

DISCUSSION

INTRA-CANAL ANTIBIOTIC PASTES MAY PROMOTE THICKER DENTIN WALLS AND CALCIUM HYDROXIDE MAY PROMOTE MORE APICAL CLOSURE



To compare the role of 2 intra-canal medications (antibiotic pastes and calcium hydroxide) during the regenerative endodontic treatments in inducing thicker dentin wall, longer roots, higher proportion of apical closure, and/or more periapical repair.

REVIEWERS

MOHAMMED MURAD AND MONTY S DUGGAL

Article Title and Bibliographic Information

Báez, Viviana; Corcos, Lorena; Morgillo, Florencia; Imperatrice, Lorena; Gualtieri, Ariel Félix (2022). Meta-analysis of regenerative endodontics outcomes with antibiotics pastes and calcium hydroxide. The apex of the iceberg. *J Oral Biol Craniofac Res* 12(1): 90-98.

SORT SCORE

A	B	C	N/A
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SORT, Strength of Recommendation Taxonomy.

LEVEL OF EVIDENCE

1	2	3
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See article 101482 for complete details regarding SORT and LEVEL OF EVIDENCE grading system.

SUMMARY

Subjects or Study Selection

Types of studies: Randomized controlled clinical trials, but uncontrolled prospective and retrospective clinical trials such as case series, pilot, and cohort studies were also included. *Inclusion criteria:* Regenerative endodontic therapy with the use of calcium hydroxide or antibiotic pastes as intra-canal medicaments. The inclusion criteria were also limited to incompletely developed human teeth diagnosed with pulp necrosis or periapical pathology. *Search methods for identification of studies:* limited to: 1) electronic searches only 2) the period between 2009 and 2020 and 3) a number of databases; Pubmed - MEDLINE, Scopus and Lilacs-BVS. Potentially relevant articles were retrieved, and read by the authors. Thirty-two trials were included.

Key Study Factor

This systematic review investigated the use of 2 intra-canal medications, antibiotic pastes and calcium hydroxide, during regenerative endodontic therapy. However, the composition of the antibiotics pastes was not the same in all the included studies. This systematic review was limited to treatment of teeth with incomplete root development, which was diagnosed with pulp necrosis or periapical pathology.

Main Outcome Measures

Assessment of the accomplished root development in regard to the root thickness, length, apical closure, and repair.

SOURCE OF FUNDING

Non-funded study

TYPE OF STUDY/DESIGN

Systematic review and meta-analysis.

KEYWORDS

Regenerative endodontics,
Antibiotics, Calcium hydroxide,
Treatment outcomes, Meta-analysis

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Main Results

The proportion of dentin wall thickening was higher when antibiotic pastes were used as intra-canal medication during regenerative endodontic therapy, while the proportion of apical closure was greater with the use of calcium hydroxide.

The antibiotic pastes were more effective than calcium hydroxide in stimulating thicker dentin walls with the percentage of 66% (CI95: 58%-73%), $I^2 = 61%$ (CI95: 38%-75%) and 53% (CI95: 26%-78%), $I^2 = 80%$ (CI95: 60%-90%) respectively. The use calcium hydroxide was more effective than the antibiotics in promoting apical closure with the percentage of 88% (CI95: 80%-93%), $I^2 = 13%$ (CI95: 0%-78%) and 66% (CI95: 58%-73%), $I^2 = 61%$ (CI95: 40%-75%) respectively.

Conclusions

The authors concluded that the use of antibiotics as intra-canal medication during regenerative endodontic therapy could lead to a higher proportion of dentin wall thickening than the use of calcium hydroxide. On the other hand, calcium hydroxide could lead to a higher proportion of apical closure than the antibiotics.

