

Retreatment of Thermafill fillings with the ProFile .04 system at 350 or 2000rpm

Retratamento de obturações com o sistema Thermafill por meio do sistema ProFile .04 em 350 ou 2.000 rpm

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 system.

Abstract

This study aimed at determining the quality of removal of the thermafill system in endodontic retreatment with utilization of the 0.04 ProFile system at two different speeds. Thirty single-rooted mandibular canines were divided into two groups. The canals were prepared with the crown-down technique and obturated with the thermafill system with a carrier #40 and Ah-plus sealer. Fillings were removed two weeks after obturation, as follows: Group I – 0.04 ProFile following the size sequence 90, 60, 45, 40 and 45, without solvent, at a speed of 350rpm; Group II – same technique at 2000rpm. The specimens were longitudinally sectioned and were scanned and analyzed by a software (ImageTool) that measured the area of remaining filling material and removal of the plastic carrier. The mean of remnants of filling material was 24.86% at

Group I, 24.91% at Group II and the area was not statistically different (Student's "t" test) between the two groups and all plastic carriers were removed. It was concluded that the quality of removal of the filling material at both speeds (350 or 2000rpm) was similar; and all plastic carriers were removed with success by ProFile .04 system.

Palavras-chave:
retratamento
endodôntico, gutta-
percha, sistema
Thermafill.

Resumo

O objetivo deste estudo foi determinar a qualidade de remoção do sistema Thermafill durante o retratamento endodôntico com a utilização do sistema ProFile .04 em duas diferentes velocidades. Trinta caninos com raízes únicas foram preparados pela técnica coroa-ápice e obturados com um carregador número 40 do sistema Thermafill, sendo utilizado como cimento obturador o Ah-plus. Duas semanas após as obturações, a remoção do material obturador foi iniciada da seguinte forma: GRUPO I – sistema ProFile .04 na seqüência 90, 60, 45, 40, 45, sem solvente e na velocidade de 350 rpm; GRUPO II – a mesma técnica, porém em 2.000 rpm. Os espécimes foram então seccionados longitudinalmente e escaneados para a análise por intermédio de um *software* específico (ImageTool), o qual mediu a área de remanescentes obturadores, assim como a presença do carregador plástico do Thermafill. A média de remanescentes de material obturador foi de 24,86% para o Grupo I e 24,91% para o Grupo II, e após a aplicação do teste T-student verificou-se que não houve diferença estatisticamente significativa entre os grupos estudados, havendo a remoção dos carregadores plásticos do Thermafill em todos os espécimes. Conclui-se que a qualidade de remoção do material obturador foi similar para ambas as velocidades empregadas e que os carregadores plásticos foram removidos com sucesso pelo sistema ProFile .04.

Introduction

Endodontic retreatment is a fundamentally important technical procedure in current Endodontics, since it allows reversal of failures of the endodontic therapy. These failures may occur because of different reasons; however, regardless of the reason, the overall aims of endodontic retreatment are proper cleansing and disinfection of the root canal system. Nevertheless, achievement of complete removal of the filling material inside the root canal, adjustment of its shape by endodontic instruments, removal of the smear layer and smear plug, followed by placement of an interappointment dressing to assure disinfection of the root canals are very difficult procedures. These difficulties are often related to the anatomical complexity inherent to each type of teeth, besides others related to the technical limitations of the method used by the professional for the endodontic retreatment.

Regarding the method employed, the literature has been indicating a new means to partially or completely achieve the objectives of retreatment. This method comprises utilization of nickel-titanium rotary instruments, and the results have demonstrated the opportunity to use them. An important technical

aspect previously demonstrated in other investigations refers to the possibility to remove the filling material without the need of gutta-percha solvents [1, 3, 5]. This is an enormous improvement, since it avoids formation of a thin gutta-percha film on the root canal walls, what occurs when solvent is employed, according to Wilcox and Juhlin [10]. This film may impair the action of the antiseptic drug utilized to assure the desired disinfection of the root canal, and also the adaptation of the filling material at completion of retreatment. Another important aspect is the avoidance of utilization of products with different carcinogenic potentials [7] and the risk of excessive solubilization of gutta-percha and its consequent extrusion through the apical foramen.

