# INTEROBSERVER AGREEMENT IN RADIOGRAPHIC ASSESSMENT OF PERIAPICAL STATUS

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## ABSTRACT

The purpose of this study is to interpret the interobserver accordance in the analytical interpretation of apical periodontitis on the digital radiograph, which is a measure of the reliability of this radiological technique. This study was conducted in the Operative dentistry unit of Islamic International Dental Hospital (IIDH), in which 100 digital radiographs taken with the Soredex Digora (R) Optime were selected for observation by 3 specialists endodontic, 3 endodontic second-year residents, and 3 BDS final year students independently. The apical status was assessed using the periapical index (PAI). All data were statistically analyzed using SPSS version 23. Fleiss kappa factual test is utilized to evaluate the degree of agreement among numerous raters. The complete Fleiss kappa result for the 9 raters observation is 0.54 (P < .001). This result is in the moderate range (0.4 to 0.6) for the 9 raters observation. The result obtained from this study has shown that in dental radiology direct digital imaging is a reliable, long lasting technique for diagnostic and endodontic treatment planning phases

Key Words: Digital radiograph, periapical status, periapical index.

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## **INTRODUCTION**

The primary culprit for apical periodontistis is disease from the pulpal tissue caused by caries or other pathways. The radiographic assessment of periapical status is significant because it helps the clinician to decide which treatment is required and the outcome of endodontic treatment can be compared to different clinical factors. A periapical index (PAI) consisting of five points on the scale is devised for measuring the periapical status. The score ranges from "normal periapical tissues to well defined apical periodontitis". The index was first devised for periapical radiographs.<sup>1</sup>

PAI is considered to be an effective index for evaluating the periapical tissue status, on the basis of which a tooth is being diagnosed as healed if there is a decline in PAI.<sup>2</sup> despite of being easily used this index has some shortcomings such as the results are totally subjective, vary with the clinicians experience and a periapical radiograph gives only a 2-dimensional view of the tooth.

Digital radiography has undergone immense im-

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provement since its development. Digital radiographic system was developed more than twenty years ago. An intraoral sensor is used in place of conventional radiographic film. Two different types of intraoral sensors are utilized in order to capture image. The most common type, uses a charge-coupled device, which is present in the RadioVisioGraphy (RVG) system, the Schick Technologies Computed Dental Radiography system, and the Sens-A-Ray system. A charge-coupled device is used in the most commonly used type of intraoral sensor, which is incorporated in RadioVisioGraphy (RVG) system and Sens-A-Ray system. The Digora system utilizes the second type. A memory phosphor plate is used to produce image.<sup>3</sup>

Advantages of using digital sensors over film are many. Significant advantages include noteworthy dose reduction: almost instantaneous generation of high-resolution digital images; ease of transmission and of archiving and retrieving images from databases or picture archiving and communication systems; facilitation of use of an all-electronic patient record; reduces exposure of personnel to hazardous chemicals; and reduced environmental impact.<sup>4,5</sup> As compared to conventional radiographic imaging system there are three major disadvantages associated with digital radiographic system namely size of sensor, initial installation cost and low image quality.<sup>6</sup> In a study of Shalini Tewary which was conducted using 150 digital periapical radiographs. The result of this study indicate that radiographic interpretation is subjective whether conventional or digital radiographic technique is used.<sup>7</sup>

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The most remarkable future for the digital imaging is its entry into cyberspace that will mix the acquisition of sound and interaction to help the clinical practitioner in making the correct diagnosis and performing trial surgeries.<sup>8</sup>

This aim of this study is to interpret interobserver agreement in the analytical interpretation of apical periodontitis based on digital radiograph which is a measure of the reliability of digital radiographic technique. The determination of interobserver agreement in the digital radiographic assessment of periapical status using periapical index is important because the decision to recommend any further investigation relates to the dentist, after clinical examination of the patient and the radiograph.

## METHODOLOGY

Soredex Digora <sup>(R)</sup> Optime 900682 (Version DXR-60-01) digital radiographic system was used to capture images. The 100 selected radiographs were taken by post graduate residents in the endodontic unit of Islamic International Dental Hospital (IIDH) between 2017 and 2018. In each case these radiographs were used for the purpose of diagnosis and endodontic treatment planning phase. Three endodontic with 10 to 20 years of experience, 3 endodontic final-year residents, and 3 BDS final year students independently documented their findings after evaluation of 100 digital images. A PAI score 2 or 3 was defined to be a sign of periapical pathology and PAI score 4 or 5 was considered to be a sign of apical periodontitis as shown in Figure 1. The radiographs were viewed by all observers using the same computer under the same lighting conditions. In order to evaluate the images the observers were not permitted to use Digora® Optime software program image enhancement inserts. Instead the digital images were manipulated by an experienced operator in order to take advantage of digital system software program. The periapical status was evaluated for the marked tooth in each digital radiograph using the periapical index (PAI) mentioned above.

