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Maxillary bone analysis in dentate and edentulous men through panoramic radiographs

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ABSTRACT

Objectives: This study aims to analyze the height of maxillary bone in dentate and edentulous men through panoramic radiographs.

Materials and Methods: This research is using analytic descriptive design with a cross-sectional approach. This study used 40 samples of panoramic radiography images, divided into a group of 20 edentulous men and a group of 20 dentate men as a control group. Maxillary bone height is measured by drawing a vertical line from the lowest point of the infraorbital ridge to the maxillary alveolar crest.

Results: The result showed that the mean value of the dentate group samples was greater than that of the edentulous group.

Conclusion: Dentate men have a higher maxillary bone height than edentulous men, as analyzed using panoramic radiography. There were significant differences in maxillary bone in edentulous and dentate men.

Keywords: *Panoramic radiography, maxillary bone, edentulous*
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INTRODUCTION

Panoramic radiography is one of the extra oral radiographs that have been commonly used in dentistry to get a complete image of the whole maxillofacial. Panoramic radiography can provide a picture of the maxilla, mandible, temporomandibular joint, teeth and supporting structures in one film.[1] One of the structures seen in the panoramic radiograph is the alveolar ridge. The alveolar ridges are the thickened, bony borders of the mandible and maxilla that are covered in soft tissue. They contain the alveolar processes which hold the teeth within the oral cavity.[2]

After losing a tooth, mechanical stimulation on the alveolar ridge will decrease and cause changes in height resulting a decrease height of the alveolar ridge maxilla. The alveolar ridge resorption velocity rate differs between the mandible and the maxilla. In the mandible the resorption rate is three to four times higher than the maxillary resorption because the maxillary bone is wider than the mandibular bone so that the stress received by the mandible were greater.[2]

The alveolar ridge resorption at the anterior maxilla tends towards backward and upward with a fairly progressive rate of bone loss. In the posterior part of the maxilla the resorption tends upward and inward so that the alveolar ridge shrinks progressively. While in the anterior and posterior mandibula, the alveolar ridge is resorbed towards the front and downward.[3]

A study by Ramadhani (2015) stated that there was a significant difference between the average mandibular alveolar ridge height in the dentate and edentulous groups of men. Measurement of the mandibular alveolar ridge in edentulous jaws, the anterior region is higher than the posterior region.[4] In a study conducted by Panchbhai in India (2013), there was a significant difference in alveolar ridge resorption between dentate and edentulous patients. Compared with dentate patients, alveolar ridge resorption in edentulous patients was found to be 29-39% in the mandible.[5]

In previous studies, a noteworthy observation emerged indicating that individuals with teeth (dentate group) exhibited a greater height of the mandibular alveolar bone compared to those without teeth (edentulous group). This distinction may be attributed to the dynamic nature of the mandible, characterized by high bone activity. On the contrary, the maxilla, constituting the jawbone integrated with the facial skeleton and remaining stationary, is likely to experience either minimal or no significant alveolar bone resorption when contrasted with the mandible. The primary objective of this study was to analyze and assess the height of the maxillary bone in both dentate and edentulous men, utilizing panoramic radiographs as a diagnostic tool.

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MATERIALS AND METHODS

This study was an observational analytic study using a cross-sectional design. This research has received approval from the ethical commission of the Faculty of Medicine, Universitas Sumatera Utara with the reference number 265/TGL/KEPK FK USU-RSUP HAM/2019.

This study learn about the dynamics of the correlation between risk factors and effects, by observing or collecting data at one time (point time approach). That is, each samples were only observed once and measurements were made on the character status or subject variables at the time of examination.

This study was conducted at the Dental Hospital of Universitas Sumatera Utara. This study used 40 samples of panoramic radiography images, divided into group with 20 edentulous men and group with 20 dentate men as a control group. Sampling by purposive sample is based on a certain consideration made by the researchers themselves, based on inclusion and exclusion criteria. Samples must meet the following criteria: for the edentulous group, having a jaw that has no teeth at all, whereas in the dentate group, having a jaw with teeth, no history of being diagnosed with cysts, jaw tumors, and suffering from systemic diseases that have manifests on bones. The equipment used in the study are Panoramic radiograph aircraft instrumentarium type OC 200 D, *software cliniview* version 10.1.2, mouth glass, tweezers, explorer, nierbeken, stationery. Materials used in this study were digital panoramic films, recording sheets, 70% alcohol, and cotton. The samples were collected and have met the criteria then divided into group of 20 men with teeth (normal) and group of 20 men without teeth. After that, the maxillary bone were measured with Cliniview 10.1.2 software.

