Alternative method for placing calcium hydroxide paste into the root canal system as intracanal medication

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ABSTRACT

Introduction: The objective of this paper is to present an alternative method for placing calcium hydroxide paste as intracanal medication used after chemical-mechanical preparation of the root canal system. **Material and methods:** The technique used a disposable plastic 1.2-mL syringe (Ultradent™) and tips for irrigation/aspiration (Capillary Tips Ultradent™). For depth control of the material to be inserted, a silicone stop was used on the Capillary Tips tip, at the working length of the root canal which had been previously prepared. Subsequently, lubrication of the plastic syringe and the tip was carried out with propylene glycol. Calcium hydroxide was combined with propylene glycol with the aid of a #24 spatula on a glass plate until a smooth, homogeneous paste was obtained. To apply the calcium hydroxide paste into the syringe, a spatula was also used. Immediately after that, the intracanal medication could be inserted into the root canal system. **Conclusion:** The technique of placing calcium hydroxide into the root canal system presented satisfactory results, clinical predictability and ease of preparation.

Keywords: Root canal therapy. Calcium hydroxide. Endodontics.

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Introduction

Endodontic treatment success depends directly on prevention and control of pulp and periradicular infections.[1] Mechanical instrumentation alone is not able to completely eliminate microorganisms inside root canals;[2,3] thus, it is necessary to combine strategies, such as chemical irrigation and intracanal dressing.[4,5]

The use of intracanal dressing between treatment sessions increases the power of disinfection achieved by cleaning and shaping the root canal, thus rendering intracanal medication an important factor to endodontic treatment.[6] Calcium hydroxide ($Ca(OH)_2$) is most often used due to its biological characteristics. In contact with an aqueous solution, $Ca(OH)_2$ dissociates into calcium ions and hydroxyl, and its main action is attributed to the effect of these ions on vital tissues, which can lead to induction of hard tissue deposition and potential antimicrobial activity.[7] Hydroxyl ions produce a highly alkaline environment and many organisms are unable to survive in these conditions. Thus, bacteria in infected root canal systems are eliminated when in contact with Ca(OH).[28,9]

Several ways of introducing $Ca(OH)_2$ into the root canal system have been proposed; for example, injection with syringe or Lentulo drill associated with lateral condensation;[10] deposition of $Ca(OH)_2$ paste with a plastic carrier followed by vertical compression to obtain a complete filling;[11] Lentulo drill[12,13] and use of a special endodontic syringe with a G-27 long needle (Calen System).[14] A simple and efficient alternative is described by Krell and Madison,[15] using a Messing gun, similar to an amalgam carrier. In addition, Estrela and Bamman[16] proposed filling the root canal with the aid of files and absorbent paper points.

However, the filling quality with $Ca(OH)_2$ paste may vary according to the technique used and this is an important factor for the occurrence of antimicrobial activity. In order to reach the completeness of the root canal with $Ca(OH)_2$ paste by means of manual and mechanical tools, Morais et al[17] conducted an *in vitro* study using extracted human incisors. Lentulo drill, McSpadden compactor and manual #35 K-file. The manual #35 K-file promoted the best filling of the root canal when compared to other instruments in the cervical, middle and apical thirds. Nevertheless, this is a technique that requires knowledge and clinical experience in order to be successful. Since the methods described in the literature have limitations regarding safety and ease of application, the presentation of alternative methods to be able to properly fill the root canal system with simple applicability, clinical predictability and safety are necessary in the dental practice.

Therefore, the aim of this paper is to present an alternative method for placing calcium hydroxide paste as intracanal medication of the root canal system, using disposable plastic syringes of 1.2-mL (Ultradent™) and irrigation/aspiration tips (Capillary Tips, Ultradent™).

Material and Methods

For technical presentation, the following material was used:

- disposable plastic 1.2-mL syringe (Ultradent™ Products Inc., Salt Lake City, USA);
- irrigation/aspiration tip (Capillary Tips, Ultradent™ Products Inc., Salt Lake City, USA);
- silicone stop;
- calcium hydroxide;
- propylene glycol;
- # 24 spatula;
- glass plate.

