Radiological accuracy of two different systems (Digital & Conventional) in endodontic apical fitness

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Abstract

Aim: The present study compares the accuracy of conventional and digital radiographic system in the determination of apical fitness in endodontic therapy.

Method: Thirty three root canals of first upper and lower molar teeth were used in this study; a K-file was inserted into the canal until its tip was fit snuggly one millimeter shorter than the apex. Each tooth was radiographed twice with two different radiographic systems; conventional & digital systems. The right-angle paralleling technique with film holders was used in both systems. The distance between the file tip and the center of radiographical apex from both imaging systems was measured by two examiners and the mean of each two measurements was recorded, the data was collected and analyzed statistically by paired t- test.

Results: The mean value of radiographic length reveals that there is a very small difference between the measurements of conventional radiographic system (0.8727mm) and those measurements of digital radiographic system (0.8367mm) when compared with the real length measurements (1mm). Paired t-test shows that there is no significant difference ($p < 0.05$) was founded between the real measurements and the radiographic measurements are taken from both conventional and digital systems. In conclusion both the conventional and digital imaging systems can be used accurately for working length determination in an endodontic therapy.

Key Words: conventional, digital, apical fitness, endodontics.

Introduction

Electronic imaging is not a new concept. Digital image results from the conversion of analog data to digital data, and the computer processed the image to be seen on the computer screen.

Film-based image or radiograph creates by the interaction of x-ray with x-ray film to make a radiograph after processing in the darkroom. (1)

Major advantages of digital radiography in endodontics are that radiographic images are immediately obtained, eliminating developing time & film processing, and radiation exposure is reduced from 50-90% compared to conventional film-based radiography. (2)

The primary disadvantages of digital radiography are the potential reduction in the image quality when compared with the conventional radiography. (3)

Different studies compared between the conventional & digital radiography in the working length determination, where, Akdeniz *et al* perceived image quality of the enhanced digital images was superior to the original and conventional film images for the evaluation of root fillings. (4) In contrary to that, Lozano

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et al found the conventional radiology remains the technique of choice in determining the root-canal length and the digital techniques yielded good results for size 15 file.[5]

The aim of this study was compared the accuracy of (Digital & Conventional) radiographic systems in the determination of endodontic apical fitness.

Materials and Methods

A fourteenth extracted multi-rooted (upper & lower first molar) teeth was used in this study. The selected teeth are placed in the normal saline after extraction, the total number of the roots were examined are 33 (figure 1) and then examined clinically to satisfy the following criteria;

1. The crown is completely formed i.e. free from the extensive carious lesion.
2. The root (s) is, without extensive curvature and abnormal anatomy.
3. The apical foramen is completely formed and free from apical resorption.
4. The canal of examined root is free from any blockage, & internal or apical resorption.

After access preparation, a K-file was inserted into the canal until the tip of the file had just seen at the main apical foramen by magnifying lens (X10), the file then was withdrawn one millimeter shorter than the apex, the working length of each root was determined, then initial instrumentation was performed two sizes larger than the first file that fit snuggly at one millimeter shorter than the apex. The file was fixed in the canal by filling the access opening with composite resin to prevent its movement during tooth position adjustment and exposure. [5]

Each tooth was positioned as in normal anatomical location in relation to the image receptor, then the sample was radiographed twice with two different radiographic systems; conventional & digital systems. The right-angle paralleling technique with film holders was used in both systems. The soft wax was used to facilitate the positioning of the examined tooth on the film holders. The radiographic machine of type TROPHY MINOREX (made in France) was adjusted on 65 kVp. , 10 mA. & 0.5 sec. of exposure time & size-2, E-speed film type (Kodak poly-soft, by Eastman Kodak company- USA) was used in the conventional system (figure 2). After processing, each radiograph viewed & examined under magnifying lens. [6] On the other hand; 62 kVp. , 8 mA. & 0.04 sec. of exposure time & Dixi sensor size-2 from Planmeca Company was used in digital system as shown in (figure 3). The distance between the file tip and the center of radiographic apex was measured for both systems. In the conventional radiographs was directly measured by two examiners using divider & vernier of 0.05mm error, the mean of two measurements was taken. Where as in digital system; these distances was directly measured in the digital images with the software of the Dimax digital program [6] (figure 4), and the mean of each two measurements was taken, the data were collected and analyzed statistically by paired t-test.

