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Research Report

Correction parameters in conventional dental radiography for dental implant

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ABSTRACT

Background: *Radiographic imaging as a supportive diagnostic tool is the essential component in treatment planning for dental implant. It help dentist to access target area of implant due to recommendation of many inventions in making radiographic imaging previously. Along with the progress of science and technology, the increasing demand of easier and simpler treatment method, a modern radiographic diagnostic for dental implant is needed. In fact, Makassar, especially in Faculty of Dentistry Hasanuddin University, has only a conventional dental radiography. Researcher wants to optimize the equipment that is used to obtain parameters of the jaw that has been corrected to get accurate dental implant.* ***Purpose:*** *This study aimed to see the difference of radiographic imaging of dental implant size which is going to be placed in patient before and after correction.* ***Method:*** *The type of research is analytical observational with cross sectional design. Sampling method is non random sampling. The amount of samples is 30 people, male and female, aged 20–50 years old. The correction value is evaluated from the parameter result of width, height, and thick of the jaw that were corrected with a metal ball by using conventional dental radiography to see the accuracy. Data is analyzed using SPSS 14 for Windows program with T-test analysis.* ***Result:*** *The result that is obtained by T-Test analysis results with significant value which p<0.05 in the width and height of panoramic radiography technique, the width and height of periapical radiography technique, and the thick of occlusal radiography technique before and after correction.* ***Conclusion:*** *It can be concluded that there is a significant difference before and after the results of panoramic, periapical, and occlusal radiography is corrected.*

Key words: *panoramic radiography, pericapical radiography, occlusal radiography, dental implant, dental radiography*

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INTRODUCTION

Radiographic imaging as a supportive diagnostic tool is the essential component in planning treatment using implant, and has benefit in helping dentist to access target area of implant due to recommendation of many inventions in making radiographic imaging previously. Although invention of technology has produced new innovation for dental implant, a conventional dental radiography tools is still the most commonly used to measure the quality and quantity of jawbone.[1]

Periapical and oclusal radiography is a radiography method that produces resolution imaging with a smoother and sharper result. Maxillary and mandible periapical radiography are generally used to evaluate the relationship status of teeth and alveolar bone that are still in the mesiodistal direction. This radiography type can also be used to determine the vertical level, form and quality of bone such as bone density, area around cortical bone, and trabecular bone, so that it can be used for the dental implant treatment.[2] A radiography that can show mouth tissues wider than periapical film is occlusal radiography. This radiography is able to give information on cross-sectional way, and also used to see the condition of alveolar ridge in mandible with buccolingual and faciolingual direction which is very useful in dental implant treatment.[2] Panoramic radiographic provides very useful information about the status of teeth in general and the relationship between the alveolar bone, basal bone, and anatomical structure that is not possible to conduct any dental implant. Although the

imaging of panoramic experiences enlargement, but the length and number of dental implant that will be placed on the edentulous area to support the implant still can be estimated. Intraoral periapical radiography can help and very important in estimating the mesiodistal dimension that is potential for implant placement and getting the initial estimation of vertical dimension. A combination between intraoral and panoramic imaging is often recommended for initial evaluation of implant target area.[1]

Tooth lost care can be done in various ways, in line with the development of technology in dentistry. Dental implant care is progressively popular at this time. Dental implant is an alternative treatment that can overcome many limitations of conventional artificial tooth.[3–5] Dental implant is an artificial tooth that replaces the root and used in prosthodontic to support the restoration of artificial tooth.[6] Dental implant is an ideal tooth replacement at this time, because its feature and shape can resemble the original tooth. Dental implant is made from titanium metal that is biocompatible.[7]

Various modern radiographic imaging diagnostic devices are used for dental implant care, but in Makassar, the availability of the equipment is still very limited. In the Faculty of Dentistry Hasanuddin University Makassar a modern three-dimensional radiographic imaging is not available. Viewing the facts mentioned above, effort is required to optimize and improve the quality of conventional dental radiographic diagnostic information. Although it is very simple, either for the quality or quantity of the jawbone for dental implant, parameter still can be obtained accurately by using many conventional dental radiographic diagnostics which are corrected such as panoramic radiography, occlusal radiography, and periapical radiography closely in the implementation of the technique. This effort can lead to more accurate parameters of width, height and the thickness of jaw, so that it may help in determining parameter of dental implant that will be placed in the patients.

