

International Journal of Research in Health and Allied Sciences

Journal home page: www.ijrhas.com

Official Publication of "Society for Scientific Research and Studies" [Regd.]

ISSN: 2455-7803

Index Copernicus value [ICV] = 68.10;

ORIGINAL RESEARCH

Evaluation of efficiency of K-file and H-file in root canal preparation

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ABSTRACT:

Aim: To evaluate H-files and K-files in an in vitro study of how fast and effective were the instrumentation in comparison with each other in root canal treatment by taking into consideration time, taperness, and deformities. **Materials and Methods:** Thirty human single rooted, single canal, and non-carious extracted premolar teeth for orthodontic treatment were collected from private dental clinics and stored in a bottle of thymol. Canal preparations were then divided into two groups: group 1 evaluated K-files and group 2 evaluated H-files. Data were analyzed using SPSS Version 23. **Results:** Overall, the maximum time taken for root canal preparation was (11.10±1.71 minutes) and the least time taken was (4.43±0.75 minutes). The time taken by both K and H-files for root canal preparation was more in phase I than phase II. In phase I, the time taken by K-file for root canal preparation was more than H-file. However, Mann-Whitney U test showed no statistically significant difference (p>0.05). On the other hand, time taken by K-file was statistically significantly (p<0.05) more than H-file in phase II. **Conclusions:** This study have shown K-file taking less time than H-file in root canal preparation. Deformities have shown more in H-file and teeth prepared with K-file have shown more tapering.

Keywords: Root canal preparation, K-file, H-file

Received: 12 April, 2020

Accepted: 24 April, 2020

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This article may be cited as: Shoaib BF, Melibary R, Alshehri R, Alghusen N, Aljohar N, Ateeq SB, Alsultan A. Evaluation of efficiency of K-file and H-file in root canal preparation. Int J Res Health Allied Sci 2020; 6(3):36-39.

INTRODUCTION

The ideal root canal preparation is to be tapered in shape, but to achieve this shape any canal aberrations may develop during the preparation. The primary goal is preparing the root canal to enhance apical healing.¹ The main purpose is cleaning all the walls of the canal with irrigation and use of instrument like files to keep the original anatomy of the canal.² To prevent cases of reinfection fluid-tight root canal fillings and sealing the coronal part of the tooth by a restoration is done.³ The notion being to perform complete chemo-mechanical debridement of the canal to the apical foramen.⁴ The ideal shape of canal for subsequent obturation is

tapering conical form with the smallest diameter in the apical.² Files can be made of carbon, stainless steel, and nickel titanium.⁴

There are several factors determined in file selection which is file length, resistance to fracture by twisting, resistance to corrosion, stiffness, and ease of use.⁵ Many studies have been published related to the cutting efficiency of H-files or K-files in vitro. The evaluation of how fast and effective where the instrumentation with H-files and K-files in the root canal treatment showed that in machining ability, H-file IS much more efficient than K-file. H-files are much smaller, smooth zips with outer wall of the canal curve and has more

favorable properties like its flexibility and round blunt tip and in filing motion. Canal enlargement with K-file was time consuming and took more than twice of H-file. K-file failed more frequently because the inflexible nature.⁶ The use of K-file in the canals is questionable.¹ H-files are more flexible and more susceptible to fracture.² With K-files the deformation were consistent during root canal instrumentation in extracted teeth. Working part of H-files had more deformities during instrumentation of the root canal in extracted teeth more than the K-files.⁷ Among deformity and fracture instruments more H-files were found to be deformed.⁸ H-file failure is closely associated with the fracture mechanism. Fracture file shows many cracks mostly located at the flutes depth region.⁹ H-file pack less of debris toward the apex than K-file. Cutting properties of H-file are outward stroke while K-file cut inward and outward.¹

In many cases, problems and difficulties in instrumentation phase of root canal preparation can happen when the files are used continuously. To avoid any future problems, files used in canal instrumentation should be obtained from one single manufacturer. Due to differences in dimensions, having files from several manufacturers can arise problems in dimensional variability. Despite the certification of the files, it is better to have them all from a single manufacturer to make sure of the proper fit during canal instrumentation.⁵ The efficiency we need to assess is how fast or efficiently the instrumentation to enlarge the dentin.⁶ These factors should be considered in future studies in order to choose the right file for each procedure.⁵ The aim of this in vitro study is to evaluate H-files and K-files how fast and effective were the instrumentation in comparison with each other in root canal treatment by taking into consideration time, taperness, and deformities.

