Dental Health 2016 - Curved Root Canals: Effects of Dimensional Parameters on the Insertion Depth of Irrigation Needles- Fabiola-Regina Rodríguez - University of Basel

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Abstract

Objective:

To investigate the effects of size and taper of the apical preparation, root canal curvature and cannula diameter on the insertion depth of irrigation cannulas into root canals.

Study Design:

One hundred and four root canals were divided into four curvature groups (0-5°; 6°-15°; 16°-25°; >25°). After apical enlargement to size 25.06 a 25G and a 30G irrigation cannula were inserted until binding. The distance between the cannula tip and the working length was related to the root canal length. The insertion procedure was repeated after enlargement to 40.04.

Results: In curved canals (>6°), the cannula never reached WL. With an apical preparation of 40.04 the 30G cannula could be introduced nearly to WL even in moderately curved canals.

Conclusion:

Only a 30G cannula allows delivery of the irrigant to the apex of a curved root canal. The cannula could be inserted closer to WL when the apical preparation size was wider with a smaller taper compared to a small apical preparation size with a wider taper.

Keywords:

Apical preparation; Insertion depth; Irrigation; Needle; Root canal curvature

Introduction:

The complexity of the root canal system is thought to be the strongest limitation to root canal disinfection as it impedes complete mechanical instrumentation of the root canal. Therefore, irrigants with chemical and mechanical effects are required to reach the regions of the root canal that remain untouched by mechanical preparation alone. To enhance the cleaning and disinfection of the apical region of the root canal, various aspects have to be considered..Also, elements of the design of the irrigation cannula such as location of the opening, pressure applied, fluid properties and velocity of the irrigant at the tip of the cannula have an impact .Optimisation of these factors seems to be a step forward to improve conventional irrigation. The aim of this study was to investigate the effects of size and taper of the apical preparation, root canal curvature and cannula tip diameter on the insertion depth of irrigation cannulas into root canals.

Materials and Methods:

Thirty-five extracted molars and premolars with 104 root canals were collected. The apices of all roots were fully formed. The root apices remained visible to facilitate length measurement. Access to the root canal system was obtained, and the canal entrances were located. A coronal reference point (P) was defined for each root canal, and the distance from this point to the canal entrance (E) was recorded in mm to the nearest 0.5 mm using a periodontal probe. After checking the root canal for patency, canal length was measured. In a first step, the root canals were prepared with Mtwo files (VDW Dental Munich; Germany) 10.04, 15.05, 20.05 and 25.06 to working length (WL) using the Endo IT Professional motor (VDW Dental Munich, Germany). Between each instrument, the root canal was irrigated with 2 ml of Ringer solution. Four root canals had to be excluded due to instrument fractures or apical obliteration.

Results:

A total of 100 root canals were analysed. The results are summarised .Two thirds of the root canals were either slightly or moderately curved. Using the 25G irrigation cannula at an apical size of 25.06, the mean value of X was 40%, whereas X was reduced to 28% at an apical size of 40.04. The use of the smaller 30G irrigation cannula resulted in a reduction of the mean value of X from 16% to 3%, particularly when increasing the apical preparation size from 25.06 to 40.04. In curved root canals (>6°), the cannula never reached WL. Regardless of the cannula diameter, X decreased with decreasing root canal curvature and increasing apical preparation size. Use of a 25G irrigation cannula resulted in X values that represented approximately 20% to 46% of the canals' length. The 30G irrigation cannula could nearly be inserted to the WL even in moderately curved canals (< 26°) when the apical preparation size was 40.04 (0.9-9.1%). The CIs revealed significant differences between the insertion depths of 25G and 30G irrigation cannulas in the four curvature groups .The increase in insertion depth when using the smaller 30G irrigation cannula was more pronounced than that observed after apical enlargement from 25.06 to 40.04

Discussion:

This study focused on the relationships between insertion depth of conventional irrigation cannulas, root canal curvature, apical size and taper of preparation. Although contemporary manual and machineassisted agitation devices have advanced during the last decade, the correlation of the clinical efficacy of these devices with improved treatment outcomes has not been proven to date . Manual syringe irrigation with irrigation cannulas is needed and can be considered as a standard in root canal treatment. Wider

diameters of the irrigation cannula correlate with higher flow rates when applying the same pressure to the syringe plunger. However, when delivering the irrigant 1 mm or more beyond a small cannula tip, the pressure far exceeds that normally applied in clinical practice. Irrigant replacement under clinical flow rate conditions can only be obtained less than 1 mm beyond the cannula tip . Therefore, placement of the cannula tip within 1 mm of the WL is required. The present results demonstrate that both adequate apical preparation size (#40) and increased taper permit insertion of the cannula deeper into the root canal regardless of its curvature. The largest differences were observed when the 25G cannula was compared to the 30G cannula at a given preparation size. This demonstrates that the cannula size has the strongest influence under consideration of the root canal taper. The results of the current study support the idea that greater curvature requires an appropriate apical preparation that facilitates the insertion of the cannula into the apical part of the root canal. In addition to the increased apical preparation size, use of the smaller 30G cannula eased the approximation of the cannula tip to the apical region due to its higher flexibility as compared to the 25G cannula. The utility of pre-bending of irrigation cannulas was not investigated in this study. A mean gain of about 4 mm (95% CI: 3.72 mm; 4.24 mm) was recorded when inserting a 30G cannula into a size 40.04 root canal as compared to a 25G cannula in a smaller size 25.06 root canal. The variations detected when using the 30G irrigation cannula at size 40.04 might be due to the distribution of different canal types within the curvature groups. Groups 2 and 3 included many palatal root canals of maxillary molars and distal root canals of mandibular molars. These root canals are mostly characterised by large curvature radii , enabling the approximation of the irrigation cannula to the apex even with increasing curvature. Severe curvature angles (group 4) are mostly associated with smaller radii.

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