender had no association with residual ridge morphology, whereas duration of edentulous period and complete denture use made the morphology more unfavorable.
Conclusion: Type A ridge morphology of maxilla (ACP classification) is most pervasive whereas Type D is the least. The ACP classified ridge types have no age and gender association, however significantly associated with the duration of edentulous period and complete denture wearing.
Keywords: Age, ACP Classification, Bone resorption, Dentate, Dentures, Edentulism, Edentulous period, Residual ridge resorption, Ridge morphology, Maxillary ridge.

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INTRODUCTION

Residual ridge resorption is a term used to describe the reduction in quantity and quality of residual ridge after tooth loss[1]. It is a chronic and progressive disease that is irreversible and disabling[2]. It is multifactorial and results in bone resorption. Its rate varies from person to person and at different times in different sites[2,3]. It is present in all individuals and sever resorption can make rehabilitation of a partially and completely edentulous patient with removable dentures more difficult and challenging[4]. The residual ridge morphology also influences different prosthodontic treatment phases and thus consideration should be given to minimize the resorptive process[5].

Residual ridge morphology of maxilla and mandible being one of the important factors, that affects masticatory functions, denture support and appearance in edentulous patients[6]. Severe resorption gradually results in horizontal discrepancy between edentulous ridges, increase interarch distance and loosening of dentures[7]. Loss of retention and stability are two

main problems encountered in complete and partial denture prosthesis if ridge morphology is compromised[7,8].

Increasing age and prolonged edentulous period without complete denture use results in loss of function, hence resulting in reduced muscular activity.[2] This reduction in the muscular activity in turn decreases the size and density of the bone especially the basal bone.[2] Many studies were performed clinically and radiographically to assess the aging effects and denture use on residual ridges[2,4,9]. Attempts were also made to classify the residual ridge morphology to discuss its various stages in edentulous state. American college of Prosthodontics (ACP) in 1999 proposed a classification system and clinically classify residual ridge morphology in to types A,B,C and D[10].

The classification was meant to evaluate the predictive complexity of treatment. This classification is clinically convenient that besides describing ridge morphology, also explains the associated musculature effect on prosthesis[10]. It is important to know the quantity and quality of available bone that has left because of the factors like aging and prolonged edentulism period and assess the bone morphology before treatment planning of complete and partial dentures[11]. By knowing the morphology of maxillary bone we can determine various stages of ridge resorption and weather conventional prosthodontic treatment will be success full or not[10]. By classifying the ridge type in our patients we can predicts which type of ridge morphology is more frequent in our region and also have an idea of the rate of resorption. Keeping it as diagnostic entity, dental planners can carefully categorize the difficulty level of the treatment and plan proper referral at initial stages which will not only save the time of both the patient and the planner but also result in executing preventive prosthodontics. This would help oral health planners for making strategies that will help in fabrication of stable and retentive removable denture

This study was conducted with an objective to clinically evaluate maxillary ridge morphology according to classification system proposed by ACP (American College of Prosthodontics) and find out its association with age, duration on edentulous period and complete denture wear was determined.

METHODOLOGY

The cross-sectional observational study was conducted at the Prosthodontic department, Lahore Medical and Dental College. Data was collected in the period of 6 months from 1st September 2019 to 1st February 2020. Non-probability purposive sampling was used to select 90 edentulous patients of both genders. The sample size was estimated to be 90, based on prevalence of awareness regarding residual ridge morphology form previous studies.

All patients above 40 years with completely edentulous maxillary arch were included. Patient. Patients who had been in edentulous state for at least 1 year were included. Partially edentulous patients and those unwilling to participate were excluded. Patients with maxillary defects both acquired and congenital and those with recently extracted teeth were also excluded. All those patients with surgical resections, incomplete healing sockets and developmental abnormalities were also not included. Patient's age was divided into following age groups decade wise; group 1(40- 60) years, group 2(61-80) years, group 3(above 80) years.

Morphology of maxillary residual ridge was classified in to types A, B, C and D according to the criteria proposed by ACP classification system 1999 (American College of Prosthodontics classification System) [10].

Type A: Anterior labial and posterior buccal vestibular depth intact. Tuberosity resisting horizontal and vertical denture base movements. Prominent hamular notch well defining the posterior extent of denture base, no exostosis and tori.

Type B: Obliterated posterior buccal vestibule, morphology of palate resist denture base vertical and horizontal movements, poorly defined hamular notch and posterior extension of denture base poorly defined by tuberosity. Lateral exostosis and tori are rounded and do not interfere.

