ORIGINAL ARTICLE

The Agreement between the Conventional and Digital Radiographs in Detection of Intracanal Separated Files

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ABSTRACT

Objective: to determine the agreement between the conventional and digital radiographs in detection of intra canal separated files.

Material & Methods: A cross sectional study was conducted at Operative Dentistry Department, Institute of Dentistry, Liaquat University of Medical and Health Sciences, Jamshoro from 01-03-2020 to 31-08-2020. A total of 71 Permanent single straight rooted, consisting of single canal extracted teeth were included in this study. Preoperatively radiograph was taken from mesiodistal (M-D) and buccolingual (B-L) direction to confirm the inclusion criteria. Root canal was prepared and the file was inserted to the working length, a counterclockwise motion was performed till the separation of file occurs. Then radiograph was taken to confirm the separated file at working length.

Results: Agreement between the conventional and digital radiographs in detection of intra canal separated files was 90.4%. The kappa value between the conventional and digital radiographs was 0.534 which is statistically significant and considered as a moderate degree of agreement.

Practical Implication: Correct radiographic detection helps identify the cause, improves in therapy choice, and offers medico legal security in cases of retreatment.

Conclusion: In conclusion, both modalities can be used for detection and facilitate in finding the cause and helps in decision making for treatment and provides medico legal security in the retreatment cases.

Keywords: Conventional radiograph, Digital Radiographs, Endodontic treatment, Separated file.

INTRODUCTION

Endodontic treatment could be failed due to procedural errors such as under access cavity design, missed canals, mechanical complications (ledges, perforations or separated instruments) and under or over extension of root filling materials. The cause of the failure needs to be carefully evaluated, ¹ including proper dental and medical history, clinical examination and radiographs for detecting the cause of failure and treatment plan designed accordingly which could be nonsurgical endodontic treatment, surgical endodontic treatment or extraction.²

Currently, rotary Nickel Titanium (NiTi)instruments are commonly used for canal preparation and these instruments have less fracture resistance than stainless steel hand instruments thus having high risk of fracture.³Due to more usage of rotary instruments, instruments separation becoming increasedwhich ultimately affect the prognosis of endodontic treatment.⁴⁻⁶ Its management is based on the stage of treatment, location of separated instrument (apically, middle or coronal third). morphology of canals and roots and type of instruments (NiTi or Stainless steel).^[4-6] Sometimes retrieval of separated files from canal become difficult because of the curvature of canals therefore the majority of clinicians usually fill the rest of canal, afterwards when it fails then during evaluation detection of separated instrument become difficult because of the continuity of radiopacity.^{5,7,8}For these type of cases apart from decision making for retreatment, detection of broken file is mandatory for medicolegal point of view.5

The different techniques for detection of separated instruments are available i.e. conventional, digital and cone beam computed tomography. Radiographic identification of separated instrument is rigorous. Proper radiographic detection is depend on exposure time, scattered radiation, superimposed anatomical structures, difference of density of bone and sometimes scratches on the radiographs. These may mimic the separated instruments.⁵

Digital radiographs have more advantages when compared with conventional type. Advantages of digital radiograph are low radiation dose, time saving technique, easy for storage and enhancement of image, provide optimum diagnostic value, high resolution, easily documented for patient's records, high radiographic properties like image contrast, sharpness and brightness can be manipulated.^{5,9} Certain studies support digital radiographs¹⁰ while some supports conventional radiographs.¹¹On the other hand, there are also some studies which concluded an agreement that there is no difference of results between these two radiographs.⁵According to study conducted by Rosen E, Azizi H, Friedlander C, Taschieri S and Tsesis I the percentage of agreement between two observers is 76%.⁵

The purpose of this was to determine the agreement between digital and conventional radiographs in terms of separated instruments. Proper detection by radiographs helps to find out the cause and helps in decision making for treatment and provides medico legal security in the retreatment cases.

MATERIAL & METHODS

A cross Sectional Study Was Conducted In Operative Dentistry Department, Institute of Dentistry, Liaquat University of Medical and Health Sciences, Jamshoro from 01-03-2018 to 31-08-2018. A total of 71 sample size was used and calculated by taking the percentage of agreement between conventional and digital radiographs in detection of separated files i.e. $76\%^5$, $1-\alpha=95\%$, margin of error = 10%. The sampling technique was non probability consecutive sampling technique. The inclusion criteria were set as permanent single rooted, single canal extracted teeth, teeth with mature root and patent canals. Previously treated teeth, root caries, resorption and perforation were excluded from the study. All samples were collected from Department of Oral and Maxillofacial Surgery, Institute of Dentistry, Liaguat University of Medical and Health Sciences, Jamshoro with written informed consent by after issuance of departmental letter. Teeth were immersed into Hydrogen peroxide (6% w/v Shahbaz laboratory B/8 Site Hyderabad) for an hour to clean and remove theremnants of blood and debris.Preoperatively radiograph was taken from mesiodistal (M-D) and buccolingual (B-L) direction to confirm the inclusion criteria. Endodontic access was prepared with round bur (Mani, Japan), working length was determined by inserting hand 10#K file (DentsplyMaillefer) into canal until the tip was visualized to exit at apical foramen. The length of canal was recorded, after that working length was calculated by subtracting 1mm from this measurement. Root canal prepared with crown-down technique and flared with Gates Glidden drills size #4 to #2 (Dentsply Maillefer). Then apical third was prepared with use of hand K-file (Dentsply Maillefer) up to 20# at measured working length. NaOCI was used as an irrigant. After instrumentation final irrigation was performed with 1ml of 17% EDTA (Meta Biomed, Korea) and then dry the canals with paper point (San Diego,C.A, USA).

