ABSTRACT

Purpose. The aim of this study was to evaluate, in vitro, the quality of calcium hydroxide [Ca(OH)₂] paste filling (Ultracal, Ultradent) associated or not with Ca(OH)₂-containing gutta-percha points (Calcium Hydroxide Plus Points™, Roeko) in curved root canals. Material and Methods. One hundred and twenty roots of extracted human teeth, randomly divided into three curvature ranges (mild - 0 to 14°; moderate - 15° to 29°; severe - >30°) were used. After chemomechanical preparation, the roots were assigned to 4 groups (n=30), according to the technique of intracanal dressing placement: group 1 - Ca(OH)₂ paste was applied with a lentulo spiral; group 2 - Ca(OH)₂ paste was applied with a lentulo spiral and a Ca(OH)₂ point was inserted into the canal; group 3 - Ca(OH)₂ paste was applied with a Navitip™ tip (supplied with Ultracal system); group 4 - Ca(OH)₂ paste was applied with a Navitip™ tip and a Ca(OH)₂ point was inserted into the canal. The roots were cleared and the quality of apical third filling was assessed by a calibrated experienced examiner. The specimens were examined under stereomicroscopy and scored 1 to 4 (i.e., from inadequate to complete root canal filling). The results were analyzed statistically by ANOVA and Duncan’s post hoc test at 5% significance level. Results. There were no statistically significant differences (p>0.05) among the curvature degrees in groups 1, 3 and 4. Severely curved roots in group 2 presented bordering significance (p=0.05). The groups that associated the use of Ca(OH)₂ paste and points (2 and 4) showed better apical filling than the other groups, but this difference was statistically significant (p<0.001) only for roots with severe curvature. Conclusion. According to the results of this study, the curvature degree did not influence the quality of filling. The techniques that used Ca(OH)₂-containing gutta-percha points yielded better filling of the apical third in roots with severe curvature.

Uniterms: Calcium hydroxide; Gutta-percha; Root canal; Intracanal dressing.
INFLUENCE OF CALCIUM HYDROXIDE POINTS ON THE QUALITY OF INTRACANAL DRESSING FILLING

INTRODUCTION

The disinfection of the root canal system is one of the most important aspects that account for the success of endodontic therapy. The use of a calcium hydroxide [Ca(OH)\textsubscript{2}]-based intracanal dressing between sessions has a major role in decreasing the microbial population within the root canals\textsuperscript{8}.

For optimal effect, Ca(OH)\textsubscript{2} should be in intimate contact with the dentinal walls, along the whole canal extension\textsuperscript{3,6,7}. Nevertheless, three-dimensional filling is not easily obtained, especially in curved canals, in which failures occur mostly in the apical third\textsuperscript{4,15,17,18}.

An alternative for intracanal dressing is the use of Ca(OH)\textsubscript{2}-containing gutta-percha points. The similarity between Ca(OH)\textsubscript{2} and conventional gutta-percha points facilitates their placement into root canals up to the working length\textsuperscript{3,11,13,14}.

There are no studies in the literature that associate the use of Ca(OH)\textsubscript{2} paste and points. Therefore, this in vitro study evaluated the quality of Ca(OH)\textsubscript{2} paste filling, associated or not with Ca(OH)\textsubscript{2}-containing gutta-percha points in curved root canals.

MATERIAL AND METHODS

The research project was submitted to review by Research Ethics Committee of Lutheran University of Brazil and the designed methodology was approved (Process #2004-138H).

One hundred and twenty roots were selected from extracted human first molars and single-rooted teeth. Buccolingual and mesiodistal radiographs were taken to confirm absence of anomalies of form and size, full development of roots and presence of a single canal per root. Maxillary first molars with more than one canal in the apical third\textsuperscript{4,15,17,18}.

