

## Original Research Article

# Undergraduates' opinion after 5-year experience with rotary endodontic instruments

Denise Piotto Leonardi<sup>1</sup>  
Flares Baratto-Filho<sup>1</sup>  
Gisele Aihara Haragushiku<sup>1</sup>  
Flávia Sens Fagundes Tomazinho<sup>1</sup>  
Maria da Graça Kfoury Lopes<sup>1</sup>  
Alexandre Moro<sup>1</sup>

### Corresponding author:

Flares Baratto-Filho  
Positivo University – Department of Dentistry  
5.300, Professor Pedro Viriato Parigot de Souza St. – Campo Comprido  
ZIP code 81280-330 – Curitiba  
E-mail: fbaratto@uol.com.br

<sup>1</sup> Department of Dentistry, Positivo University – Curitiba – PR – Brazil.

**Received for publication: July 26, 2010. Accepted for publication: August 29, 2010.**

### Keywords:

Endodontics; dental education; rotary instrumentation; root canal preparation.

### Abstract

**Introduction:** Dentistry evolution in the past few years has revolutionized daily practice in some specialties. One of these revolutions has occurred in Endodontics due to the advancement of rotary techniques for root canal preparation and its subsequent incorporation into the teaching of Dentistry undergraduates. **Objective:** The aim of this study was to report a 5-year experience on the undergraduate laboratorial and clinical use of rotary endodontic preparation at a private university. **Material and methods:** Data survey was performed by using a questionnaire composed of nine objective questions; the questionnaire was answered by the undergraduates. **Results:** The results showed a positive acceptance regarding the undergraduate teaching of the rotary technique (94.7%). The following advantages were highlighted: faster root canal preparation (91.6%) and reduction of patient's stress (80.9%). **Conclusion:** It can be concluded that the experience with the two undergraduate groups was excellent due to the high acceptance level of the new technique by the students.

## Introduction

The evolution of Nickel-Titanium (NiTi) endodontic files for root canal shaping has provided a new reality in Endodontics. The research has reported the efficacy of rotary instruments preparation in addition to their advantages over hand files, such as a better performance, faster preparation, and less stress for both the patient and professional [1, 2].

Although rotary instrument techniques have not been part of the basic procedures taught at all Dentistry schools, general dental clinicians, newly graduated dentists, and specialists in Endodontics have acquired and used the different options of rotary instruments and automated devices at their offices [8].

In 2001, the European Society of Endodontology published guidelines emphasizing the importance of raising the status of the undergraduate teaching of Endodontics in order to guarantee an improvement in daily clinical practice [5]. According to Spangberg [17], in that same year, it was logical and natural that Dentistry schools taught at least one technique employing NiTi rotary instruments.

In Brazil, rotary instrument techniques have developed mainly in the past few years, which led to the introduction of this technique in the Endodontic disciplines of the Dentistry graduation courses. This was also an "unavoidable evolution" because of its high acceptance in the Brazilian market.

Endodontics' curricular guidelines, at graduation, have aimed to improve the educational pattern through introducing and using more modern and current systems. These latter guidelines, therefore, also stimulate the continued education and enable the undergraduates to obtain a minimum competence level for executing most of the endodontic treatments [8]. In addition, it would be better for students to learn the rotary instrument techniques during undergraduate studies than through the representative personnel of the rotary instruments' manufacturers. Moreover, theoretically, undergraduates can develop a higher ability level in rotary instrument handling than dentists who have already graduated because they would not possess any bad habits with hand instrumentation.

Despite the greatest technological advancement, NiTi rotary endodontic instruments have presented a high fracture level when compared to stainless steel hand files. Because NiTi instruments do not show apparent deformation, the probability of occurring fractures considerably increases after several uses, mostly if the proper precautions were not performed during their use and discard. Some of

these precautions include imposing proper velocity, keeping the instrument in adequate kinematics, and maintaining a torque control [13, 18, 19].

Even facing the inherent difficulties of root canal mechanized preparation, several authors reported that the previous training could reduce the accidents to acceptable levels; they also stated that hand technique would be more complex. Therefore, they are indicated to be taught after the rotary technique, which would be considered simpler [16].