Results and Discussions

The mean value of radiographic length reveal that there is a very small difference between the measurements of conventional radiographic system (0.8727mm) and those measurements of digital radiographic system (0.8367mm) when compared with the real length measurements (1mm) (Table 1). However (0.036mm) difference has no clinical significance, because clinically, the working length

is generally measured to the nearest 0.5 mm. [7]

Paired t-test (Table 2) shows that there is no significant difference ($p < 0.05$) was founded between the real measurements and the radiographic measurements had taken from both conventional and digital systems. But, still the digital image is more accurate in the working length determination according the difference between the mean of real length and the mean of radiographic length of digital imaging system (0.1273), which is less than that mean difference between the real and radiographic length of conventional imaging system (0.1633). This may be due to the image quality of the enhanced digital images was superior to the conventional film images for the evaluation of root fillings. [4]

The results gained from the present study coincide with the previous studies performed by Goaz [2] *et.al* and Jones *et.al*, [8] they concluded that the digital imaging system is more reliable radiographic technique for working length determination in an endodontics. In contrary with the studies made Lozano et.al [5] and Mouyen Forner, [3] they concluded that the conventional radiography remains the technique of choice in determining the root-canal length.

Conclusions

1-There was no significant different between the accuracy of both radiographic systems.

2-Both the conventional and digital imaging systems can be used accurately for working length determination in an endodontic therapy.

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Table 1: Statistical analysis of the Real, Conventional & Digital measurements.

	Real measurement control	Conventional measurements	Digital measurements
N	33	33	33
Mean	1.0000	0.8727	0.8367
Std. Error of Mean	0.0000	3.995E-02	5.944E-02
Std. Deviation	0.0000	0.2295	0.3415
Minimum	1.00	0.20	0.34
Maximum	1.00	1.20	1.90

Table 2: Comparison of measurements from conventional & digital systems with normal measurements by the paired t-test.

Variables	No	Mean	Mean difference	Standard deviation	Std. Error mean	t-value	df	p- value
Real length (control)	33	1.0000	-	0.000	0.000	-	-	-
Conventional system	33	0.8727	0.1273	0.2295	3.995 E-02	3.186	32	0.05
Digital system	33	0.8367	0.1633	0.3415	5.944 E-02	2.748	32	0.05

Figure (1): The samples of 14 extracted upper and lower molar teeth.

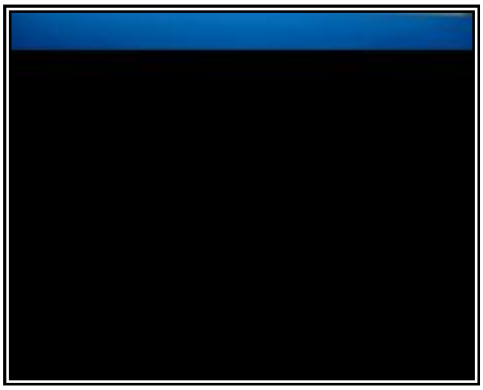

Figure (2): Position of the tooth in the conventional radiographic system.

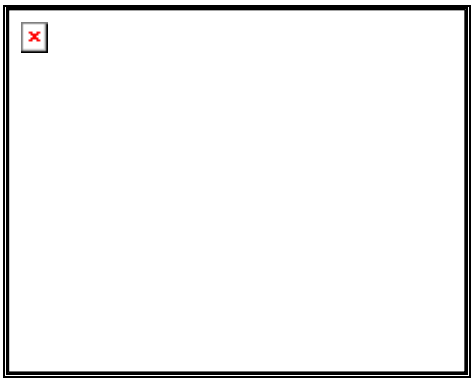

Figure (3): Position of the tooth in the digital radiographic system.

Figure (4): Digital radiographic measurement by the digital system.