



In Vitro and *In Vivo* Comparison of Self Adjusting Files (SAF) System and Manual Instrumentation for Root Canal Preparation and Obturation in Deciduous Teeth

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Received: March 11, 2020; Published: March 17, 2020

Abstract

Objectives: This study was designed to evaluate *in vitro* the use of SAF system in root canals of deciduous teeth in comparison with K-files, and to compare *in vivo* the clinical results.

Materials and Methods: *In vitro*-Root canals of eight deciduous incisors were prepared using K-files and SAF system and obstructed with iodoform paste. The roots were sliced horizontally and observed under light microscope. *In vivo*-Root canals of two deciduous mandibular second molars were treated in a young girl using K-files or SAF system.

Results: *In vitro*-The K-files reshaped the original contour of the canals to oval and caused dentinal cracks. The SAF system retained original contour of the canals and no dentinal cracks were observed. The iodoform based paste penetrated the dentin tubuli, deeper when the SAF system was used. *In vivo*-The clinical case showed that the result of pulpectomy in deciduous molar using of the SAF system was similar to the result obtained with K-files.

Conclusion: Clinically the use of SAF in deciduous teeth can prevent cracks in the dentin and retain the original thickness of the dentin walls.

Keywords: Deciduous Molars; Dentinal Cracks; Iodoform Paste; K-files; SAF System

Introduction

The primary goal in pediatric dentistry is to retain the deciduous teeth in the oral cavity until physiological exfoliation in order to preserve arch integrity and normal eruption of permanent teeth [1]. The pulpectomy procedure is the treatment of choice when encountering symptomatic deciduous teeth with chronic inflammation or necrosis of the radicular pulp [2]. This procedure involves complete removal of the pulpal tissue, debridement, irrigation and preparation of the canal space followed by obturation with a suitable resorbable paste [3]. Proper biomechanical preparation greatly increases the chance of success of this treatment [4]. An adequate cleaning and shaping of the canals is important for removal of the infected tissue and provide a pathway for the irrigating solution to reach the apical third of the root and for proper obturation [5]. Hand instrumentation with files is the standardized method of cleaning and shaping of the canals in deciduous teeth and despite being the most acceptable method, it is time consuming and can

result in iatrogenic errors [6]. In permanent teeth Nickel-titanium (Ni-Ti) rotary instrumentation is widely used. Using various rotary Ni-Ti systems for instrumentation of the deciduous root canals is emerging among pediatric dentists in the last years. Several studies have been conducted to evaluate the efficiency of using rotary instrumentation for pulpectomy in primary teeth [7,8]. In India, 50% of the pediatric dentists are using rotary systems for pulpectomy in deciduous teeth and 27% of them felt that both length and taper of the existing rotary files caused potential difficulties in using them in children. Also, 66% of them felt that an easy exclusive pediatric rotary file should be invented for treatment of primary teeth in children [9].

The Self-Adjusting File (SAF) system is a cleaning-shaping-irrigation system [10]. It preserve the original shape of the root canal, clean the dentinal walls and irrigates the canal during the procedure [11,12]. In permanent teeth the SAF system showed promising results.

Aim of the Study

The aim of the study was: a. To assess, *in vitro*, the effect of SAF system in comparison to hand K-files on root canal preparation and obturation of deciduous incisors and b. To compare, *in vivo*, the differences between SAF and hand K-files preparation in treatment of the root canals of deciduous second molars.

Materials and Methods

All the procedures were performed by a single pediatric dentist having adequate knowledge with rotary and hand instrumentation techniques.

In vitro study: Eight primary anterior teeth were used. The teeth were intact without loss of tissue due to caries or trauma and were extracted for orthodontic reasons. The teeth were kept in saline till the root canal preparation. The teeth were divided into 2 groups.

Group 1: In four teeth the pulp chamber was accessed with 330 carbide bur under adequate irrigation. Hand instrumentation was performed with #15, 20, 30, 35 K-files with irrigation with saline after each file. The canals were filled with iodoform containing paste, Endoflas (Sanlor Laboratories, Colombia, Batch 141, Expire date: 02-2022), using a lentulo bur. A periapical X-ray was performed to assess the pulpectomy and obturation quality (Figure 1A).