Biomechanical root canal shaping with rotary instruments is a reality in several universities worldwide. In Brazil, as of 2004, only five dental schools employed this technology at graduation. Currently, more than sixty schools employ this technique. In this context, the aim of this study was to report the undergraduates' opinion and acceptance concerning rotary endodontic instrumentation, followed-up during the last 5 years (2005-2009) at a private university.

## Material and methods

This research was approved by the Ethical Committee in Research of the Positivo University. The study was performed by analyzing the responses to a questionnaire made up of nine multiple-choice questions. The questionnaire was randomly distributed to 250 undergraduates of the 4<sup>th</sup> (125) and 5<sup>th</sup> (125) grades of the Dentistry School of the Positivo University during the experiment. The questionnaire was delivered and returned personally. Data obtained from the responses were submitted to percentage analysis and presented as tables (tables I and II).

The teaching-learning process used in the Endodontics discipline of the Positivo University has been performed in the following way: at the laboratory (4<sup>th</sup> grade), a theoretical-practical approach is executed where the hand technique is taught followed by the teaching of the rotary technique. Both techniques have been applied at the laboratorial phase (during 4 months) in all dental groups before the beginning of the clinical phase. In the Endodontic clinics, throughout 4 months, the undergraduate must execute at least two teeth per technique. The undergraduate is then free to choose which technique will be employed in the following treatments. At 5<sup>th</sup> grade (last year of graduation), the student decides which technique will be employed during the clinical treatment. On average, at each semester, root canals of 900 extracted teeth and 190 teeth of patients has been shaped and filled in Positivo University's Endodontic clinic.

The endodontic treatments performed in the Endodontics discipline have been taught and performed in crown-down technique when the undergraduate uses the hand technique with K-Flexofile hand files (Dentsply-Maillefer, Ballaigues, Switzerland) and Gates Glidden burs (Dentsply-Maillefer, Ballaigues, Switzerland), and also when using Profile.04 rotary instruments (Dentsply-Maillefer, Ballaigues, Switzerland), connected to a pneumatic reducer micromotor. The contra-angle handpieces mostly used during the questionnaire's application period were: Endoflex 70:1 (Dentflex,

Ribeirão Preto, SP, Brazil), without torque control; and NiTi Control 64:1 (Anthogyr, Sallanches, France), without torque control.

## Results

The descriptive statistic analysis was employed. The return index of the questionnaires was 52.4% of the 250 questionnaires. Table I expresses the number of questionnaires distributed and answered according to the grade studied. The questions and their respective answers are shown in table II.

**Table I** - Number of questionnaires distributed and responded

<b>Delivered Questionnaires/Grade</b>	<b>Responded Questionnaires/Grade</b>
125 (100%) / 4 <sup>th</sup>	46 (36.8%) / 4 <sup>th</sup>
125 (100%) / 5 <sup>th</sup>	85 (68.0%) / 5 <sup>th</sup>
Total 250 (100%)	131 (52.4%)

**Table II** - Total applied questionnaire showing numeric and percentage results

<b>N</b>	<b>%</b>	<b>Questions</b>
		1) Considering the root canal preparation techniques taught by the discipline, which do you prefer?
53	40.5%	Hand instrumentation
78	59.5%	Rotary instrumentation
		2) Do you consider positive the introduction of rotary instrumentation during graduation?
124	94.7%	Yes
7	5.3%	No
		3) Which technique do you think that provides a faster preparation?
11	8.4%	Hand instrumentation
120	91.6%	Rotary instrumentation
		4) Which technique is safer?
90	68.7%	Hand instrumentation
41	31.3%	Rotary instrumentation
		5) Which technique do you think that provides a better root canal preparation?
50	38.2%	Hand instrumentation
81	61.8%	Rotary instrumentation
		6) Which technique do you think that allows a better access to the most restricted areas of the mouth?

