Endodontics
ISSN 1516-4055 *versão impressa*

ECLER Endod. v.1 n.3 São Paulo Set. 1999

EVALUATION AND COMPARSION OF THE CUTTING EFFICIENCY OF NITIFLEX AND FLEXOFILE IN NATURAL TEETH

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SUMMARY

Objective: The aim of this study was to evaluate the cutting efficiency of nickel-titanium files (NiTiflex), and to compare it with the one of stainless steel files (Flexofile). **Methods:** For so much, natural teeth were instrumented with the aid of an apparel that allowed to transmit the instrument constant movements with time, speed, frequency and controlled tension. . Teeth were weighted before and after preparation with the machine, obtaining so the weight differences of the sample wich means its cutting efficiency. **Results and Conclusion:** Statistical analysis of the results showed that nickel-titanium files sizes 25 and 35 ($p>0.05$) and 30 ($p>0,001$) cut less than Flexofiles and it was not significant for the other sizes.

Keywords: Cutting Efficiency – Instruments – Root canal preparation

INTRODUCTION

During endodontic treatment, debridement of the root canal system is an important stage, especially because such preparation presents as objectives the cleanliness and shaping of the root canal.

This properties are directly associated to the enlargement and instrumentation of the root canal, wich are obtained by action of instruments on the canal walls in association with chemical substances.

About these instruments, some properties are demanded, wich have been suffering continuous alterations and consequent improvements in its revenue according to the technician - scientific development, on its design and alloy.

The characteristics and material used in its manufacture promote the instrument some properties, among them we would mention, for example, flexibility, torsional resistance, bending, besides cutting efficiency.

Among new technological compositions of endodontic instruments, it is stood out manufactured them in a nickel-titanium alloy. These one presents as properties a larger flexibility checked by several authors [1,5,6,7,8,9,10,11,18] being like this of big worth when used in accentuated curved canals.

Though, in the inquiry referent its torsional resistance, they have an inferior behavior comparing to the stainless steel ones [4], what indicates its using with caution, specially when of its using in rotation movements.

Among other demand properties, cutting efficiency is a fundamental requirement to obtain a more efficient root canal preparation. The results were contradictory in the analysis of the literature [2,3,13,14], maintaining the doubt in relation to the performance of this instrument and its consequences, such as obtaining an adequate shape and desinfection.

The purpose of the present study was to evaluate "in vitro" the cutting efficiency of Flexofile instruments due to its efficiency, front NiTiflex.

MATERIALS E METHOD

a) Materials

- 24 stainless steel instruments with 21mm length - Flexofile (Maillefer-Swiss Made)
- 24 stainless nickel-titanium instruments with 21mm length - NiTiflex (Maillefer-Swiss Made)

- 8 mandibular pre-molars with curvatures between 10 e 30 degrees
- Chemically activated resin Dencor (Clássico – São Paulo - SP)
- Mettler analytic balance with accuracy of 3x10-5g (Mettler H80) between values to 160g with standard deviation of 0,1mg

- An appliance (Fig. 1) wich was composed of an electric motor of 24V, that could reach until 1800rpm, was connected directly to a centric disc (Cd) with a diameter of 16,5 cm, that it was united by a pulley to another eccentric disc (Ed) with a diameter of 56,5 cm that established a reduction of : 3,42, that means for each turn of Cd, the Ed should give 3,42 turns. From the Ed a piston that promoted the pull action movement in the horizontal direction to a driller broaches, where the instrument would be trapped. This movement width from 3 to 4mm. It also had a General key (Gk) that turned on the set, and also worked as a time counting (variation between 0 and 60s). After every actuation, it was necessary to turn the General Key (Gk) on to restart. It also had a speed regulator (Sr) that, due to the characteristics of motor and disks to tie up, it made movements to the piston up to 526 blows per minute (1800rpm/3,42-redution).

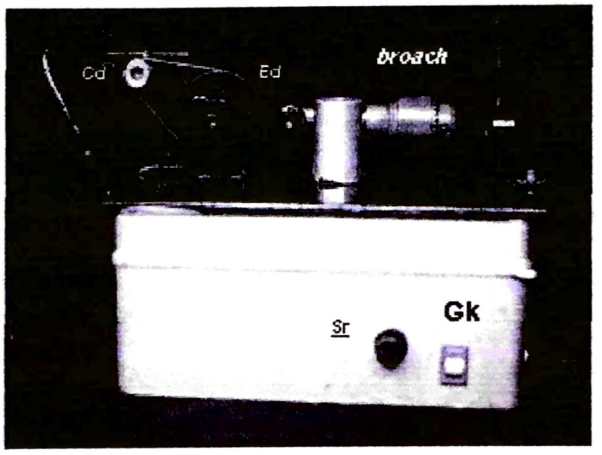

Fig 1 – machine that evaluate the cutting efficiency, see the Cd, joined by a pulley to the Ed, the general key (Gk) and the speed regulator (Sr) and the broach

