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EFFECT OF COLTOSOL®EXPANSION ON THE CROWN OF TEETHE NDODONTICALLY TREATED: ORIGINAL STUDY

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ABSTRACT

Introduction: Defective apical seals were identified as the main cause of failures in endodontic treatment, and several studies have emphasized the importance of adequate coronal sealing between sessions for successful endodontic therapy.
Objective: to evaluate the effects of Coltosol® prey expansion on the remaining coronary structure of endodontically treated teeth.
Methods: Four human molars were used, extracted for reasons unrelated to this work. After the endodontic treatment, they were restored with Coltosol®. Among the 4 teeth used, we changed the measurements of the surrounding walls and the cavity. Two elements with 2 mm of surrounding wall, one with occlusal cavity and one with Mesio-Occlusal-Distal cavity (MOD).
Results: The expansion of prey of Coltosol® caused significant tensions in the remaining coronary structure, it was also noticed that teeth that have walls with thickness of 1.0 mm can suffer cracks after the expansion of the obturator and the absence of proximal walls in the cavities Mesio -Occlusion-Distal decreases the tension of the expansion (O) with 1.0 mm of surrounding wall was the most cracks due to stress expansion in the remaining walls.
Conclusion: Coltosol® prey expansion can cause significant strains in the remaining coronary structure. Teeth that have 1.0 mm thick walls may be cracked after the shutter expands. The absence of proximal walls in the MOD cavity decreases the expansion strain on the remaining walls.

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INTRODUCTION

The ideal temporary crown sealer should promote good marginal sealing, minimum porosity, dimensional stability, abrasion and compression resistance, be easy to insert and remove, biocompatible, esthetic, low cost, low solubility and antimicrobial activity (Milani, 2017 and Pytko-Polończyk, 2016). Defective apical seals were identified as the main cause of failures in endodontic treatment, and several studies have emphasized the importance of adequate coronal sealing between sessions for successful endodontic (Milani, 2017).

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The persistence of microorganisms and reinfection of root canal, or both are the main factors that contribute to the failure of endodontic treatment (Milani, 2017 and Pytko-Polończyk, 2016). For this reason, avoiding marginal infiltration, keeping the delay dressing intact becomes a prerequisite, and this is possible by placing a good temporary coronary sealing (Tennert, 2016). Solubility, thermal expansion, porosity and contraction are significant variables in the clinical performance of these materials (Tennert, 2016 and Milani, 2016). The use of temporary restorative materials in endodontics is of extreme importance because it prevents contamination of the root canal, preventing infections and allowing the action of the medication used as a dressing for delay when the treatment is

done in sessions. The temporary restorer Coltosol® (Coltène) is composed of a mixture of: zinc oxide, monohydrate zinc sulfate, calcium sulfate hemihydrate, diatomaceous earth, ethylene-vinyl acetate copolymer and mint flavor. The hygroscopic expansion of Coltosol® corresponds to 17.0 - 20.0% of its volume, and its prey is directly linked to fluid absorption, thus hygroscopic expansion together with masticatory forces are directly related to crown fracture endodontically treated teeth. The temporary restorative Coltosol® (Coltène) is composed of a mixture of: zinc oxide, monohydrate zinc sulfate, calcium sulfate hemihydrate, diatomaceous earth, ethylene-vinyl acetate copolymer and peppermint flavor. The hygroscopic expansion of Coltosol® corresponds to 17.0 – 20.0 % of its volume, and its prey is directly linked to fluid absorption, thus hygroscopic expansion together with masticatory forces are directly related to dental fracture of crowns of endodontically treated teeth (Nóbrega, 2013). Thus, the sealing material, however, can in turn provide antimicrobial activity, allowing the reduction or elimination of microorganisms that remain in the cavity or that penetrates through microfiltrations in the coronary sealant (Milani, 2017 and Al‑Hezaimi). The objective of this study was to evaluate the effects of Coltosol prey expansion on the remaining coronary structure of endodontically treated teeth.

MATERIALS AND METHODS

Four human molars were used, extracted for reasons unrelated to this work. After the endodontic treatment, they were restored with Coltosol®. Among the 4 teeth used, we changed the measurements of the surrounding walls and the cavity. Two elements with 2 mm of surrounding wall, one with occlusal cavity and one with Mesio-Occlusal-Distal cavity (MOD). The other 2 elements were left with 1mm of surrounding wall, one with Occlusal cavity and the other with MOD cavity. The teeth were included in a mufla and immersed in Kin Hidrat® artificial saliva where they remained for 7 days. After this period the results were obtained through standardized photos, comparing before / after.

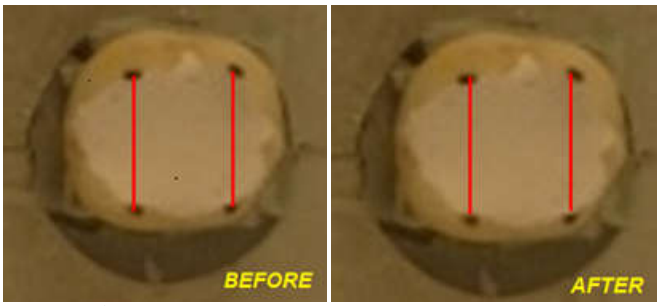
Main Predictors Continuous or Categorical: The main predictor was use of Coltosol®.

Main Predictors Answer: The main predictor of response was expansion and cracking.

RESULTS

Coltosol® presented excellent results in relation to its sealing capacity. It is important to emphasize that this is due to the expansion of the material when in contact with moisture, not justifying its use as a cavity base. In addition, it should be aware of its indications of use: short time and small cavities, which prevents the embrittlement of dental structures during the expansion of it.