78	59.5%	Hand instrumentation
53	40.5%	Rotary instrumentation
		7) Have you ever fractured an instrument? Which?
1	0.8%	Hand files
3	2.3%	Rotary files
52	39.7%	Gates
75	57.2%	I have not
		8) Do you know when you should discard the files?
95	72.5%	Yes
36	27.5%	No
		9) Which technique do you think that reduces the patient's stress?
24	18.3%	Hand instrumentation
106	80.9%	Rotary instrumentation
1	0.8%	Blank answer

## Discussion

Studies on the evaluation of the consequence of rotary instrumentation teaching at Dentistry graduation can guide the demonstration of new techniques and construction of new instruments, according to the undergraduates' acceptance and comments. Undergraduates do not yet have the habit of employing any type of endodontic instrument (either hand or rotary).

The teaching-learning process employed in the Endodontics discipline of the Positivo University has been developed based on problematization, in which the content is organized in order that the undergraduate correlates theory to practical learning. This avoids the separation of the theoretical from the practical learning and enables the problems to be perceived and solved through the reality observation, creating constant cognitive challenges for professors and students. In problematization, the transformative action-reflection-action relation is the basic axis of the process orientation [3]. Therefore, the professor can identify the individual difficulties of the students and guide them so that they establish a proper relationship between the theoretical and practical knowledge regarding root canal mechanical instrumentation.

The incorporation of rotary instrumentation within the teaching-learning process of undergraduates was considered highly positive (94.7%) in this study. It

was observed that the undergraduates appreciate the possibility of choosing which technique they could employ, demonstrating a preference regarding the mechanical technique (59.5%). The undergraduate's contemplation of the rotary instrumentation also occurs because they have been participating in an important evolution of Endodontics, as well as due to the introduction and use of resources that, previously, were taught only in post-graduate courses.

The topics comprising the questionnaire of this study were: the velocity and quality of the preparation, reduction of patient's stress, safety during the instruments use, fracture index, knowledge on the instruments discard, and the access of restricted mouth areas.

The quality and time amount of root canal shaping were pointed out as the most positive aspects. Interestingly, both depend on the operator's ability. The sensation of fastness could be due to ease of technique and lack of tactile sensibility during the preparation, which results in lower clinician fatigue.

NiTi alloy has enabled great advancements in the design of new instruments, such as taper and cut angles variations, as well as support surfaces and spirals with greater escapement area; this leads to the creation of new preparing techniques [6]. Other factors that may contribute to the ease of technique were the evolution of the reducer contra-angle handpieces connected to micromotors

in addition to the consolidation of the crown-down technique [7] performed in the crown-apex direction. The preparation fastness provided by rotary instruments, which was highlighted by the undergraduates in this research, would occur not only because of the instrument rotation furnished by the contra-angle, but also because the use of the crown-down technique principle applied by the discipline, which facilitates the access to the apical third of the root canal.

According to the responses obtained in this study, the reduction in patient's stress was pointed out as a significant factor for choosing the use of rotary instrumentation. The reduced time in performing the endodontic treatment, as well as the decrease in the discomfort caused by the file movements when employing hand files, provided a higher level of comfort to the patient.

The European Society of Endodontology stated that each undergraduate must prepare a total of twenty teeth during the course; however, some authors questioned if this number should be increased with the introduction of the automated preparation, and if there would be a better learning with either the two systems or the substitution of hand to rotary instrumentation [5, 15, 16]. Due to clinical experience, it is known that rotary instruments have been used to optimize the endodontic treatment and not to banish hand instruments. This is true mainly when use of hand files would be essential, such as in cases of elbows within curved root canals, in which it is necessary to previously curve the stainless steel file to surpass them.

A greater operator's insecurity regarding the possibility of accidents was indicated as the main disadvantage in using rotary instrumentation. The risk of instrument fracture has been the main problem associated with the automated preparing, reported by newly graduated professionals with little experience [11, 19]. It is difficult to completely eliminate the risk of errors and accidents; however, the clinician should aim to reduce these occurrences, employing a safe technique (mainly based on the knowledge of the instrument design and adequate kinematics). The presence of nickel-titanium alloy in rotary instruments' composition not only enabled a lower number of preparation defects. It is important to note that the taper also has influenced the flexibility and, consequently, may interfere in shaping. Hand files have a .02 taper and can be more flexible than NiTi instruments with a higher taper, such as #.04 and #.06. Therefore,

it is important to note that the instrument design and the technique employed influence the final quality of the root canal shaping.

