



## A RADIOGRAPHIC ASSESSMENT OF BONE AVAILABILITY IN MAXILLARY POSTERIOR REGION FOR PLACEMENT OF ZYGOMATIC IMPLANTS- A RADIOGRAPHIC STUDY

### Dental Science

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### ABSTRACT

**AIM:** The aim of the study was the radiographic assessment of bone availability in maxillary posterior region for placement of zygomatic implants.  
**METHOD:** The study included diagnostic panoramic radiographs of patients. The patient should be free of any systemic disease affecting the bone. The radiographic selection criteria included absence of obvious facial asymmetry, clearly visible anatomic structures and no surgical and fracture history. Measurements were made from reference lines drawn from anatomical landmarks on standardized panoramic radiographs. The heights were measured at pre-determined sites on radiographs using digimatic caliper. Results will be subjected to statistical analysis.  
**CONCLUSION:** It was concluded that the OPG gave a fairly good idea about the amount of bone availability in posterior maxilla for zygomatic implants. It also concluded that bone height in posterior maxilla in males is greater than the bone height in posterior maxilla in females.

### KEYWORDS

Radiography; panoramic; vertical height; bone height ; posterior maxillary; zygomatic bone; zygomatic implants.

### INTRODUCTION

Atrophy of alveolar process after the loss of teeth is an inevitable process. This process is continuous throughout life because of the lack of stimuli (disuse atrophy) seen on alveolar process of the jaws.<sup>1</sup> Location of the anatomical structure like mandibular canal, vertical height of bone, maxillary sinus and nerve and blood supply is an important prerequisite for pre-prosthetic surgery, denture fabrication and implant planning and placement in the jaws.<sup>2</sup> Dental implants have become the most popular and reliable treatment option for restoring missing teeth.<sup>3</sup> Assessment of available vertical bone height for implant placement is very important for the implant planning. Various techniques have been used for measurement of accurate bone availability of implants.<sup>2</sup> Lateral cephalometric radiograph, CBCT, CT and panoramic radiography are the most commonly used modality for the determination of bone height in patients for implant placement.<sup>4,5,6</sup> Panoramic radiograph is the most commonly used diagnostic radiographic tool and hence a convenient radiographic approach for surveying dental conditions, providing information about most dental aspects with only one radiograph. As it's a common radiographic modality determining alveolar bone quantity would be of great importance for the patient and the clinicians.

The concept of zygomatic implants was first given by Per Ingvar Branemark in the year 1997. Malevez et al described zygomatic implants as self-tapping screws in commercially pure titanium with a well-defined machined surface. They are available in 8 different lengths, ranging from 30 to 52.5 mm. They present a unique 45° angulated head to compensate for the angulation between the zygoma and the maxilla. The portion that engages the zygoma, the apical two thirds, has a diameter of 4.0 mm, and the portion that engages the residual maxillary alveolar process, alveolar one third, has a diameter of 4.5 mm to 5 mm.

The purpose of this study was to establish a ratio of variable bone height from the infra zygomatic alveolar crest height to that of constant bone height ie infra orbital zygomatic height. This can help in estimating the alveolar bone resorption and vertical height position of the ridge, and to estimate the relative sinus floor position from that of alveolar crest in maxillary first molar region. The main aim of the study is the radiographic assessment of the availability of bone in posterior maxillary area for placing zygomatic implants with a commonly available opg radiographs. This was carried out in partially

edentulous (missing maxillary posterior teeth) males and females, using panoramic radiographs.

### MATERIAL AND METHODS

A study was conducted at the SDM Institute of Dental Sciences for assessment of bone availability in posterior maxilla for the placement of zygomatic implants. A total of 20 panoramic radiographs of 12 males and 08 females were evaluated to establish a ratio between a variable bone height (from most inferior point of infra zygomatic arch to alveolar crest between first and second molar region) to constant reference bone height (from inferior part of the infraorbital notch to the inferior point of the infra zygomatic arch) for the maxillae and, to estimate the relative sinus floor position from alveolar crest of maxillary first molar region on panoramic radiographs.

