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# Mandibular Bone Height Measurements for Tooth Implantation by Using Film and Digital Panoramic Radiograph

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## Key words
Digital panoramic, film panoramic, mandibular canal, implant.

## Abstract
An important objective of the preoperative radiographs evaluation of the implant is to determine the height and width of the bone available for implant insertion. The aim of the study is to confirm the ability of film and digital panoramic radiographs by measuring the distance from the crest of alveolar bone to the roof of the mandibular canal, also compare each type of radiographs using with the tracing chart reading which is a standard measure for both implant length and diameter that supply with the implant system.In this study thirty nine patients needing implants in the lower premolars and molars region in both sides were included. Digital panoramic radiograph were examined by using computerized analysis by software of dimax system , by measuring the distance from the crest of alveolar bone to the roof of the mandibular canal , while in film panoramic radiograph, a ruler was used to measure the distance from the crest of the alveolar bone to the roof of the mandibular canal with the utilization of a viewing box. it was found that film panoramic radiograph had higher value than digital panoramic radiograph in all sites of the teeth specially in the molar region.

## Introduction

For the dental implant insertion in the posterior portion to the mental foramen, the localization of the mandibular canal has to be precisely determined .Therefore; several studies have been performed to determine the best method for the localization of the mandibular canal and its preservation during surgical procedures [(1)].

The radiographic image of the mandibular canal is a dark linear shadow with thin radiopaque superior and inferior borders that bound the canal. The width of the canal shows some inter patient. Variability but is usually rather constant anterior to the third molar region.

The relationship of the mandibular canal to the root of the lower teeth may vary from one in which there is close contact with all molars and second premolar to one in which the canal has no intimate relation to any of the posterior teeth [(2)].

An important objective of the preoperative radiographic evaluation of the implant is to determine the height and width of the

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bone available for implant insertion[3] .Ideally the bone should allow complete coverage of all implant threads on both buccal and the lingual sides [4] .The available bone height must therefore be estimated from that part of the alveolar bone in which a sufficient bone width and height is found to a site specific anatomic border in the vertical direction [5,6]. A preoperative planning for implant surgery in the posterior region is more complicated than other regions [7, 8] Panoramic radiography is a widely used technique because it has the advantage of providing, in a single film, the image of both jaws, with a relatively low radiation dose, in a short period of time and at lower cost if compared to more sophisticated techniques. In implantology, this technique can offer information about the localization of anatomic structures and vertical bony dimensions .However, without knowing the magnification degree and the image distortion, mistakes in measurements may occur. In addition, panoramic radiography does not provide the buccolingual view of the bone [9].Digital and conventional panoramic radiographs can be used for preliminary estimate of the available bone height. An implant should not reach the border of the mandibular canal, and should be used just penetrate the cortical border to obtain the necessary anchorage [10].

## Materials and Method

Thirty nine consecutive patients were selected from patients who referred from oral and maxillofacial surgery department to the oral radiology department, in hospital of specialized surgery (12males, 27 females) who were seeking for teeth implantation. The age of the patients were ranged between 28-40.the area that was selected in this research was lower premolars and molars area and divided into groups according to the position of tooth implantation as follows:

A) Ten patients at first premolar.
B) Twelve patients at second premolar.
C) Nine patients at first molar.
D) Eight patients at second molar.

The missing teeth were either one or two teeth for each patient. All patients were sent for both digital panoramic radiograph by dimax system with different kVp and mA according to the patient gender and age, and film panoramic radiographs by using planmeca orthopentomograph machine PM 2002, CC . Proline , 15 second exposure time with different kVp and mA according to the age and gender of the patients .

Digital panoramic radiograph were examined by using computerized analysis by software of dimax system, by measuring the distance from the crest of alveolar bone to the roof of the mandibular canal , while in film panoramic radiograph , ruler was used to measure the distance from the crest of the alveolar bone to the roof of the mandibular canal with the utilization of a viewing box.

The examination and measurement for both digital and film panoramic radiograph were done by two highly professional radiologist and maxillofacial surgeon separately. Then all the data of both digital and film panoramic radiographs were compared together, and with the tracing chart reading with excluding any wrong measurements that result from that reading. Then the data were arranged in table to compare the mean value of each group.

## Results

The differences between digital and film panoramic radiographs appears in table (1). It shows that there were a differences between both types, it was found that film panoramic radiograph had higher value than digital panoramic radiograph in all sites of the teeth specially in the molar region that are ranged between (1.6-2.95), Table (2) show the mean value of measurement of the distances from the crest of alveolar bone to the roof of mandibular canal by digital panoramic in comparison to the tracing chart reading which indicated the standard measurement of the implant system , the results show almost the same reading with slight difference that are ranged between (0.00-0.25), while table (3) show the comparison

between the film panoramic and the tracing chart which show more differences between the mean value of film panoramic according to that of the tracing chart that are ranged between (0.7-2.9) .
Statistical analysis using t-test between groups revealed that there are a significant differences between digital and film panoramic radiographs regarding the evaluation of bone height.

