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RESEARCH ARTICLE

EVALUATION OF VERTICAL BONE HEIGHTS OF MAXILLARY AND MANDIBULAR RESIDUAL RIDGES AMONG EDENTULOUS DIABETICS BY DIGITAL ORTHOPANTOMOGRAPH

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ABSTRACT

Background: Progressive residual alveolar ridge resorption is one of the main causes of loss of stability and retention of complete denture. The severity of bone loss is a serious clinical condition facing the aging population. Resorption of residual alveolar bone is further accelerated by uncontrolled diabetes. So the present study was conducted to compare the bone heights of residual alveolar bone in edentulous patients between diabetes and non- diabetes and also to correlate with the HbA_1C level of diabetes.

Materials and Methods: 25 Apparently healthy (non-diabetic) and 25 diabetic edentulous age and sex matched subjects were recruited in the present study with a mean age of 61-65 years. Resorption of the maxillary and mandibular residual alveolar ridges were assessed in digital panoramic radiographs. Measurements were performed using Romexis software. The amount of resorption was calculated and correlated to gender, age and duration of edentulousness. Statistical analysis was performed using SPSS (V17.0). Level of significance was set at 0.05.

Results: Our results showed that residual ridge resorption was higher in females (52%) when compared to males (48%). Diabetics had significantly ($p<0.05$) more residual alveolar bone resorption in right and left Mandibular premolar, Maxillary premolar and molar regions. There was no significant difference ($p<0.05$) in Gonial angle between the groups. A significant correlation was found between HbA_1C level and residual ridge resorption. A weak positive correlation ($r=+1$) was observed between duration of edentulism and resorption of residual alveolar ridge.

Conclusion: Completely edentulous, women in particular, are at more risk to have ridge resorption than non-diabetic subjects. Reduced mandibular height is directly related to years of edentulousness with greater amount of resorption among diabetics.

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INTRODUCTION

The origination of edentulousness requires tooth loss as a basic requirement. Edentulousness is attributed to various factors like poor oral hygiene, poor nutrition, degenerative systemic diseases, and various unfavourable medications. The prevalence of edentulousness in elderly was found to be in range of 70.3% to 91.2% (Abdul hadi *et al*., 2009). Hence, modern dentistry aims to restore the edentulous patients to normal contour, function, comfort, aesthetic, speech and health regardless of the atrophy, disease or injury (Abdul hadi *et al*., 2009). Residual alveolar ridge resorption (RRR) is a life-long continuous process maximum in the first 6 few months after tooth extraction and then gradually tapers off (Jabrah *et al*., 2011 and Ural *et al*., 2011). This resorption is affected by various factors like local and systemic factors.

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Local factors includes the condition of alveolar process after teeth extraction (size, shape), duration of edentulousness and occlusal stress from the denture to the ridge. Systemic factors include patients age, gender, low calcium intake and diabetes mellitus (Abdul hadi *et al*., 2009 and Zlataric *et al*., 2002). Diabetes mellitus represents one of the major health concern. It is also one of the main endocrine gland which is involved in bone and calcium metabolism. Residual alveolar bone resorption has been shown to significantly increase with the severity of the diabetic condition (Abdul hadi *et al*., 2009). There are several radiographic techniques to measure RRR. Panoramic radiography is a very popular radiographic technique in dentistry due to its simplicity and low radiation dose (Abdul hadi *et al*., 2009). It helps in visualizing all the anatomical structures at once like the mental foramen, maxillary sinus, mandibular canal and also to evaluate the presence of any unerupted teeth or any other pathologies and to have a gross estimate on the residual bone height (Abdul hadi *et al*., 2009). The evaluation of these structures helps in proper

treatment planning.Hence the present study was conducted to assess and compare the vertical bone heights of maxilla and mandible in panoramic radiographs of apparently healthy (non-diabetic) and diabetic edentulous patients. To correlate Glycated hemoglobin level (HbA_1C), duration of edentulism and resorption of residual alveolar bone in diabetic edentulous patients.

MATERIALS AND METHODS

The study was conducted in the Department of Oral Medicine and Radiology, Bengaluru over a period of one and half year from January 2015 to June 2016. The research proposal was reviewed and approved by the ethical committee of the Oxford Dental college and Hospital, RGUHS university.

Inclusion/exclusion criteria

Apparently healthy edentulous patients aged between 45-70 years, controlled or uncontrolled diabetic edentulous patients and OPGs in which distinct landmarks seen at least in one end are included in the study. Any distortion of images of the jaws, patients with any systemic disorders like osteoporosis, hypertension, bony abnormalities or impacted tooth in the area of measurement are excluded from the study.

