

# Digital panoramic assessment of maxillary implant insertion areas among controlled type 2 diabetic patients

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## ABSTRACT

**Background:** Restoring the edentulous maxilla with dental implants is a complex and challenging procedure especially for individuals with type 2 diabetes mellitus. Appropriate pre-placement planning, in which digital panoramic image plays a pivotal role for assessment of alveolar bone heights and localization of anatomic landmarks, allows the dentist to place these implants with relative ease and predictability. The Aim of the study was to assess pre operatively the vertical bone heights of edentulous maxilla of controlled type 2 diabetes mellitus patients for implant length selection and planning.

**Materials and methods:** Digital panoramic images were taken from 50 male with controlled type 2 diabetes mellitus and 50 healthy male subjects (age ranged from 42-81 years). Five sites in maxilla were measured on every image, and the collected data were processed and statistically analyzed by using Medcalc Software program (version 11.5).

**Results:** There was a highly significant difference for vertical bone height measurements of edentulous maxilla between healthy subjects and controlled type 2 diabetics. there was no significant difference for vertical bone height measurements with ageing. The linear regression model showed that the duration of type 2 diabetes mellitus had more effects on alveolar bone resorption than age.

**Conclusion:** Edentulous subjects with type 2 diabetes mellitus had more alveolar bone resorption even they had a control state of the disease unlike the healthy non-diabetic one and the bone resorption progressed with increased duration of the disease.

**Key words:** Digital panoramic image, edentulous maxilla, controlled type 2 diabetes mellitus, vertical bone height. (J Bagh Coll Dentistry 2012;24(1):61-63).

## INTRODUCTION

Dental implants have become part of routine treatment plans in many dental offices because of their increasing popularity and acceptance by patients and offering long-term solutions to patients with total and partial edentulism. Appropriate pre-placement planning, in which imaging plays a pivotal role, helps to ensure a satisfactory outcome. The development of precise pre-surgical imaging techniques and surgical templates allows the dentist to place these implants with relative ease and predictability<sup>(1)</sup>. Radiographs are used to evaluate bone support and amount at the potential implant recipient site of a dental implant at each of the three phases of implant treatment pre-surgical, evaluation and maintenance<sup>(2)</sup>. Panoramic radiograph is a useful tool for the measurement of alveolar bone heights and determination of anatomic landmarks<sup>(3)</sup>. One of the most important anatomical landmarks for implant planning is the maxillary sinus which is the widest paranasal sinus, pyramidal in shape and varies remarkably in size<sup>(4)</sup>.

The placement of dental implants in posterior maxillary region is considered a complicated procedure because of the presence of the maxillary sinus, as increased osteoclastic function and bone loss following extraction of posterior maxillary teeth leads to extension of maxillary sinus towards the alveolar process, commonly named pneumatization. As a result, posterior maxillary process in edentulous patients contains low-density cancellous and laminar cortical bone with decreased stress-bearing abilities. In advanced cases following long-term edentulous, a paper-thin cortex may separate maxillary sinus from the oral cavity, leaving insufficient support for the implant. Sinus elevation or sinus lift is performed in such cases before the placement of dental implant<sup>(5)</sup>. Differences have been observed between individuals in the amount and speed at which alveolar bone is lost, which have been attributed to a diversity of factors such as age, gender, facial anatomy, metabolism, oral hygiene, parafunctions, general health, nutritional status, systematic illnesses, osteoporosis, medications and the amount of time the patient has been edentulous<sup>(6)</sup>. Diabetes mellitus is a group of metabolic diseases characterized by hyperglycemia resulting from defects in insulin secretion, insulin action or both<sup>(7)</sup>. Type 2 diabetes significantly increases the risk for periodontal disease, with either attachment loss or bone loss as a criterion<sup>(8,9,10)</sup>. The volume of bone available determines the type of implant and

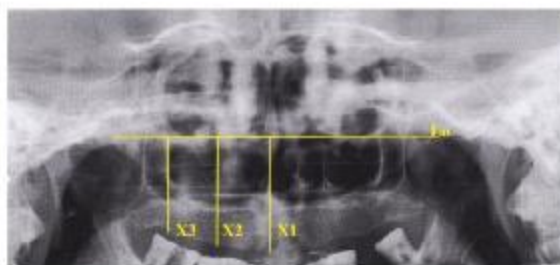
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contributes to the success of dental implant surgery<sup>(11)</sup>.