MATERIAL AND METHOD

The design of research is analytical observational with pre-post test approach. The subjects are 30 humans with criteria as follows loss of 1–2 teeth, aged 20–50 years old, and have good bone density. Tools used are extraoral radiography set and intraoral radiography by using the panoramic radiography, periapical radiography, and occlusal radiography techniques. Film used is pericapical intraoral film with 3 × 4 cm in size, occlusal film with 5.7 × 7.5 cm in size, and panoramic film with 15 × 30 cm in size. A metal ball with 6 mm in size is used for correcting the radiographic results. Research is conducted at the Mouth and Dental Education Hospital, Dentistry Faculty of Hasanuddin University on February to March 2009.

Research procedure that is conducted starts with patient that comes to hospital and wants to be treated with dental implant who meets the criteria of research is informed to be subject based on his/her consent. The clinical examination is then conducted on the teeth that will be placed with implant. Radiographic diagnostic examination is conducted with the three radiographic techniques namely panoramic radiography, periapical radiography, and occlusal radiography. Before the image of target area of implant is taken, the area is given a metal ball with 6 mm in size as a material to make a correction. After the results of three radiographic techniques is obtained, the next step is analyzing the measurement of the width, height, and thick jawbone before and after correction, as an effort to get the accurate size of the dental implant that will be placed in patient.

Data is analyzed by using SPSS 14 for Windows program. Then it is tested using the t-test analysis to get the right parameters from the width, height, and thick of jawbone before and after correction by using conventional dental radiography techniques which are panoramic, periapical, and occlusal radiography.

RESULT

The research result can be seen in Table 2, 3, and 4. The result that is obtained by t-test analysis results with significant value which $p < 0.05$ in the width and height of panoramic radiography technique (Figure 3), the width and height of periapical radiography technique (Figure 1), and the thick of occlusal radiography technique (Figure 2) before and after correction.

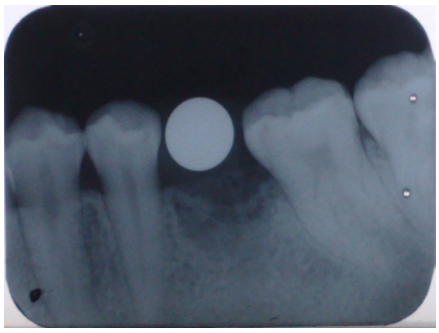

Figure 1. Periapical radiography with a metal ball.

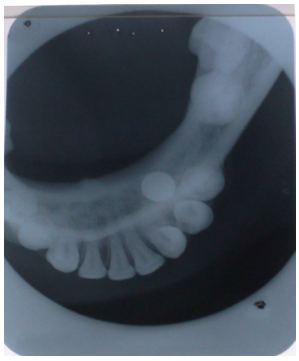

Figure 2. Occlusal radiography with a metal ball.

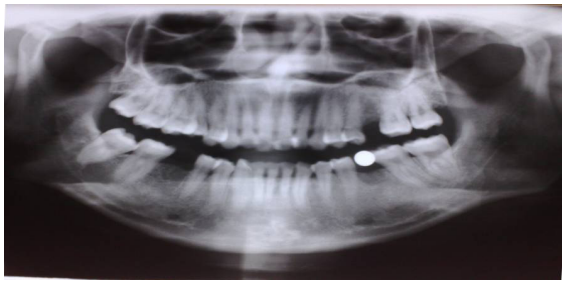

Figure 3. Panoramic radiography with a metal ball.

