

Cleaning ability of rotary instruments in the apical third of curved molars

CAPACIDADE DE LIMPEZA DE INSTRUMENTOS ACIONADOS A MOTOR NO TERÇO APICAL DE CANAIS CURVOS

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The purpose of this study was to evaluate microscopically the efficiency of two rotary instruments in cleaning the apical thirds of curved canals. Forty mesial canals (twenty lower molars) were used as samples. Instrumentation was performed with Profile 0.04 Taper Series 29 and Quantec SC instruments. The apical 3mm of the roots were horizontally sectioned after instrumentation and submitted to histological and staining procedures. All samples were observed under stereomicroscopy at X 40 magnification. The results were analyzed with the Image Pro Plus program for Windows and submitted to statistical analysis (ANOVA – $p \leq 0.005$; LSD, Tukey and Student tests). Group 1 (Profile) showed 28,91% of remaining debris while Group 2 (Quantec) showed 20,02%. Statistical analysis showed no significant difference among the groups (significance level – $p < 0,05$ in all tests). No instrument was able to clean the apical thirds completely. Quality of cleaning seemed to be related not only to the instrument but also to the anatomy of the root canals.

UNITERMS: Rotary instruments; Cleaning ability; Apical third.

INTRODUCTION

Endodontic therapy tends to be somewhat difficult in curved canals sometimes even presenting frustrating results. Variations in root canal anatomy represent great part of the difficulty since remainders of pulp tissue and debris may be left untouched on canal walls.

Several authors have emphasized the importance of the critical apical anatomy of the root canal system regarding the prognosis of the endodontic

therapy^{1,4,15}. Anatomic irregularities like isthmus between mesial canals or elliptical canals are commonly observed and are preferable sites for pulp tissue and debris to remain within the root canal system⁸. Indeed, endodontic instruments must touch canal walls to clean and in those cases of anatomic complexities, cleaning is done solely by the flow and backflow of irrigating solutions^{5,11}. Nowadays nickel-titanium instruments of conic shapes and variable tapers¹⁷ represent a hope of better instrumentation of curved canals for their ability to follow curvatures

better. Recent reports relate about those instruments' physical properties, cutting efficiency and apical transport^{14,19}. However, no literature work has yet described the efficiency of such instruments in cleaning the apical third of curved root canals therefore becoming the purpose of this study.

MATERIAL AND METHODS

Mesial canals from twenty recently extracted human permanent lower molars were used in this study. Teeth had complete apical formation and curvatures ranging from 20 to 40°, according to Schneider¹³. Teeth were stored in 10% formaline solution before initiation of the procedures. Conventional coronary access was made, patency was checked with a #10 file (Maillefer) introduced in the canal until visible at the apex. The same file was used to verify the consistency of the remaining pulp tissue that should still be firm and stiff. Teeth with any clinical signs of pulp necrosis were discarded. All teeth were prepared to working length, determined to be at 1mm from patency length, then randomly divided into 2 groups.

Group 1 was prepared with Profile .04 Taper Series 29 instruments (Tulsa Dental Products, Dentsply) while Group 2 was prepared with Quantec SC files (Analytic TM)⁹. Instrumentation sequences followed recommendations from manufacturers. Canals were copiously irrigated with 5% sodium hypochlorite during the entire preparation time.

After instrumentation, teeth were placed in 10% formaline solution again. Coronary portions of the teeth were removed with a 3/4-inch carborundum separating disk. The remaining apical third of each root was submitted to histological procedures.

The apical thirds were taken to a microtome (American Optical Co. 820 Spencer) where histological cuts were made. The samples were analyzed with the Image Pro Plus computer program for Windows (Media Cybernetics) and the entire perimeter of the root canal was measured and recorded.

