International Journal of Research in Health and Allied Sciences
Journal Home Page: www.ijrhas.com
Official Publication of "Society for Scientific Research and Studies" [Regd.]
ISSN: 2455-7803 Index Copernicus value [ICV] = 68.10;

Original Research

To compare and evaluate the difference in implant length and diameter when planning with conventional technique of radiography (OPG) and ridge mapping with Cone Beam Computed Tomography in planning implant placement

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ABSTRACT:
Background: OPG is one of the most common imaging methods for routine examination in clinical practice. As it provides only two-dimensional information about the implant sites, especially in relation to buccolingual width of alveolar bone .This measurement of alveolar ridge dimension can be accomplished using ridge-mapping technique. CBCT identifies various anatomical structures three-dimensionally is of great value to the diagnostician. **Materials and method**: A total of 20 implants were placed in subjects requiring implant placement. A total of 20 patients are advised to get OPG and CBCT done in selected subjects were grouped on the basis of type of treatment plan according to use of radiographic diagnostics aid as: Treatment plan I: according to CBCT only, Treatment plan II: according to OPG and ridge mapping. In 10 patients implant were placed according to treatment plan I whereas in remaining 10 patients implant were placed according to treatment plan II. **Results:** There was difference in alveolar bone volumes obtained from OPG with ridge mapping and CBCT. The distances measured by OPG with ridge mapping were highly correlated with that measured by CBCT. **Conclusion:** Radiography plays an important role in implant dentistry. The quality and amount of bone available should be determined during the planning stage.
Key words: Implant, Cone beam

Received: 14 January, 2021 Accepted: 20 February, 2021

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This article may be cited as: Gupta R, Chib V, Vashisht D, Aggarwal B, Singh P, Arora N. To compare and evaluate the difference in implant length and diameter when planning with conventional technique of radiography (OPG) and ridge mapping with Cone Beam Computed Tomography in planning implant placement. Int J Res Health Allied Sci 2021; 7(2):111-116.

INTRODUCTION

As use of endosseous implant revolutionized oral rehabilitation, many specialized techniques have been available for pre- operative planning of oral implant placement. Orofacial diagnostic imaging techniques have drastically grown in recent years with the objectives of pre-implant assessment, evaluating the normal anatomical structures, detecting any pathologies in surrounding areas, and estimating the quality and quantity of bone where the implants are supposed to be placed. Depending on the site of implant placement, the anatomical structures in and around them is considered the crucial factor for selecting the implants to be placed and preventing complications.

Orthopantomography (OPG) is an important imaging method to assess vertical bone volume and detect dental caries and periodontal diseases with the advantages including panoramic, easy and cheap to conduct, and informative regarding jaw morphology, bone density, etc. Therefore, OPG is one of the most common imaging methods for routine examination in clinical practice. However, these two-dimensional radiographs can be affected by tissue superimposition

due to malocclusion deformity or other complex situations.

As it provides only two-dimensional information about the implant sites, especially in relation to buccolingual width of alveolar bone .This measurement of alveolar ridge dimension can be accomplished using ridge-mapping technique. This technique involves making custom tray putty index on the diagnostic cast which were marked with points at definite level with markings at facial and lingual surface of cast. These markings then replicated on putty index and from this putty index these markings are replicated on graph. So when the tracings on the graph have been made, the buccolingual width has been measured.

In recent years, maxillofacial cone beam computed tomography (CBCT) has been widely used in dental implanting, assessment of orthodontic treatment, complex alveolar surgery, oral local system reconstruction and treatment of tooth and dental pulp diseases. CBCT is advantageous in high spatial resolution, short scan time and rapid image acquisition. The use of virtual modeling provides the opportunity for clinicians to solicit and combine input from a multidisciplinary team to create a single optimal treatment plan which could be the most efficient and cost effective method for planning. However, CBCT is expensive and delivers relatively high radiation dose to the patient.

With the improvement of living standards, the demand for dental implantation is increasing quickly. In India, it is a trend to use three dimensional imaging of high precision to replace two-dimensional imaging for stomatological diagnosis. However, due to the cost and medical investment, the local hospitals usually don't have access to CBCT, especially in state of Himachal Pradesh. The doctors in local hospitals have to make reasonable dental implanting using OPG and ridge mapping to reduce risks. Then, clinicians could be able to estimate the real bone measurement based on the OPG measurement as well as ridge mapping to obtain the ideal implants placement. In the present study, the two treatment plans are formulated according to the data obtained by OPG and CBCT images. Variations in implant dimensions have been studied when treatment plan in which OPG and ridge mapping have been used with respect to treatment plan in which CBCT has been used as reference.

