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Comparative evaluation of Computerized Tomography and routine Panoramic Radiography in pre- surgical assessment of implant zone

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ABSTRACT

The overall objective of this study was to compare between the accuracy of panoramic images and CT images for measurement of implant recipient zones with a radiographic guide incorporating glass sphere which represent the control measurements. This study was conducted at OPD of Department of Dentistry in Medical College. The clinical experiment included 12 subjects requiring implants in compromised ridges. Computerized Tomography (CT) scan and routine Panoramic Radiography (PR) were used for imaging. Acrylic template incorporating a metal sphere was constructed for each patient. Every patient was subjected to both CT (4 dimensional) and two PRs one of them taken with acrylic template incorporating the metal spheres in place. The diameter of the glass sphere was measured using the caliper. The measurements taken in this study are on control, CT and PR group. For the CT group and the control group the readings have some differences ranging from 0.1 mm to 0.2 mm, for the control group the highest reading was 14.5 mm and the lowest one was 3 mm, for the CT group the highest reading was 14.4 while the lowest reading was 3.1 mm. For the PR group the highest reading was 18 mm while the lowest reading was 5 mm. This study highlighted the significant effects of positional variations on the distortion of panoramic images. There were clear advantages with CT scanning as an adjunct to treatment planning, including its inherent accuracy (0-1mm).

INTRODUCTION

The use of implants has become a routine method of replacing missing teeth. However, the placement of implants requires sufficient volume of sound bone in which to place the fixtures.[1] The primary objectives of implant planning are to determine the available bone quantity and quality, identify nearby anatomical structures, and diagnose pathology such as buried roots. Success in implant placement largely depends on presurgical evaluation and treatment planning. One can use a number of tools for this purpose.[2]
No single radiographic procedure provides ideal images for all of the steps in the implant planning process. Most patients will undergo a series of imaging studies including intra-oral x-rays, lateral skull films, and panoramic radiography (PR).[3] Increasingly however computed tomography (CT) is being regarded as the modality of choice for detailed planning prior to the surgery itself.

MATERIALS AND METHODS

This study was conducted at OPD of Department of Dentistry in Medical College. The clinical experiment comprised of 12 subjects requiring implants in compromised ridges. Alginate impression was made for each patient to construct a partial acrylic template; a metal sphere inserted into the acrylic template before processing keeping that surface of the sphere in contact with the soft tissue covering the alveolar ridge where the implant fixture planned to be inserted.

The acrylic template incorporating a metal sphere [Fig 4] was constructed for each patient. Every patient was subjected to both 4 dimensional CT Fig 2 and two PRs one of them the patient was exposed with the acrylic template incorporating the

metal in place [Fig 1 and Fig 4]. The diameter of the glass sphere was measured using the caliper. The PR with the metal sphere for each patient was considered the control group by using the following formula to eliminate the magnification:

The following formula has been used to calculate the control group for each patient:

$$\frac{D1xV}{D2}$$

Where D1 stands for the diameter of glass sphere measured by the caliper.

D2 stands for the diameter of glass sphere measured on the x-ray by the caliper.

V stands for the vertical bone depth mea-sured on the x-ray by the caliper.

In the second group (PR) each patient has been exposed to x-ray using the panoramic machine, the vertical bone depth measured in mm using the caliper. In the third group (CT) group, each patient was exposed to mandibular CT scanning using the Philips CT machine. The vertical bone depth was measured by the 4D dental software provided with the Philips machine.

RESULTS

Measurements taken in this study were of control, PR and CT group. The readings for the three groups were recorded in mm. For the CT group and the control group the readings were almost the same or with some differences ranging from 0.1 mm to 0.2 mm, for the control group the highest reading was 14.5 mm and the lowest one was 3 mm, for the CT group the highest reading was 14.4 while the lowest reading was 3.1 mm. For the PR group the highest reading was 18 mm while the lowest reading was 5 mm.

The mean for the control group was 9.808 while the mean for CT group was 9.758 this indicates that both control and CT group have similar mean with very small difference, the correlation coefficient equal to 0.996 and this suggest a very strong relation between the groups. The value of t equal to 0.491 and comparing this value with p value which is 0.633 (>0.05) indicate that there is no significant difference between the two groups.

The mean for the control group was 9.808 while the mean for PR group was 12.025 this indicates 22% distortion in PR, the correlation coefficient equal to 0.970 and this suggest a very strong relation between control group and PR group: the value of t is 7.631 comparing this value with p value which is 0.000 (< 0.05) indicate that there is a highly significant difference between the two groups.

DISCUSSION

The volume of the bone available and the quality of the bone are two factors that determine the type of surgical procedure and the type of implant. Both of these factors contribute to the success of the dental implant surgery.[3] Success in implant placement largely depends on presurgical evaluation and treatment planning. One can use a number of tools for this purpose. Imaging is an irreplaceable part of this armentarium.[4] All radiographic systems have inherent errors, technique peculiarities and different radiation dosages. The operator should be aware of these factors when making the choice of the most appropriate diagnostic technique.

