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COMPARISON OF BONE LEVELS BETWEEN DENTATE AND EDENTATE REGIONS IN MANDIBLE - A CROSS-SECTIONAL STUDY

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ABSTRACT

The human body is constantly changing. Scientific evidence shows that alveolar bone undergoes changes after extraction. These changes continue as time of edentulousness progresses. These changes continue occurring even after prosthesis is inserted.Different methods for the assessment of alveolar bone height have been commonly used in practice out of which the panoramic radiograph is excellent for visualization of general structures of the face. The aim of this study is to compare the bone levels in dentate and edentate areas of the mandible with orthopantogram. A retrospective study done in the Department of Prosthodontics, Saveetha Dental College. Data was collected from a total of 86000 patients who visited Saveetha dental college between Jun,2019 to March,2020. Out of this, OPG of 40 patients in the age group of 35-50 years and who fell in Kennedy's Class 1 classification of mandible were retrieved for the study. The OPG was analysed in ImageJ software. The bone height was measured from the inferior border of the mandible and the crest of the ridge in edentulous areas; the inferior border of the mandible and the alveolar crest in the dentulous areas. The height was obtained in pixels from the software which was later converted into distance in millimeter (mm). The data obtained was tabulated in SPSS for windows, version 20. Paired t-test was done to determine difference in the bone levels of dentate and edentate regions.The paired samples t-test revealed statistically significant difference between dentate and edentate regions in both males (P=0.000) and females (P=0.000). The correlation between dentate and edentate regions for males and females was also statistically significant with P=0.011 and P=0.000 respectively. Pearson correlation was done between gender and difference in bone levels in dentate and edentate regions was not statistically significant with P=0.342. However, Pearson correlation was done between age and difference in bone levels in dentate and edentate regions was statistically significant with P=0.031. The present study was conducted to understand the correlation between bone levels in the dentate and edentate areas of patients with Kennedy's class 1 mandible. Within the limitations of this study, it can be concluded that there is significant difference in the bone levels of dentate and edentate areas in both male and female patients.

Keywords: Partially edentulous mandible, Kennedys class 1, OPG, Bone levels, Bone resorption

INTRODUCTION

The human body is constantly changing. Infact, according to Heraclitus, ‘Change is the only constant’. As dental practitioners, we have to consider the biologic changes that influence the treatment plans. The treatment provided to the patient must be modifiable, according to the change(Atwood and Coy, 1971; Ajay *et al.*, 2017).

Scientific evidence shows that alveolar bone undergoes changes after extraction(Jyothi*et al.*, 2017). These changes continue as time of edentulousnessprogresses(Ashok and Suvitha, 2016). These changes continue occurring even after prosthesis is inserted(Ariga*et al.*, 2018). Certain hormonal and metabolic factors can also influence change(Vijayalakshmi and Ganapathy, 2016; Basha, Ganapathy and Venugopalan, 2018). According to Jagadeesh et al, reduction in bone height has a linear relationship with age(Jagadeesh and Jagadeesh, 2012).

In a microscopic level, mandible shows osteoclastic activity, especially on the surface of the alveolar ridge(Kannan and Venugopalan, 2018). Mandibles having severe resorption may display gross porosity of the medullary bone on the crest of the ridge. This eventually leads to the exposure of the mental foramen and the inferior alveolar canal(Ashok *et al.*, 2014; Sharma *et al.*, 2019).

Different methods for the assessment of alveolar bone height have been commonly used in practice(Ganapathy, Kannan and Venugopalan, 2017). Either direct measurements with millimeter graded rulers or more elaborate methods including the application of digital imaging and computer software programs have been used(Venugopalan*et al.*, 2014; AlSheikh*et al.*, 2019). There are several methods devised to measure the ridge resorption like cephalometric roentgenograms, photogrammetric methods for monitoring changes in the ridge , and visual analogue scale. Wical and Swoope, in 1974, devised a method to analyse residual ridge resorption by using an orthopantomogram(Wical and Swoope, 1974).

Radiographic examination is part of routine dental treatment. They include the periapical, bitewing, and panoramic radiographs. The panoramic radiograph is excellent for visualization of general structures of the face. There are multiple advantages to using panoramic radiographs to monitor residual ridge resorption. This radiograph can be used when there are difficulties in taking intraoral radiographs. Also, since they are taken during routine dental examinations, there is no additional cost or exposure involved. Hence, they can be used in retrospective studies for many years. (Wenzel, 2013; Raj *et al.*, 2019). With the introduction of digital radiography, it is even more convenient to store these radiographs.