MATERIALS AND METHODS

An in vivo study was conducted in the Department of Prosthodontics, Crown and Bridge and Oral Implantology, H. P Government Dental College and Hospital, Shimla, Himachal Pradesh. A total of 20 implants were placed in patients based on inclusion and exclusion criteria.

Inclusion criteria

- Patients consented to participate in the study and willing for surgery and proper follow up.
- Partially edentulous patients, with one or more teeth missing.
- Patients with adequate amount of bone and keratinized tissue.
- Patients greater than or equal to 18 years of age.
- Periodontally healthy patients.

Exclusion criteria

- Medically compromised patients where surgery was contraindicated and affected the healing process.
- Patients with poor oral hygiene and with lack of motivation for dental implants.
- Insufficient bone quality and quantity.
- Patients having any parafunctional habit.
- Patients with history of alcohol, drug dependency, smoking and poor health.
- Patients suffering from periodontal diseases.

Study Groups

A total of 20 implants were placed in subjects requiring implant placement . A total of 20 patients are advised to get OPG and CBCT done in H. P Government Dental College and Hospital, Shimla, Himachal Pradesh. Selected subjects were grouped on the basis of type of treatment plan according to use of radiographic diagnostics aid as:

Treatment plan I: according to CBCT only

Treatment plan II: according to OPG and ridge mapping

In 10 patients implant were placed according to treatment plan I whereas in remaining 10 patients implant were placed according to treatment plan II. In treatment plan I (based on CBCT measurements) The mandibles were stabilized on a polystyrene stand and scanned by a CBCT unit operating at 120 kVp, 3-8 mA, and 0.5 mm nominal focal spot size. The data were imported into implant planning software (TRIANA). The images of the planes were transferred to an image storage and measurement system (Med3D) and calibrated using the implant planning software reference gauge lines. The distance on the radiographic image was measured with a tool built into the image storage and measurement software. The CBCT measurements for calculating the width was done at buccolingually and the vertical height of the mandible was measured.

In treatment plan II (based on OPG and ridge mapping) The mandibles were stabilized on a polystyrene stand and scanned by an OPG CS 8100 unit. Digital panoramic images were taken at 73 kV, 10 mA with an exposure time of 10.8 s.Panoromic radiograph has been obtained through Dry viewer 5950 laser imager. Now

the OPG measurements for calculating the vertical height of the mandible were measured. Ridge mapping is done to calculate the width buccolingually.

On diagnostic cast wax spacer is placed from adjacent teeth adjoining edentulous space where implant has to be placed. Over the wax spacer custom tray has been fabricated with autopolymerising resin. From this custom tray wax spacer has been removed and putty index has been formed. Markings on the diagnostic cast has been formed with indelible marker at the level of crest of ridge marked as 0 from these level markings has been placed at 3mm and 6mm buccally as well as lingually.These markings then extended to the putty index. Now these

markings on putty index has been transferred to graph paper and with help of putty index proper pattern on graph paper has been drawn with markings at proper level.On graph paper now bone is measured buccolingually.

Now when the two treatment plans has been formulated half of the patient would be done according to treatment plan I and half of the patient according to treatment plan II.

Statistical analysis: The entire data was collected and analyzed using quantitative and qualitative tests. The paired t-test was used to compare the vertical distances and horizontal distance between the two methods. $P < 0.05$ was considered statistically significant. Pearson correlation analysis was used to analyze the relationship between the data acquired using the two methods. The correlation coefficient (R) between the paired samples was calculated and was considered highly related if R was between 0.5 and 1.