Different rotary instruments have already been employed for that purpose. The most widely investigated was the ProFile system [1, 2, 5], and Bramante and Betti [3] studied the Quantec SC rotary instruments. It should be highlighted that these two systems exhibit different features. The first is usually presented in a series of instruments with the same taper (unitaper), whereas the second is originally multitaper. The instruments display different tapers, and both have a modified transverse section. This

section is named “U-shaped” for the ProFile system and has three cutting blades, and in the Quantec SC system it is described by Soares and Goldberg [6] as presenting an asymmetric design with two cutting blades. It should be emphasized that both present the “radial land”, or lateral guide, which keeps the instrument centered inside the original root canal and may significantly reduce the cutting ability when a negative cutting angle is found, as observed in the ProFile system. However, this design provides the instrument with a higher resistance, since a larger amount of nickel-titanium alloy is concentrated on its central core. Obviously, these physical differences lead to different outcomes in the procedure of endodontic retreatment. Moreover, the manufacturer of the ProFile .04 system recommends increasing the number of rotations per minute, what was followed by Sae-Lim *et al.* [5].

The aim of this study was to evaluate the remaining filling material after utilization of the ProFile.04 system at the speeds of 350 and 2000rpm, as well as the persistence or not of the Thermafill carriers after endodontic retreatment.

Materials and methods

Thirty single-rooted mandibular canines were selected, with straight root canals and a media length of 25mm. The teeth were supplied by the teeth bank of the University of Joinville (UNIVILLE), where they were stored at a 0.1% thymol solution. This study was approved by the UNIVILLE ethical committee (number 041/2003 – PRPPG/CEP).

The thirty specimens were prepared by the crown-down technique, with Gates Glidden burs (Dentsply-Maillefer, Ballaigues, Switzerland) #1, 2 and 3 in 2mm steps for preparation of the medium and cervical thirds. The apical third was instrumented with ProFile.04 files (Dentsply-Maillefer, Ballaigues, Switzerland) with the electric machine TC 3000 (Nouvag, Switzerland), and the working length instrument was established at file #40.

Filling was performed with the Thermafill system (Dentsply-Maillefer, Ballaigues, Switzerland), on which a thermafill verifier #40 was placed in the working length of the root canal. This length was then transferred to a Thermafill carrier #40. After drying of the root canal, the AH-plus sealer (Dentsply-Maillefer, Ballaigues, Switzerland) was applied on the root canal walls with the Thermafill verifier, the obturator was heated and then inserted in the root canal up to the working length. The carrier was cut at the level of the root canal opening with a diamond bur

#1014 (KG Sorensen, Barueri, Brazil). A radiograph was taken with the X-ray beam in buccolingual direction for observation of the quality of the filling. Afterwards, the specimens were randomly divided into two groups:

GROUP I – Retreatment with the ProFile.04 system at 350rpm.

GROUP II – Retreatment with the ProFile.04 system at 2000rpm.

Removal of the filling material with the ProFile.04 system was initiated two weeks after obturation, by means of the following sequence: ProFile 90 at the cervical third; ProFile 60 up to the medium third; ProFile 45 on the medium third. Thereafter, the apical third was reached with the ProFile 40 and filling removal and enlargement at the apical region was completed with the ProFile 45. The irrigation was performed with 5ml of sodium hypochlorite at 5% between each instrument. The operator pushed the instrument against the root canal walls until it was completely loose. The electric machine employed was also the TC 3000, set at the predetermined speeds of the experimental groups. Removal of the filling materials was recorded by means of radiographs taken in buccolingual direction. All endodontic treatments and retreatments were performed by a single operator and figure 1 displays how the carriers are removed by the rotary instrument.



Figure 1 - Carriers cut by instrument friction

After clearing of the root canals, the specimens had their crowns sectioned with a carborundum disc. The same discs were employed for fabrication of two orientation grooves, one on the buccal and the other on the lingual aspect. After preparation of these grooves, the specimens were longitudinally sectioned with utilization of a chisel and hammer, and two fragments were then obtained (figure 2).

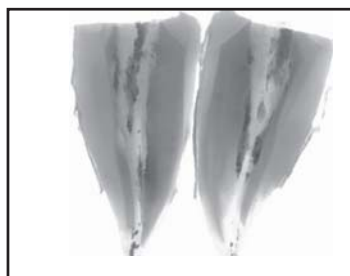


Figure 2 – Aspect of the two fragments achieved after utilization of the chisel and hammer

The fragments were digitized (Genius color page-HR7 series) (figure 2) and submitted to analysis on a specific software named ImageTool (UTHSCSA, version 1.21) (figure 3).



