

SELF-ADJUSTING FILES (SAF) A FILE WITH A WILL OF ITS OWN- A REVIEW



Dr. VASUNDHARA SHIVANNA, M.D.S.,
Professor & Head



Dr. SURESH SHENVI, PG student

Department of Conservative Dentistry and Endodontics,

INTRODUCTION

Endodontics is under constant revolution and with the introduction of the Nickel Titanium(NiTi) alloy for the manufacturing of manual and rotary endodontic instruments made treatment is more efficient and less time consuming. The NiTi are mainly used for its extraordinary characteristics of superelasticity and strength^{1,2} which made it possible to manufacture rotary instruments with double, triple and quadruple taper compared to the traditional manual instruments in turn making it easier to obtain a perfect shaped canal with the use of very few instruments in a short period of time.^{3,4} Many file designs have been tested and introduced which mainly differ in rake angle, radial lands design, helical pitch, or thickness of the core.⁵⁻⁷

But recently many studies have found that in cases of long-oval canals such as distal canals in lower molars, the circular design of these conventional NiTi files leave around 60% or more canal surface uninstrumented.⁸ The same limitations can also be found in other cross-sectional canal configurations like round, flattened, or irregular canals in which both hand and rotary instruments when used in a reaming motion leave untouched fins or recesses which might harbor remnants of pulp tissue or bacterial biofilms and may also contain dentin chips generated and pushed during instrumentation resulting in compromised seal of root canal filling.⁹

Self-adjusting file (SAF) by ReDent-Nova(Figure No.1) is one such new endodontic file that has a capacity to allow uniform dentin removal along the perimeter of these

anatomically complex root canals with few other advantages over the conventional NiTi rotary files.⁸

ADVANTAGES OVER CONVENTIONAL ROTARY NITI FILES

When an flat or oval canals are prepared with conventional rotary files, there is inadequate preparation of buccal and lingual and area facing the isthmus in tear-shaped one, mainly because of the round cross-section of current rotary files.⁹ An in- vitro study done by Ove A. Peters and Frank Paque to study the Canal Preparation of Maxillary Molars With the use of Self-adjusting File found that canals in maxillary molars were homogenously and circumferentially prepared with little canal transportation as confirmed under Micro-computed Tomography.¹⁶ Conventional rotary NiTi files also produce apical canal transportation in curved root canals and also have greater chance of straightening of the root canal at the midroot section. Another document drawback with these files is the chances of unexpected separation in the canal during preparation.¹⁰

The SAF helps to overcome these disadvantages as it adapts itself to the three- dimensional anatomy of root canals and removes higher and uniform amount of dentin from the inner wall of the canal as seen under high resolution micro-CT. Hence the name is self adjusting file. There is also less chances of canal transportation and even if the over instrumentation takes place, there is minimal chances of zip formation. Hence it helps to achieve the principle of maintaining the original canal anatomy too.^{8,11}

DESIGN OF SELF-ADJUSTING FILE

The SAF is a hollow and flexible instrument designed as a compressible thin-walled pointed cylinder composed of 120-mm-thick NiTi lattice (Figure No.2). The surface contains is light abrasive to which helps for uniform removal of dentin during a back-and-forth grinding motion. A reciprocating vibrating handpiece is necessary for the use of SAF files.^{8,11}

METHOD OF USE

With the vibration SAF is pushed until it reaches the predetermined working length and operated with in-and-out manual motion with continuous irrigation using two cycles of 2 minutes each for a total of 4 minutes per canal. This procedure is said to remove a uniform dentin layer of 60- to 75-mm thick from the canal circumference. The SAF file is designed for single use. A vibration, of 3,000 to 5,000 per minute and a 0.4-mm amplitude is used during the action 3 to 5 min.^{8,11}

METHOD OF IRRIGATION

A special rinsing unit is attached to the hollow design which allows for continuous delivery of irrigants throughout the procedure. Irrigation is performed via a silicon tube that is attached to a rotating hub on the shaft of the file. Once the irrigant freely escapes into the canal through the lattice wall, it then flows back coronally and escapes through the access cavity.^{8,11} Sodium hypochlorite is the most commonly preferred irrigant with SAF too^{8,11,12,13}. However, many research have confirmed that when it is used along with EDTA the greater amount of smear layer removal can be obtained.¹⁴

A study done by Zvi Metzger et al evaluated the cleaning ability of the Self-Adjusting File (SAF) system in terms of removal of debris and smear layer. It found that the SAF operation with continuous irrigation, using alternating irrigants, resulted in root canal walls that were free of debris in all thirds of the canal in all (100%) of the samples. In addition, 100% and 80% of the coronal and middle thirds of the canal, were free of smear layer respectively. But only 65% of root canals were smear layer free in apical one third.¹⁷

In a study it was also found that application of the SAF does not push the irrigant beyond the apical foramen.¹¹

In another study done by Jose' F. Siqueira et al the ability of the newly developed SAF system to eliminate viable *Enterococcus faecalis* populations from long oval root canals of extracted human teeth as compared with rotary NiTi instrumentation with syringe and needle irrigation and found that the SAF cleaning-shaping-irrigation system was significantly more effective than rotary NiTi instrumentation used with syringe and needle irrigation in eliminating viable *E. faecalis* cells from long oval root canals in vitro.¹⁵

METHOD FOR OBTURATION OF THE SAF PREPARED CANALS

The obturation with solvent dipped customized master cones is more useful in appreciating the actual shape of SAF treated canals. However any method of obturation can be used for SAF treated canals.⁸

MECHANICAL ANALYSIS OF SAF FILES

The durability of SAF is higher as there is absence of core making it possible to have greater flexibility, which allows the distribution of the forces thought the file, hence it is less susceptible for fracture. A study done by Rafael Hof, Valery Perevalov, Moshe Eltanani, Raviv Zary, and Zvi Metzger found that the SAF file may be elastically compressed from a diameter of 1.5 mm to dimensions resembling those of an ISO # 20 K-file mainly because of its special design (Figure No.3) Compressing the SAF file generates circumferential force which makes it more elastic than the conventional NiTi files. Also the ability to remove dentin declines as the diameter of the canal enlarges. The SAF file is mechanically durable for continuous operation for 29 minutes.¹¹

LIMITATIONS OF SAF

Although SAF has been proved superior to other conventional NiTi files, but originally they were introduced only for preparation of anterior tooth.¹⁶ However many recent studies have found good results when they are used in posterior tooth as well.^{8,9,11,16} Another must requirement is the need of separate irrigation system which needs to be connected to the file during preparation.^{8,11,17}

CONCLUSION

The SAF , a file with a will of its own , a new approach in endodontic file design, one single file for better preparation quality due to its self-adapting property with less chance of formation of canal aberrations, transportations and separated instruments . In the end giving a better canal preparation with higher smear free canal surface.

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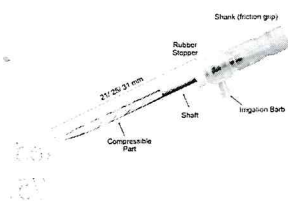


Figure No 1. Self
Adjusting Files



Figure No.2. Thick NiTi
lattice of SAF files

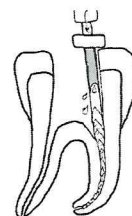


Figure No.3. Adaptation
of SAF files to the canals