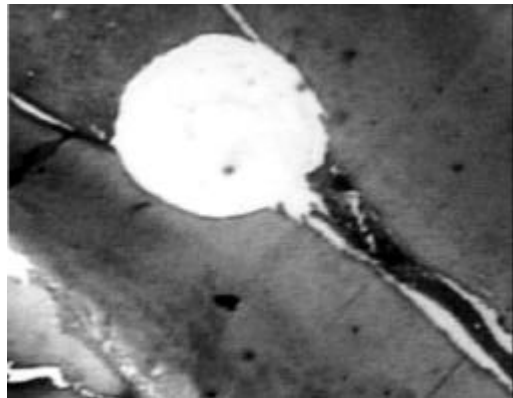
RESULTS

All samples were analysed individually.

The numbers obtained correspond to the amount of remaining pulp tissue and debris found in the examined areas (3mm from the foramen). Group 1

(Profile) presented an average 28.91% of remaining pulp tissue and debris, while Group 2 (Quantec) presented approximately 20.02% (Figures 1 and 2).

Statistics — Analysis of Variance Test- ANOVA – $p \leq 0,05$ – showed no significant difference between the two groups. LSD, Tukey and Student tests also showed a $p \leq 0,05$ significance level demonstrating no significant statistical difference among the two instrumentation groups.



DISCUSSION

A fundamental requirement to obtain a correct endodontic preparation depends on the respect, during cleaning and shaping, of the original morphology of the apical foramen, so that the filling material will form a complete seal.

Many studies have related about different instrumentation techniques and new types of instruments considering mostly canal transportation, risk of perforation, ledge formation and cleaning ability^{3,12,14,16,17,19}. However, it's widely known that the anatomy of the apical region is extremely complex and remaining pulp tissue and debris are

usually confined in areas that remain untouched by endodontic instruments^{2,7,18}. In an effort to minimize procedural complications, the apical preparation of the curved canals is frequently restricted to file sizes in the 25 to 30 range. The current design of the Ni-Ti rotary instruments may require that apical preparations be enlarged to a minimum of size 40.

Areas untouched by the instruments, therefore not clean, become critical for the success of the endodontic therapy. A frequent and copious irrigation of the root canal system with substances capable of dissolving organic matter are thus fundamental to reach any anatomic irregularity in the apical region since those areas can only be cleaned by the action of the irrigating solutions through their flow and backflow out of the canal throughout preparation time.

Canals with more anatomic variations showed greater amounts of debris, in areas where instruments did not reach. Round canals were thoroughly cleaned while irregularly shaped canals always showed some amount of debris.

The anatomy of the root canal, instead of the type of instrument used, proved to be directly related to the quality of cleaning achieved.

CONCLUSIONS

In our study, both Profile and Quantec instruments were not able to clean apical walls completely.

RESUMO

O presente estudo teve como propósito avaliar microscopicamente a eficiência de dois instrumentos acionados a motor na limpeza do terço apical de canais radiculares curvos. Quarenta canais mesiais de vinte molares inferiores foram instrumentados com instrumentos Profile Taper 0.04 Série 29 e Quantec SC. Os 3 mm apicais das raízes foram seccionados horizontalmente após a instrumentação e submetidos ao processamento histológico e corados. Todos os espécimes foram levados para análise em microscópio ótico (aumento de 40 X). As imagens foram digitalizadas e transferidas ao programa Image Pro Plus for Windows para medição do perímetro do canal e áreas de resíduos. No Grupo 1 (Profile) pôde-se observar 28,91% de resíduos após a instrumentação enquanto 20,02% de resíduos foram observados nos espécimes do

Grupo 2 (Quantec). Foi realizada a análise estatística pelos testes ANOVA ($p \leq 0.005$), LSD, Tukey e Student, a qual demonstrou não haver diferença significativa entre os grupos ($p \leq 0,05$). Nenhum instrumento foi capaz de limpar completamente o terço apical dos canais. A qualidade da limpeza está diretamente relacionada à anatomia do canal e não somente ao instrumento utilizado.

UNITERMOS: Instrumentos rotatórios; Capacidade de limpeza; Terço apical.

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