#### Inclusion criteria includes

1. Clearly visible nasal septum, anterior nasal spine, and nasopalatine foramen
2. Absence of obvious facial asymmetry
3. No surgical and fracture history
4. Only films of adult patients 18 years of age or older were used.
5. Clearly visible lower edges of the piriform apertures
6. Undistorted images of the mandible and maxillae. The size of the images of the posterior teeth and the ridges could be neither magnified nor narrowed in the horizontal dimension.
7. The space between the maxillary and mandibular teeth had to form a gentle arc such that the mid portion of the arc was lower than the ends.
8. The radiograph had to be free of artifacts in the sites being measured.
9. Clearly visible maxillary sinuses
10. Clearly visible inferior margins of the zygomatic processes of the maxilla
11. Clearly visible mental foramina
12. Clearly visible superior borders of the mandibular canals.

#### Exclusion criteria includes

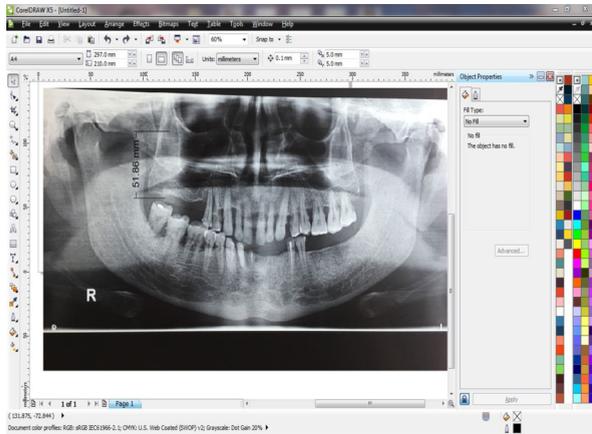
All patients who did not fulfill the above mentioned criteria were excluded from the study.

#### Method of collection

- 20 patients with pre-existing orthopantomograms with missing

maxillary posterior teeth were chosen for the study.

- Out of these, 12 were male patients and 8 were female patients.
- Measurements: A first horizontal reference line was drawn joining the most inferior border points of the right and left bony orbits. A second horizontal reference line was drawn joining the tip of alveolar crest margins of maxillary first molars on right side and left side. A vertical line was drawn perpendicular to the inter-orbital line extended to meet at the tip point at alveolar crest. All the measurements were made from reference lines drawn from anatomic landmarks on soft versions of standardized panoramic radiographs.
- Bone height was measured using CorelDraw<sup>x5</sup> software using digital measuring tools as in figure below.(figure 1)



- Statistical analysis - Statistical Analysis of the entire pool and also between males and females was performed with student T test.

**RESULTS**

Twenty pantomographs from 12 male and 08 female subjects were investigated. Various vertical heights were measured between selected radiologic reference points in the maxilla (Table 1).

Student T test was done to compare the bone height in males and females. The bone height assessment of the entire pool was done (Table 2). The vertical bone heights of the posterior maxilla were significantly greater in edentulous males than in the edentulous females (Table 3 and 4). The means and standard deviations of the values are shown below in pie diagrams

**Table 1:**

Name of the patient	Bone height in posterior maxilla in mm
1)Gangappa	46.6
2)Bibijan	44.9
3)Yankanna	53.7
4)Sangappa	49.3
5)Arundathi	47.2
6)Abdul V	48
7)Abdul A	51.6
8)Laxmibai	46.1
9)Bharathi	45.3
10)Neelavva	45.5
12)Amruthappa	48.2
13)Ravindranath	51.7
14)Yallavva	48.6
15)Shankrappa	47.9
16)Basavaraj K	53.5
17)Anuradha	42.1
18)Shantavva	49.8
19)Md.Hanif	46.3
20)M Vasudev	48.6

**Table 2: BONE HEIGHT ASSESSMENT FOR THE ENTIRE POOL**

MEAN	STANDARD DEVIATION
48	2.501

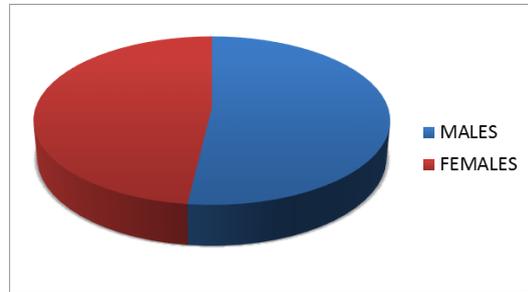
**Table 3: BONE HEIGHT ASSESSMENT IN MALE SAMPLES.**