Type C: Anterior labial vestibule lost minimal resistance to the horizontal and vertical movement by palatal morphology, torus palatinus and bony exostoses having under cuts not affecting the extension of denture base. Anterior ridge hyper mobile and provides compromised denture base support and stability. Coronoid process reduces posterior malar space during mandibular movements.

Type D: Anterior and posterior vestibule obliterated. Denture base movements are not resisted by palatal vault morphology. Palatal tori and exostoses interfere with denture's posterior border, anterior ridge hyperplastic, anterior nasal spine well defined. Data collection was done by experienced doctors and was registered in examination proformas. Single researcher collected patient's information like age, gender, length of edentulous period and duration of complete denture use. Maxillary residual ridges and associated oral tissues were clinically examined with the help of diagnostic instruments (probe and mouth mirror) and manual palpation. Residual ridges were then classified in to types A, B, C and D according to the criteria proposed by ACP classification system 1999 (American College of Prosthodontics classification System)[10].

Data Analysis: Data was analyzed by using SPSS Version 20. The associations of the residual maxillary ridge morphology with age group, gender, duration of edentulism and duration of denture use were tested with Chi Squared. The significance level was set at 5%.

RESULTS

A total of 90 edentulous patients were selected. 55.6% patients were females n=50 whereas male patients were 44.4%, n =40. The age ranged was 40 to 80 years. The average age was 60.81 years; ±SD1.104. In the study majority patients were in age group 51 to 60 years (n=25; 27.8%). Least reported age group was 71-80 years (n=21; 23.3%).

Complete denture wearers were n=53; 58.9% whereas those who were non-denture wearers were n=37; 41.1% respectively. The mean edentulous period was found to be 6.10 years ±SD 4.702. The mean denture use duration was 5.08 years ±SD 4.038. Maximum duration of denture use reported was 16 years (Table-I).

Table-I: Frequency of different variables studied (N=90)

Variables (in years)	Mean±SD	Minimum-Maimum
Age	60.81±11.373	40-80
Duration of Edentulous period	6.10±4.702	1-18
Duration of denture use(n=53)	5.08±4.038	1-16

The majority patients had type A morphology of maxillary ridge n=54; 60.0%, type B (n= 26; 28.9%) followed by type C (n=10; 11.0%). However, no patients were reported having type D ridge morphology.

The patients belonging to all ridge types had insignificant difference with ages (p value .130), however the association between edentulous period and type of ridge morphology was significant (p= 0.00) (Table-II). Significantly higher mean edentulous period duration was observed in the patients with type C (15.50± SD 1.958) as compared to type A (4.20± SD 3.450) and B (6.42±2.982) ridge morphologies (Table-II).

Table-II: Association of age and edentulous period duration with residual ridge (N=90)

Variables	Type A (mean±SD)	Type B (mean±SD)	Type C (mean±SD)	F statistics	P value
Age	57.81 ±11.193	64.65 ±10.811	67.00 ±8.807	9.47	.130
Duration of edentulous period	4.20 ±3.450	6.42 ±2.982	15.50 ±1.958	27.6	.000

Insignificant difference seen between the type A and B. We found majority of male patient with type A morphology (n= 19; 21.1%) followed by type B (n=15; 16.7%) and C (n=6;6.7%) Table III. Similar results were obtained in the female patients Type A (n=35 ;38.9%, Type B n=12; 13.3%, Type C n=3; 3.3%), so statistical significance was not present that shows no gender association with maxillary ridge morphology p=.081, (Table-III).

Type A ridge morphology was mostly prevalent in patients using dentures (n= 40; 44.4% and type B n=20;22.2% in patients without dentures which was statistically significant (p value 0.00), (Table-III).

Table-III: Association of Gender and denture wear with ridge morphology (N=90)

Variables	Type A	Type B	Type C	x^2	p value
Gender					
Male	19(21.1%)	15(16.7%)	6(6.7%)	5.025	.081
Female	35(38.9%)	12(13.3%)	3(3.3%)		
Denture wear					
Wearer	40(44.4%)	7(7.8%)	6(6.7%)	17.486	0.00
Non wearer	14(15.6%)	20(22.2%)	3(3.3%)		

DISCUSSION

After tooth extraction the ongoing bone resorption changes the morphology of the residual ridge[11]. The annual bone loss in edentulous patients has been reported both in mandible 6.31% and maxilla; 0.97% and it's an ongoing process[12]. Ridge resorption in an edentulous patient continues throughout life and in a patient with denture it affects ridge morphology[13]. In the current study morphology of maxillary ridge was clinically evaluated, as the radiographic evaluation is not very authentic and reliable and does not suitable for each patient[9]. Furthermore the classification system possesses a logical progression, describes the effects of ridge morphology and associated musculature on maxillary complete[10].