- statistical analysis was used the program GMC7.2 in a computer Pentium MMX 166

b) Method

Teeth were included in chemically activated resin to facilitate the apprehension and retentivity, and the crown-root junction should be at the level of the resin, keeping the crown in the external position. (Fig.2)

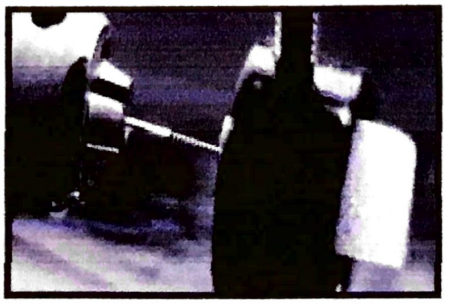

Fig. 2 – file in position to instrument the root canal in the machine

Thus, dental crowns were wasted with carboril disks with consequent exposition of radicular duct wich was instrumented. This set should present height, width e lengths of approximately 15mm accomplishing the waste when necessary.

The samples were divided in two groups (Table 1) and for each tooth an instrumentation was accomplished o a complete seriation that was composed for instruments from 15 to 40. Initially these ones were taken to the scale and then were weighed. This procedure was accomplished so that each new weighing; the scale should be gauged in zero. Then, it was weighed a leaf of aluminum paper, to avoid possible residues to interfere. It was proceeded to *the weighing of tooth descounted later the weight of paper.*

Table 1 – division of the groups to be instrumented

GRUPOS	tipo de instrumento
Grupos 1 a 4	Flexofile
Grupos 5 a 8	NiTiflex

The samples were taken to the machine, and the instrument was inserted and joined in the broach that should be to a height of 30mm from the base in a platform. The tooth was placed in this platform extreme in a metal hoop with a diameter of an inch and at 22mm from the base of the platform, what allowed maintaining it in a closed height to the instrument.

Once the positioned instrument, the machine had been turned on for 2 minutes (2 times of 1 minute) with 250 rpm (or blows per minute) in agreement MELLO et al (1992)[16].

In each instrument changing, teeth were weighed again, following the same way previously described. The found weight difference was considered the Cutting action of the instrument. *These values were analyzed in absolute and percentage values.*

From these values, similar sizes and types was averaged it, wich were compared between different types and sizes. To these Values was applied the test of normality and statistical analysis by the Kruskal-Wallis test.

RESULTS

Results are shown in tables 2 and graphic 1. Statistical analysis is shown in table 3.

Table 2 – Absolute values obtained from the differences , in grams, of the weight differences of Flexofile e NiTiflex files and relationship in percentage among them.

File Size	File Type NiTiflex	Flexofile	% NiTiflex X Flexofile
15	0.0010	0.0007	30% (NiTi)
20	0.0003	0.0003	0%
25	0.0008	0.0060	86.67% (Flexo)
30	0.0012	0.0053	77.36% (Flexo)
35	0.0007	0.0025	72.00% (Flexo)
40	0.0007	0.0008	12.5% (Flexo)
total	0.0047	0.0156	69.88% (Flexo)

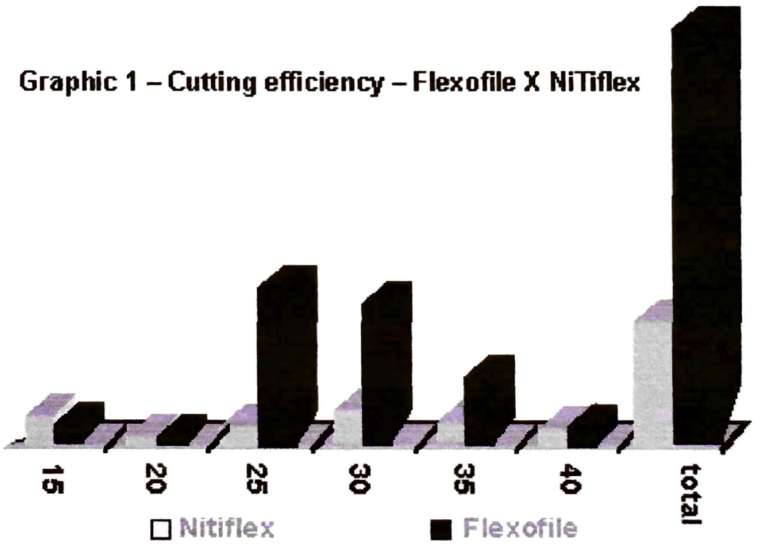

Table 3 – Significance Statistical Analysis according Kruskal-Wallis test.