Straight lines are drawn horizontally at the lowest point of the infra orbital ridge (line O) and on the zygomatic (line Z). Line O and line Z are parallel. The measurement of the maxillary bone on panoramic radiography is the distance between the lowest point of the infraorbital ridge (line O) and the alveolar crest on the maxilla (lines A, B, C). The alveolar crest in edentulous patients is visible on radiographic images, whereas in patients with teeth it is located 1.2 mm from the cementoenamel border. Line O and line Z form an angle of 90^0 to lines A, B and C. There are three calculation points, namely incisors, premolars and molars. In edentulous patients, the incisor point is located in the midline of the jaw, guided by the nasal septum, nasopalatine foramen and anterior nasal spine, the premolar point is located mesial to the infraorbital foramen and the molar point is located at the inferior point of the zygomatic process. In dentate patients (control group) the teeth that must be present are the first incisor, first premolar and first molar. There are three calculation points, the incisor point is located on the midline of the jaw or the midpoint of the two central incisors, the premolar point is located distal to the first premolar and the molar point is located distal to the first molar.[5] An independent T-test was employed for stastical analysis.

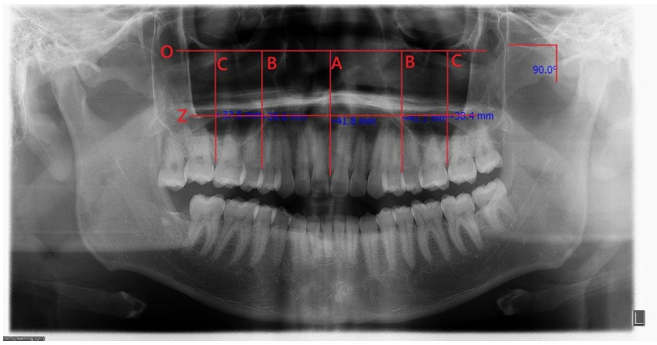

Figure 1. Measurement of the maxillary bone height in dentate males. O line = infraorbital line; Z line = zygomatic line; lines A, B, C are the height of the maxillary bone = distance from line O to the alveolar crest (1.2 mm from the cementoenamel junction)

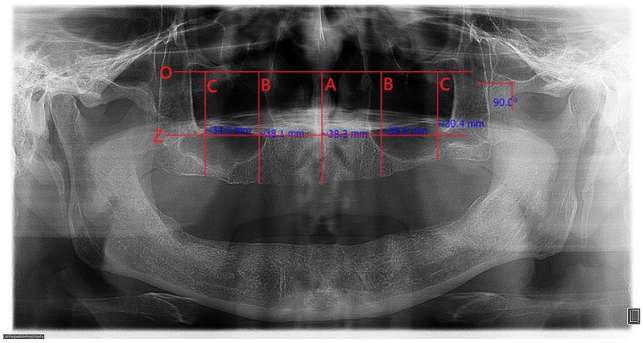

Figure 2. Measurement of the maxillary bone height in edentulous males. O line = infraorbital line; Z line = zygomatic line; lines A, B, C are the height of the maxillary bone = distance from line O to the alveolar crest

Table 1. The Length of Suffering Diabetes Mellitus in Respondents

	Sample	N	Mean	Standart Deviation	Standart Error Mean
Insisiv (midline)	Edentulous	20	34.79	4.14	.92
	Dentate	20	41.60	2.78	.62
Right premolar	Edentulous	20	33.72	4.75	1.06
	Dentate	20	41.09	3.06	.68
Right molar	Edentulous	20	31.44	3.81	.85
	Dentate	20	39.00	3.13	.70
Left premolar	Edentulous	20	33.53	3.99	.89
	Dentate	20	40.62	3.01	.67
Left molar	Edentulous	20	31.84	3.79	.84
	Dentate	20	38.53	3.54	.79

Table 2. The Length of Suffering Diabetes Mellitus in Respondents

Sample	N	Minimum	Maximum	Mean	Standart Deviation
Edentulous	100	25.1	44.5	33.06	4.22
Dentate	100	33.0	47.9	40.17	3.28

RESULTS

In Table 1, the outcomes of the study's measurements pertaining to the average maxillary bone height are meticulously presented. The examination focused on specific dental positions, including the midline point, the distal premolar point, and the distal molar points on both the left and right sides. Table 2 shows that the measurement of the mean value of the height of the maxillary bone in men with teeth is greater than that of men with edentulous.

To validate these observations statistically, independent T-tests were employed, and the results indicated a significant difference ($P < 0.05$) in the overall height of the maxillary bone at specific measurement points, namely, incisor teeth (midline), right premolars, right molars, left premolars, and left molars, when comparing dentate males to their edentulous counterparts.

