

Prevalence of Residual Ridge Resorption (RRR) Pattern in Edentulous Mandible and its Association with Complete Denture - A Retrospective Study

Research Article

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Abstract

Residual ridge resorption is a term that is used to describe the changes which affect the alveolar ridge following tooth extractions, which continue even after healing of the extraction socket throughout the life. The present study aims to evaluate the prevalence of different types of residual ridge resorption and its relation with demographic data among the Chennai population. This retrospective study was conducted among the patients visiting the outpatient department of a private dental college. The data of patients with edentulous mandibles were evaluated from there available case sheets. The collected data was statistically analysed using IBM SPSS Software (20.0). We observed that, It can be seen that high well rounded is the most prevalent among all the age groups; The age group of 60-69 years shows the highest incidence of all the three types of RRR; There is no or little significant association between age and the type of RRR (Pearson chi-square value- 8.260; p-value- 0.603; phi- 0.145). It is observed that RRR is more prevalent among the male population; There is no or little significant association between gender and the type of RRR (Pearson chi-square value- 2.529; p-value- 0.282; phi- 0.2); It can be seen that there is a significant association between the history of using a denture and the type of RRR (Pearson chi-square value-15.511 ; p-value-0.001 ; phi-0.19). Within the limits of the study, It can be seen that high well rounded is the most prevalent among all the age groups; The age group of 60-69 years shows the highest incidence of all the three types of RRR; It is observed that RRR is more prevalent among the male population; It can be seen that there is a significant association between the history of using a denture and the type of RRR.

Keywords: Atwood; Denture; Edentulous Mandible; Prevalence; Residual Ridge Resorption.

Introduction

Atrophy of the jaw bone following tooth loss is a multifactorial disease that is not attributable to the prosthesis alone, as its occurrence is observed in a population without modern prosthetic treatment. The residual ridge undergoes a series of changes in shape and height of the following pattern of resorption described for modern populations [1]. Loss of teeth, especially in the mandibular arch frequently leads to the rapid reduction of height of the alveolar process. This morphological change in the residual alveolar ridges is considered to be a major oral disease entity [2].

The rate of resorption is supposed to be twice more pronounced in the mandible when compared to maxilla [2, 3].

In a prosthetic sense bone is considered to be the base which provides support for the denture. In a physiological sense it is the area where forces are created while biting and chewing food are transmitted. Continuous bone rebuilding occurs in the due course of life [4]. Bone remodelling occurs constantly throughout life through bone resorption and bone formation. During the growth phase, bone formation usually exceeds bone resorption with exception to osteoporosis, where there is a generalised bone

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resorption that exceeds bone formation. This balance between bone deposition and resorption is usually seen in the young and healthy. In older people, the lifespan and proliferation of osteoclasts are significantly decreased which causes an increase in the resorptive process when compared to osteogenesis. Bone loss is considered to begin in humans at 35-40 years of age after the peak bone mass has reached after which the atrophic process continues with varying intensities. The atrophic process is accelerated in pre-menopausal women when compared to men [5-12]. Alveolar bone loss occurs in a bucco-palatal direction in the maxilla and linguo-buccal direction in the mandible [13, 14]. According to Parkinson [15] mandibular bone resorption is more common in comparison to maxillary bone resorption.

Mandibular bone resorption is localized around teeth, in case of periodontal disease and it may be due to certain local pathologic processes. RRR is also a localized pathologic loss of bone but it cannot be resolved by removing the causative factors. If the bone growth in the endosteal layer does not keep pace with the external osteoclastic activity, there would be an absence of a cortical layer. The best method for determining the amount and rate of RRR over a period of time is by using lateral cephalometric radiographs. A technique described by Wical and Swoope uses the panoramic radiographic technique to grossly estimate the amount of RRR. Other methods include absorptiometry, quantitative computed tomography, neutron activation analysis and intraoral microdensitometry [16-18]. Previously our team has a rich experience in working on various research projects across multiple disciplines. [19-33]. Now the growing trend in this area motivated us to pursue this project.

The present study aimed to evaluate the prevalence of different types of residual ridge resorption and its relation with demographic data among the Chennai population.

Materials and Methods

Study Setting:

The present study was conducted to evaluate the prevalence of RRR among the population visiting a private dental college

from June 2019 to March 2020. Ethical clearance for this study was obtained from the Institutional Ethical Committee with the ethical approval number being SDC/SIHEC/2020/DIASDATA/0619-0320. A total of 86,000 case sheets were reviewed and final data was collected from 145 patients who had edentulous mandibles.

