

## The effect of developer age and film thickness on diagnostic accuracy of Kodak insight (F-speed) and Ektaspeed plus (E-speed) films in position assessment of file tip to radiographic apex

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### ABSTRACT

**Objectives :** To determine the effect of developer age and film thickness on diagnostic accuracy of E and F- speed films in position assessment of file tip to radiographic apex., **Study design:** Endodontic files size 10 and 15 were placed in mandibular first molar and second premolar up to the root apex or 1.5 mm shorter. Ten series of radiographs were made with two types of film: Kodak insight (F-speed film) and Ektaspeed plus (E-speed film) in different positions of file in apex or 1.5 mm short. The films of each series were processed manually on each day, using Champion chemicals. The films were assessed by four endodontists. They rated the position of file tip to radiographic apex using a 3-point confidence scale in the questionnaires (tip to tip, 1.5 mm under, can not diagnose). The diagnostic performance of observers was compared with true diagnosis., **Results :** Mean Az value of E and F-speed films, that shows the diagnostic accuracy is 0.986 and 0.983 for E and F-speed films respectively, that was not significantly different ( $P = 0.777$ ). Also diagnostic accuracy of films processed during 10 days was not statistically different ( $P = 0.726$ ). Assessment of files tip size 10 and 15 in lower molar and premolar canals was not significantly different ( $P = 0.712$ )., **Conclusion :** The performance of the F-speed film was not statistically different from E-speed for assessment of file tip to radiographic apex. Because of less required exposure, we suggest to use Kodak insight (F-speed film) in clinical examination.

**Key words:** Diagnostic accuracy, Intra oral radiographic film, Working length

### INTRODUCTION

Radiography is an essential tool in routine dental practice for caries diagnosis and root canal treatment [1]. Assessment of the working length is an initial important stage in root canal therapy. Parallel periapical radiography

is the best technique for assessment and measuring the working length [2]. Ektaspeed plus films usually are used to determine the working length because of their excess availability [3,4].

A major objective of diagnostic radiology is to provide images of optimal quality at a radiation dose as low as reasonably achievable [1]. One of the most effective ways to reduce patient radiation exposure is using more sensitive films (Kodak insight F-speed film). These films have larger silver halid grains and thicker emulsion, thus need lower x-ray radiation (20% less x-ray exposure compared with E-speed films) to produce equal diagnostic accuracy [5,6]. According to former studies, the conditions of processing influence

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the sensiometric characteristics of F-speed films [7,8].

Today in dental office, developers are used in little volume (about 250 cc) and about one week. If the diagnostic accuracy of E and F-speed films in low volume developer was similar, it would reduce patients and personnel dose and increase x-ray tube life. In addition, the effect of developer age and file thickness on diagnostic accuracy of E and F-speed films to determine the position of file tip to radiographic apex, have been studied.

## MATERIALS AND METHODS

In order to simulate clinical examination, a dried human mandibular segment containing premolar and molar teeth was used. The root canal of the left second premolar and the mesiobuccal and distobuccal canals of the first molar were accessed. The radiographic length of the root canals was determined under the supervision of endodontist with a #20 K-file (Dentsply-Maillefer, Ballaigues, Switzerland) and Kodak Ektaspeed dental film (Eastman Kodak Co. NY, USA). Endodontic #10 and 15 K-files (Dentsply-Maillefer, Ballaigues, Switzerland) were placed at the apex or 1.5 mm shorter. A light-cured composite resin stop was used, so that, the files could be reused in the same position. A series of radiographs with different combinations of correct and short file length was made with Planmeca Prostyle x-ray unit (Planmeca Oy, Helsinki, Finland) operating at 63 kvp, 8 mA and 36 cm SID. The parallel technique with a endodontic film holder (Endoray, Rinn Densply) was used to minimize the magnification and distortion.

The exposure time was 0.20s for E-speed dental film and 0.16s for F-speed dental film according to the manufacturer's recommendation (about 20% less exposure for F-speed film compared with E-speed film). 1.7cm selfcure acrylic resin was used as scattering agent to stimulate soft tissue.

Four identical series of radiographs were obtained with each type of films and file sizes. because of different file length (tip to tip or 1.5mm shorter) in three canals, each series

consisted of eight different modes and therefore 32 radiographs were obtained. To assessment the effect of developer age on diagnostic accuracy of radiographs, this procedures was done 10 days and finally 320 radiographs were made.

The films were processed manually with Champion chemicals (X-ray Iran Co, Tehran, Iran) in the same condition (1min developing, 15s washing, 2min fixing and 5min final washing) at  $25 -C \pm 1$ . For similarity to dental office, little volume developer (250cc) was used. Every day, 32 radiographs randomly were divided into eight groups of four. Each group was processed in individual set (eight similar set for developer, fixer and water). To similarity the number of processed radiographs with dental office and helping developer aging, eight radiographs of a step-wedge were processed until day 9<sup>th</sup>. Four endodontists were asked to rate the position of file tip in relation to the apex of the tooth on a three-point scales: U:1.5mm under, T: tip to tip and CD: can not diagnose.