METHODS

Thirty freshly extracted permanent human premolar teeth were collected from private dental clinics in Riyadh. Sample power was 0.8 (80%). The teeth were extracted reason for orthodontic treatment. Teeth were stored in bottle containing thymol solution at room temperature

Selection criteria of teeth

Single root

Non-carious

Single canal

Teeth preparation done in laboratory

Pre-operative digital radiograph using (Sidex program)

Pre-operative preparation (Mounting the tooth in plaster blocks)

Root canal preparation

Divided in two groups:

“Prodent” Hedstrom files (length 25 mm)

“IMD” K-files (length 25 mm)

Irrigation: Normal saline (0.9% w/v sodium chloride and 2.5 % sodium hypochlorite)

Lubricant: MD-Chelcream (EDTA-cream)

Instrumentation was done and time was measured after each phase in minutes. Post-operative radiograph is taken using same program. Inter-examination will be done between investigators as well as intra-examination to calculate the result and check reliability of canal preparation. Data were subjected to statistical analysis using IBM SPSS Version 23. Mann-Whitney U test was performed for statistical significance. A p value of ≤ 0.05 was considered statistically significant.

RESULTS

Overall, the maximum time taken for root canal preparation was by examiner 3 using K-file during phase I (11.10 ± 1.71 minutes) and the least time taken was by examiner 4 using H-file during phase II (4.43 ± 0.75 minutes) (Table 1). The time taken by both K and H-files for root canal preparation was more in phase I than phase II. In phase I, the time taken by K-file for root canal preparation was more than H-file. However, Mann-Whitney U test showed no statistically significant difference ($p=0.878$). On the other hand, time taken by K-file was statistically significantly ($p=0.031$) more than H-file in phase II (Figure 1). One H-file was broken during preparation. Intra-examination between the examiner done and reliability and efficiency of canal preparation done between each examiner. Figure 2 shows deformities of the files. None of the three K-files showed deformities. On the other hand, only one H-file showed no deformities, one was broken, and the other corrosion. Figure 3 shows the tapering of the canal. Two of the three K-file showed very acceptable tapering of the canal and one showed acceptable tapering of the canal. On the other hand, two of the three H-file showed poor tapering of the canal and one showed acceptable tapering of the canal. However, tapering depends on the morphology of the canal.