RESULTS

Table 1: Mean of Bone dimension (Mesio-distal) in Two Groups

Variable	Group 1		Group 2		't'value	p value	Correlation
	Mean	± SD	Mean	± SD	-2.404	0.027	0.931
Mesiodistal	7.728	2.019	8.265	2.55			

Table 2: Mean of Bone dimension (Bucco-lingual) in Two Groups

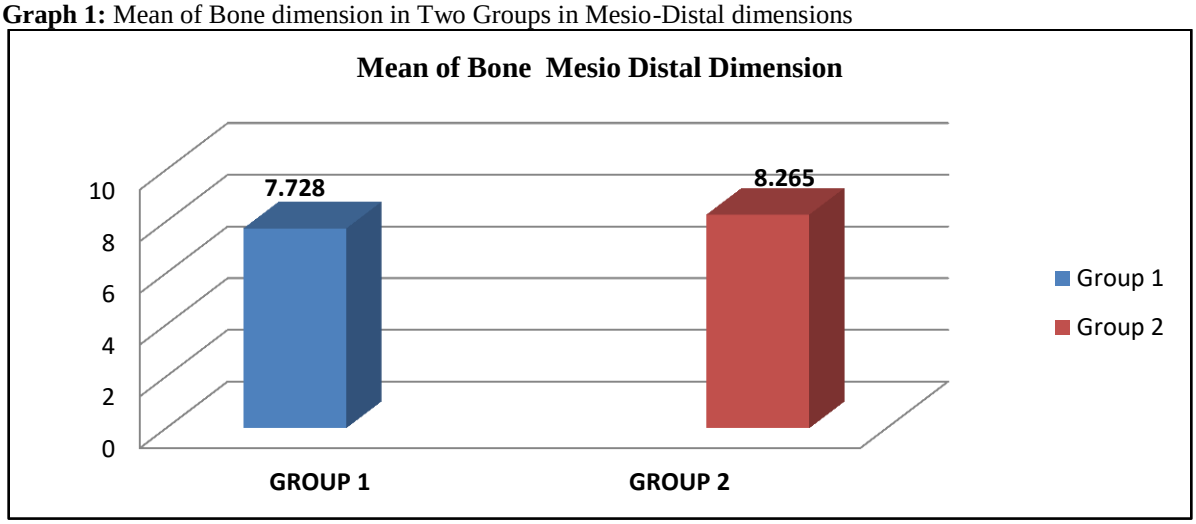
Variable	Group 1		Group 2		't'value	p value	Correlation
	Mean	± SD	Mean	± SD	-4.583	0.001	0.837
Buccolingual	7.39	1.784	8.425	1.718			

Table 3: Mean of Bone dimension (Apico-coronal) in Two Groups

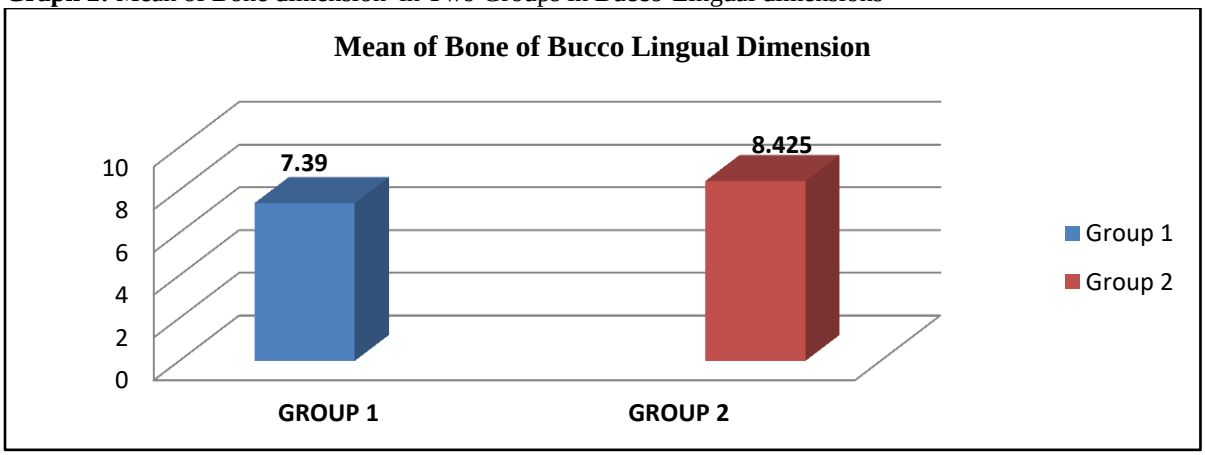
Variable	Group 1		Group 2		't'value	p value	Correlation
	Mean	± SD	Mean	± SD	-3.333	0.003	0.799
Apicocoronal	12.521	2.1834	13.700	2.6278			