COMMENTARY AND ANALYSIS

For several decades, the long-term use of calcium hydroxide prior to obturation was the treatment of choice for necrotic immature permanent teeth in order to induce or stimulate the formation of a biologic calcified apical barrier (apexification). The formation of a calcified apical barrier requires several treatment appointments. In addition, the prolonged application of calcium hydroxide as an intra-canal medication could potentially weaken the root, and increase the risk of fracture.¹ However, the creation of an artificial apical barrier with MTA overcame some of these drawbacks, and reportedly achieved higher success.²

Although both Ca(OH)₂ and MTA achieve apical barriers against which root canal obturation material can be placed, these techniques do not promote the qualitative or quantitative development of the thin, fragile, and short roots.³ The ultimate aim of the current regenerative (revitalization) endodontic therapy is to promote the full development, including length, thickness, and apical closure of these roots.⁴ In most revitalization protocols, one of the important steps is to achieve root canal disinfection and initiate inter-canal bleeding, which might allow stem cells to migrate into the root canal space and serve as scaffolds with growth factors to provide an appropriate environment for regeneration. Indeed, in some cases clinical responses to vitality tests have been reported.⁵

The most common medications for disinfecting the canals are calcium hydroxide and triple antibiotic paste (ciprofloxacin, metronidazole and minocycline).^{3,6}

This systematic review and descriptive meta-analysis are based on a number of prospective and randomized clinical trials. However, the inclusion of the case series, prospective and retrospective uncontrolled studies has significantly reduced the strength of this systematic review; in systematic reviews, guidelines (GRADE, PRISMA, PRISMA-P, and Navigation Guide) usually remove such uncontrolled trials due to the difficulties in assessing the study internal validity.⁷ For example, the antibiotics used, irrigation protocols and even regenerative protocols, which all could have considerable impact on stem cells survival, were not the same in all the included studies.

Despite the fact that the assessment of risk of bias in the included studies was conducted, no details were provided to support or to explain the reasons behind the authors' judgments. In addition, the performance bias (blinding of participants and personnel) was considered to be low in 4 studies and unclear in 7 studies. However, it could be argued that the blinding of operators in dentistry is not always possible, especially when using medications which have different color, texture or different methods of application. Furthermore, the selection bias (random sequence generation and allocation concealment) and performance bias were considered by the authors as not applicable for one of the included randomized clinical trials.

In this systematic review, the characteristics of excluded studies and the reason for exclusion were not provided and the characteristics of the included studies were not reported. One issue of major concern was that the studies included in the analysis did not all have a uniform or a standardized way of measuring dentin thickness or apical closure. In some studies, measurements were made using simplistic digital methods alongside semi-standardized radiographs,⁸ while in some studies efforts were made to achieve complete standardization of radiographs, and sophisticated and validated image analysis tools were applied.⁹ It is also not clear how the authors pooled the data for apical closure, and whether apical closure means continuation of development around the apical area of the root and narrowing of the apical constriction or just deposition of hard tissue to form a barrier without any further root development. Without this clarity, it is difficult to ascertain if the improved apical closure in this review with calcium hydroxide is just the formation of an apical hard tissue barrier, which is known to result from the application of calcium hydroxide, rather than the revitalization procedure.

Another issue that can certainly affect the outcome of revitalization is the etiology of pulp necrosis in immature teeth. The studies included immature teeth that had been treated due to a number of reasons, such as trauma, and also developmental anomalies such as dens invaginatus, which also have an important bearing on the outcomes.

This systematic review does not provide clear evidence that the use of antibiotic pastes promotes thicker dentin walls or that the use of Ca(OH)₂ promotes more apical closure. It merely gives an indication of the potential role of these 2 materials when used for revitalization procedures, but further clinical evidence derived from studies that use these materials as direct comparators is needed.

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REVIEWERS

MOHAMMED MURAD, BDS,

Clinical MSc in Endodontics (University of Manchester, UK), Clinical MSc in Prosthetic Dentistry (University of Bristol, UK) Division of Clinical Dentistry, The Primary Health Care Corporation, Doha, Qatar P.O. Box: 26555 dr_m_murad@hotmail.com.

M. S. DUGGAL (DEAN OF COLLEGE OF DENTAL MEDICINE), BDS, MDS, FDS RCS (LONDON), FDS (PAED DENT), RCS (LONDON), PHD (UNIVERSITY OF LEEDS, UK),

College of Dental Medicine, Qatar University Health, Qatar University mduggal@qu.edu.qa.