The results of each observer interpretation were statistically analysed using Fleiss kappa analytical test.

## RESULTS

The complete Fleiss kappa for the 9 raters observation is 0.54 (P < .001). This is in the moderate range (0.4 to 0.6) of agreement for the 9 rater's observation as shown in table given below. The degree of agreement between specialist endodontic and endodontic final-year residents is observed as 85%, between specialist endodontic and students is observed as 60%. The percentage of agreement between endodontic final-year residents to students is observed as 70%.

## DISCUSSION

The interobserver agreement assessment in the diagnosis of periapical status using digital radiographic system has a special practical implication because a large number of dentists use this method along with clinical examination and other radiographic investigations.

The disparities associated with construing and interpreting radiographic images is a factor influencing the diagnostic accuracy of identifying periapical lesions. Interpretation of information captured by radiographic imaging modalities is central to the diagnostic process.<sup>9</sup> Systematic and methodical interpretation processes must be followed for all images. There are different factors that can influence the process of interpretation which include type of digital radiographic system, viewing conditions, human eye limitations, optical illusions, training and experience of the examiner. "According to Goldman et al, we do not read radiographs; we interpret them. If the interpretation is not correct, then the diagnosis could be incorrect". A study reported that

TABLE 1: "FLEISS KAPPA" ANALYTICAL TEST VALUES

Kappa Value	Degree of agreement
<u>≤</u> 0	Poor
0.0-0.2	$\operatorname{Slight}$
0.2-0.4	Fair
0.4-0.6	Moderate
0.6-0.8	Substantial
0.8-1.0	Almost perfect



Fig 1: Periapical Index (PAI) score

digital radiographic system is the most commonly used imaging modality used by most of the endodontists.A question is still there that whether this imaging modality has enhanced the operators radiographic image interpretation skill and make a proper diagnosis?<sup>10</sup>

In our study the interobserver agreement ranges from 60% to 85%. The interobserver agreement as calculated by fleiss kappa is 0.54(P < .001) which is in the moderate range (0.4 to 0.6) of agreement. The results found in our study are similar to Tirell et al.,who found a high interobserver agreement of 85.6%. Another study conducted by Abhishek Rajan Pati shows similar results who found good inter-rater (kappa > 0.61) agreement score for the interpretation of two different radiographic techiques.<sup>11</sup>

The percentage of agreement between specialist endodontist and endodontic final-year residents was observed as 85%, between specialist endodontist to students was observed as 60%.The percentage of agreement between endodontic final-year residents to students was observed as 70%.These results show that interobserver agreement is excellent for experienced observers while it is moderate when observers have a different level of experience.

The primary objective of radiographic technology in dentistry is to facilitate a dentist in the process of detection and diagnosis of disease. This study establishes that advances in digital radiographic system have led to better interpretation of radiographic images and subsequent diagnosis of disease processes.

The limitation of our study is that in order to evaluate images the observers were not permitted to take advantage of any image enhancement inserts incorporated in the Digora® Optime software system. Instead the digital images were manipulated by an experienced operator in order to take advantage of digital system software program. This could have a beneficial effect on the observers image interpretation ability but individual adjustments would be difficult to record. Results of the prior studies have illustrated that use of such image enhancement tools do not seem to have any beneficial effect on examiners image interpretation ability and subsequent diagnosis.

## CONCLUSION

The results of this study have shown that in dental radiology direct digital imaging is a reliable technique

used by endodontists in order to make diagnosis and execute definitive treatment. The results show that the diagnosis of periapical status using digital radiographic system may not lead to an unjustified number of additional selective radiographs. The results are influenced by two important factors which include familiarity of the operator with a given digital radiographic system and the years of practice of the observers.

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1 Romana Yaqoob:	Principal author, abstract, Introduction, discussion,
2 Nazia jahan:	Literature search.
3 Alia Ahmed:	Idea, conclusion.
4 Anum Moiz:	Reference citation.
5 Usman Ibrahim:	Data collection and data analysis.