DISCUSSION

The results showed the average of the maxillary bone height in a dentate men was greater than that of the edentulous men at each measurement point. In incisive (midline) teeth, the mean value was greater in the dentate men ± 41.60 mm ± 2.78, compared to edentulous men ± 34.79 mm ± 4.14. These results are in accordance with the study of Canger *et al* (2013) in Turkey, getting the result that the average height value of the incisor teeth (midine), is higher in dentate men that is 47.57 mm ± 3.55, compared with edentulous men namely 39.90 mm ± 4,53.4 These results are also in accordance with Panchbai's (2013) study in India, which found that incisor (midline) teeth, mean values were greater in dentate men with 4.47 mm, compared with edentulous men with 3,76 mm.[5] Alveolar bone is constantly undergoing remodeling in response to mechanical stress and metabolic demands. The jawbone, like bones in general, is formed from bone cells, namely osteocytes, osteoclasts, and osteoblasts. Osteocytes function in the manufacture of bone matrix. Osteoclasts function to destroy bone, these cells originate from monocytes or macrophages, while osteoblasts are specific cells that form bones that are cuboidal or short cylindrical.[6]

In the right premolar, the mean value was greater in dentate men, with 41.09 mm ± 3.06, compared to the edentulous with 33.72 mm ± 4.75. In left premolar teeth, the mean value was greater in dentate men with an average value of 40.62 mm ± 3.01, compared with edentulous 33.53 mm ± 3.99. This result is in accordance with the study of Canger *et al* (2013) in Turkey, which found that in premolar teeth, the mean height was greater in dentate men, 42.81 mm ± 3.61, compared with edentulous men 30,58 mm ± 4,47.[6] In a study conducted by Panchbai (2013) in India, the results showed that premolar teeth, the average value was greater in dentate men which was 4.26 mm, compared with edentulus men 3.27 mm.[5] Alveolar ridge resorption begins with the loss of teeth and the periodontal membrane which is responsible for bone formation. Loss of teeth causes a decrease in metabolism in the alveolar ridge and causes biochemical bone resorption due to dental plaque endotoxins, prostaglandins factors, and osteoclast production which stimulate alveolar ridge resorption.[7,8]

In the right molar, the mean height was greater in dentate men, 39.00 mm ± 3.13, compared to the edetulous 31.44 mm ± 3.81. In left molars, the mean value was also greater in dentate men, 38.53 mm ± 3.54, compared with edentulous 31.84 mm ± 3.79. This result is in accordance with the study of Canger *et al* (2013) in Turkey, which found that in molar teeth, the average height was greater in dentate men, 23.81 mm ± 2.86, compared with edentulous 23,47 mm ± 3,5.[6] In the Panchbai (2013) study in India, the result was that the molar teeth, the average value was greater in the dentate men 3.95 mm, compared with the edentulous men 3.05 mm.[5] Several studies state that there are several factors that cause tooth loss such as periodontal disease and caries. Most studies state that caries and periodontal disease are the main causes of

tooth loss.[9-11]

The average value of maxillary bone as a whole in dentate men is greater than in edentulous men. The average of the maxillary bone height in dentate men was 40.17 mm ± 3.28, compared with edentulous 33.06 mm ± 4.22. This result is in accordance with Panchbai's (2013) study in India, which found that the average value was greater in dentate men compared to edentulous, where the mean of maxillary bone height was 2.27 mm ± 0.21 for dentate men, compared with 2.11 mm ± 0.28.[5] The results of this study indicate differences in the height of the maxillary bone in edentulous and dentate men. Statistically, there are significant differences between groups at each measurement point. These results are in accordance with several previous studies by Panchbai (2013) in India and Changer *et al* (2013) in Turkey[4-6], their study said there were differences in height of maxillary bone.

Research Abdulhadi *et al* (2009) in Malaysia, said that alveolar ridge resorption occurs after tooth loss, the length of tooth loss affects the magnitude of alveolar ridge resorption and causes a decrease in alveolar ridge height.[12] Samyukta *et al* (2016) research in India states that after tooth extraction ,wound healing will occur for seven days.[13] Alveolar ridge resorption will occur rapidly in the first three months after healing the wound and then slowly diminish but will not stop. This is because alveolar ridge resorption is progressive and is a lifelong process.[14] Anatomical factors also affect alveolar ridge resorption, which is the quantity and quality of bones from the alveolar ridge. Thus there is a possibility in dentate men if the volume of bone is greater, then resorption will be seen.[15] This is consistent with D'Souza (2013) research in India, which found that anatomic factors, namely the quantity and quality of bones from the alveolar ridge, play an important role in the resorption of alveolar ridges.[16] This might be the reason on why dentate men and edentulus men experience different of maxillary bone height.