A size 10 K-type file was introduced into the canal until the step-back technique up to a size 50 K-type file, the size 30 K-type file being the memory file. At each change of instrument, the canals were alternately irrigated with 2 mL of 1% sodium hypochlorite and 2 mL of 17% trisodium EDTA.

Working length (WL) was calculated by subtracting 1 mm from the working length\textsuperscript{2,11,13,14}.

Canal entrance was cleaned and the wax was removed (Figure 1); Score 1: inadequate root canal filling – 0-50% of intracanal space was filled (Figure 1); Score 2: root canal filling with the designed methodology was approved (Process #2004-138H).
great failures – 51-70% of intracanal space was filled (Figure 2); Score 3: root canal filling with minor failures – 71-85% of intracanal space was filled (Figure 3); Score 4: complete root canal filling – 86-100% of intracanal space was filled (Figure 4).

Intra-examiner reliability was assessed by Intraclass Correlation Coefficient (ICC) after reexamination of 15 specimens. Data referring to the quality of filling obtained with the different techniques, as a function of curvature degree, were described as means and standard deviations. Analysis of variance compared the results of the groups at curvature levels and Duncan’s post hoc test identified the differences. Significance level was set at α=0.05. Data were assessed using SPSS software, version 11 (Statistical Package for the Social Sciences, Adobe Systems Inc., San Jose, CA, USA) and Sigma Plot (Sigma-Aldrich Corp. St. Louis, MO, USA).

RESULTS

During clearing procedures, 5 specimens were lost because of infiltration of liquids used in the process. Intraclass Correlation Coefficient was 0.72. Means and standard deviations of the scores attributed to each group are shown Table 1.

Regarding the degree of curvature, it was observed that in groups 1 (lentulo), 3 (Navitip™) and 4 (Navitip™ + point) there were no statistically significant differences (p>0.05) among the curvature ranges. In group 2 (lentulo + point) there was bordering statistical significance (p=0.05) for severe curvature in comparison to the other curvature degrees.

Regarding the filling techniques, the groups that associated the use of Ca(OH)₂ paste and points (2 and 4) showed better filling of the apical third than the groups that received Ca(OH)₂ paste alone as intracanal dressing (1 and 3). However, this difference was statistically significant (p<0.001) only for the roots with severe curvature.

DISCUSSION

This study evaluated the quality of intracanal dressing placement in root canals filled with Ultracal Ca(OH)₂ paste. This paste has a new injectable application system, NaviTip™, which was developed for use in curved canals. Lentulo spirals, which are still the most indicated instruments for this purpose, were also used in comparison.
to the manufacturer-supplied tips\textsuperscript{4,5,12,15,17,18}. The hypothesis that the placement of Ca(OH)\textsubscript{2} points into canals filled with Ca(OH)\textsubscript{2} paste would produce an embolus effect and improve apical filling quality was also investigated.

The roots used in this study were classified in each of the curvature ranges not only by their angulation. The initial position of curvature was also considered because both parameters determine the severity of root curvature\textsuperscript{1,11}.

Apical foramen was provisionally sealed with wax prior to application of intracanal dressing to prevent air escape from the canal. Foramen patency could produce a falsely adequate filling that would not reflect the clinical situation\textsuperscript{18}.

The findings of this study indicate that, under the investigated conditions, the quality of root canal filling was not influenced by curvature degree in the groups filled using lentulo spiral, Navitip\textsuperscript{TM} and Navitip\textsuperscript{TM} + point. There were no statistically significant differences (\(p>0.05\)) among the three curvature ranges (mild, moderate and severe) for these groups. These results are not consistent with those of Torres and Luft\textsuperscript{17} (2003), who reported better root filling quality in teeth with mild curvature than in severely curved roots, regardless of the technique used. This discrepancy of results may stem from the variability of root anatomy. Far more than curvature, the complexity of the root canal systems, with its numerous ramifications, is a variable difficult to control and may either facilitate or impair the filling of the canals.