Table 1. Correction parameters in conventional radiography

No	Radiography	Mean (mm)		Difference
		Before correction	After correction	
1	Occlusal	7.46	7.32	0.16
2	Periapical (height)	11.30	10.62	0.71
3	Periapical (width)	10.56	9.87	0.72
4	Panoramic (width)	11.58	10.29	1.32
5	Panoramic (height)	13.58	11.78	1.81

Table 2. Results of panoramic radiography on 30 subjects before and after correction

Measurement	Mean (mm)		Significance
	Before correction	After correction	
Width	11.58	10.29	0.000*** ($p < 0.05$)
Height	13.58	11.78	0.000*** ($p < 0.05$)

Table 3. Results of periapical radiography on 30 subjects before and after correction

Measurement	Mean (mm)		Significance
	Before correction	After correction	
Width	10.56	9.87	0.000*** ($p < 0.05$)
Height	11.30	10.61	0.000*** ($p < 0.05$)

Table 4. Results of occlusal radiography on 30 subjects before and after correction

Measurement	Mean (mm)		Significance
	Before correction	After correction	
Thick	7.46	7.32	0.001*** ($p < 0.05$)

DISCUSSION

The three radiographic techniques above found radiographic techniques arranged by the accuracy: 1) occlusal radiography technique in thick/buccolingual measurement which is the most precise technique that almost approach the accurate value of the actual jawbone, 2) periapical radiography techniques in height/vertical measurement, 3) in width/mesiodistal measurement, 4) panoramic radiography techniques in width/mesiodistal measurement and 5) in height/vertical measurement.

Panoramic radiography technique gives a whole maxillomandibular image in one film, can reduce the time consuming, requires little oromaxillofasial radiographic expertise, and it does not give any uncomfortable effect for the patient. But in addition to positive things, one thing that has to be remembered is the magnification. Because of magnification, lack of definition and overlapping structure, the diagnosis of panoramic radiography possibly less accurate compare with intraoral radiography.

The difference is appeared as a correction parameter value and it is used as a subtracted value (Table 1). The size of dental losing area which is measured in certain radiography method is subtracted with the difference value or correction parameter value to get the real size of alveolar bone space.

There are a difference between before and after correction on panoramic radiography technique (Table 2). Both in width/mesiodistal and high/vertical measurement has significant result ($p < 0.05$). This is because the panoramic radiography technique experiences an enlargement image from the original size. Distortion on panoramic radiography technique cannot be avoided because of the illumination towards film, and structure projections which varies in some individuals and between individuals themselves. Differences in shape and size of jawbone and teeth, variations in the order of teeth on jaw and asymmetry between the right and left, all of them cause a difference in distortion degree.[8]

Panoramic radiography is considered only as a complement of examination, not as a substitute for pericapical radiography. Panoramic radiography should be used in the examination of wide jawbone area, for example the edentulous patient, the patient who does not need intraoral radiography well, or patient with wide pathologic symptom.[9] Panoramic radiographic provides very useful information about the status of teeth in general and the relationship between the alveolar bone, basal bone, and anatomical structure that is not possible to conduct any dental implant. Although the imaging of panoramic experiences enlargement, but the length and number of dental implant that will be placed on the edentulous area to support the implant still can be estimated.[1] There are difference of parameter values before and after correction on periapical radiographic technique (Table 3). Both in width/mesiodistal and high/vertical measurement of jawbone, has significant result ($p < 0.05$). This is because the periapical radiography has certain distance between film and X-ray which is 16 inches, and film position and ray source is set in such a way to make it upright. Although periapical radiography with a parallel technique has relatively high sharpness and accuracy but image magnification is still

inevitable. This is because variation in morphology of residual alveolar ridge.[2] Periapical radiography is helpful and very important in estimating the width/mesiodistal dimension that is potential for implant placed and getting the initial estimation of height/vertical dimension. A combination between panoramic and periapical radiography is often recommended for initial evaluation of dental implant target area.[1]

The difference of parameter values before and after correction on occlusal radiography technique was seen on Table 4. The thick/buccolingual measurement of the jawbone has significant value result which is in $p < 0.05$. Although this is the most significant and accurate techniques to a correction value but still it has enlargement. This is because only a part of the widest jawbone that can be measured, that is the bottom edge of mandible. In addition, this technique cannot describe the maxillary well because of anatomical limitation.[10]

In previous research it obtained a significant result before and after radiographic examination of panoramic radiographic, occlusal radiographic, and periapical radiographic with $p < 0.05$. Another thing was also shown by Reddy and Wang,[11] that implant position in jaw alveolus is needed to know by random block design to ensure that the same implant variety doesn't always get expected position in jaw alveolus.

From the results of this research, it can be concluded that there is a difference before and after the results of panoramic, periapical, and occlusal radiography is corrected in a measurement of jaw bone area that will be installed with dental implant.

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