Sampling:

It is a retrospective study. The data was collected by reviewing the case records of the patients visiting the outpatient department of a private dental college. The data included in the study were from June 2019 to March 2020. All the available case sheets with respect to edentulous mandibles were reviewed and data evaluation was done. Simple random sampling, collecting more data sources and including the data only from the Institute were the measures taken to minimise the bias.

Data Collection:

The data collection was done by reviewing the patient's case records and the results were tabulated. Cross verification was done with the OPGs and photographs. The incomplete or censored data were verified and excluded from the study. The obtained data was segregated using Atwood's classification.

Data Analysis:

The data were entered and analysed using Statistical Product and Service Solution Software by IBM Version 20.0. Descriptive Statistics were calculated to explore the general features of the data. Independent variables were age and gender and the dependent variable was the type of RRR. Association was assessed through a Pearson chi-square test and phi test.

Results & Discussion

From our observations, we can see that high well rounded type of residual ridge constitutes to 58.93%; knife edged type of residual ridge constitutes to 27.55%; low well rounded type of residual ridge constitutes to 13.52% [Figure 1]. It can be seen that the

Figure 1: Frequency distribution chart showing the prevalence of different types of residual ridge resorption among the population. X axis is the type of RRR and Y axis represents the percentage of patients. Highest prevalence of high well rounded ridge (58.93%) was seen when compared to the other types.

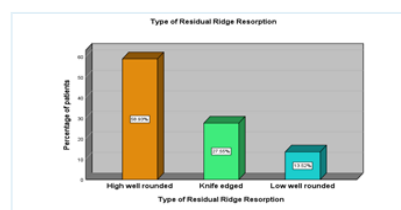


Figure 2: This bar graph shows association between different types of residual ridge resorption and the age of the population. X axis is the age of the patients and Y axis represents the percentage of patients exhibiting a particular type of RRR. Pearson chi-square test, p-value- 0.603>0.05, therefore statistically insignificant. It can be seen that the highest number of high well rounded, Knife edged and low well rounded are seen among the 60-69 year age group.

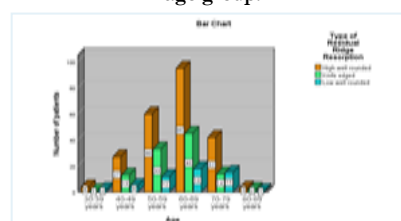


Figure 3: This bar graph shows association between different types of residual ridge resorption and the gender of the population. X axis is the gender of the patients and Y axis represents the percentage of patients exhibiting a particular type of RRR. Pearson chi-square test, P-value- 0.282>0.05, therefore statistically insignificant. It can be seen that there is a higher prevalence of High well rounded, Knife edged and low well rounded ridges among the male population.

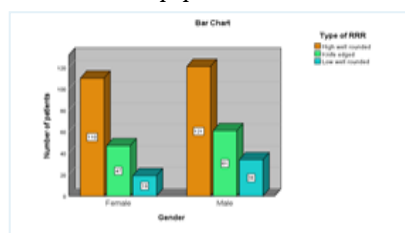


Figure 4: This bar graph shows association between different types of residual ridge resorption and the history of using a denture. Y axis represents the denture usage history of the patients and X axis represents the percentage of patients exhibiting a particular type of RRR. Pearson chi-square test, p-value-0.001, shows high statistical significance. It can be seen that the highest number of high well rounded, Knife edged and low well rounded are seen among the patients who did not use a denture previously and this association is statistically significant.

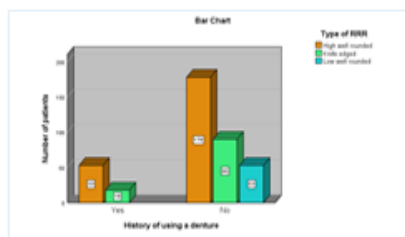


Table 1. This table shows the prevalence of different types of RRR with relation to age, gender and the history of denture usage.

		Types of RRR			Statistical values		
		High well rounded	Knife edged	Low well rounded	Pearson chi-square	P value	phi
Age (years)	30-39 yrs	4	1	2	8.26	0.603	0.145
	40-49 yrs	27	13	5			
	50-59 yrs	60	33	12			
	60-69 yrs	95	45	18			
	70-79 yrs	42	14	15			
	80-89 yrs	3	2	1			
Gender	Female	110	47	19	2.529	0.282	0.2
	Male	121	61	34			
History of denture usage	Yes	53	18	0	15.511	0.001*	0.19
	No	178	90	53			

*(Since the p value is lesser than our chosen significance level ($\alpha=0.05$), it is statistically significant).

highest number of high well rounded (95), Knife edged (45) and low well rounded (18) are seen among the 60-69 year age group [Figure 2]. It is observed that the highest number of high well rounded (121), Knife edged (61) and low well rounded (34) are seen among the male population [Figure 3]. It can be seen that the highest number of high well rounded (95), Knife edged (45) and low well rounded (18) are seen among the patients who did not use a denture before [Figure 4].

