MEAN PERCENT REDUCTION IN MANDIBULAR RIDGE HEIGHT IN EDENTULOUS PATIENTS

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ABSTRACT

Complete edentulism is the physical state of the jaw following removal of all erupted teeth and the condition of the supporting structures available for reconstructive / replacement therapies. The evaluation of decrease in alveolar ridge height can be done by different radiographic techniques using lateral cephlaographs or panoramic radiographs. The purpose of this study was to determine the mean percent reduction in mandibular ridge height in edentulous patients. This cross sectional study was carried out in the Department of Prosthodontics, Dr. Ishrat-ul-Ebad Khan Institute of Oral Health Sciences, Karachi. Fifty male patients were enrolled in the study from July 2015 to May 2016. Wical and Swoope method was used to measure ridge resorption. The mean age of the study population was 63.02 ± 12.19 years. The mean duration of edentulism years was 3.37 ± 2.99 years. The mean decrease in mandibular ridge height according to age in group 1(40-60 years) was 7.57 ± 3.13mm and in group 2(61-80 years) was 7.96 ± 5.55mm (p-value 0.59). Mean percentage decrease in mandibular ridge height according to duration of edentulism in group A(1-5 years) was 24.43 ± 10.38% and in group B (6-10 years) was 21.30 ± 9.32% (p-value 0.39). The results of this study show that residual ridge reduction occurs in all patients. Reduced ridge height can lead to compromised success of prostheses. Therefore due consideration should be given to minimize the resorptive processes.

Key Words: Ridge resorption, alveolar ridge, residual alveolar, mandibular ridge height, edentulism.

INTRODUCTION

Complete edentulism refers to the condition of mouth after removal of all teeth and the state of remaining structures present for rehabilitation treatments.[1] Complete dentures should primarily fulfill felt and communicated need of an edentulous patient.[2] The factors mainly influencing the ability of complete dentures to attain this aim are retention, support and stability.[3] The retention, support and stability of dental prostheses are to a great extent influenced by the height of the alveolar ridge.[4]

Alveolar ridge is the part of oral cavity that contain the tooth sockets and provides support for the teeth.[5] The contour of the alveolar ridge, after the teeth have been extracted and the ridge has healed, is known as residual alveolar ridge.[6] The alveolar ridge undergoes a chronic, complex, biophysical multi factorial process of bone remodeling which is known as residual ridge resorption.[5,7] Factors related to ridge resorption comprise of gender, age, duration of edentulism and systemic diseases such as osteoporosis.[7] There is continuous remodeling of bone throughout the life, although the rate of overall bone loss is varied among different individuals.[8] In elderly people bone loss is more pronounced, as there is domination of resorptive processes over osteogenesis.[9] The degree of ridge reduction is greatest in first 6 months after extraction and decreases with time.[10] There is, however, continued resorption even after 25 years.[11]

The evaluation of decrease in alveolar ridge height can be done by different radiographic techniques using lateral cephlaographs[12,] or panoramic

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radiographs.[13,14] Panoramic radiographs have the ability to record a greater area of hard and soft tissue and also to allow visualization of the adjacent areas. Thereby, the mental foramen can be located more precisely in both the horizontal and vertical dimensions.[13] A method for measuring the rate of residual resorption, using orthopantamogram, was given by Wical and Swoope.[14] In a study conducted by Karaagaclioglu et al[15], the percentage of decreased mandibular ridge height was found to be 21.88% with edentulous age. Patients exhibited significant (p < .01) initial loss in mandibular bone height with decreased rate of mean resorption in the later period. The mean percent reduction in mandibular ridge height in edentulous patients was 23.33 ± 1.98[15].

In the present study we used the method given by Wical and Swoope to measure ridge resorption. The purpose of this research was to determine the mean percent reduction in mandibular ridge height in edentulous patients. Similar studies have been done previously on western population but there is no local data available on this topic. In future with improved knowledge of the decrease in height occurring in mandibular residual ridge we can modify our treatment, within our financial constraints, to satisfy the patients' needs and improve their quality of life.

MATERIALS AND METHODS

This cross sectional study was conducted at Department of Prosthodontics, Dr. Ishrat ul Ebad Khan Institute Of Oral Health Sciences, Karachi, from July 2015 till May 2016. The sample size was 50 (prevalence 23.33 ± 1.983[15], confidence interval 95%, margin of error 1%) and non probability, consecutive sampling technique was applied.

Inclusion Criteria: Completely edentulous patients.

Males (females were not included in this study to avoid variables like osteoporosis)

Patients between 40-80 years of age, who had been edentulous for less than 1 to 10 years were included after taking consent.

Exclusion Criteria: Patients having history of osteoporosis, steroid therapy, congenital anomalies and jaw fracture were not included.

Ethical approval for this study was taken from Institutional Review board (IRB). A standard panoramic radiograph (OPG) of good quality was made for each patient, which is a part of diagnosis and treatment planning of every completely edentulous patient. The cost of the radiographs was borne by the principal investigator. On each radiograph the mandibular ridge height (upto inferior boundary of mental foramen a1) was taken by measuring the distance from the lower border of the mandible to the inferior edge of the mental foramen.