*p-value<0.05 is significant

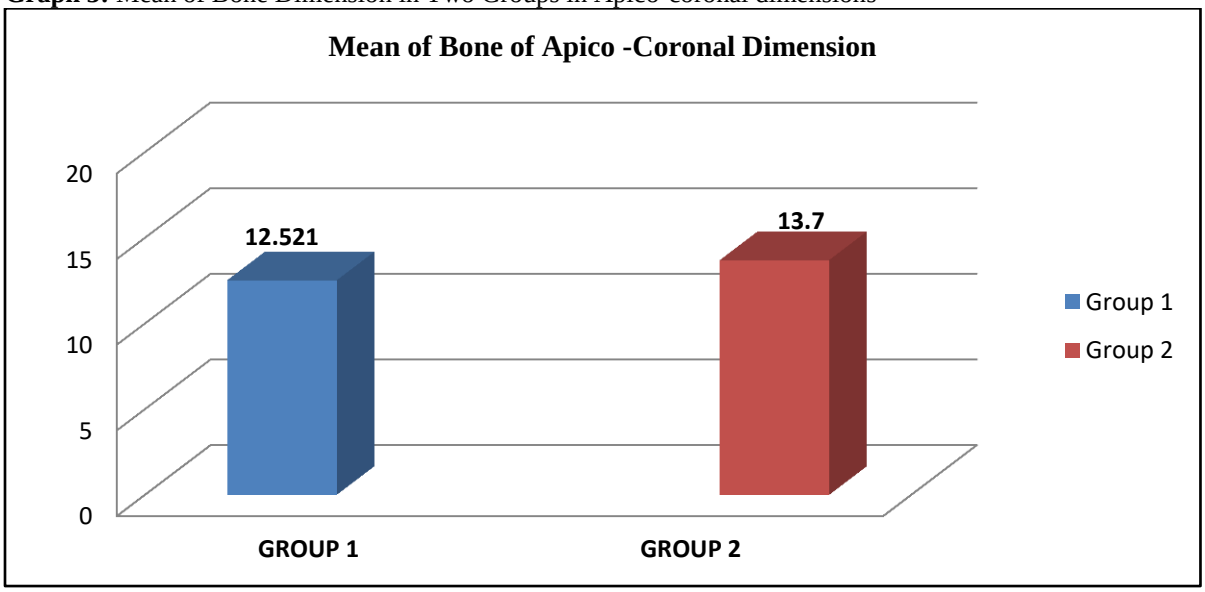
Graph 1: Mean of Bone dimension in Two Groups in Mesio-Distal dimensions