Technical description

The first step consists of placing a silicone stop on the Capillary Tips tip at the working length of the root canal which had been previously prepared (Fig 1). Subsequently, lubrication of the plastic syringe and the tip was carried out with propylene glycol (Fig 2). Two to three drops were applied into the syringe and the plunger was pushed, so that propylene glycol could reach the entire length of the lumen and the syringe tip. Calcium hydroxide was combined with propylene glycol with the aid of a #24 spatula on a glass plate until a smooth, homogeneous paste was obtained (Fig 3). With the aid of the spatula, the $Ca(OH)_2$ paste was inserted into the syringe (Fig 4). The plunger was positioned while removing residual air; immediately after that, intracanal medication could be inserted into the root canal (Fig 5). Filling in the apical third occurred first, followed by the middle third, and finally the cervical third of the root; that is, from the inside out. The syringe plunger was pushed, sliding the tip of the working

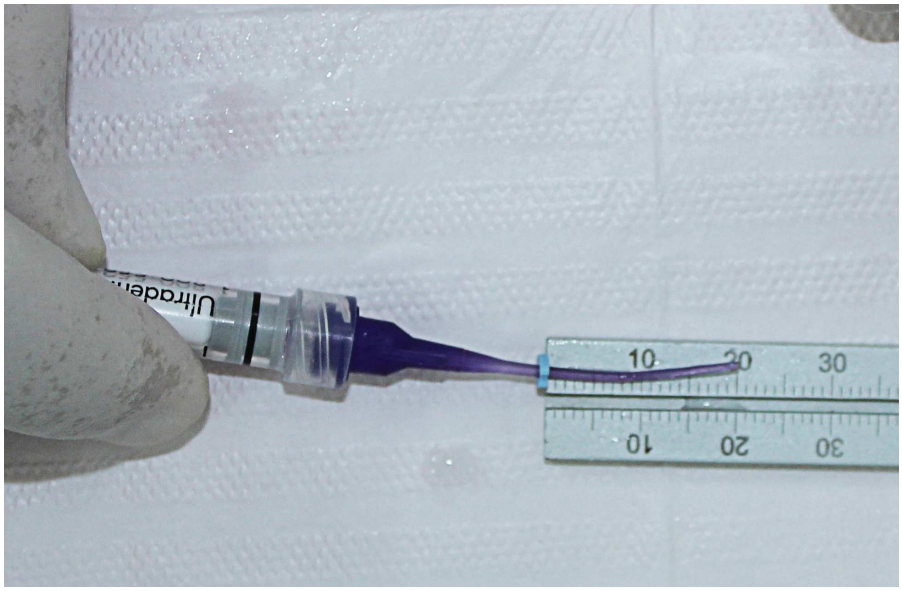

Figure 1. Capillary Tip calibration at the working length with silicon stop.

Figure 2. Syringe and Capillary Tip lubrication with propylene glycol.

length out up to the cervical level. Filling at the level of the pulp chamber should also be checked for with the aid of a mouth mirror. Periapical radiograph, combined with a radiopacifier, is able to reveal the obtained filling (Fig 6).

Discussion

In order to have filling as ideal as possible, it is necessary that root canal instrumentation be carried out completely before the use of calcium hydroxide.[18] Moreover, to maximize the antibacterial properties of

Figure 3. $Ca(OH)_2$ paste preparation with propylene glycol.

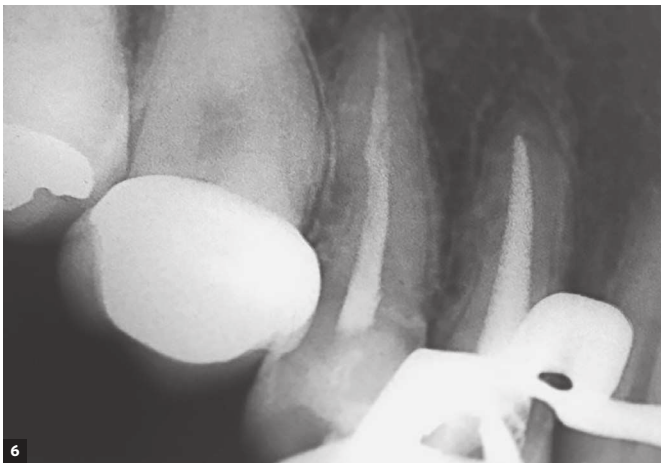

Figure 4. $Ca(OH)_2$ paste placement into the syringe with the aid of a spatula.