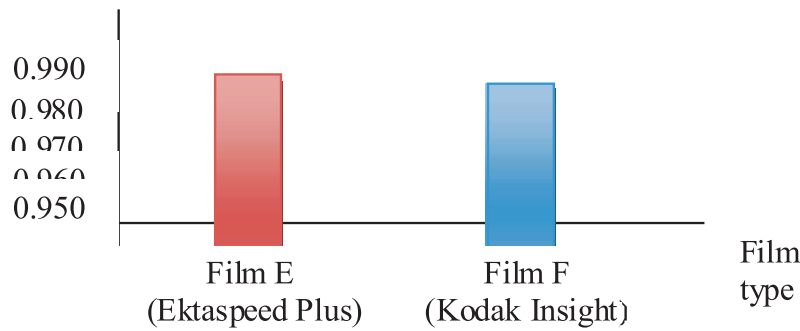
Data analysis was performed with ROC, T-test and ANOVA tests.

## RESULTS

Mean value (showing diagnostic accuracy) of Kodak insight (F-speed) and Ektaspeed plus (E-speed) films were determined with ROC analysis and were compared with each other (Table 1- Figure1). value of E-speed film was 0.986 and for F-speed film was 0.983. According to the analysis, there was no significant difference between two types of films in determining the position of file tip in relation to the apex ( $P = 0.777$ ).

Diagnostic accuracy of determining the position of size #10 and 15 K-files, was not statistically different in mandibular second premolar and first molar canals ( $P=0.712$ ). Also, the comparison of mean Az value from day 1<sup>st</sup> to day 10<sup>th</sup> showed that, diagnostic accuracy of processed films in 10 days of

**Figure 1:**  $A_z$  mean values of four observers with E and F-speed films



**Table1:**  $A_z$  values of four observers with E and F-speed films, and comparison them with T-test analysis

	$A_z$ of E film	$A_z$ of F film
No.1 observer	0.994	0.992
No.2 observer	0.969	0.956
No.3 observer	0.994	0.992
No.4 observer	0.990	0.994
$A_z$ Mean value	0.986	0.983

developer aging, was not significantly different (P = 0.726) (Table 2).

## DISCUSSION

	$A_z$ First day	$A_z$ Second day	$A_z$ Third day	$A_z$ Fourth day	$A_z$ Fifth day	$A_z$ Sixth day	$A_z$ Seventh day	$A_z$ Eighth day	$A_z$ Ninth day	$A_z$ Tenth day
No.1 observer	0.979	0.990	0.979	0.990	0.990	1.000	1.000	1.000	1.000	1.000
No.2 observer	0.969	0.948	0.990	0.938	0.990	0.969	0.938	0.990	0.958	0.938
No.3 observer	0.979	0.990	0.969	0.990	1.000	1.000	1.000	1.000	1.000	1.000
No.4 observer	0.979	0.958	1.000	1.000	1.000	1.000	1.000	1.000	0.990	0.990
$A_z$ Mean value	0.976	0.971	0.984	0.979	0.995	0.992	0.984	0.997	0.987	0.982

The main variable in this study was the film. Syriopoulos et al, reported mean value of E and F-speed films, 0.966 and 0.962 respectively and founded that this two types of films had no significant difference in determining the position of file tip to radiographic apex [4].

According to the analysis, E and F-speed films are not different in determining the position of file tip in relation to the apex and in clinical examination, Kodak insight (F-speed) films can be used because of its lower x-ray exposure needed.

Another effective parameter in this study was developer aging. Meanof observers was not significant difference in 10 days and were in agreement with Casanova et al findings [3]. They showed that useful developer aging in first 19 days was similar.

Determining the exact useful solution life without volume consideration will not be practical. We concluded that, Kodak insight (F-speed) films do not have any undesired effect on image quality but also reduce the patient and personnel exposure dose. This study continued after day 10<sup>th</sup> with only E-speed film and size15 file. The results indicated that, image quality was acceptable until day 20<sup>th</sup>.

In conclusion, we founded that proper exposure and careful processing with little volume developer can be used in dental office at least for ten days. Also, under standard conditions of the exposure and processing, files size #10 and 15 can be used in determining working length in normal root canal anatomy and proper position (e.g. posterior of mandible). It is obvious that, if the position of teeth is improper (e.g. posterior of maxilla) and the root canals are unusual, files size #10 and 15 will help less often, and larger files (at least size20) must be used to determine apex position.

## CONCLUSION

Under the condition of this study, we suggest to use Kodak Insight (F-speed) films in clinical examination, because of less required exposure.

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