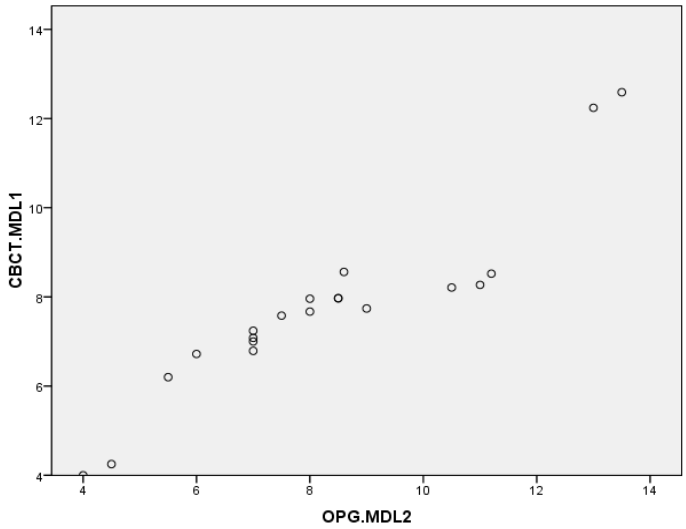


Graph 2: Mean of Bone dimension in Two Groups in Bucco-Lingual dimensions

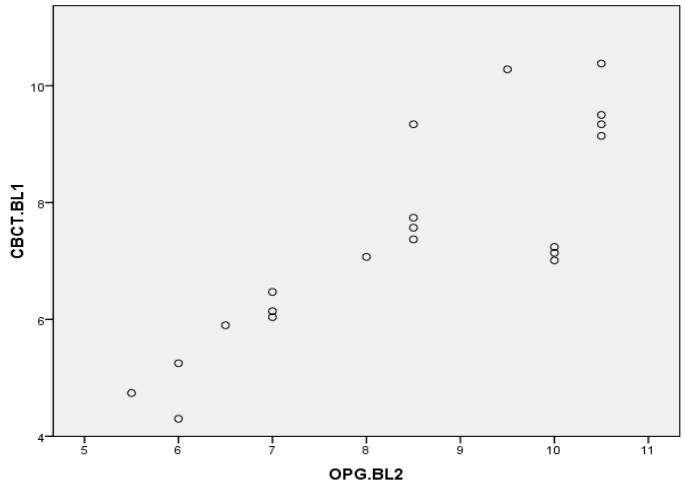


Graph 3: Mean of Bone Dimension in Two Groups in Apico-coronal dimensions

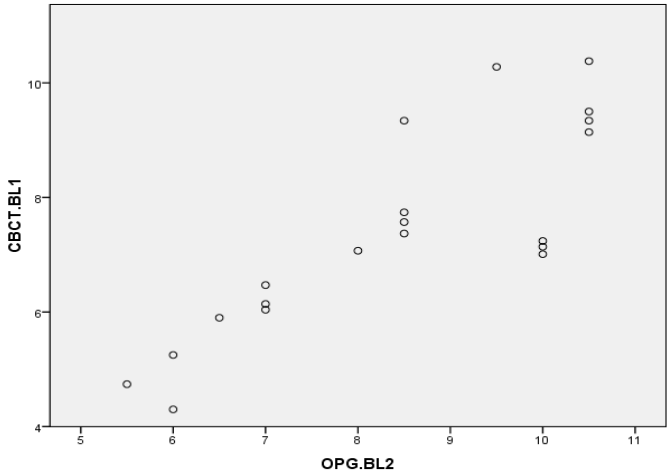




1. Scatter plot showing the correlations between the two sets of the MESIO DISTAL measurements



2. Scatter plot showing the correlations between the two sets of the Buccolingual measurements



3. Scatter plot showing the correlations between the two sets of the Apicocoronal measurements

DISCUSSION

When comparing patient's bone in all three dimensions with the procedure, the present study showed that the mean of the patient's bone dimension mesiodistally for the CBCT procedure was 7.728 while the mean of the patient's bone dimension for the OPG procedure was 8.265(Table 1).**The p-value was 0.027 which is considered to be significant and correlation value is 0.931.** When comparing patient's bone dimension buccolingually with the procedure, the present study showed that the mean of the patient's bone dimension buccolingually for the CBCT procedure was 7.390 while the mean of the patient's bone dimension for the ridge mapping procedure was 8.425(Table 2).**The p-value was 0.001 which is considered to be significant and correlation value is 0.837.** When comparing patient's bone dimension apicocoronally with the procedure, the present study showed that the mean of the patient's bone dimension apicocoronally for the CBCT procedure was 12.521 while the mean of the patient's bone dimension for the OPG procedure was 13.700(Table 3). **The p-value was 0.003 which is considered to be significant and correlation value is 0.799.** The measurements derived from OPG are comparable with CBCT a result that is in accordance with the present study.

CONCLUSION

Radiography plays an important role in implant dentistry. The quality and amount of bone available should be determined during the planning stage. Various radiographic imaging techniques such as panoramic periapical, and occlusal radiography and conventional and computed tomography have been used in planning dental implant treatment and for post treatment evaluation of the hard tissues surrounding implants. CBCT has been widely advocated for implant site assessment and is regarded as the most useful method because of its capacity to evaluate trabecular and cortical bone separately. CBCT may improve pretreatment diagnosis and treatment planning for implants, allowing clinicians to place the longest implant with confidence. Moreover, the fact that CBCT identifies various anatomical structures three-dimensionally is of great value to the diagnostician.OPG is one of the most common imaging methods for routine examination in clinical practice. As it provides only two-dimensional information about the implant sites, especially in relation to buccolingual width of alveolar bone .This measurement of alveolar ridge dimension can be accomplished using ridge-mapping technique. But in the setups where CBCT is not available can alternate methods could be used to plan implant placement.

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