Figure 3 – Calculation of the area of remaining filling material on the ImageTool software

In this software, the fragments had their total area of the root canal and the area of the remaining filling material (sealer, carrier and gutta-percha) calculated in square millimeters. After this calculation, the areas of both fragments were added, as well as the areas of the remaining filling material, therefore providing a precise calculation of the total area of remaining filling material of each specimen. Moreover, the presence or absence of the plastic Thermafill carrier was checked on the ImageTool by investigation of the color of the remnants (sealer – white; gutta-percha – pink; carrier – gray).

The numerical data related to the remaining filling material were submitted to statistical analysis.

Results

The working length previously established was rapidly reached in all specimens.

All plastic carriers of the Thermafill system were completely removed, since the gray color was not found in the analysis of the tooth fragments.

The media of filling material was 24.86% at 350rpm and 24.91% at 2000 rpm. Table I displays the area of remaining filling material recorded in square millimeters in both experimental groups.

Table I – Results achieved after analysis of the images on the ImageTool (square millimeters)

| Group I | | | | | | | Group II | | | | | | |
|-----------|-------|-------|-------|-------|-------|-------|-----------|-------|-------|-------|-------|-------|-------|
| | A | A1 | B | B1 | C | D | | A | A1 | B | B1 | C | D |
| 1 | 61.98 | 19.49 | 63.94 | 20.41 | 39.90 | 31.68 | 16 | 67.86 | 27.34 | 69.87 | 21.18 | 48.52 | 28.50 |
| 2 | 58.21 | 17.15 | 61.18 | 14.35 | 31.50 | 26.38 | 17 | 72.35 | 28.36 | 73.65 | 20.23 | 48.59 | 33.28 |
| 3 | 65.65 | 18.50 | 64.89 | 16.29 | 34.79 | 26.65 | 18 | 67.64 | 14.28 | 66.96 | 12.99 | 27.27 | 20.26 |
| 4 | 69.89 | 17.32 | 68.58 | 15.49 | 32.81 | 23.69 | 19 | 70.21 | 20.54 | 71.14 | 23.69 | 44.23 | 31.29 |
| 5 | 54.32 | 12.65 | 56.89 | 14.38 | 27.03 | 24.30 | 20 | 67.56 | 14.31 | 65.87 | 17.79 | 32.10 | 24.05 |
| 6 | 71.30 | 17.44 | 69.56 | 19.78 | 37.22 | 26.42 | 21 | 62.56 | 16.72 | 64.89 | 18.47 | 35.15 | 27.61 |
| 7 | 68.69 | 18.30 | 66.12 | 19.44 | 37.74 | 27.99 | 22 | 64.32 | 15.90 | 66.57 | 14.67 | 30.57 | 23.35 |
| 8 | 68.35 | 14.85 | 65.89 | 12.38 | 27.23 | 20.28 | 23 | 59.89 | 10.34 | 60.05 | 14.28 | 24.62 | 20.52 |
| 9 | 69.65 | 16.37 | 68.59 | 17.42 | 33.79 | 24.44 | 24 | 65.44 | 13.47 | 66.01 | 12.98 | 26.45 | 20.12 |
| 10 | 68.65 | 15.40 | 68.62 | 13.29 | 28.69 | 20.90 | 25 | 69.72 | 18.99 | 68.62 | 15.48 | 34.47 | 24.91 |
| 11 | 62.25 | 9.98 | 61.56 | 12.34 | 22.32 | 18.02 | 26 | 63.12 | 13.38 | 65.25 | 17.97 | 31.35 | 24.42 |
| 12 | 68.69 | 13.44 | 69.98 | 14.79 | 28.23 | 20.35 | 27 | 63.19 | 14.42 | 63.59 | 18.47 | 32.89 | 25.94 |
| 13 | 63.56 | 14.56 | 64.86 | 16.44 | 31.00 | 24.13 | 28 | 68.81 | 14.01 | 66.88 | 17.04 | 31.05 | 22.88 |
| 14 | 71.02 | 19.37 | 70.95 | 17.68 | 37.05 | 26.09 | 29 | 64.21 | 18.99 | 65.17 | 17.43 | 36.42 | 28.14 |
| 15 | 69.89 | 19.44 | 67.56 | 23.99 | 40.43 | 31.59 | 30 | 60.23 | 9.50 | 61.56 | 12.97 | 22.47 | 18.44 |