Study procedure

The study sample comprises of 25 diabetic and 25 apparently healthy (non-diabetic) edentulous age and sex matched subjects with a mean age of 61-65 years. Out of these patients 26 were females (52%) and 24 were males (48%). After consent detailed medical and dental history was obtained to rule out presence of any other systemic disease that influences bone resorption. Subjects who fulfilled the criteria were exposed to Panoramic radiographs. FBS was performed for all the subjects and Glycated hemoglobin test was performed for diabetic subjects to know the status of diabetes over the past 3 months.

Measurements

For each patient an OPG was taken using Planmeca Proline XC digital panoramic machine (G-XR10727).

Maxillay RRR was assessed by measuring the vertical distance between alveolar crest and a line joining inferior margins of zygomatic process at premolar and molar region (L_Z)were marked and measured bilaterally (Jabrah *et al*., 2011). Mandibular RRR was assessed by using the MF and the inferior border of the mandible, as they appear in OPGs, as reference points using Wical and Swoope Analysis method.[4] The original height of the mandible is assumed to be 3 times the distance between the inferior border of the mandible to the lower border of the MF. The amount of resorption (R) from the original mandibular alveolar level to the measured level of the residual ridge (L) was expressed as a percentage of the original height of the mandible. The amount of resorption was calculated according to the formula: $R = 3x - L$, (where R: amount of mandibular RRR; *x*: distance from inferior border of mandible to the lower border of MF; L: height of mandibular residual alveolar ridge). Measurements were performed 3times to avoid bias using Romexis software 2.1.1.R. Gonial angle was measured as, angle between a line on panoramic radiographs tangential to the most inferior points at the gonial angle and the lower border of the mandibular body and tangential to the posterior borders of the ramus and the condyle on both right and left sides (Ainamo *et al*., 2004).

Statastical analysis

The statistical calculations were performed using the software SPSS for Windows (Statistical Presentation System Software, SPSS Inc. 1999, New York) version 21.0. Descriptive statistics were used to evaluate the differences in mean values of mandibular RRR between Diabetic and non-diabetic group of subjects. Student's t-test was used to determine whether there were gender differences in the amount of RRR and DM. Pearson's correlation co-efficient was used to correlate the correlate Glycated hemoglobin level (HbA_1C), duration of edentulism and resorption of bone in diabetic edentulous patients.

RESULTS

Table 1 depicts the distribution of subjects between diabetes and non-diabetes between different age groups. The mean age of both the groups ranged between 61-65 years of age group.

Table 1. Distribution of subjects in diabetic and non-diabetic groups according to age groups

Age group of diabetics (years)	Age group of non-diabetics (years)	Number in each group	Percentage
46-50	46-50	3	12.0%
51-55	51-55	3	12.0%
56-60	56-60	5	20.0%
61-65	61-65	8	32.0%
66-70	66-70	6	24.0%

Table 2. Comparisionof resorption of residual alveolar ridge (Mand. premolar, Max. premolar and molar regions) between genders

Parameters	Gender	N	Mean	Std. Deviation	P- value
Rtmand. premolar	Male	24	11.10	2.29	0.022*
	Female	26	13.24	3.85	
Lt mand. premolar	Male	24	11.36	2.56	0.049*
	Female	26	13.35	4.37	
Rt. max. premolar	Male	24	12.62	2.69	0.012*
	Female	26	14.66	2.78	
L.max. premolar	Male	24	12.27	2.51	.008*
	Female	26	14.46	3.00	
R. max. molar	Male	24	11.52	2.72	.013*
	Female	26	13.87	3.58	
L. max. molar	Male	24	11.19	2.30	.012*
	Female	26	13.67	4.17	

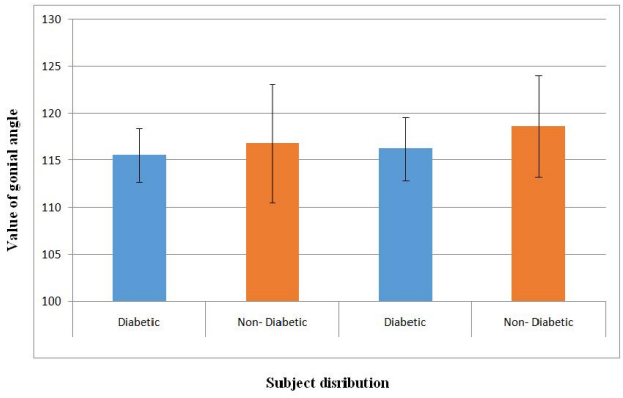
*P < 0.05 – significant - Indicates significant at 5% level of significance.