Bordering statistical significance (\(p=0.05\)) was observed in group 2 (lentulo + point) when degree of curvature was compared. In this case, the action of the Ca(OH)\textsubscript{2} point seemed to be beneficial for filling severely curved canals but did not affect the quality of filling in the other curvature ranges.

Regarding the filling technique, groups 2 and 4 presented higher scores than the other groups in mild and moderate curvature ranges, but this difference was not significant statistically (\(p>0.05\)). The superiority of the techniques employing Ca(OH)\textsubscript{2} points was established in roots with severe curvature. In this range, groups 2 and 4 presented better root canal filling (\(p<0.001\)) than the other groups in which Ca(OH)\textsubscript{2} paste alone was used.

The results of this study are in agreement with those of Estrela, et al.\textsuperscript{5} (2002), who reported an adequate root canal filling when a Ca(OH)\textsubscript{2} paste prepared with an aqueous vehicle was used as an intracanal dressing. In the present study, in all groups, Ca(OH)\textsubscript{2} paste was condensed at canal entrance towards the apex using a paper point of great diameter. In the groups where Ca(OH)\textsubscript{2} points were used, condensation of the intracanal dressing occurred in apical third. These findings suggest that the physical embolus action of the Ca(OH)\textsubscript{2} point resulted in better filling quality, pushing the paste into an intimate contact with root canal walls. Therefore, a similar effect may be expected if conventional gutta-percha points are used in the same way. Further studies should be carried out to investigate this possibility.

The filling obtained with use of Ultracal paste alone corroborates the findings of previous studies. This system seems to be inadequate for use in curved canals because the diameter of the tip supplied with the kit (0.76 mm) is not compatible with that of severely curved root canals. According to Staehle, et al.\textsuperscript{16} (1997), needles with diameters greater than 0.6 mm can be employed only for straight canals enlarged apically at least up to a size 50 file, which did not occur in the present study.

In view of these findings, it seems clear that the quality of curved root canal filling with an aqueous calcium hydroxide paste is considerably improved when Ca(OH)\textsubscript{2} points are also used. The association of paste and points seemed to make the difference, mainly in canals with more accentuated curvatures.

### CONCLUSIONS

According to the methodology proposed and based on the results of this study, the following conclusions may be

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**TABLE 1** Means and standard deviation (±SD) of filling scores for each technique of intracanal dressing placement and curvature degree

| Technique                | Degree of Curvature | Mild     | Moderate | Severe   | \(p\)  |
|--------------------------|---------------------|----------|----------|----------|--------|
| Lentulo (n=29)           |                     | 2.3 ± 1.2| 2.0 ± 1.0| 2.0 ± 0.9| 0.76   |
| (Group 1)                |                     |          |          |          |        |
| Lentulo + Point (n=29)   |                     | 2.6 ± 0.7| 2.5 ± 1.0| 3.3 ± 0.5| 0.05   |
| (Group 2)                |                     |          |          |          |        |
| Navitip (n=29)           |                     | 2.1 ± 0.8| 2.2 ± 0.6| 1.7 ± 1.0| 0.39   |
| (Group 3)                |                     |          |          |          |        |
| Navitip+ Point (n=28)    |                     | 2.9 ± 0.7| 2.8 ± 0.7| 2.8 ± 0.4| 0.89   |
| (Group 4)                |                     |          |          |          |        |

\(p\) = Statistical significance by analysis of variance.
drawn:
1. All techniques were unable to fill root canal apical third completely.
2. When lentulo spiral, Navitip™ tip and Navitip™ + Ca(OH)₂ points were employed, the curvature range did not influence the quality of apical third filling.
3. When lentulo spiral was associated with Ca(OH)₂ point, canals with severe curvature presented better filling than those with mild to moderate curvatures.
4. The techniques that associated Ca(OH)₂ paste and point (lentulo + point and Navitip™ + point) yielded better filling quality at root canal apical third in roots with severe curvature.

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