Amostras comparadas	Significância
Flex 15 X NiTi 15	*Ns*
Flex 20 X NiTi 20	*Ns*
Flex 25 X NiTi 25	*5%*
Flex 30 X NiTi 30	*0,1%*
Flex 35 X NiTi 35	*5%*
Flex 40 X NiTi 40	*Ns*

NiTi – NiTiflex; Flex – Flexofile; Ns – no significant

DISCUSSION

The scientific – technological evaluation, specially in what is reported about the instruments of endodontic using, generates a great progress with nickel-titanium alloys in its manufacture, facilitating the accomplishment for the preparation of severely curved root canals with larger safety and less occurrence of zips, elbows and apical deviations [1,6,7,8,9,10,11,18]. According to this fact, , its comprovated largest flexibility when compared to stainless steel instruments [17], aiding us in the reach of the main objectives of cleaning and desinfection and consequent preservation of the tooth.

Besides this great flexibility, other properties should be printed out, as torsional resistance, wich is lower[4] And also cutting efficiency, wich show us previously results different and some times contradictory [2,3,13,14] what may limitate this instrument indication.

Using natural teeth takes us to a closer result for our clinical reality, even using an apparatus wich presents constant power and cinematics and different from the common used. However, this condition, for us, was essential to standardize the action of the instrument and to allow, this way, the used analogies. The evaluation accomplished through the weight variance with the aid of a scale of precision,, allows an effective [13,16].

Instrument choosing was base on recent literature , and it was established Flexofile as control for our experiment comparing to a nickel-titanium one.

From the result analysis, we verified a great variation, especially relationed to the diameter of the instrument used. We verified a tendency in the case of nickel-titanium files of a similar cutting for all file sizes, but to Flexofile ones there is a tendency of a larger cutting in instruments sizes 25, 30 and 35

When used Kruskal-Wallis test (Table 3) for the statistical analysis, we verified there is no significant difference between groups of size 15, 20 and 40. However, there is significant difference at the level of 0,1% for file sizes 30 and at the level of 5% for files sizes 25 and 35.

In relation to the percentage of cutting efficiency of nickel-titanium files in relation to Flexofiles, we can verify that files sizes 15, the first ones have 42,85% larger cutting than stainless steel files (0,0010g X 0,0007g). ,For the size 20 files, booth have similar values

(0,0003g), while files in larger sizes , it means 25, 30, 35 and 40, have presented similar results, respectively 86,67%(0,0008g X 0,0060g), 77,36% (0,0012g X 0,0053g), 72% (0,0007g X 0,0025g) e 22,5% (0,0007g X 0,0008g) lower , showing an amount of weight losses of 0.0047g to the nickel-titanium files and 0.0156g to Flexofile, what means 69,88% less, showing its smallest cutting.

This findings allows us to elaborate clinical consequences, such as the need of a delayed preparation with nickel-titanium files, knowing that, for a continuous preparation it is necessary to enlarge the canal until a higher size file can reach the apical portion of the canal and continue the preparation.

To minimize that time losing, instruments with caliber intermediary may be used (Golden Mediums for example). They facilitate the preparation because they are intercalled with nickel-titanium ones. Another variation to be considered is the technique used, being possible to limit instrument action to the apical third, as the Cervico-apical technique [15], where cervical and medium thirds of the root canal are instrumented with Gates-Glidden drills, leaving the incidence of strength of the instrument to the apical third, allowing a better and quicker preparation

So, the use of rotating instruments, or with drills for instrumentation of the medium and cervical thirds of the canal, even with files to the apical third of the canal, they seems to be valious aids in obtaining a faster and efficient preparation, specially when used with instruments of nickel-titanium alloy.

This set of characteristics, it shows a great flexibility, wich allows to take preparations in severely curved root canals, with larger amplifications of apical region, being possible a better desinfection and cleaning of the root canal, besides shape, making possible the filling procedures in a simple way, being therefore, a great assistant of our arsenal for those cases. However, its cutting efficiency wouldn't justify its employment in straight canals or with soft curvatures.

CONCLUSION

1. For sizes 25, 30 e 35, nickel-titanium has a lower cutting efficiency then stainless steel.
2. The cutting efficiency for nickel-titanium files is similar for different sizes, while Flexofiles presents a tendency of higher cutting efficiency for sizes 25, 30 and 35.

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