Table 2 Generally, results showed that females significantly had increased residual alveolar ridge resorption than males (P < 0.001). Statistically significant gender differences in mandibular RRR have been recorded in DM (P < 0.001) and control (P < 0.05) group in all the four parameters on both the sides. Table 3 and graph 1-4 shows that among all the parameters, statistically significant differences (p<0.001) were observed in right and left mandibular premolar, maxillary premolar and molar regions in diabetics than non-diabetics.

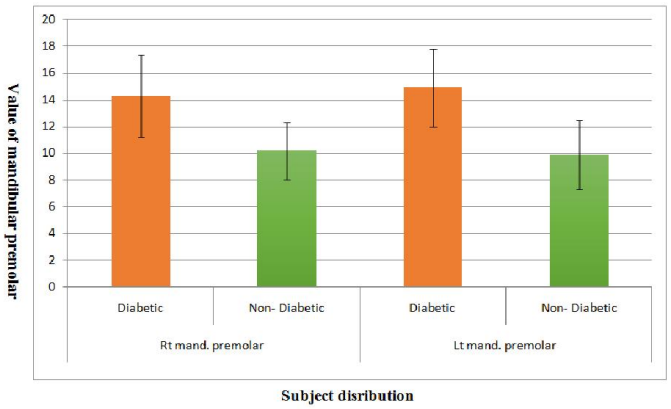
Table 3. Comparison of mean ± SD gonial angle, Right and Left premolar and molar region measurements between diabetic and non-diabetic group

Variables	Group	Mean	Std. Deviation	P- value
Rtgonial angle	Diabetic	115.55	2.86	0.36
	Non- Diabetic	116.81	6.28	
Lt gonial angle	Diabetic	116.27	3.36	0.064
	Non- Diabetic	118.65	5.40	
Rtmand. premolar	Diabetic	14.27	3.08	0.001*
	Non- Diabetic	10.16	2.15	
Lt mand. premolar	Diabetic	14.90	2.91	0.001*
	Non- Diabetic	9.88	2.58	
Rt. max. premolar	Diabetic	14.57	2.28	0.028*
	Non- Diabetic	12.78	3.20	
Lt.max. premolar	Diabetic	14.62	2.62	0.003*
	Non- Diabetic	12.20	2.83	
Rt. max. molar	Diabetic	13.73	2.92	0.039*
	Non- Diabetic	11.76	3.57	
Lt. max. molar	Diabetic	13.48	3.19	0.048*
	Non- Diabetic	11.48	3.75	

*P < 0.05 – Indicates significant at 5% level of significance.



Graph 1. Comparison of mean+ SD Gonial angle measurements between diabetics and non-diabetics on right and left sides

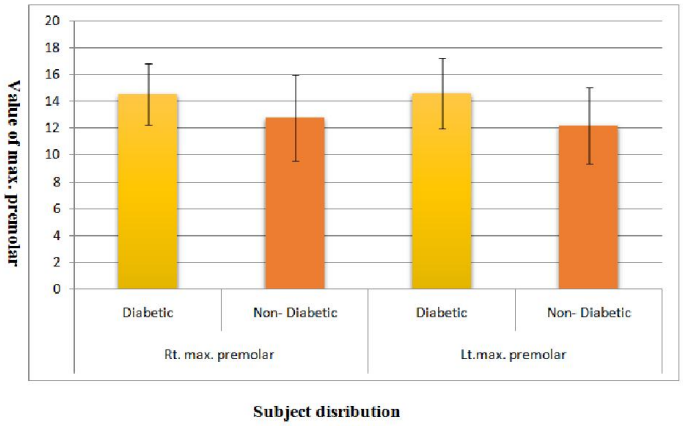


Graph 2. Comparison of mean+ SD of resorption of residual alveolar bone in Rt and Lt Mandibular premolar region between diabetics and non-diabetics

No statistical difference was observed between right and left Gonial angle in between the groups. Table 4shows correlation of duration of edentulism with the amount of mandibular RRR between Diabetic and non-diabetic group. It has been shown that RRR is directly proportional to period of edentulousness. Table 5depicted a positive correlation between HbA_1C level and resorption of residual alveolar bone.