A – Fragment 1 – total area of the root canal (mm²); A1 – Fragment 1 – area of remnants in the root canal (mm²); B – Fragment 2 – total area of the root canal (mm²); B1 – Fragment 2 – area of remnants in the root canal (mm²); C – area of the remnants in both fragments (mm²); D – Percentage of remnants of filling material in the root canal (%)

The areas of remaining filling material were then submitted to the statistical tests by means of the Student's "t" test, which revealed that there was no statistically significant difference in remaining filling material between the two experimental groups.

Discussion

Endodontic retreatment is a complex and often slow procedure. The improvements in the nickel-titanium rotary instruments undoubtedly improved the removal of the filling material.

The Thermafill system, in turn, leads to doubts as to the difficult or easy removal of the system carriers if needed, because of its easy and fast accomplishment.

Wilcox [9] conducted a comparative study between teeth obturated with Thermafill system. During retreatment, the experimental groups were established as to the employment of solvent (chloroform) or not. The results demonstrated the lack of statistically significant differences between the two groups. The author further highlights that a successful retreatment of teeth obturated with the Thermafill systems largely depends on the ability of the professional to remove the plastic carrier (core) from the root canal.

Ibarrola *et al.* [4] carried out a comparative study on the removal of Thermafill fillings employing four different solvents (chloroform, xylol, eucalyptol and halothane) associated to K files as the study variables. The results demonstrated that both the carrier and the gutta-percha did not pose obstacles for the accomplishment of retreatment, however the chloroform demonstrated to be faster and more effective.

Sae-Lim *et al.* [5] investigated the utilization of ProFile in the retreatment with and without chloroform, and the outcomes were compared to the traditional technique employing hand files and the same solvent. The authors emphasize that complete cleansing is almost impossible, yet the results achieved with isolated utilization of the ProFile were the best, especially at the medium and apical thirds, what led them to state that this method is a feasible option for endodontic retreatment.

Investigations such as that conducted by Barrieshi *et al.* [2], on which the ProFile system was associated to solvents, did not reveal statistically significant differences as to the quality of cleansing of the different thirds of the root canal. Reinforcing the non-utilization of solvents, Valois and Costa Jr. [8] stated that the ProFile.04 system may be utilized without solvents, with no influence on the effectiveness of cleaning of the root canal walls.

Baratto Filho *et al.* [1], employing the ProFile.04 system (300rpm), achieved better results concerning

removal of the filling material. Even though just three completely clean specimens were obtained, satisfactory outcomes were found at the medium third, differently from the present study, on which no specimen was completely clean and the media of remnants of filling material was 24.86% at 350rpm and 24.91% at 2000 rpm. This difference in removal of the filling material is probably due to the difference in the size of the Thermafill carrier employed, which was #40 in the present study, compared to #30 in the investigation of Baratto Filho *et al.* [1]. It is further highlighted that there was complete removal of the plastic Thermafill carrier in both studies.

Regarding the remaining filling material, no statistically significant differences were found between the speeds employed, probably due to variations in the internal anatomy of the tooth investigated, therefore indicating that the kinematics of utilization of the ProFile.04 system during endodontic retreatment (pushing the instruments against the root canal walls) is more effective than the speed itself.

Finally, the instrument #90 at this speed had its screwing action in the root canal increased due to the difficulty to control penetration of the instrument in the cervical third of the root canal. For that purpose, the operator should be careful when employing wide instruments at this speed.

Conclusions

- The Thermafill carriers were removed in all cases;
- There was no difference in the quality of removal of the filling material at 350 or 2000rpm;
- Total removal of the filling material was not observed in any specimen investigated.

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Odontologia

O aperfeiçoamento contínuo dos professores, as atividades comunitárias, a clínica geral e as aulas de odontologia para atendimento de bebês, de crianças, de pessoas na terceira idade e de pacientes com necessidades especiais tornam o curso de Odontologia um dos melhores da região sul do país. Clínicas Odontológicas oferecem infra-estrutura com equipamentos de última geração, como simuladores e equipamentos a laser.

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