It can be seen that high well rounded is the most prevalent among all the age groups; The age group of 60-69 years shows the highest incidence of all the three types of RRR; There is no or little significant association between age and the type of RRR(Pearson chi-square value- 8.260 ; p-value- 0.603; phi- 0.145).

It is observed that RRR is more prevalent among the male population; There is no or little significant association between gender and the type of RRR(Pearson chi-square value- 2.529; p-value- 0.282; phi- 0.2); It can be seen that there is a significant association between the history of using a denture and the type of

RRR(Pearson chi-square value-15.511 ; p-value-0.001 ; phi-0.19). [Table. 1]

Atwood first postulated the four main factors namely anatomic, prosthetic and metabolic and functional factors that are responsible for the loss of alveolar bone [34, 35]. The different orders of RRR as proposed by Atwood are: Order II: Immediately following extraction; Order III: High well rounded; Order IV: Knife edged; Order V: Low well rounded; Order VI: Depressed ridge [36].

The other classifications for RRR include: Resorptive pattern of the edentulous ridge by Mercier, 1995. The ridge is wide enough at its crest to accommodate the recently extracted teeth. Type I – Minor ridge modelling. The ridge becomes thin and pointed. Type II – Sharp atrophic residual ridge The pointed ridge flattens to the level of the basal bone. Type III – basal bone ridge The flattened ridge becomes concave as the basal bone resorbs. Type IV – basal bone resorption [37, 38].

Residual ridge form has been classified by Cawood and Howell as follows: Class I – dentate, Class II – post-extraction, Class III – convex ridge form, with adequate height and width of alveolar process, Class IV – knife edge form with adequate height but inadequate width of alveolar process, Class V – flat ridge form with loss of alveolar process, Class VI – loss of basal bone that may be extensive but follows no predictable pattern [39, 40].

In our study we can see that RRR is more prevalent among 60-69 year olds which is similar to the observations by Andrade et al [41], Al-Jabran and Al-Shumailan [37], Klemetti et al., [42] and Jagadeesh and Patil, 2013 [43]. We observed that males were more frequently than a female which is contradictory to the general census. Observations of studies by Al-Jabran and Al-Shumailan [37], Liang et al., [44] and Basha et al., [38] show that the female population show more prevalence of residual ridge resorption. The reason for this could be due to the size of population and unequal number of male and female population. In our present study as the duration of edentulism increased, mandibular bone height decreased which is similar to the observation by Al-Jabran and Al-Shumailan [37], Ajay et al., [40].

In case of high well rounded ridges, fabrication of a denture and restoring the function and esthetics of the patient is highly possible with the regular technique. In cases of knife edged and low well rounded ridges, in order to preserve the alveolar ridge and to reduce the amount of occlusal load, a few general principles must be followed during the fabrication of a complete denture. One of the methods of achieving this is by having broad area of coverage under the denture base (which reduces the force per unit area); Usage of specialised impression techniques like McCord & Tyson technique, Zafrulla Khan technique and admix technique; Reducing the number of denture teeth; Decreasing the buccolingual width of teeth; Usage of monoplane teeth to decrease the amount of force required to masticate food; Neurocentric or lingualized occlusal scheme can be used during tooth setup to reduce the number of inclined planes (which minimises the dislodgement of dentures and shear forces) and to achieve a centralisation of occlusal contacts (which increases the stability of dentures and to maximise compressive load); When the maxillo-mandibular relationship is accurately recorded with special regard to vertical rest dimension, this will decrease the frequency and duration of tooth contacts, thereby adequate rest is given to the underlying ridges [16, 17, 45, 46].

Limitations of the study include geographical isolation and the size of the population. Future research with equal male and female population with a large population could be carried out. Our institution is passionate about high quality evidence based research and has excelled in various fields [47, 57]. We hope this study adds to this rich legacy.

Conclusion

Within the limits of the study, It can be seen that high well rounded is the most prevalent among all the age groups; The age group of 60-69 years shows the highest incidence of all the three types of RRR; it is observed that RRR is more prevalent among the male population; It can be seen that there is a significant association between the history of using a denture and the type of RRR.

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