MEAN	STANDARD DEVIATION
49.8	2.612

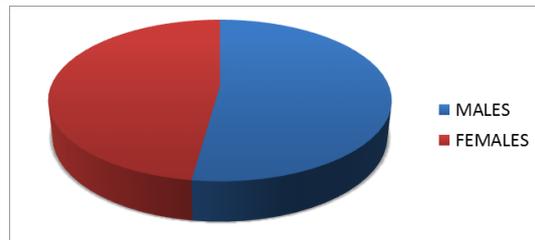
**Table 4: BONE HEIGHT ASSESSMENT IN FEMALE SAMPLES**

MEAN	STANDARD DEVIATION
46.2	2.391

**Figure 2: mean value**



**Figure 3: standard deviation**



The study results gave two conclusions :

- Orthopantomograms give a fairly good idea about the amount of bone availability for zygomatic implants.
- Bone height in posterior maxilla in males is greater than the bone height in posterior maxilla in females.

**DISCUSSION**

There are no reports of measuring intact alveolar bone height in the edentulous maxillae on panoramic radiographs in an Indian population. Hence this could be the first attempt to estimate the heights of the fully developed partially edentulous maxilla on pantomographs in Indian population. Panoramic radiographs are the most commonly used radiographic modality for the clinical mode of examination in any dental hospital and clinic.

Surgical rehabilitation of patients with severe maxillary resorption is a prime factor for the overall rehabilitation and well-being of the patient. Full mouth rehabilitation with implants is a highly expensive procedure. Hence to avoid cost, grafting and donor site morbidity, the most successful techniques to rehabilitate patients are zygomatic implants. Zygomatic implants use four cortical portions of cortical bone. Sinus reactions to zygomatic implants seem to lead to the adaptation and maintenance of normal physiology, making it a very successful mode of treatment for severely resorbed maxilla.

Orthopantomograms have been used as a diagnostic tool for assessing bone height in posterior maxilla for placement of zygomatic implants. Magnification error is a common problem with opps. However in this study the same machine is used and the distance and the dose of radiation was standardised to avoid the magnification errors.<sup>8</sup>

Koivumaa used a pantomographic assessment as part of his investigation into changes in periodontal tissues and supporting structures associated with partial dentures.<sup>9</sup> Although he admitted that measurement of actual lengths could not be done accurately on pantomograms, he pointed out that "shifts of the object and the film along the roentgen beam cause no changes in the mutual relations of the different parts of the images, provided the object and film retain their mutual position". This would seem to justify the use of ratio in comparing alveolar bone height with other constant distances on the films.<sup>9,2</sup>

This study shows that posterior maxillary vertical bone height in edentulous maxilla of Indian edentulous males is more than Indian

edentulous females. The result of this study coincides with the study of A. Jain and R. Chowdhary, whose study shows that there is significant difference in the vertical height of posterior maxilla in dentulous population between males and females.<sup>2</sup> But according to Saglam et al, height of maxilla were not significantly different between men and women in dentulous patients of Turkish population.<sup>6</sup>

So, this method may be of greater value in studying chronological changes to estimate reduction in height of the maxillary alveolar process of an edentulous patient. This result will help us in determining the success of placement and function of zygomatic implants in severely resorbed maxilla cases. Another conceivable use for the data obtained might be the predicting of relative long-term success of the zygomatic implant supported full mouth prosthesis. Even with less bone and severe pneumatization of sinus, zygomatic implant in posterior area provides better longevity and success of placement and function the prosthesis.

This is because the ideal positions for zygomatic implants are second premolar area, traversing the maxillary sinus, and fixated into the body of the zygomatic bone. The apical portion of the implant should be 8-10mm in zygomatic bone. Hence with virtually no bone and no grafting, a full mouth fixed rehabilitation is a reality to these patients.

### CONCLUSION

This study describes a method of estimating alveolar bone height on panoramic radiographs by using constant anatomic landmark reference points and calculating ratios of given distances between certain of these landmarks alveolar crest in partially edentulous patients. This study helped to determine the relative difference in bone height of the posterior maxilla in males and females and provide a baseline to determine the treatment.

The study results gave two conclusions ie Orthopantomograms give a fairly good idea about the amount of bone availability for zygomatic implants and Bone height in posterior maxilla in males is greater than the bone height in posterior maxilla in females.

Hence this study can be used as a diagnostic and predictive tool in zygomatic implant treatment planning but further long-term evaluation is still required with larger sample size to prove the efficacy of this study.

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