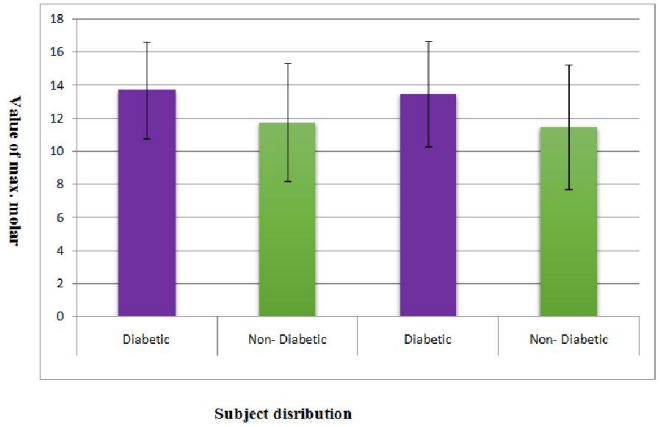
DISCUSSION

The study population consisted of all the subjects who attended (referred) to the Oral Medicine and Radiology Department for the provision of CD construction. The patients were interviewed in the department and their OPGs were evaluated to determine the amount of RRR and compared between Diabetic and non-diabetic patients.



Graph 3. Comparison of mean+ SD of residual alveolar bone resorption in Rt and Lt Maxillary premolar region between diabetics and non-diabetics

Residual alveolar ridge resorption (RRR) is a life-long continuous process maximum in the first 6 few months after tooth extraction and then gradually tapers off. The severity of RRR depends on the duration of edentulousness and other systemic diseases that affect the bone metabolism (D'souza *et al*., 2013). Diabetes mellitus is one of the most prevalent disease worldwide and has become a growing global health problem. About 95% of the individuals with diabetes belong to Type 2, while the other 5-10% belong to type 1 diabetes (Greenberg *et al*., 2003). The risk for alveolar bone loss is greater and bone loss progression more severe, for subjects with poorly-controlled T2DM compared to non-diabetic individuals or with better controlled diabetes.



Graph 4. Comparison of mean+ SD of residual alveolar bone resorption of Rt and Lt Maxillary molar region between diabetics and non-diabetics

respectively. The new finding of the present study is there is no statistical difference ($p<0.05$) in Gonial angle on right and left side between diabetic and non-diabetic group. Till date there are no studies available in literature comparing the Gonial angle without complete denture in diabetics and non-diabetics. Our study revealed a weak positive correlation between duration of edentulousness and residual alveolar ridge resorption. Similar findings were found by Jabrah 2013, Rusiniak-kubik *et al* (Zmysłowska *et al*., 2007) and Jabrah 2011. The reason could be attributed to the continuous maximum residual ridge resorption takes place during the 1st year of extraction. Maximum number of subjects in our study fall in to the duration of 8months to 1year which supports the literature. Out of 50 patients 5 patients revealed different appearences in the jaws such as drooping of maxillary sinus, presence of mental foramen at the crest of alveolar ridge

Table 4. Correlation between duration of edentulousness and resorption of residual alveolar bone

r = -1 to +1

Duration of edentulousness	Rt mand premolar (3)	Lt mand premolar (4)	Rt. Maxpremolar (5)	Lt.maxpremolar (6)	Rt. Max. Molar(7)	Lt. Max. Molar (8)
Pearson Correlation	.071	.026	.143	.254	.154	.147
Sig. (2-tailed)	.625	.858	.322	.075	.286	.308

Table 5. Correlation between HbA_1C level and resorption of residual alveolar bone among diabetic subjects

r= -1 to +1

Hba_1c	Rtmand. Premolar (3)	Lt mand. Premolar (4)	Rt. Max. Premolar (5)	Lt.max. Premolar (6)	Rt. Max. Molar(7)	Lt. Max. Molar (8)
Pearson Correlation	.587	.598	.410	.480	.150	.420
Sig. (2-tailed)	.002*	.002*	.042*	.015*	.475	.036*

T2DM was positively associated with greater risk for a change in bone score when compared to subjects without diabetes. In this study it was found that the amount of RRR of alveolar bone among T2DM subjects was higher than that among non-diabetic subjects. It has been reported that diabetic patients have a wide range of defects that delay the healing process and that increase their susceptibility to infection. Furthermore, the prevalence of bone resorption among patients with diabetes tends to be greater than among the general population. This difference may be related to hyperglycemia in the former group. The present study also showed gender related differences in both the groups.