Group 2: The pulp was accessed with 330 carbide bur under adequate irrigation. Root canal access was performed with file #25. The canals were prepared with the SAF system under adequate irrigation during the procedure. Preparation duration was 2 minutes for each root canal. The root canals were filled with iodoform containing material, Endoflas (Sanlor Laboratories, Colombia, Batch 141, Expire date: 02-2022), using a lentulo bur. A periapical X-ray was performed to assess the pulpectomy and obturation quality (Figure 1B).



Figure 1: *In vitro* root canal preparation and obturation using SAF system and K-files. A. X-ray of the deciduous centrals treated with SAF system. B. X-ray of the deciduous centrals treated with K-files.

All teeth were invested in epoxy resin (Epofix Resin, Struers, Denmark, Batch 8134-01) and the roots were sliced horizontally into slices of 2 mm thickness using Isomet 1000. The slices were examined using a light microscope (Best scope) at X10 enlargement, and the pictures were transferred to a computer.

In vivo treatment: A three years old healthy girl was referred to the pediatric dental clinic at Barzilai Medical University Center in Ashkelon due to complain of pain in the lower deciduous molars. She was diagnosed with severe early childhood caries (Figure 2A). The treatment was performed under general anesthesia due to behavior problem and multiple treatments needed.

In the left mandibular second deciduous molar, pulpectomy was performed using K-files, #15-35 with saline irrigation between files, obturation with a iodoform based paste (Endoflas-Sanlor Laboratories, Colombia, Batch 141, Expire date: 02-2022) and a stainless steel crown (3M/ESPE, Germany) was cemented. In the right deciduous second molar pulpectomy was performed using the SAF system, after gaining access to the pulp chamber with #25 K-file. Each canal was filed for 2 minutes while rinsing with saline, finalizing the obturation with iodoform based paste and a stainless steel crown cemented. Periapical radiographs were performed to assess the result of the procedure (Figure 2B).

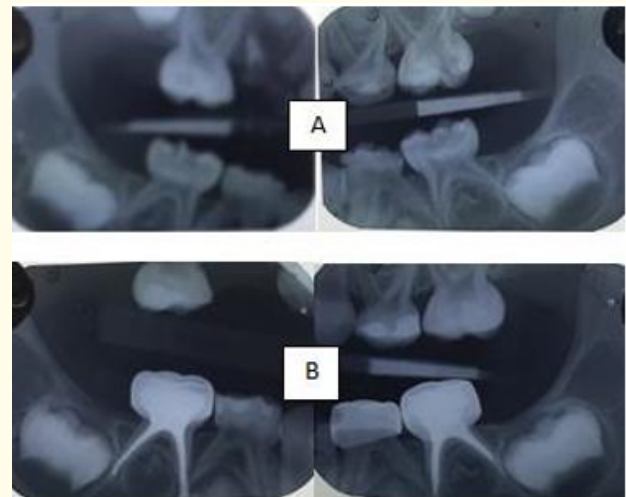


Figure 2: *In vivo* case. A. Bite wings of the teeth before treatment. B. Post-operative X-rays of the second deciduous molars treated with SAF system (left) and K-files (right).

Results

In vitro: The final X-rays showed an acceptable obturation of the canals with both systems (Figure 1). In the deciduous incisors treated with hand K-files, the canal was reshaped to oval and did not follow the external shape of the root. In three out of the four root canals treated with hand K-files dentinal cracks were observed. Two of cracks were up to half the width of the root dentine, and one included the entire width of the root dentine. The cracks were observed on all slices of the root (Figure 3A). In the root canals treated with SAF the contour of the canal was not changed and followed the external shape of the root. None of the teeth treated with the SAF system showed fractures or cracks (Figure 3B). Another finding observed in the two groups was the spread of the iodoform paste into the dentine tubuli from about a third of the dentin width in the canals treated with hand files to more than half of the width of the dentine in canals treated with the SAF system (Figure 3A and 3B).