Figure 5. $Ca(OH)_2$ paste ready for placement into the root canals.

Figure 6. Periapical radiograph of maxillary right first premolar revealing the achieved filling.

$Ca(OH)_2$, it is important that the latter be in contact with the walls of the root canal system, forming a dense and homogeneous filling.[8,9] Thus, by using the method proposed by the present study and considering that root canals were fully prepared following the principles of cleaning and shaping, it was possible to achieve a satisfactory filling, thus demonstrating the clinical applicability of the technique.

Different methods for placing calcium hydroxide ($Ca(OH)_2$) as intracanal medication have been proposed since the early studies about the biological properties of this material.[10-16] However, to date, no studies have been found to suggest new, safe methods to facilitate the dentist's clinical practice.

The method proposed in this study uses ultrafine polypropylene plastic tips (Capillary Tips) which are flexible and have different gauges. By selecting the correct caliber of the tip, the dentist can reach appropriate, controlled depths (using a silicone stop at the working length), thus providing clinical predictability and safety for correct material deposition and reaching the entire root canal system. Studies have shown that whenever Lentulo drill is used alone, material deposition is more efficient 1 mm from the apical region of curved canals roots when compared to the Calen System™ and the combination of the two techniques.[19] However, the use of Lentulo drill carries risks that may be irreversible, since should it break inside the root canal, it may be difficult or sometimes even impossible to be removed. In contrast, other authors have shown that root canal filling with injection systems is more satisfying, more predictable[20] and simpler to be used[21] when compared to Lentulo drill. Furthermore, Staehle, Thoma and Muller[22] reported that, for $Ca(OH)_2$ deposition, the injection system (Calen™) is more effective than K-files. However, with the Calen™ system, G-27 long needles are used, which may hinder insertion of the material in curved canals, in addition to often promoting clogging (or blocking) of the system after several applications. On the other hand, manual #35 K-files promoted better filling of the root canal when compared to other types of instrument.[17] Nevertheless, this technique requires that the professional have knowledge and clinical experience in order to succeed.

Propylene glycol was used to prepare the $Ca(OH)_2$ paste proposed in the present study; however, this technique allows the dentist to change the vehicle so as to be more appropriate to the clinical strategy to be used.[23] In addition to propylene glycol, there are several other vehicles that can be used to place calcium hydroxide into the root canal system, for instance: distilled water, camphorated paramonochlorophenol, and 2% chlorhexidine gel, all of which contribute with antimicrobial action.[24,25] Propylene glycol mixed with $Ca(OH)_2$ has a good antimicrobial potential compared to other vehicles; for this reason, it is more indicated.[25] In general, oily and viscous vehicles prolong the action of $Ca(OH)_2$, when compared to aqueous solutions.[25] Studies have demonstrated that distilled water has no antimicrobial effect, acting only as a vehicle for placing $Ca(OH)_2$.[26] Camphorated paramonochlorophenol is effective in fighting against microorganisms when added to $Ca(OH)_2$;[27] however, it is toxic to periradicular tissues.[28] 2% chlorhexidine gel is also an option for intracanal dressing, being extremely effective, especially against *E. feacalis*, whether combined or not with calcium hydroxide.[27,29-32] Nevertheless, the choice of the vehicle should be in accordance with the strategy to be adopted by the dentist, the period of time intracanal dressing remains inside and the clinical condition.[4,33]

Furthermore, in order to radiographically confirm total filling of root canals, a radiopacifier substance, such as iodoform, barium sulfate or zinc oxide, can be added to the $Ca(OH)_2$ paste. However, the choice of this substance and its use should be in accordance with the dentist's experience and preference.

Conclusion

The present study will not only provide an alternative to place calcium hydroxide paste into root canal systems, but it also serve as the basis for future studies comparing different methods.

The proposed technique employed to place calcium hydroxide into root canal systems, as intracanal dressing, presented satisfactory results, clinical predictability and ease of preparation. Furthermore, this technique allowed medication to be newly prepared and manipulated with the desired vehicle.

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