The purpose of this study was to compare the bone levels in dentate and edentate areas of the mandible with orthopantogram.

MATERIALS AND METHODS

A retrospective study done in the Department of Prosthodontics, Saveetha Dental College.Data was collected from a total of 86000 patients who visited Saveetha dental college between Jun,2019 to March,2020. Out of this, OPG of 40 patients in the age group of 35-50 years and who fell in Kennedy's Class 1 classification of mandible were retrieved for the study

The OPG was analysed in ImageJ software. The bone height was measured from the inferior border of the mandible and the crest of the ridge in edentulous areas; the inferior border of the mandible and the alveolar crest in the dentulous areas. The height was obtained in pixels from the software which was later converted into distance in millimeter (mm) (Figure 1).

The data obtained was tabulated in SPSS for windows, ver 20. Descriptive statistics was analysed. Paired t test was done to determine a significant difference in the bone levels. Pearson correlation was done to determine correlation between age, gender and difference in bone levels in dentate and edentate regions in both male and female patients.

RESULTS & DISCUSSION

The male patients had a mean bone level of 40.035±2.628 (Figure 4) in the dentate regions and 34.480±3.051 (Figure 5) in edentate regions. The female patients had a mean bone level of 36.535±2.973 (Figure 6) in the dentate regions and 31.405±3.037 (Figure 7) in edentate regions(Table 1).

Paired t test was done to determine difference in the bone levels of dentate and edentate regions. The paired samples t-test revealed statistically significant differences between dentate and edentate regions in both males (P=0.000) and females (P=0.000) (Table 2). The correlation between dentate and edentate regions for males and females was also statistically significant with P=0.011 and P=0.000 respectively (Table 3).

Pearson correlation was done to determine the correlation between gender and age and bone levels in dentate and edentate regions in both male and female patients. Association between gender and difference in bone levels in dentate and edentate regions was not statistically significant with P=0.342 (Figure 2). However, association between age and difference in bone levels in dentate and edentate regions was statistically significant with P=0.031 (Figure 3).

In all ageing individuals, bone keeps changing. These changes can lead to rapid resorption or slow resorption(Selvan and Ganapathy, 2016). Continuing bone resorption results in changes in the denture-bearing foundation. This is a big challenge to the dentist because of frequent inability of the patient to function with a mandibular denture(Duraisamy*et al.*, 2019).

Resorption of the residual alveolar ridge has been measured using a variety of radiographic techniques. However, the use of panoramic radiographs has been limited due to the difficulty in controlling the distortion and magnification of the image. Errors due to distortion and magnification may also be minimized by comparing proportions rather than actual measurements of successive panoramic radiographs(Ganapathy*et al.*, 2016; Nileema and AbedeeraJayasuriyaSeena, 2016).

In the present study, the correlation between the bone levels in the dentate and edentate areas in both male and female patients was statistically significant (Table 2). This is in accordance with Jagadeesh et al, who stated that bone levels have a linear relationship with age(Jagadeesh and Jagadeesh, 2012). Wical&Swoope (1974) used panoramic radiographs to obtain a ratio of the height of the mandible at the mental foramen and the height of the mental foramen from the lower border. One of the major drawbacks of this technique is that it records linear ratios at only one point of the mandible, and hence cannot represent the alveolar bone(Wical and Swoope, 1974). However, Wilding et al stated that the use of panoramic radiographs has several drawbacks, mainly that the mental foramen canal cannot be easily recognised(Wilding, Levin and Pepper, 1987).

Resorption pattern in edentulous ridges is such that that maxillae resorb upward and inward to become smaller, whereas in the mandible it is downward and outward, which causes them to widen progressively(Subasree, Murthykumar and Dhanraj, 2016; Ranganathan, Ganapathy and Jain, 2017). However, there is no common pattern of resorption in partially edentulous arches(Subasree, Murthykumar and Dhanraj, 2016).

A study done by Unger et al states that mandibular length has no relationship loss of residual ridge height in both maxilla and mandible. They also stated that alveolar bone loss in one jaw had no relationship with bone loss in the other jaw(Unger, Ellinger and Gunsolley, 1992).