The expansion of prey of Coltosol® caused significant tensions in the remaining coronary structure, it was also noticed that teeth that have walls with thickness of 1.0 mm can suffer cracks after the expansion of the obturator and the absence of proximal walls in the cavities Mesio -Occlusion-Distal decreases the tension of the expansion (O) with 1.0 mm of surrounding wall was the most cracks due to stress expansion in the remaining walls (Figures 1-4).



Source: Author, 2017.

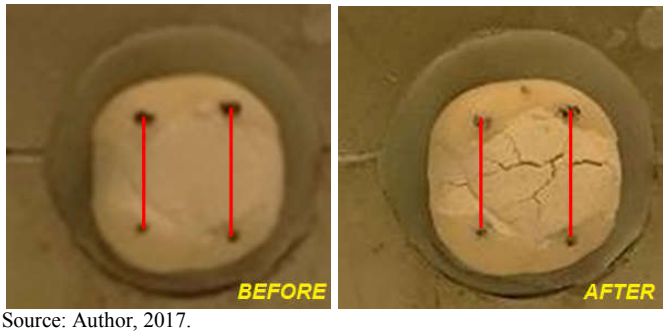
Figure 1. Tooth with 1.0 mm of thickness and occlusal cavity

Source: Author, 2017.

Figure 2. Tooth with 1.0 mm thick and cavity MOD

Source: Author, 2017.

Figure 3. Tooth with 2.0 mm of thickness and occlusal cavity



Source: Author, 2017.

Figure 4. Tooth with 2.0 mm thickness and cavity MOD

DISCUSSION

Endodontic treatment cannot always be performed in a single session. In such situations, it becomes necessary to seal the access cavity by means of a temporary restorative material. This material should provide total isolation between the oral cavity and the root canal. The presence of marginal infiltration may contaminate the pulp cavity, alter the effect of delay medication, and compromise the success of endodontic therapy (Milani, 2017 and Pytko-Polończyk, 2016). In addition, Endodontics does not end with root canal filling; as important as the sealing of the apical region is the coronary sealing to

prevent infiltration, and several studies have shown that this may compromise the entire treatment of the canal (Tennert, 2015). The antimicrobial activity is aggregated to the sealing action of these products, contributing in the performance to decrease or eliminate foci of growth of components of the oral microbiota present in the coronary portion during or after the endodontic therapy (Pytko-Polończyk, 2016 and Milani, 2016). However, the antimicrobial activity of the temporary coronary sealers employed in the intracanal medication phase or the waiting period of the definitive restoration is a subject that has not been much approached (Pytko-Polończyk, 2016 and Milani, 2016). The literature has shown that the Coltosol® sealer showed the best results, corroborating with different authors (Milani, 2017; Pytko-Polończyk, 2016; Tennert, 2015; Milani, 2016 and Domingos, 2015). Coltosol®, as well as Citodur® and Cavit® are ready-to-use materials, without the need for any mixing and easy manipulation. Coltosol® determined the highest mean of microbial growth inhibition halos and was indicated in the study samples as the best antimicrobial property in vitro. Another study stated that the Cavit® sealer has a very similar composition to Coltosol®, having a zinc-related antibacterial activity (Zn^{2+}), due to the dissociation of zinc oxide and zinc sulfate present in the formulation (Al‑Hezaimi). In addition, Coltosol® and materials based on barium sulfate have a high hygroscopic characteristic, which gives them linear expansion when in contact with water, generating literary conflicts. This expansion results in a better marginal seal, explaining its good results in microleakage tests. However, this expansion may lead to fractures of the remaining dental structure, and Coltosol® maladjustment in the occlusal sense, which may result in microleakage (Milani, 2017; Laustsen, 2005; Martins and Pereira, 2006). Tennert et al. (Tennert, 2015), showed that fractures can occur in four days, when Coltosol® is used in temporary sealing, in extensive Class II coronary cavities.

It is important to emphasize that, in order to be effective, it is necessary that temporary restorative materials present, besides satisfactory antimicrobial activity, other characteristics: adequate sealing of the cement-tooth interface, dimensional alteration similar to the tooth, abrasion resistance, compression and ease of insertion and removal of the cavity (Milani, 2017 and Salazar-silva, 2004). The use of temporary coronary seal materials between sessions or at the end of endodontic therapy is one of the determinants of treatment success or failure (Milani, 2017 and Pytko-Polończyk, 2016). These materials are intended to temporarily seal the tooth, preventing the entry of fluids, microorganisms and other debris into the root canal system and prevent the loss of medication (Milani, 2017 and Tennert, 2015). Coronal temporary seal materials should exhibit adhesiveness, low solubility, high mechanical strength, dimensional stability with a similar coefficient to dental tissue, antimicrobial activity, aesthetically acceptable thermal expansion and allow easy placement and removal in the oral cavity (Tennert, 2015; Milani, 2016). However, the type of material, improper preparation of the cavity, misalignment and maladaptation of the material in the cavity walls, and the absence of a temporary crown seal of dental wear can lead to microleakage as well as unwanted expansion leading the formation of cracks in teeth (Milani, 2017 and Domingos, 2015). In the present study, it is important to emphasize that the teeth were at rest, and if they had mouth they would suffer masticatory forces and the chances of having cracks would be greater. In this context, teeth filled with Coltosol® presented greater expansion and consequent formation of dental cracks. Still, teeth that have walls with a thickness of 1.0 mm and Occlusal Class are more likely to suffer cracks after the expansion of the obturator.

Conclusion

Coltosol® prey expansion can cause significant strains in the remaining coronary structure. Teeth that have 1.0 mm thick walls may be cracked after the shutter expands. The absence of proximal walls in the MOD cavity decreases the expansion strain on the remaining walls.

Competing Interests: The authors declare no competing interests.

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