Mandibular ridge height (upto alveolar ridge crest a2) was taken by calculating the space from the inferior border of the mandible to alveolar ridge crest. The distance was measured in millimeters by a scale. Original height of mandibular ridge (b) was taken as being 3 times the distance from the inferior boundary of the mandible to the lower boundary of the mental foramen (Wical and Scoope[14] method). Original height of mandibular ridge (b) = Mandibular ridge height (a1) × 3

The decreased mandibular ridge height (c) was taken by subtracting the mandibular height from the measured original height of mandibular ridge (b). Decreased mandibular ridge height (c) = Original height mandibular ridge (b) measured - Mandibular ridge height (a2)

Decreased mandibular ridge height in percentage (d) was taken as a percentage of the original mandibular ridge height (b). Decreased mandibular ridge height in percentage (d): Decreased mandibular ridge height (c) / Original height of mandibular ridge (b) × 100

All measurements were made with a scale to the nearest 0.5 mm by the same individual. The data analysis was done using SPSS software (version 16). Measures of central tendency (including mean and standard deviation) were calculated for age distribution, duration of edentulism and decreased mandibular ridge height. Stratification of data was done for age distribution, duration of edentulism. Stratification for gender was not done as sample only included males. Post stratification independent sample t-test was applied. P-value ≤ 0.05 was taken as significant.

RESULTS

The mean age of the study population was 63.22 ± 11.71 years (range 40-80 years). Mean duration of edentulism years was 3.37 ± 2.99 years (range 1-10 years). The mean decrease in mandibular ridge height was 7.78 ± 4.55 mm (range 2-21 mm). The mean percentage decreased mandibular ridge height was 23.8 ± 20.16% (range 8-53%). Ridge height was taken as a percentage of original ridge height to reduce the margin of error.

The sample was categorized into 2 groups according to age to assess whether ridge height is influenced by increasing age. The mean decrease in mandibular ridge height according to age in group

TABLE 1: MEAN DECREASE IN MANDIBULAR RIDGE HEIGHT (MM) ACCORDING TO AGE

Group	Age	Decrease in mandibular ridge height	
		Mean(mm)	Std. Deviation(mm)
1	(40 – 60 years)	7.57	3.13
2	(61 - 80 years)	7.96	5.55

TABLE 2: INDEPENDENT SAMPLES TEST FOR MEAN DECREASE IN MANDIBULAR RIDGE HEIGHT (MM) ACCORDING TO AGE

		Levene's Test for Equality of Variances		t-test for Equality of Means					95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
height_difference	Equal variances assumed	5.426	.024	-.305	48	.762	-.398	1.306	-3.023	2.228
	Equal variances not assumed			-.318	42.108	.752	-.398	1.252	-2.924	2.128

TABLE 3: MEAN PERCENTAGE DECREASE IN MANDIBULAR RIDGE HEIGHT IN RELATION TO AGE

Group	Age	Percentage decrease in mandibular ridge height	
		Mean(%)	Std. Deviation(%)
1	(40 – 60 years)	24.65%	3.13
2	(61 - 80 years)	23.07%	5.55

TABLE 4: INDEPENDENT SAMPLES TEST FOR MEAN PERCENTAGE DECREASE IN MANDIBULAR RIDGE HEIGHT IN RELATION TO AGE

		Levene's Test for Equality of Variances		t-test for Equality of Means					95% Confidence Interval of the Difference	
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	Lower	Upper
PERCENTAGE	Equal variances assumed	1.108	.298	.543	48	.590	1.578	2.906	-4.264	7.420
	Equal variances not assumed			.554	47.612	.582	1.578	2.847	-4.147	7.303

TABLE 5: MEAN DECREASE IN MANDIBULAR RIDGE HEIGHT (MM) IN RELATION TO DURATION OF EDENTULISM

Group	Duration of edentulism.	Decrease in mandibular ridge height	
		Mean(mm)	Std. Deviation(mm)
A	(1 – 5 years)	8.18	4.71
B	(6 - 10 years)	6.2	3.67

TABLE 6: INDEPENDENT SAMPLES TEST OF MEAN DECREASE IN MANDIBULAR RIDGE HEIGHT (MM) IN RELATION TO DURATION OF EDENTULISM

		Levene's Test for Equality of Variances		t-test for Equality of Means						
				T	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
		F	Sig.						Lower	Upper
height_ difference	Equal variances assumed	.290	.593	1.232	48	.224	1.975	1.604	-1.249	5.199
	Equal variances not assumed			1.431	17.241	.170	1.975	1.381	-.935	4.885

TABLE 7: MEAN PERCENTAGE DECREASE IN MANDIBULAR RIDGE HEIGHT IN RELATION TO DURATION OF EDENTULISM

Group	Duration of edentulism	Percentage decrease in mandibular ridge height	
		Mean(%)	Std. Deviation(%)
1	(1 – 5 years)	24.43	10.382
2	(6 - 10 years)	21.30	9.322