The rate of bone resorption increases as the aging continues and osteoclastic activity takes over the osteoblastic activity. Formation of bone in growing individuals is way more than resorption but with increasing age senile osteoporosis occurs as a result of increased osteoclastic activity[14]. In this study, the age of the patients ranged from 40-80 years and interestingly we found no correlation of bone resorption with age of the participants. Few other studies in favor of our study depicted no correlation of alveolar bone resorption with age of participants[15,16]. However in contrast to the results of current study Jayaram[17] found increased ridge resorption in older individuals in relation to edentulism than in younger. Similar results found in Latifa Jabbarah[18] where he found significant increase in resorption with increasing age (8.63% in patient aged 50-59 and 27.69% belonging to 70-79). Similarly increase in rate of bone resorption was reported by Venkatesan[19] and coworkers. We suggest that the contrasting results of current study could be due to its small sample size, or racial difference in the regulation of metabolism of minerals[20].

Literature have shown mixed results about the rate of resorption and its association with gender. Venkatesan[19] and coworkers reported increase resorption rate with increasing age and women showed more resorption than men. They reported reduced height of maxilla and mandible more in females than males. Some other studies have also reported increased resorption rate in women[8, 21]. We found majority of females with edentulous state than males, however no significant gender difference with respect to the type of ridge morphology was found. In contrast to the result of present study, a study reported men with greater mandibular bone height than women and had a negative correlation between bone height and age with significance. Whereas, negative correlation between age and bone height which was not significant was seen in females[22]. In light of the results of current study we could say that ridge resorption is more in females as compare to males because of factors like menopause resulting in decrease estrogen levels and other hormones, thus accelerating the osteoclastic activity of bone[23].

Ride resorption is an ongoing process in an edentulous jaw and directly affects the ridge morphology of a denture wearer. We clinically evaluated the residual ridge morphology in our study participants and found type A ridge to be the most frequently observed ridge type, followed by type B and C in both genders. Type D morphology was not present in our participants. Type D ridge possesses complete vestibular width loss, highly compromised tissue, hyperplasia and presence of tori. Al Helal[24] and coworkers carried out a study of denture bases of maxilla and similar to the result of current study, found type A

morphology of the ridge as most prevalent and none of the patients had type D. Similarly, Sharma and coworkers[16] has reported type A ridge morphology to be the most commonly observed ridge morphology followed by type B and type C. None of their participants had type D.

The residual ridge resorption is multifactorial and edentulism is among one of the factors that can affect the resorption rate. A study carried out on mandibular arch reported significant correlation between the bone resorption and complete denture use[21]. It can be said that the extensive resorption is seen in those patients who have be edentulous for longer period of time. We also found significant association of the ridge morphology type with respect to the duration of edentulous period in the study participants. The type of morphology converted from A to B and then to C type with increased edentulous period duration. This finding was common in both genders. Another study reported rapid reduction in height of the bone that became slower as the edentulism period increased[17]. We suggest that the ridge resorption is a continuous process and prolonged edentulous period without complete denture use results in loss of function, hence resulting in reduced muscular activity which in turn decreases the size and density of the bone[2].

Since bone resorption increases with prolonged edentulism and denture use as evidenced in our study. Attempts should be made to preserve bone by practicing preventive prosthodontics. To date very few studies carried out to study the effect of age, gender and edentulous duration in Pakistani patients. Future studies are needed to evaluate the effects of these variables on bigger scale.

CONCLUSION

Type A ridge morphology of maxilla (ACP classification) is most pervasive whereas Type D is the least. The ACP classified ridge types have no age and gender association, however significantly associated with the duration of edentulous period and complete denture wearing.

AUTHOR'S CONTRIBUTION

Qamar K: Data collection, Manuscript writing
Shah MU: Conceived idea, Designed research methodology
Zakir A: Statistical analysis
Khan MH: Data collection
Aqeel R: Manuscript final reading
Arif M: Literature review

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