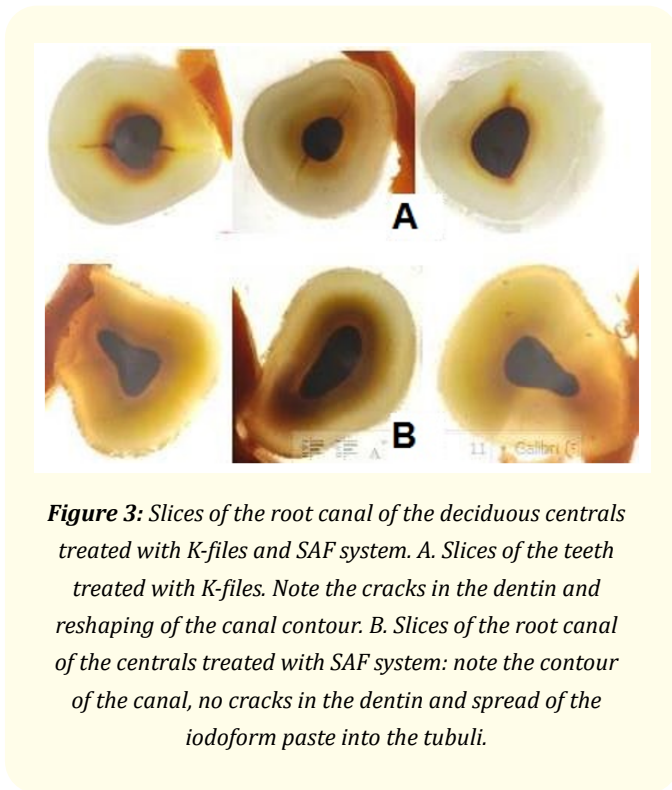


Figure 3: Slices of the root canal of the deciduous centrals treated with K-files and SAF system. A. Slices of the teeth treated with K-files. Note the cracks in the dentin and reshaping of the canal contour. B. Slices of the root canal of the centrals treated with SAF system: note the contour of the canal, no cracks in the dentin and spread of the iodoform paste into the tubuli.

The clinical case: No significant differences were observed between the root canal treatment of the two deciduous molars (Figure 2B). Follow up of one year showed no clinical symptoms in the teeth.

Discussion

New and traditional files in endodontic treatment work using the same system-as long as the canals are simple straight and narrow with a round cross-section, the goals of root canal instrumentation and shaping are achieved. The problems begin with either oval or C-shaped canals, when the hand or rotatory files will change the shape of the roots. Another problem is the creation of micro-cracks in the radicular dentin in a high percentage, which may dispose the treated roots to vertical root fracture [13-16]. The SAF system is a shaping and cleaning system designed for minimally invasive endodontic treatment [17,18]. Complete debridement of the root canal system can be used as an aide predicting endodontic success. Extrusion of debris into the periapical region may result in post-operative inflammation and treatment failure. The use of the SAF system in comparison with two rotatory systems showed that the SAF system exhibited significantly less debris extrusion [19]. This may also explain the minimal post-operative pain observed when SAF system was used in one-visit endodontics in comparison with continuous rotary system and a reciprocal system [20]. In deciduous teeth the use of SAF system showed significantly less dentin removal and instrumentation time was similar to rotatory system and less than manual instrumentation [21]. In this *in vitro* study the use of SAF system resulted in root canal shape similar to the outer shape of the root, in comparison to the oval root canal shaping of the manual files, almost no removal of dentin and no horizontal cracks formation in the root dentin. The SAF system reduces the chance of horizontal and vertical root fracture by keeping the full thickness of the root dentine and no cracks formation. The better infiltration of the iodoform paste into the dentinal tubules may be explained by the amount of debris accumulated on the dentin tubuli openings. The SAF system created less debris and the tubules are wide open, facilitating more iodoform paste to enter and spread almost to the cementum layer.

The clinical case showed that the SAF system can be used successfully in one-visit root canal treatment of primary molar and the final x-ray showed a very good result.

Conclusion

In primary canal system the K-files changed the outline of the canal and caused dentin cracks.

The SAF system maintained the canal shape and no dentin cracks were performed.

The iodoform paste penetrated the dentin tubuli to a larger extent after using the SAF, probably due to lesser amount of debris on the tubuli openings.

Statement

The authors deny any conflicts of interest related to this study.

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Volume 3 Issue 4 April 2020

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