## Discussion

Variation in the position or angulations of the implant result, when the anatomy found at surgery implant placement different from that planned preoperatively. This can be avoided nowadays by using digital panoramic radiograph with the help of software dimax system. The current study reported that there were obvious differences between digital and film panoramic radiographs in the measurement of the length of the crest of alveolar bone to the roof of mandibular canal to estimate the length of the implant that uses, and this result was in agreement with Bondemark L,etal. And Ahmed etal.,who stated that these differences may be due to;
1-In digital radiographs can easily change the contrast, and increase the resolution of the radiographs by the help of computerized analysis.
2-the magnification in digital panoramic is less than that in film panoramic
3-less superimposition of bone structure present in digital panoramic than film panoramic.
Also the conventional images are interpreted against a light board which enables the radiologist to view several images, concomitantly, while digital images are read on screen at work station in succession or simultaneously, depending on the size and capacity of the screen, the soft ware and the amount of screens .Digital images can be post – processed at the work station and the diagnostic output may thus be increased. [11, 12, 13, 14, 15, 16].
Also the study shows that obvious difference were detected between film panoramic and tracing chart reading, in the measurement of appropriate length of implant, these differences are due to the same reason that mentioned in panoramic reading, beside that the tracing chart reading were as standard measures for both implant length and diameters that supply with the implant system, in which the oral surgeon depend on his standard measurements for selection of implant.
As a conclusion, digital panoramic radiograph give more accurate results than conventional one regarding the measurements of the height of the bone which is necessary before implantation.

Table (1):- mean value of the distance measurement from the crest of alveolar bone at different mandibular posterior teeth to to the roof of mandibular canal by digital and film panoramic radiographs.

| Site of teeth | Digital panoramic radiorgraph | Mean value | Film panoramic radiograph | Mean value |
|---|---|---|---|---|
| 1st premolar | 12-14 mm | 13 mm | 14.1-15.2 mm | 14.65 mm |
| 2nd premolar | 11 -12 mm | 11.5 mm | 12.8- 13.4 mm | 13.1 mm |
| 1st molar | 9-10mm | 9.5 mm | 11-11.9 mm | 11.45 mm |
| 2nd molar | 8-10mm | 9 mm | 11.8-12.1 mm | 11.95 mm |

The statistical evaluation between digital panoramic and film panoramic radiographic

| No. of groups | 4 | 4 |
|---|---|---|
| Correlation | 0.961 | 0.923 |
| Sig. (2nd trails) | 0.039 | 0.077 |

Table (2):-mean value of the distance measurement from the crest of alveolar bone to the roof of mandibular canal by digital panoramic in comparison to the tracing chart reading .

| Site of teeth | Digital panoramic radiograph | Mean value | Tracing chart | Mean value |
|---|---|---|---|---|
| 1st premolar | 12-14 mm | 13 mm | 12.1-13.8 mm | 12.95 mm |
| 2nd premolar | 11-12 mm | 11.5 mm | 10.9-12.1 mm | 11.5 mm |
| 1st molar | 9-10 mm | 9.5 mm | 9.3-10.2 mm | 9.75 mm |
| 2nd molar | 8-10 mm | 9 mm | 8.1-10 mm | 9.05 mm |

The statistical evaluation of distance measurements between the digital panoramic and tracing chart.

| No. of groups | 4 | 4 |
|---|---|---|
| Correlation | 0.961 | 0.917 |
| Sig. (2nd trails) | 0.084 | 0.083 |

Table(3):- mean value of of the distance measurement from the crest of alveolar bone to the roof of mandibular canal by film panoramic in comparison to the tracing chart reading

| Site of teeth | Film panoramic radiograph | Mean value | Tracing chart | Mean value |
|---|---|---|---|---|
| 1st premolar | 14.1-15.2 mm | 14.65 mm | 12.1-13.8 mm | 12.45 mm |
| 2nd premolar | 12.8-13.4 mm | 13.1 mm | 10.9-12.1 mm | 11.5 mm |
| 1st molar | 11-11.9 mm | 11.45 mm | 9.3-10.2 mm | 10.75 mm |
| 2nd molar | 11.8-12.1 mm | 11.95 mm | 8.1-10 mm | 9.05 mm |

The statistical evaluation of distance measurements between the film panoramic and tracing chart.

| No. of groups | 4 | 4 |
|---|---|---|
| Correlation | 1000 | 0.780 |
| Sig. (2nd trails) | 0.222 | 0.221 |

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