TABLE 8: INDEPENDENT SAMPLES TEST FOR MEAN PERCENTAGE DECREASE IN MANDIBULAR RIDGE HEIGHT IN RELATION TO DURATION OF EDENTULISM

		Levene's Test for Equality of Variances		t-test for Equality of Means						
				t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
		F	Sig.						Lower	Upper
PERCENTAGE	Equal variances assumed	.047	.829	.867	48	.390	3.125	3.603	-4.120	10.370
	Equal variances not assumed			.926	15.112	.369	3.125	3.374	-4.062	10.312

1 (40-60 years) was 7.57 ± 3.13mm (range 2-13mm) and in group 2 (61-80 years) it was 7.96 ± 5.55mm (range 2-21mm) (Table 1). No significant decrease in mean reduction in ridge height was found between different age groups. (p-value 0.762) (Table 2)

The mean percentage decrease in mandibular ridge height according to age in group 1 was 24.65 ± 8.77% (range 11-40%) and in group 2 it was 23.07 ± 11.33% (range 8-53%) (Table 3). There was no significant decrease in mean reduction in ridge height with increasing age (p-value 0.59). (Table 4)

The study population was also categorized into two groups according to duration of edentulism. The mean decrease in mandibular ridge height according to duration of edentulism in group A (1-5 years) was 8.18 ± 4.71mm (range 2-21mm) and in group B (6-10 years) it was 6.2 ± 3.67mm (range 2-13mm) (Table 5). There was no significant decrease in mean ridge height with increasing duration of edentulism (p-value 0.224). (Table 6)

The mean percentage decrease in mandibular ridge height according to duration of edentulism in group A was 24.43 ± 10.38% (range 8-53%) and in group B it was 21.30 ± 9.32% (range 11-36%) (Table 7). However there was no significant decrease in mean ridge height with increasing duration of edentulism (p-value 0.39). (Table 8)

DISCUSSION

There is continuous remodeling of bone (bone deposition and resorption) throughout life, but rate of overall bone loss is varied among individuals.[8,16,17] In older individuals the resorptive processes are more pronounced leading to a more significant bone loss.[9] As success of complete dentures depends on adequate ridge height and contour the loss of bone leads to a number of problems in making complete dentures.[7,18] This makes it essential to know factors that are involved in residual ridge reduction. In this study reasearchers analyzed the reduction in ridge height of mandible in edentulous patients in relation to age and duration of edentulism.

The results of this study showed that there was a mean (23.8%) reduction in residual ridge height of all patients. This was taken as a percentage of original ridge height to decrease the margin of error. These results were similar to those reported by Al-Jabrah[19] who found that all edentulous patients aged between 45 to 82 years were affected by residual ridge resorption (range between 2%-57%) with mean reduction to be approximately 20%.

Different studies have revealed different results on variation of residual ridge resorption with age.

No significant increase in ridge height reduction with increasing age was observed. These results coincide with those of Humphries and Devlin[20] who found that ridge height reduction does not increase with age. Karaagaçiioglu[15] found a significant correlation between age and residual ridge resorption. He divided his sample into two age group. Both age groups showed resorption however it declined in the older age group.

Jabbarah however in his study found that the amount of residual ridge resorption significantly increased with the age (8.63% in patient aged 50-59 years and 27.69% in patients belonging to age group 70-79).[19]

The duration of edentulism has always been considered to be a major factor in residual ridge resorption. Tallagren[11] did a mixed longitudinal study over a period of 25 years on denture wearing patients and he found continued loss of ridge throughout the period of his observation. In the present study a decrease in ridge height was observed in both groups. (group A edentulism years 1-5, group B edentulism years 6-10). However when the two groups were compared, the results showed no significant decrease in mean ridge height with increasing duration of edentulism. Results of this study are similar to Humphries and Devlin.[20] who found no significant decrease in ridge height with duration of edentulism in men.

Jayaram[21] however found more accelerated ridge resorption in older individuals in relation to duration of edentulism than in younger individuals. Latifa[22] also found that ridge height reduction increases with duration of edentulism when the difference between edentulous years is more. Statistically significant results were present when patient who had been edentulous for 0-5 years were compared with patients who had been edentulous for 16 years. This could possibly be due to the fact that in the first year after extraction there is more rapid loss in bone, which is later followed by a gradual decline in rate of resorption.

Limitations of study

Cbct should be used to determine exact measurements and to avoid limitations of opg such as distortion of image and magnification. In future longitudinal study should be done to determine bone loss over a number of years.

CONCLUSION

The present study showed that residual ridge reduction occurs in all edentulous patients. Therefore due consideration should be given to minimize the

resorptive processes. Treatment modalities should be implemented that preserve ridge height and contour, to improve the quality of life of edentulous patients.

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CONTRIBUTIONS BY AUTHORS
All authors contributed substantialy