

The difference of canines, first and second premolar teeth size resulted from cone beam computed tomography imaging with Moyers Prediction Table on the working study model

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ABSTRACT

Model study is one of the standard orthodontic components which is important for diagnosis and treatment plan, but in some patients with high gag reflex, it will be difficult to get this kinds of study models. The existence of a new device which is able to show the condition of patients' mouth in three space areas (axial, sagittal, and coronal) is expected to be an alternative when a study model is difficult to get. The purpose of this study is to find out whether or not there are any differences on the size of canine's mesiodistal, first and second premolar resulted from CBCT imaging with Moyers analysis on the study models. The method of the research is comparative descriptive. Measurements are made on 10 CBCT imaging results and 10 study models. The mesiodistal size, the result of CBCT imaging are measured by the available computer program and also the mesiodistal size of the study models is measured using a sliding compass, and then the size of canines, first and second premolar teeth resulted from CBCT imaging are compared to the result of Moyers method analysis on the study models. The t-test is used to find out if there is a difference on teeth size value between the CBCT imaging with the study models. The significance is determined based on the p value < 0,05. The statistical test result shows a significant difference between the size of canines mesiodistal, first and second premolar teeth, the result of CBCT imaging and the Moyers analysis result in the study models in which t count > t table.

Key words: CBCT 3D, Moyers analysis, canines, first and second premolar teeth mesiodistal size

ABSTRAK

Model studi merupakan salah satu komponen standar ortodonti yang penting untuk menegakkan diagnosis dan rencana perawatan, namun pada beberapa pasien dengan refleks muntah tinggi sulit untuk mendapatkan model studi ini. Adanya alat baru CBCT yang dapat memperlihatkan gambaran keadaan mulut pasien dalam tiga bidang ruang (aksial, sagital, dan koronal), diharapkan dapat menjadi alternatif ketika model studi sulit untuk didapatkan. Tujuan penelitian ini adalah untuk mengetahui apakah terdapat perbedaan ukuran mesiodistal gigi kaninus, gigi premolar pertama dan kedua hasil pencitraan CBCT dengan analisis Moyers pada model studi. Metode penelitian ini adalah deskriptif komparatif. Pengukuran dilakukan pada 10 hasil pencitraan CBCT dan 10 model studi. Ukuran mesiodistal hasil pencitraan CBCT diukur menggunakan program komputer yang telah tersedia serta ukuran mesiodistal

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pada model studi diukur menggunakan jangka sorong, kemudian jumlah ukuran gigi kaninus, gigi premolar pertama dan kedua pada hasil pencitraan CBCT dibandingkan dengan hasil analisis metode Moyers pada model studi. Uji t-test digunakan untuk mengetahui apakah terdapat perbedaan nilai ukuran gigi antara hasil pencitraan CBCT dengan model studi. Kemaknaan ditentukan berdasarkan nilai $p < 0,05$. Hasil penelitian menunjukkan adanya perbedaan signifikan antara ukuran mesiodistal gigi kaninus, gigi premolar pertama dan kedua pada hasil pencitraan CBCT dengan hasil analisis Moyers pada model studi.

Kata kunci: CBCT 3 D, analisis Moyers, ukuran mesiodistal gigi kaninus, premolar pertama dan kedua

INTRODUCTION

The success of an orthodontic treatment depends on the diagnosis and the treatment plan and the comprehensive mechanotherapy. Study models, photography, radiography, and clinical examination provide important information for a diagnosis.¹³

Study model is one of the essential orthodontic standard components that helps to establish a diagnosis, present a case, determine a treatment plan, and to hold a treatment progress evaluation. This kind of study model is commonly used for determining size discrepancy, shape and position of teeth as well as studying the size, shape and arch relationship of upper and lower jaws.^{15,17}

There is a new technology in the field of radiography imaging, namely Cone Beam Computed Tomography (CBCT) which is becoming widely known as an innovative device for helping to establish a diagnosis and for planning an orthodontic treatment. The ability to show a three dimensional picture of patients' mouth and their maxillofacial area has provided major advances in orthodontic field.^{8,13} This includes detecting and finding the locations of teeth impaction and supernumerary, learning mixed dental, planning the placement of orthodontic anchoring device, identifying pathological lesion, evaluating the growth and development of craniofacial, and planning orthognathic surgery.¹¹

CBCT has the ability to produce images of teeth, jaws, TMJ, skull and the tissues around them. Therefore, orthodontists will obtain the quality of periapical radiography, panoramic, cephalogram and occlusal, as well as TMJ diagnostics.⁹ By the existence of this digital model, the CBCT technology may replace the molding needs to get a study model.¹¹

Garib in Felicio (2010) states that one of the possible usefulness of CBCT in the area of orthodontic is a precise diameter measurement of mesiodistal for evaluating teeth and bones discrepancies.⁶ The three dimensional view helps the occlusion analysis more quickly and efficiently, especially on patients in mixed dental stage that shows the eruption and development, as well as the position and the establishment of permanent teeth root.⁶