Although the undergraduates reported a higher insecurity, a great majority (97.7%) responded that they never fractured any rotary instrument, an index very close to the fractures that occurred in hand instrumentation (99.2%). In the specific question about instrument fractures, most of the respondents reported that they never fractured any instrument (57.2%). Fifty-two undergraduates (39.7%) answered that they had fractured the Gates Glidden bur. Consequently, the use of this instrument as a cervical and medium third shaper must be employed with extreme caution, mainly when bur #1 is used. The high fracture index of Gates Glidden bur does not cause greater problems because the fragment is easily removed (when the fracture occurs in the concordance radius) or can be surpassed by an instrument due to its transversal section [10]. Although the fracture of rotary instruments was present in 2.3% of the questionnaires, it can be considered low and did not interfere with the choice of the undergraduates to use automated instrumentation. It is worth noting that, before introducing any rotary instrument inside the root canal, the undergraduate uses small-sized files to negotiate it, for previously knowing root canal morphology and verifying its path and negotiation. In 2009, Shen *et al.* [14] showed that rotary systems were successfully introduced at graduation concerning fracture index; however, small-sized instruments, such as Profile #20, must be discarded after its first use because of its great possibility of showing torsional deformation.

In an attempt to reduce the fracture index, the discard of instruments after a number of uses should be considered. The university where this study was conducted states that the NiTi files must be discarded after a mean of five uses, and the K-type and Flexofile after one to three uses. Notwithstanding, not only the number of uses could influence on the life cycle of an instrument, but also the root canal characteristics in which the instrument was employed (e.g., markedly curved root canals) [12]. When the undergraduates were questioned about the adequate discard of the files, 95 (72.5%) answered that they knew when performing it. In 2006, Iqbal *et al.* [9] evaluated the fracture incidence between hand and rotary instruments employed in graduation and observed that NiTi rotary instruments showed a greater tendency towards fracture compared to stainless steel hand

files. However, these authors reported that the fracture index of rotary instruments was low, even when used by undergraduates with little experience.

Despite the low fracture index found by this study, it is worth highlighting that the undergraduates generally used reducer contra-angle handpieces with and without torque control, even though it is known that torque-controlled electric motors have shown advantages regarding this accident type. In 2002, Yared and Kulkarni [20] verified the instruments' fracture index in relation to different torque levels (high, moderate, low) during root canal preparation performed by experienced and inexperienced professionals. The authors observed that inexperienced professionals reached a lower fracture level when root canal shaping was performed with low torque. This index was also low when experienced professionals employed high or moderate torque during root canal preparing, confirming the importance of controlled and constant torque in addition to the professional experience, which is achieved only with clinical practice. Therefore, it is quite clear that instrument fracture is a complex problem that involves several factors, such as operator's experience and ability, root canal morphology, torque control, and number of instrument uses.

Root canal shaping with rotary instruments is a reality in current Endodontics because Endodontists and general dentists have employed it at their offices. Consequently, teaching mechanized instrumentation during undergraduate studies is sensible. The teaching of the Profile system was chosen because this is made up of instruments with a more basic design among rotary systems. This teaching facilitates the undergraduates' comprehension, mainly because they use the same technique sequence both for hand and rotary preparation. To complement the analysis of the Endodontic treatments using rotary files in undergraduation, it would be important to conduct a study in the future to evaluate the outcome of these endodontic treatments through clinical and radiographic follow-up examinations [4].

The preference for this new technology occurs due to the increase of velocity and efficiency of endodontic treatments, providing more comfort and benefit for the patient and operator. Additionally, the preferences presented here show the undergraduates' opinion, reflecting a natural tendency due to its employability.

## Conclusion

The 5 years of rotary technique teaching at a private university is considered excellent because the undergraduates demonstrated a great level of acceptance of the new technique.