## MATERIALS AND METHODS

This study was conducted on 100 male participants with edentulous maxilla, who attended Dental Specialist Center in An Najaf City, with age ranged from 42-81 years. The sample was divided into control group with 50 healthy subjects and study group with 50 controlled type 2 diabetes mellitus patients. A Fasting Plasma Glucose (FPG) test was done for both study and control groups to ensure that all subjects in control group were free from this disease, and Hemoglobin A1c (HbA1c) test was done for study group to assess the controlling state of patients for this disease. Digital panoramic images would take from every subject in both control and study groups. Five measurements in edentulous maxilla were carried out on every image. The measurements represented the vertical distances from a reference line- was drawn to join the inferior points of the orbits- to the alveolar crest<sup>(12)</sup>. The 1<sup>st</sup> measurement represented the vertical line of the midline of maxilla which was determined by images of the nasal septum, anterior nasal spine, and nasopalatine foramen, this line approximates anterior sector, the 2<sup>nd</sup> and 3<sup>rd</sup> measurements were drawn through mesial margin of infraorbital foramina of both sides of maxilla from reference line to the alveolar crest, these two lines approximate premolar sector, and the 4<sup>th</sup> and 5<sup>th</sup> measurements were drawn through the zygomatic process of maxilla from reference line to the alveolar crest of both sides of maxilla, these two lines approximate molar sector. The points and lines were marked manually with a pencil and ruler, and the measurements were performed with an electronic digital caliper by mm.



Lo: reference line, X1: anterior sector, X2: premolar sector, X3: molar sector

**Figure 1: Measurements of maxillary bone height.**

Statistical analysis were done for collected data by using MedCalc version 11.5 computer software.

The outcome measurements were normally distributed quantitative variables and thus were conveniently described by mean, SD, SE and tested for statistical significance of difference in mean between 2 groups by independent samples t-test, while between more than 2 groups ANOVA was used. P-value less than 0.05 level of significance was considered statistically significant. Linear regression model was used to predict the effect of independent variables on the value of the dependent variable. ROC analysis was used to evaluate the ability of a test to discriminate diseased cases from normal cases.

## RESULTS

Statistical analysis showed that there was no difference in the mean value of vertical bone height measurements between right and left sides of maxilla for both control and study groups, the measurements of vertical bone height for control group are higher than that for study group, age had lesser reduction effect on the vertical bone height in healthy subjects than that in subjects with controlled diabetes mellitus. Linear regression model showed that there were indirect relationships between vertical heights of maxilla with age and duration of the disease, and also the effect of the duration of disease on vertical bone height measurement was greater than the effect of age.

## DISCUSSION

The resorption of the residual ridges of edentulous maxilla in patients with controlled type 2 diabetes mellitus is greater than that for healthy subjects. Abbassy et al.<sup>(13)</sup> stated that DM decreases bone formation, reduces the rate of bone turnover in the alveolar bone, and affects the quality of bone structure. The present study shows that the age has lesser reduction effect on healthy subjects than patients with controlled type 2 diabetes mellitus. Löe<sup>(14)</sup> stated that the loss of alveolar bone increased with age and was higher and more frequent in people with diabetes mellitus compared with people without diabetes. The statistical analysis shows that the duration of diabetes mellitus has more effect on alveolar bone resorption than age of patients. Belting et al.; Glavind et al.; Hugoson et al. and Ghassan<sup>(15,16,17,18)</sup>, reported that DM patients with long duration had significantly more alveolar bone loss than in short-duration diabetics.

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