The mixed dental analysis commonly used is the analysis Moyers' method using a prediction table based on the relationship between the total width of four mandible incisive teeth and the total width of canines, first and second premolar teeth.¹⁶ To conduct the mixed dental analysis, a study model is required to estimate the canines, the first and second premolar teeth accurately¹⁶ and it can affect the treatment plan whether or not the extraction serial, eruption guidance, space maintaining, and the needed space return are required or just an observation.² However, there are some conditions where it is not possible for molding to get study models in children with high gag reflex.⁷ In order to overcome it, it is necessary to get other alternatives to get study models in patients with difficulty in molding process.

The development of computer software displays an interactive digital model of CBCT. The advantage of using this digital model is, if the imaging result is 1:1 with the original teeth model, then molding is not required to get a study model by using alginate. This method can be an alternative for replacing a study model. Since 2007, Faculty of Dentistry of Universitas Padjadjaran has the CBCT device type Picasso Trio with EZ software in which the imaging result of teeth size has not been studied, whether it is actually 1:1 comparing to the original model. The accuracy of the CBCT

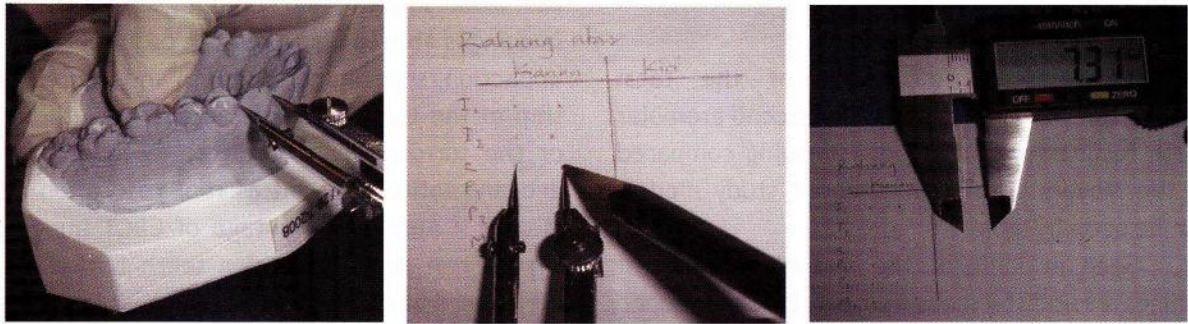


Figure 1. Dental mesiodistal measurement on the study models. A. Mesiodistal measurement using a compass; B. The result of measurement using a compass is assigned on a piece of paper; C. The impression point is measured using a sliding compass.

imaging result is important in teeth size analysis in orthodontic field for diagnosis and determining a treatment plan.

Based on the research background, the author is interested in finding if there is any difference in the size of canines, first and second premolar teeth based on the result of CBCT imaging compared to the Moyers prediction table in study models. It is expected that the result of this study can be used as an alternative for study models in conducting Moyers analysis.

METHODS

This research was a descriptive comparative research aims to compare the size of mesiodistal canines, first and second premolar teeth based on the result of CBCT imaging with the size of canines, first and second premolar teeth based on Moyers prediction table in study models.

The population of the research was the CBCT radiography of all patients visited the Oral and Dental Hospital of Faculty of Dentistry of Universitas Padjadjaran in 2007-2010, with the inclu-

sion criteria: CBCT imaging result and the study models of patients aged 8-11 years old in mixed dental period; four incisive permanent teeth of the lower jaw have fully erupted; complete incisive teeth of the lower jaw, four incisive teeth that will be measured in study models with no clinical anatomy discrepancy; no break/fracture in porus, no attrition, carries or filling that can affect the mesiodistal size of teeth crown. The research was conducted in the Clinic of Post Graduate of Orthodontic and Radiology Installation of Oral and Dental Hospital of Faculty of Dentistry of Padjadjaran University.

Measurement was conducted to 10 CBCT imaging results and 10 study models. In the study models, the researchers perform a mesiodistal width measurement of incisive teeth of the lower jaw using a compass that has two sharp points on each tip, the measurement result is marked on a piece of paper in the form of points, then the distance between the two points are measured using a digital sliding. The researchers record the measurement results. The measurement result of four incisive of the lower jaw is put into the Moyers prediction table using the prediction score 75% for determining the size of canines, the first and second premolar teeth, and then it is recorded.

The result of CBCT imaging using the available program, the researchers measured the width of canines mesiodistal, the hidden first and second premolar teeth, then was recorded.

Then, the canines, first and second premolar teeth mesiodistal size according to Moyers prediction table on the study models were compared to the size of canines, first and second premolar teeth resulted from the CBCT imaging, and then was inserted into the statistical analysis.