Panoramic radiographs are used for investigations in the field of dentistry because they are able to provide a picture of the teeth and the supporting structures on both the maxilla and the mandible. Panoramic radiography as a diagnostic aid is an essential component in implant treatment planning, because the panoramic radiography technique has an enlarged image from the original picture. Distortion in panoramic radiography cannot be avoided because the shading of objects on the film is related to the projected structure which varies in several individuals.[17] Incorrect implant placement of the maxilla is at risk of causing damage to anatomical structures such as the maxillary sinus and nasal fossa. This can cause infection, redness and swelling around the implant, as well as symptoms of the maxillary sinus including fistula formation and complications in the sinus such as rhinitis.[18] Because of this, the use of dental radiographs to estimate the height of the maxillary bone is urgently needed so that treatment plans in edentulus patients can provide a good prognosis.[17]

CONCLUSION

The conclusion of the study was that dentate men apparently had a higher maxillary bone height than edentulous men analyzed using panoramic radiography. There were significant differences in maxillary bone in edentulous and dentate men.

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None.

FOOTNOTES

All authors have no potential conflict of interest to declare for this article. This research has received approval from the ethical commission of the Faculty of Medicine, Universitas Sumatera Utara with number 265/TGL/KEPK FK USU-RSUP HAM/2019.

REFERENCES

1. Langlais RP. Excercises in Oral Radiology and Interpretation. 5th ed. St Louis: Saunders; 2016.
2. Larheim TA. Westesson P-LA. Maxillofacial Imaging. 2nd ed. Berlin: Springer; 2018.
3. Reich KM, Huber CD, Lippnig WR, Ulm C, Watzek G, Tangl S. Atrophy of the residual alveolar ridge following tooth loss in an historical population. Oral Dis. 2011;17(1):33-44.
4. Ramadhani NF. Ketinggian mandibular alveolar ridge pada gambaran radiografik panoramic pasien laki-laki tidak bergigi. Dentilomaxillofac Rad Dent J. 2015;6:6-10.
5. Panchbhai AS. Quantitative estimation of vertical heights of maxillary and mandibular jawbones in elderly dentate and edentulous subjects. Spec Care Dent J. 2013;33(2):62-9.
6. Canger EM, Celenk P. Radiographic evaluation of alveolar ridge heights of dentate and edentulous patients. Gerodontology. 2012;29(1):17-23.
7. Desyaningrum H, Epsilawati L, Rusyanti Y. Karakteristik kerusakan tulang alveolar pada penderita periodontitis kronis dan agresif dengan pencitraan cone beam computed tomography. Padjadjaran J Dent Res Stud. 2017;1(2):139-44.
8. Benza-Bedoya R, Pareja-Vasquez M. Diagnosis And Treatment Of Aggressive Periodontitis. Res Odontoestomatol. 2017;19 (30):29-39.
9. Lourenço TG, Heller D, do Souto R, et al. Long-term evaluation of the antimicrobial susceptibility and microbial profile of subgingival biofilms in individuals with aggressive periodontitis. Braz J Microbiol. 2015;46(2):493-500.
10. Burr DB, Allen MR. Basic and Applied Bone Biology. USA: Elseiver Oxford; 2014.
11. Siagian KV. Kehilangan sebagian gigi pada rongga mulut. J e-clinic (eCl). 2016;4(1):1-6.
12. Abdulhadi LM, Kasiapan S. Residual alveolar ridge resorption in completely edentulous patients influenced by pathophysiologic factors. J Dentika Dent. 2014;3:30-5.
13. Samyukta S, Abirami G. Residual ridge resorption in complete denture wearers. J Pharm Sci Res. 2016;8(6):565-9.
14. Esan TA, Olusile AO, Akeredolu PA, Esan AO. Socio-demographic factors and edentulism: the Nigerian experience. BMC Oral Health. 2004;4(1):3.
15. Könönen E, Müller HP. Microbiology of aggressive periodontitis. Periodontol. 2014;65(1):46-78.
16. Emami E, de Souza RF, Kabawat M, Feine JS. The impact of edentulism on oral and general health. Int J Dent. 2013;2013:498305.
17. White SC, Pharoah, Michael J. Oral Radiology. Principles and Interpretation. In: Journal of Dentistry. 7th Ed. London: Mosby Co; 2014.
18. Ibsen OAC, Phelan JA. Oral Pathology for the Dental Hygienist. 6th Ed. St. Louis Missouri: Elsevier; 2014.