Gross resorption of the alveolar ridge leads to significant problem for the dental practitioner. However, According to Atwood et al, there is low correlation between rate of reduction of residual ridges with age(Atwood and Coy, 1971).

The limitations of this study is that since orthopantomogram was used, the bone could only be viewed in 2 dimensions and the patients were not assessed for the presence of systemic diseases. Hence, the width and density of the bone could not be assessed. Further studies need to be done to assess the pattern of resorption in partially edentulous individuals also considering the systemic diseases.

CONCLUSION

The present study was conducted to understand the correlation between bone levels in the dentate and edentate areas of patients with Kennedy's class 1 mandible. Within the limitations of this study, it can be concluded that there was significant difference in the bone levels of dentate and edentate areas in both male and female patients.

AUTHOR CONTRIBUTIONS:

The primary author contributed to establish the materials and methods and analysing the results followed by manuscript writing.
The co-author verified the results and manuscript before submission.

CONFLICT OF INTEREST:

There are no conflicts of interest.

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APPENDIX

	Dentate Male	Edentate Male	Dentate Female	Edentate female
Mean±SD	40.04±2.629	34.48±3.052	36.54±2.973	31.41±3.037

Table 1 - Represents the mean and standard deviation of the bone levels in dentate and edentate regions in both male and female patients.

Paired t test	Male	Female
Mean	5.555	5.130
Standard deviation	2.700	1.267
Standard error	0.603	0.283
t value	9.198	18.101
Df	19	19
P value	0.000	0.000

Table 2 - Represents the mean, standard deviation, standard error, t value, Df and significance of the paired t test between dentate and edentate regions of male and female patients. P value for both males and females was 0.000 which is <0.05, hence proving that the difference in bone levels is statistically significant.

Pearson Correlation	Male	Female
Value P Value	0.557 0.011	0.011 0.000

Table 3 - Represents the association done between dentate and edentate regions of male and female patients. P value for males was 0.011 and for females was 0.000, both of which are <0.05, hence proving that the difference in bone levels is statistically significant in both male and female patients.

	Pearson Correlation	Difference in bone levels between dentate and edentate regions
Gender	Value P Value	-0.154 0.342
Age	Value P Value	-0.341 0.031

Table 4 - Represents the association between gender and age and difference in bone levels between dentate and edentate regions in both male and female patients. P value between gender and difference in bone levels between dentate and edentate regions was 0.342. P>0.05, hence proving that there is no statistically significant association between difference in bone levels between dentate and edentate regions and gender. However, P value between age and difference in bone levels between dentate and edentate regions was 0.031. P<0.05, hence proving that there is statistically significant association between difference in bone levels between dentate and edentate regions and age.