## References

1. Baratto Filho F, Carvalho JR, Fariniuk LF, Sousa Neto MD, Pécora JD, Cruz Filho AM. Morphometric analysis of the effectiveness of different concentrations of sodium hypochlorite with rotary instrumentation for root canal cleaning. *Braz Dent J.* 2004;15(1):36-40.
2. Baumann MA, Roth A. Effect of experience on quality of canal preparation with Rotary nickel-titanium files. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod.* 1999;88(6):714-18.
3. Cyrino EG, Toralles-Pereira ML. Discovery-based teaching and learning strategies in health: problematization and problem-based learning. *Cad Saúde Pública.* 2004;20(3):780-8.
4. De Quadros I, Gomes BP, Zaia AA, Ferraz CC, Souza-Filho FJ. Evaluation of endodontic treatments performed by students in a Brazilian dental school. *J Dent Educ.* 2005;69(10):1161-70.
5. European Society of Endodontology. Undergraduate curriculum guidelines for Endodontology. *Int Endod J.* 2001;34(8):574-80.
6. Fariniuk LF, Baratto Filho F, Cruz-Filho AM, Sousa Neto MD. Histologic analysis of the cleaning capacity of mechanical endodontic instruments activated by the Endoflash system. *J Endod.* 2003;9(10):651-53.
7. Gurgel-Filho ED, Vivacqua-Gomes N, Gomes BPFA, Ferraz CCR, Zaia AA, Souza-Filho FJ. *In vitro* evaluation of the effectiveness of the chemomechanical preparation against *Enterococcus faecalis* after single- or multiple-visit root canal treatment. *Braz Oral Res.* 2007;21(4):308-13.
8. Hänni S, Schönenberger K, Peters OA, Barbakow F. Teaching an engine-driven preparation technique to undergraduates: initial observations. *Int Endod J.* 2003;36(7):476-82.
9. Iqbal MK, Kohli MR, Kim JS. A retrospective clinical study of incidence of root canal instrument separation in an endodontics graduate program: a PennEndo database study. *J Endod.* 2006;32(11):1048-52.

10. Luebke NH, Brantley WA, Alapati SB, Mitchell JC, Lausten LL, Daehn GS. Bending fatigue study of nickel-titanium Gates Glidden drills. *J Endod.* 2005;31(7):523-5.
11. Mesgouez C, Rilliard F, Matossian L, Nassiri K, Mandel E. Influence of operator experience on canal preparation time when using the rotary Ni-Ti ProFile system in simulated curved canals. *Int Endod J.* 2003;36:161-5.
12. Plotino G, Grande NM, Cordaro M, Testarelli L, Gambarini G. Influence of the shape of artificial canals on the fatigue resistance of NiTi rotary instruments. *Int Endod J.* 2010;43(1):69-75.
13. Pruett JP, Clement DJ, Carnes Jr. DL. Cyclic fatigue testing of nickel-titanium endodontic instruments. *J Endod.* 1997;23(2):77-85.
14. Shen Y, Coil JM, McLean AG, Hemerling DL, Haapasalo M. Defects in nickel-titanium instruments after clinical use. Part 5: single use from endodontic specialty practices. *J Endod.* 2009;35(10):1363-7.
15. Sonntag D, Delschen S, Stachniss V. Root-canal shaping with manual and rotary Ni-Ti files performed by students. *Int Endod J.* 2003;36(11):715-23.
16. Sonntag D, Guntermann A, Kim SK, Stachniss V. Root canal shaping with manual stainless steel files and rotary Ni-Ti files performed by students. *Int Endod J.* 2003;36(4):246-55.
17. Spangberg L. Editorial: the wonderful world of rotary root canal preparation. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod.* 2001;92(5):479.
18. Yared GM, Bou Dagher FE, Machtou P. Failure of ProFile instruments used with high and low torque motors. *Int Endod J.* 2001;34(6):471-5.
19. Yared GM, Bou Dagher FE, Machtou P. Influence of rotational speed, torque and operator's proficiency on ProFile failures. *Int Endod J.* 2001;34(1):47-53.
20. Yared GM, Kulkarni GK. Failure of ProFile Ni-Ti instruments used by an inexperienced operator under access limitations. *Int Endod J.* 2002;35(6):536-41.

---

**How to cite this article:**

Leonardi DP, Baratto-Filho F, Haragushiku GA, Tomazinho FSF, Lopes MGK, Moro A. Undergraduates' opinion after 5-year experience with rotary endodontic instruments. *RSBO.* 2011 Jan-Mar;8(1):61-7.

---