To separate the K file#25 file, a groove was made at 2 mm from the tip with high speed bur. Then the file was inserted in the prepared canalup to the working length and rotated with counterclockwise motion till the separation occurs. The radiograph was taken to confirm the separation at working length. The canal obturated to the level of separated fragment. Then digital radiograph [(CSN Industries Sri with RX4 intraoral sensor (Cinisello Balsamo Mi-Italy)] and conventional radiograph [(Searcher Model Dx-068 (Takara Belmont, Osaka, Japan)] were taken of all the teeth. The conventional radiograph wasoperated at 65kVp, 8mA with the focus object distance of 20 cm with the conventional Primax RDX-58E Soft film (E Speed, Berlin-Germany).

The evaluator having an experience of 5 years post fellowship, who was not involved during the procedure and also was not informed about any instrument separation, firstly randomly he were evaluated all digital radiographs, after a week the same evaluator was evaluated all conventional radiographs of same teeth to remove the memory bias. Separated instrument was assessed as radiopaque material of at most 3mm in length having flutes in appearance that lies in canal space on radiograph. If conventional radiograph and digital radiograph both show separated instrument in canal space is the agreement as both radiographs show same results. If conventional radiograph and digital radiograph both does not show separated instrument in canal space is also the agreement as both radiographs show same results. Data was entered and analyzed through SPSS version 20. Frequency and percentage was calculated for agreement. Kappa statistics was applied to see the strength of association between conventional and digital radiographs k≥0.8 was taken as significant.

RESULTS

A total of 71 teeth were included in this study. Digital and conventional radiographic finding in detection of intra canal separated file are shown in figure 1 and 2.

Agreement between the conventional and digital radiographs in detection of intra canal separated file shown in figure 3. Measure of agreement is shown in table 1. The kappa value between the conventional and digital radiographs was 0.534 which is statistically significant and considered as a moderate degree of agreement.



Figure 1: Digital radiographic finding in detection of intra canal separated File. (n=71)



Figure 2: Conventional radiographic finding in detection of intra canal separated File. (n=71)



Figure 3: Agreement between the conventional and digital radiographs in detection of intra canal separated File (n=71)

Table 1: Strength of association between conventional and digital radiographs

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Measure of	Kappa	Std. Error	P-Value
agreement	0.534	0.154	0.0005

DISCUSSION

One of the common complication of endodontic instruments is file separation during cleaning and shaping.^{11, 12} which may affect root canal treatment prognosis due to inadequate canal preparation, compromised cleaning and inadequate obturation.⁶Moreover it bears a medicolegal risk if not diagnosed preoperatively because such cases results in failure of treatment and needs to be retreated oftenly.¹³ To date, one of the gold standard modality used for diagnosis and treatment planning in endodontics is the periapical radiograph.^{14, 15}This is also one of the immediate technique used to identify a retained separated file in root canals during the procedure and in filled roots^{15, 16}The detection and diagnosis of separated file in filled roots may be challenging because of the continuousradiopaque appearance of the instrument and the filling material within the canal.¹⁷

In this study agreement between the conventional and digital radiographs in detection of intra canal separated instruments was 90.4% showing strong agreement.¹⁸The kappa value between the conventional and digital radiographs was 0.534 which is statistically significant and considered as a moderate degree of agreement. According to different studies, diagnostic potential ^{19,20} and length determination²¹ of digital images are superior to conventional radiographs; while others have favored the conventional radiographs.²² This could be due to image modification like change in brightness and contrast in digital radiographs. No significant difference was observed in an in vitro comparing conventional and digital radiograph for detection of simulated root canal voids.23 Moreover, another factor is the experience, more experienced the observers, the better they are able to identify the details and points of a radiographic image. Thus, in this study, the evaluator having an experience of 5 years post fellowship, who was not involved during the procedure and also was not informed about any instrument separation, firstly randomly evaluated all digital radiographs, after a week the same evaluator re-evaluated all conventional radiographs of same teeth to remove the memory bias.

CONCLUSION

In conclusion, no significant difference was observed between conventional and digital imaging systems for detection of intra canal separated file. We found that both modalities can be used for detection and facilitate in finding the cause and helps in decision making for treatment and provides medicolegal security in the retreatment cases.

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