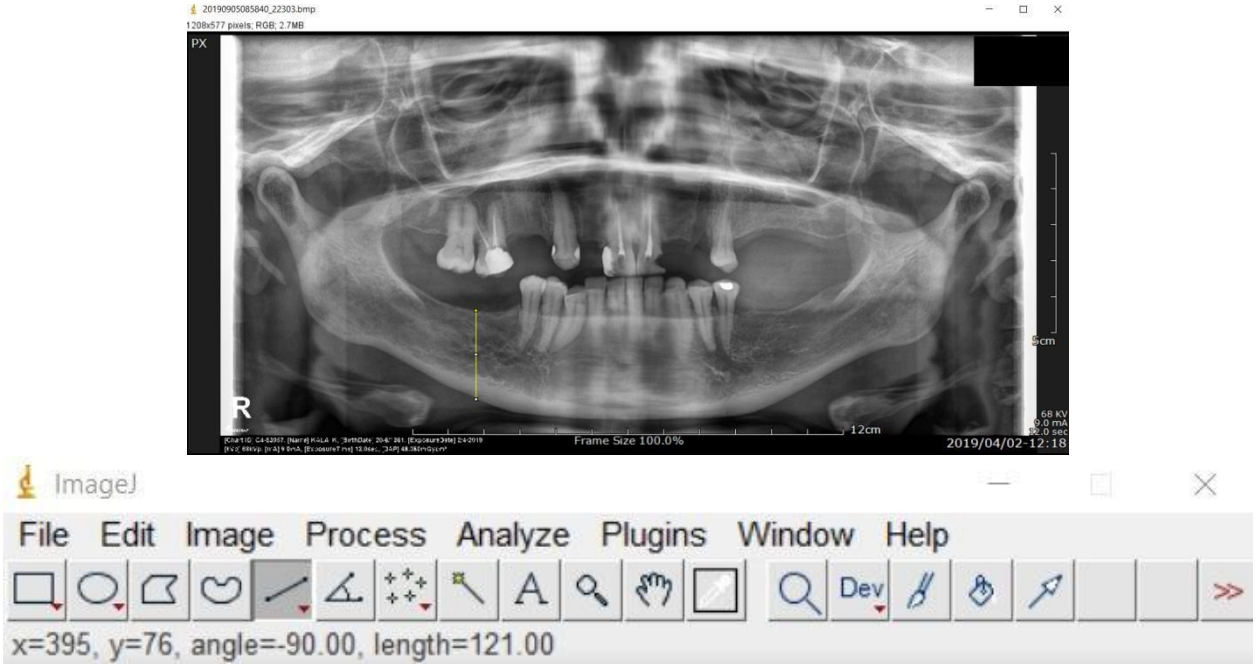

Figure 1 - Orthopantomogram being measured in ImageJ software. The bone height was measured from the inferior border of the mandible and the crest of the ridge in edentulous areas; the inferior border of the mandible and the alveolar crest in the dentulous areas. The height was obtained in pixels from the software which was later converted into distance in millimeter (mm).

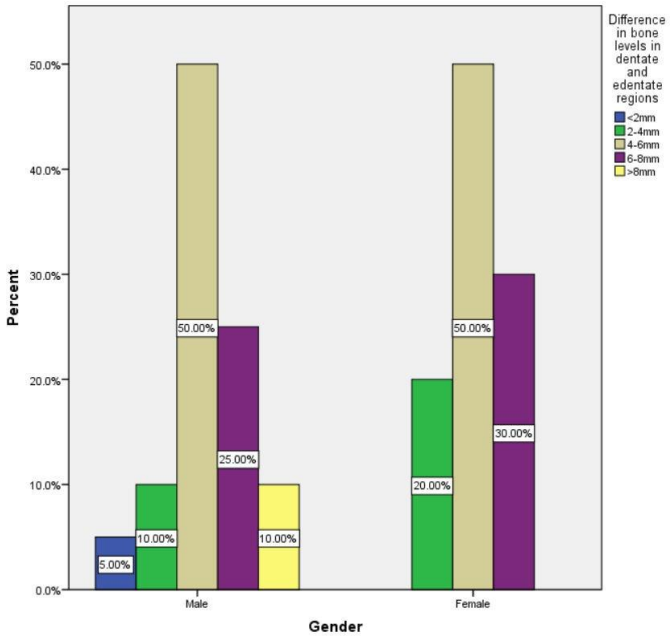

Figure 2 - Bar graph representing association between gender and difference in bone levels in dentate and edentate regions of both male and female patients. X-axis represents gender and Y-axis represents the percentage of difference in bone levels in dentate and edentate regions of both male and female patients. 50% of both males and females had a difference in bone levels of 4-6mm. Pearson correlation was done. (Pearson correlation Value:-0.154, P value:0.342 (>0.05), hence not statistically significant). There is no significant association between gender and difference in bone levels in dentate regions and edentate regions of both male and female patients.