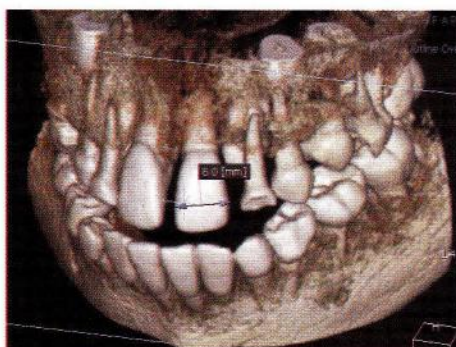


Figure 2. Dental mesiodistal measurement on the result of CBCT imaging.

RESULTS

The average difference of the total mesiodistal size canines, first and second premolar teeth resulted from the CBCT imaging compared to the Moyers prediction table on study models can be seen in Table 1.

Seen in Table 1, the statistical result of canines mesiodistal measurement, first and second premolar teeth resulted from the CBCT imaging were statistically different from the Moyers prediction table on the study models.

The difference of the t-test statistical analysis of the Moyers analysis on the study models with the total size of canines mesiodistal, first and second right premolar teeth resulted from the CBCT imaging show the t count 6,25 which was higher than the t table value= 2,09 (p value < 0,05).

Table 1. The difference of the total size of canines, first and second premolar teeth resulted from the CBCT imaging compared to the Moyers prediction table on the study models

Statistic	M3Dka vs MyMS	M3Dki vs MyMS
Average	0.95	1.07
std	0.645	0.682
n	18	18
t count	6.25	6.67
t table	2.09	2.09
p value	8.762E-06	8.974E-06
character	Sign	Sign

Note:

MyMS = canines, first and second premolar teeth size according to the Moyers prediction table on the study models. M3Dka = the total measurement of canines mesiodistal, first and second right premolar teeth on the CBCT models

M3Dki = the total measurement of canines mesiodistal, first and second left premolar teeth on the CBCT models.

DISCUSSION

Imaging diagnosis and study models are the important source for carrying out a diagnosis and determining a treatment plan in the orthodontic field. The conventional radiography technique provides two dimensional imaging of three dimensional structures so that there are some shortcomings in accuracy and space orientation, size, shape and inter-anatomy structures relationship.⁶ Different from the conventional radiography that shows an object in one area, the CBCT shows the relationship between structures in three space ar-

eas; axial, sagittal, and coronal⁶, so that the CBCT imaging is able to figure out the positions of teeth impaction, supernumerary teeth and the relationship of the teeth with the adjacent teeth crown or the surrounding structures, teeth inclination and angulation, as well as root resorption more clearly.¹⁹ Another advantage of CBCT imaging is that it can also see hidden teeth buried inside bone, so that it was possible to measure the size of teeth mesiodistal using the available computer program.⁶

This research aimed to find out if there was any difference in the size of canines mesiodistal, first and second premolar teeth resulted from the CBCT imaging compared to the Moyers prediction table on study models, so that this CBCT imaging result can be an alternative if study models are difficult to get.

The comparisons result of the size of canines mesiodistal, first and second premolar teeth on 10 CBCT imaging results and 10 study models show the significant difference with the t count (6.25-6.67) > t table (2.09) and also show a big difference, approximately between 0.95-1.07 mm. Felicio⁶ reports that there is size difference between the total size of canines mesiodistal, first and second premolar teeth resulted from the CBCT imaging compared to the size of canines mesiodistal, first and second premolar teeth according to the Moyers prediction table, because by using CBCT, dental mesiodistal that has not yet erupted can be measured directly and not in the form of prediction as in Moyers' Table.⁶ Bernabe & Flores-Mir¹ stated that mixed dental analysis should result the size with minimal error, so that even a small space is very valuable in the setting of space needed for permanent teeth eruption in normal arch.¹

Many researches stated that there was no difference between measurement with CBCT and clinical measurement, but there were some factors that have to be considered when implicating the measurement result using CBCT clinically. The accuracy of CBCT measurement can be affected by the reduction of image quality due to the existence of soft tissues passed by the x-ray and the possibility of patients moving during the process of scanning.⁴ Pinsky¹³ state that variations of bones' density may also affect the result of CBCT imaging. This statement is also supported

by Periago¹² that indicates the scanning process depends on the software algorithm, the resolution difference, the thickness and calcification level of bones structures, and the operator's skill. In this research, the possibility of the difference in measurement result can also caused by patients movement during scanning process, considering the patients in this study are children aged 8-10 years old. Another possibility is the calibration inaccuracy of the CBCT device itself.

CONCLUSION

The results show the value of the size of canines, first and second premolar teeth resulted from the CBCT imaging are significantly different compared to the Moyers prediction table on study models. Thus, the CBCT imaging result in Faculty of Dentistry of Padjadjaran University still cannot be used as an alternative of Moyers method.

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