A good diagnostic orthopantomography (OPG) otherwise known as dental panoramic radiography (PR) provides the clinician with a good overview of the oral cavity,[1] but the main problem with PRs, as with other plain films, is that they are two-dimensional in nature. Bone height may appear to be adequate on the PR, but there may be insufficient bone width to support an implant. They display image slices through the jaws by producing a single image of the maxilla and mandible and their supporting structures in a frontal plane. PR results in 10%-20% image magnification, which is non- uniform. This magnification is undesirable for both implant selection and implant site assessments.[4]

Approximately 63.8% of the dentists prescribe only panoramic radiography for dental implant assessment and 28.9% ordered panoramic radiography plus periapical radiography and or conventional and or computed tomography. Only 7.2% of the dentists perform CT as a single examination, although 10.1% follow it in combination with other imaging modalities.[5] The main reason given for prescribing panoramic radiography were broad coverage and cost,[5] and there are large variations in frequency of use of both conventional and computed tomography for dental implant. A substantial factor influencing the technique chosen was its availability rather than clinical need.[6]

More reliability is anticipated regarding the insertion of implants by establishing both clinical and radiological examination.[7] This study demonstrated the characteristic distortions (0.22%) associated with PR and its effect on implant

length selection. The mean for the control group was 9.808 while the mean for PR group was 12.025 this indicates 22% distortion in PR (Table4-6), and this is because the magnification in the vertical plane depends on the focus-film distance (which is constant for each exposure) whereas the magnification in the horizontal plane varies with the changing position of the film and the x-ray beam.

Computed tomography (CT) scans provide the implant dentist with a substantial amount of valuable information. Accurate measurements can be made, which is particularly important when working within the posterior mandible.[1,5] This study demonstrated the inherent accuracy of CT scan (0-1mm). The value of t equal to 0.491 and comparing this value with p value which is 0.633(> 0.05) this indicate that there is no significant difference between the groups (Table 1-3).

CT scans are more precise, panoramic radiography is sufficiently accurate for routine clinical purposes. However, an additional advantage with CT is in pre-surgical planning, since they reveal the horizontal dimension and shape of the mandible, along with the topography and buccolingual location of the inferior alveolar canal.

CONCLUSION

This study highlighted the significant effects of positional variations on the distortion of panoramic images, but panoramic radiography is sufficiently accurate for routine clinical purposes.

The CT scans are more precise, there were clear advantages with CT scanning as an adjunct to treatment planning, including its inherent accuracy (0-1mm). CT scans have, however, an additional advantage in presurgical planning, since they reveal the horizontal dimension along with other significant features.

REFERENCES

[1]. Reynolds A, Goldner S. The CAD and CAM of dental implants, Dentist; 2001; 53.
[2]. Bhat S, Shetty S, Shenoy KK. Imaging in implantology. The journal of Indian Prosthodontic Society 2005; 5 (1):10-14.
[3]. Sethi A, Kaus T. Additional Diagnostic Procedures. Practical Implant Dentistry, 2005 Quintessence pub-lishing Co. Ltd. Pp. 17-25.
[4]. Homilka P, Beer A, Birkfellner W, et al. Bone mineral density measurement with dental quantitative CT prior to dental implant placement in cadavar mandibles. Radiology, 2002; 224-247.
[5]. Sakura CE, Morais J, Loffredo LCM, Scaf G. A survey of radiographic prescription in dental implant assessment, Dentomaxillofacial Radiology, 2003; 32: 397- 400.
[6]. Ekestubbe A, Gronadahl K, Gronadahl HG. The use of tomography for dental implant planning. Dentomaxillofacial Radiology, 1997; 26 (4): 206-213.
[7]. Juodzbalys G, Raustia AM. Accuracy of clinical and radiological classification of the jawbone anatomy for implantation. Journal of Oral Implantology, 2004; 30 (1): 30-39.

Table 1: Paired sample statistics for Control and CT group

	Mean	N	Std. Deviation	Std. Error Mean
Control group(mm)	9.808	12	4.0860	1.1795
CT group(mm)	9.758	12	4.1408	1.1953

Table 2: Paired sample correlation between Control and CT group

	N	Correlation	Sig.
Pair 1 Control group (mm) & CT group(mm)	12	.996	.000

Table 3: Paired sample test for Control and CT group

	Paired Differences					t	df	Sig. (2-tailed)
	Mean	Std. deviation	Std. Error mean	95% confidence interval of the difference				
				Lower	Upper			
Pair 1 Control Group (mm) - CT Group (mm)	.050	.3529	.1019	-.174	.274	.491	11	.633

Table 4: Paired sample statistics for Control and PR group

	Mean	N	Std. Deviation	Std. Error Mean
Control group(mm)	9.808	12	4.0860	1.1795
PR group(mm)	12.025	12	4.1236	1.1904

Table 5: Paired sample correlation between Control and PR group

	N	Correlation	Sig.
Pair 2 Control group (mm) & PR group(mm)	12	.970	.000

Table 6: Paired sample test for Control and PR group

	Paired Differences					t	df	Sig. (2-tailed)
	Mean	Std. deviation	Std. Error mean	95% confidence interval of the difference				
				Lower	Upper			
Pair 2 Control group(mm) - PR group(mm)	-2.217	1.0062	.2905	-2.856	-1.577	-7.631	11	.000