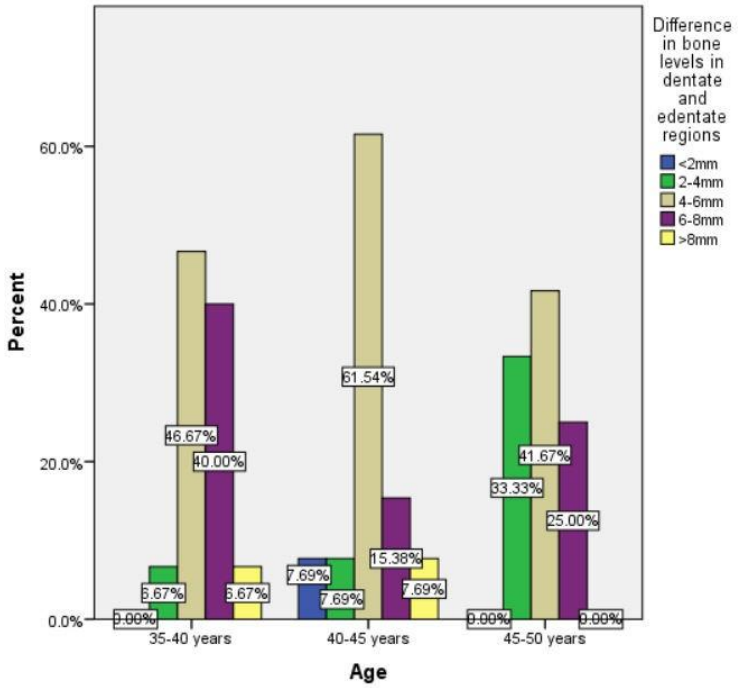

Figure 3 - Bar graph representing association between age and difference in bone levels in dentate and edentate regions of both male and female patients. X-axis represents age and Y-axis represents the percentage of difference in bone levels in dentate and edentate regions of both male and female patients. Patients between the age group 40-45 years had more bone loss than other groups. Pearson correlation was done. (Pearson correlation Value:-0.341, P value:0.031(<0.05), hence statistically significant). There is significant association between age and difference in bone levels in dentate and edentate regions of both male and female patients.

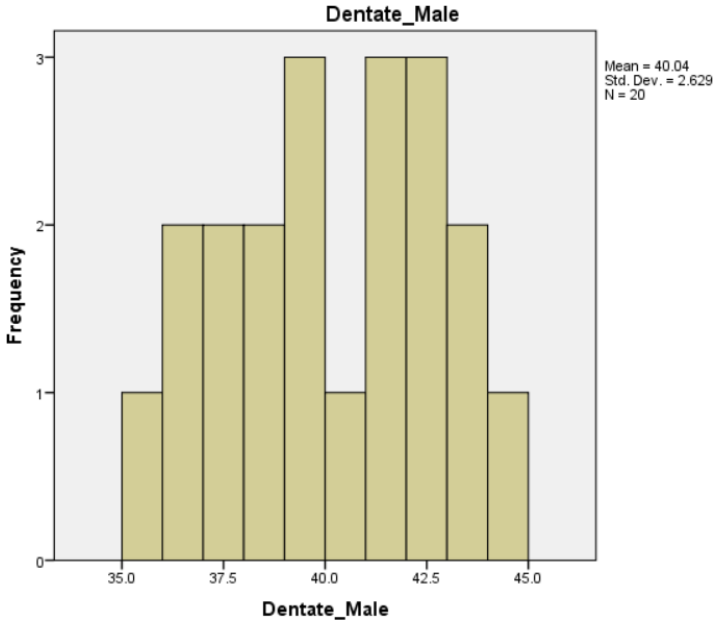

Figure 4 - Bar graph represents a mean bone level in the dentate regions of male patients. X-axis represents the bone levels in the dentate regions of male patients and Y-axis represents the frequency of male patients with the same bone level. A mean and standard deviation of 40.04±2.629 was obtained in 20 patients.

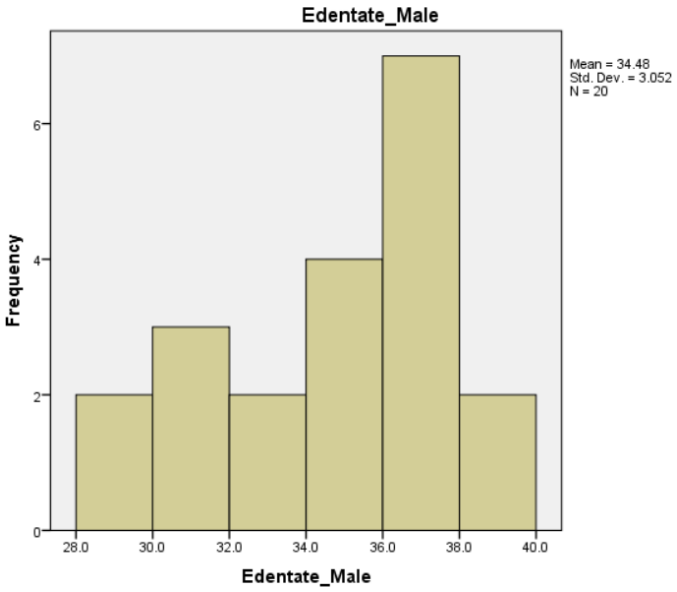

Figure 5 - Bar graph represents a mean bone level in the edentate regions of male patients. X-axis represents the bone levels in the edentate regions of male patients and Y-axis represents the frequency of male patients with the same bone level. A mean and standard deviation of 34.48±3.052 was obtained in 20 patients.