Women had significantly greater amount of resorption of residual alveolar bone when compared to males in all the four parameters (maxillary premolar and molar, mandibular premolar) and on both the sides of jaw ($p<0.05$). Several studies reported that females have more residual alveolar bone resorption than males [Jabrah OA, Bianchi and Sanflippo Xie et al and Canger and Celenk] (Jabrah *et al*., 2011; Biachi *et al*., 2002 and Canger *et al*., 2012). Our study revealed a significant correlation (r=+1) between HbA_1C level and residual alveolar bone resorption indicating that as the level of HbA_1C increases the risk of residual alveolar resorption also increases. This is in context with Taylor *et al* study who also concluded that as the level of HbA_1C increases there is an increased risk of residual alveolar bone resorption (Taylor *et al*., 1998). The reason could be attributed to the uncontrolled level of diabetes leading to increased accumulation of advanced glycated end products and their effects on osteoblasts and osteoclasts. The normal Gonial angle ranges between 108.5º to 138.5º degrees in old age. The mean Gonial angle in our study in diabetic group was 115.55 and 116.27 on the right and left sides respectively. In non-diabetic group the mean angle is 116.81 and 118.65 on the right and left sides and impacted teeth. This is in context with the study by Degeoglu *et al*. (Dedeoglu *et al*., 2015), in Turkish population which also revealed similar findings. Limitations of our study includes smaller sample size, the comparision between glycated hemoglobin with bone resorption between controlled and uncontrolled diabetics was not possible because of the inadequate subject distribution and Inter and intra observer bias was not evaluated.

Conclusion

The following conclusions were drawn from the present study.

- Females were found to have significantly more residual alveolar ridge resorption than males in all areas of maxilla and mandible (Max. premolar and molar, mandibular premolar) on both right and left sides.
- The mean value of residual alveolar bone resorption of all the four parameters was significantly increased ($p<0.05$) among diabetics than non-diabetics.
- No significant difference ($p<0.05$) was observed between right and left gonial angle between diabetics and non-diabetics.
- Weak Positive correlation (r=+1) was observed between duration of edentulousness and resorption of residual alveolar bone in both the groups.
- Positive correlation (r=+1) was observed between HbA_1C level and resorption of residual alveolar bone in diabetics.

REFERENCES

Abdul hadi, L.M., Kasiapan, Saad. 2009. Residual alveolar ridge resorption in completely edentulous patients

influenced by pathophysiologic factors. *Dentika dental Journal*, 1(14);29-36.

Ainamo, A.Q. 2004. Correlation of gonial angle size with cortical thickness, height of mandibular residual body and duration of edentulism. *J. Prosthet. Dent*., May 91; 477-82.

Biachi, A. and Sanflippo, F. 2002. Osteoporosis: The effect on mandibular bone resorption and therapeutic possibilities by means of implant prostheses. *International Journal of Periodontics and Restorative Dentistry*, 22,231-9.

Canger, E.M. and Celenk, P.C. 2012. Radiographic evaluation of alveolar ridge heights of denture and edentulous patients. *Gerodontology.,* 29, 17-23.

D'souza D. residual ridge resorption – Revisited. Oral health care prosthodontics, periodontology, biology research and systemic conditions. 2013.

D'souza, D. 2013. Residual ridge resorption – Revisited. Oral health care prosthodontics, periodontology, Biology research and systemic conditions.

Dedeoglu, N., Atala, M.H. and Eser, B. 2015. Different radiological findings in Turkish edentulous patients. OOO, 3;1-5.

Greenberg, M.S., Glick, M., Becker, B.C. 2003. Hamilton In: Burket's oral medicine, diagnosis and treatment. 10th ed, Mealey B; P.563-577.

Jabrah OA. Shumailan YA. 2013. Association of complete denture wearing with the rate of reduction of mandibular residual ridge using digital panoramic radiography. *Int J of Dental Research*, 2(1);20-25.

Jabrah OA.Association of type 2 diabetes mellitus with the reduction of mandibular residual ridge among edentulous patients using panoramic radiographs. *Open Journal of Stomatology*, 2011; sep 1;61-68.

Lazic, B. 2002.Resorptive changes of maxillary and mandibular bone structures in removable denture wearers. Acta Stomatol Croat.,36.

Taylor, G.W., Burt, B.A., Becker, M.P., Genco, R.J. and Shlossman, M. 1993. Glycemic control and alveolar bone loss progression in type 2 Diabetes. Annals of periodontology. July, 3.

Ural, C., Bereket, C., Sener, I., Aktan, A.M., Akpinar, Y.Z. 2011. one height measurement of maxillary and mandibular bones in panoramic radiographs of edentulous patients. *J. Clin. Exp. Dent*., 3(1):e5-9.

Xie, Q., Wolf, J. and Ainamo, A. 1997. Quantitative assessment of vertical heights of maxillary and mandi-bular bones in panoramic radiographs of elderly dentate and edentulous subjects. *Acta Odontologica Scandi-navica*, 55, 155-161.

Zmysłowska, E., Ledzion, S. and Jędrzejewski, K. 2007. Factors affecting mandibular residual ridge resorption in edentulous patients: a preliminary report. *Folia Morphol.,* Vol. 66, No. 3, p. 346–352.

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