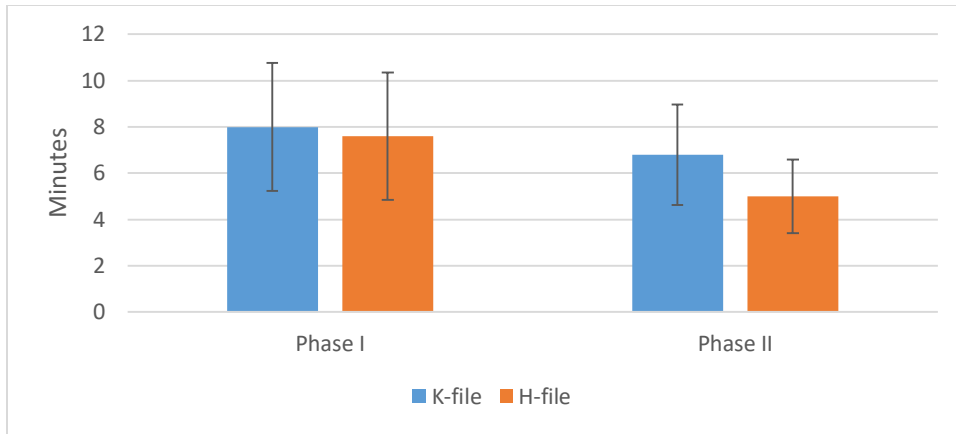


Figure 1. Comparison of time taken (minutes) for root canal preparation

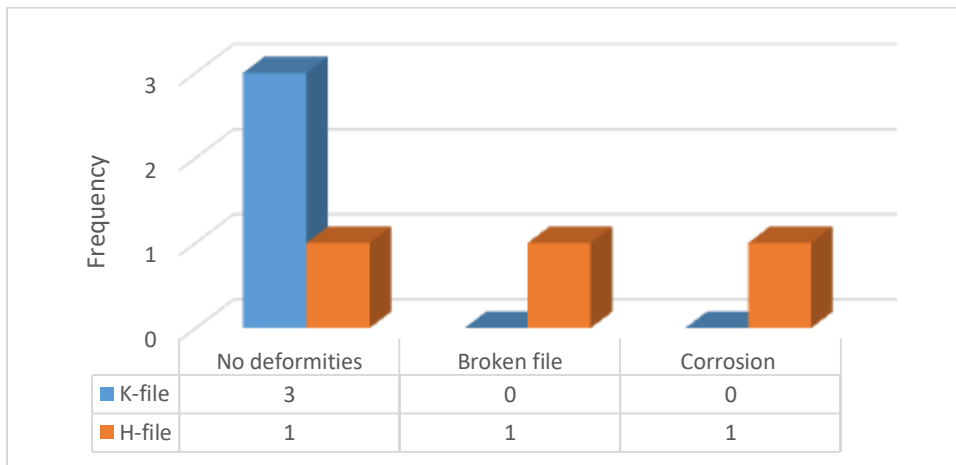


Figure 2. Defective files

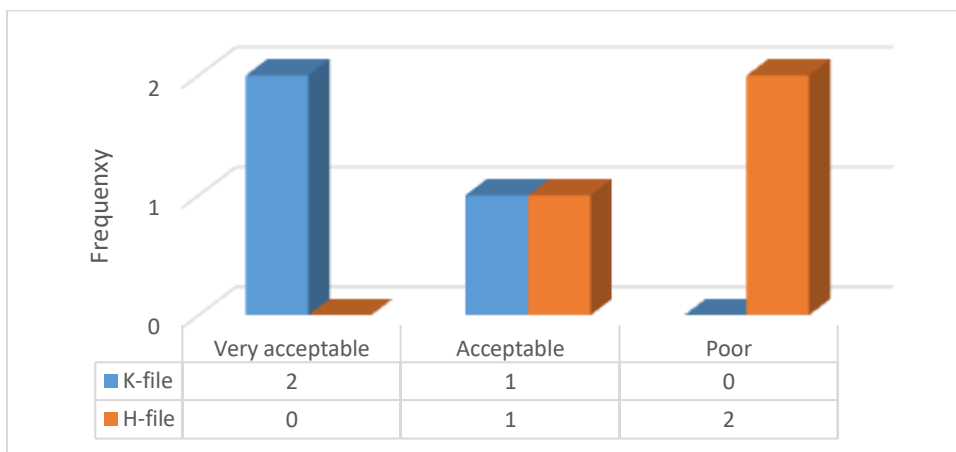


Figure 3. Tapering of the canal

Table 1. Mean±Standard Deviation time (minutes) for root canal preparation

File	Examiner	Mean±Standard Deviation	
		Phase I	Phase II
K-file	Examiner 1	6.51±2.12	5.59±0.92
	Examiner 2	6.37±1.09	5.71±1.10
	Examiner 3	11.10±1.71	9.11±2.14
H-file	Examiner 4	9.10±2.60	4.43±0.75
	Examiner 5	6.98±1.38	4.62±2.54
	Examiner 6	7.10±4.00	5.79±0.48

DISCUSSION

The primary goal root canal preparation is preparing the root canal to enhance apical healing. One of the most important objectives of root canal treatment is root canal preparation system which includes removal of necrotic pulp tissues and canal debris along with infected dentine. Canal preparation facilitate canal disinfection by using root canal medicaments and irrigations to prevent cases of reinfection. Significant finding of present study is that the instrumentation time recorded for manual instrumentation of H and K-files. The working time by both H and K-files for root canal preparation required for phase I has been shown to be longer when compared phase II. On the other hand, working time required for K-file has been shown to be longer when compared to H-file.

Using of H-file hand instrument may have shorter time preparation than the K-file. In the present study, to obtain similar instrumentation conditions, all instruments were used 4 times in 4 different extracted premolar teeth. None of the three K-files showed deformities. On the other hand, only one H-file showed no deformities, one was broken, and the other corrosion. Other study showed similar result, deformation of K-files were fairly consistent during root canal instrumentation in extracted teeth and deformation of the working part of H-files were also fairly consistent during instrumentation of the root canal in extracted teeth but in a slightly larger number than the K-files.⁷ Deformity and fracture instruments were more, maximum H-files were deformed.⁸

CONCLUSION

In endodontic treatment, the main objective is to achieve tapering canal shape and minimizing and preventing any canal aberrations during the preparation with minimized working time. In this study have K-files have taken less time than H-files. Deformities were more in H-file and teeth prepared with K-file showed more tapering than H-file.

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