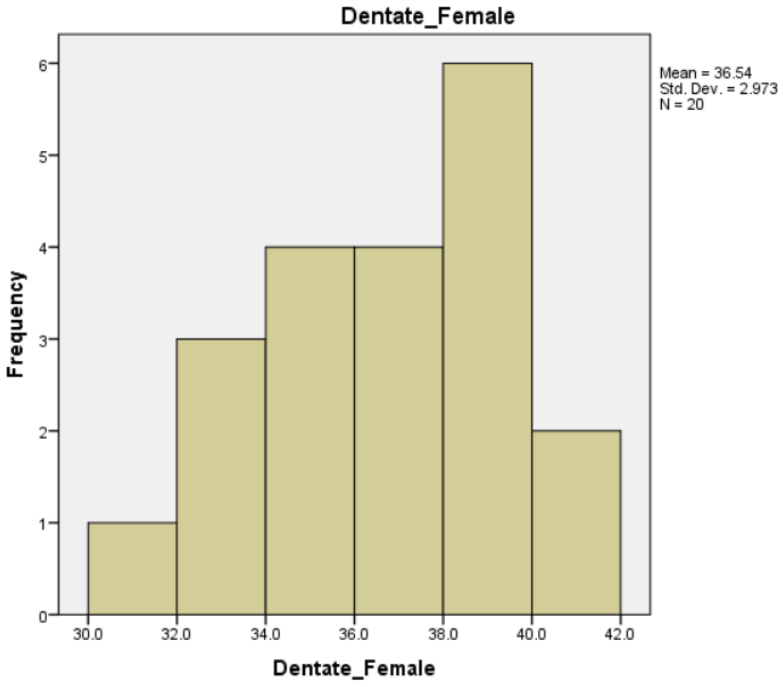

Figure 6 - Bar graph represents a mean bone level in the dentate regions of female patients. X-axis represents the bone levels in the edentate regions of female patients and Y-axis represents the frequency of male patients with the same bone level. A mean and standard deviation of 36.54±2.973 was obtained in 20 patients.

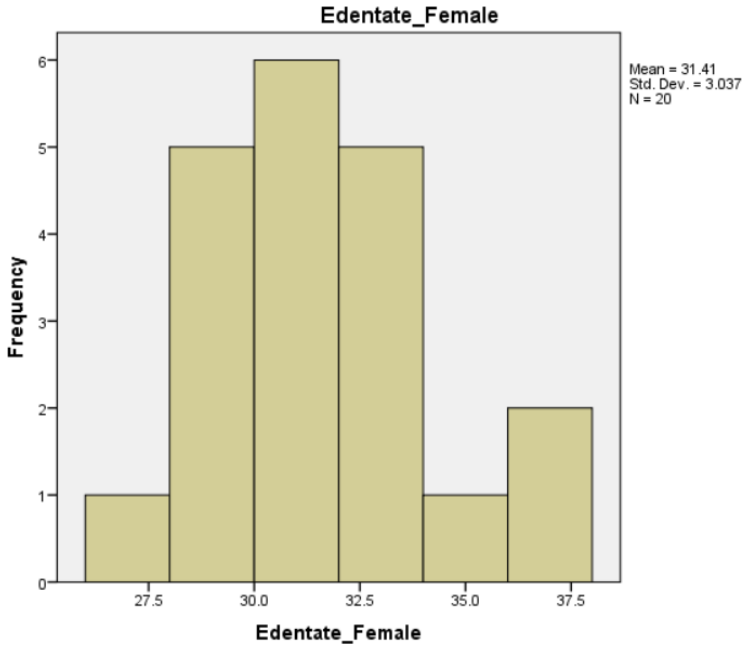

Figure 7 - Bar graph represents a mean bone level in the edentate regions of male patients. X-axis represents the bone levels in the edentate regions of male patients and Y-axis represents the frequency of male patients with the same bone level. A mean and standard deviation of 31.41±3.037 was obtained in 20 patients.