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In vivo evaluation of microbial reduction after chemo-mechanical preparation of necrotic root canals with or without apical periodontitis

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ABSTRACT

Objectives: Assessment of bacterial reduction after chemo-mechanical preparation (using 3% sodium hypochlorite) with or without intracanal dressing (calcium hydroxide paste ($Ca(OH)_2$) or 2% chlorhexidine digluconate gel (CHX)) in necrotic pulps associated or not with apical lesion.

Methods: Prospective clinical trial, in 69 adult patient's teeth with pulpal necrosis associated or not with apical periodontitis. Microbiological root-canal-sampling occurred before treatment (S1), after chemo-mechanical preparation (S2) and after 14 days intracanal dressing (S3). Colony Forming Units (CFU) were counted after growth in aerobic, anaerobic and microaerofilic cultures. Comparison of the median CFUs treatments and culture media was done with the Friedman test. Comparison of the intracanal dressing effect at S3 was done with the Wilcoxon and the Mann–Whitney tests. Because of the huge differences in bacterial counts variations were expressed as log 10 to analyze differences among intracanal medication groups. S2 and S3 counts were expressed as percentage of CFU reduction regarding S1 counts.

Results: Significant differences were detected between S1, S2 and S3 (Friedman test; $p < 0.001$), showing a significant decrease from S1 to S2 (Wilcoxon test; $p < 0.004$), followed by a significant increase from S2 to S3 ($p < 0.001$) for the CHX group, maintenance for the $Ca(OH)_2$ group in aerobic/anaerobic (Wilcoxon test; $p = 0.777/0.227$), and increase in the microaerofilic culture (Wilcoxon test; $p = 0.047$). The two groups only differed significantly in S3 (Mann–Whitney test; $p \leq 0.001$), with a worse performance in the CHX group.

Conclusions: Treatment significantly reduced the number of bacteria but failed to render all root canals sterile. $Ca(OH)_2$ performed better than CHX gel.

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Avaliação da carga bacteriana após preparação químico-mecânica de dentes necrosados com ou sem lesão periapical

Palavras-chave:
Tratamento antimicrobiano
Necrose pulpar
Periodontite apical
Medicação intracanalar
Infeção endodôntica

RESUMO

Objetivos: Avaliar a eficácia da preparação químico-mecânica com ou sem medicação intracanalar (pasta de hidróxido de cálcio [$Ca(OH)_2$] ou gel de digluconato de clorhexidina a 2% [CHX]) no tratamento de dentes necrosados com ou sem lesão periapical.

Métodos: Ensaio clínico prospetivo em 69 dentes monocanalares com necrose pulpar ou periodontite apical. A colheita microbiológica ocorreu antes do tratamento (S1), após preparação qui'mico-mecânica (S2) e após 14 dias de medicação intracanalar (S3). Mediram-se as unidades formadoras de colónias (UFC) em aerobiose, anaerobiose e microaerofilia. As medianas de UFP de diferentes tratamentos e culturas foram comparadas com o teste de Friedman. A comparação do efeito da medicação intracanalar em S3 utilizou os testes Wilcoxon e t. Mann-Whitney. Dada a grande variabilidade de UFC nos distintos momentos de colheita, as diferenças entre S1, S2 e S3 foram traduzidas em logaritmos de 10. As contagens de S2 e S3 foram expressas como percentagem de redução de carga bacteriana relativamente a S1.

Resultados: Encontraram-se diferenças significativas entre S1, S2 e S3 (teste Friedman; $p < 0{,}001$), com decréscimo significativo de S1 para S2 (teste Wilcoxon; $p < 0{,}004$), e aumento significativo de S2 para S3 ($p < 0{,}001$) no grupo de CHX, manutenção em aerobiose e anaerobiose (teste Wilcoxon; $p = 0{,}777/0{,}227$) e aumento em microaerofilia (teste Wilcoxon; $p = 0{,}047$) para o grupo experimental com $Ca(OH)_2$. Os 2 grupos só diferiram significativamente em S3 (teste Mann–Whitney; $p \leq 0{,}001$), com pior desempenho da CHX.

Conclusões: O tratamento reduziu, de forma significativa, a carga bacteriana, mas não esterilizou os canais radiculares. O $Ca(OH)_2$ apresentou melhor desempenho que a CHX.

Introduction

Apical periodontitis (AP) results from pulp space polymicrobial infection[1–3] dominated by fastidious anaerobes, which, by symbiotic relationships, acquire specific sources of longer survival.[4,5] Thus treatment must aim at all bacteria, microaerophilic, aerobic or anaerobic, strict or facultative, that is to say that the best scientific evidence-based documented procedure for the best outcome in endodontic treatment is based on the maximum disinfection of the root canal system.[6]

Regardless of the number of sessions, an effective bacteriological control is mandatory. The biologic concerns should always be a priority.[7,8]

Mechanical instrumentation coupled with sodium hypochlorite (NaOCl) irrigation dramatically reduces bacterial counts.[9] However, since not all microorganisms are eliminated, intracanal dressing, primarily Calcium hydroxide paste ($Ca(OH)_2$), has been advocated.[10] Though, efficacy of this added step is controversial,[11] both up to 97% bacterial reduction[12–16] and increases in bacteria counts[17,18] were reported. To overcome $Ca(OH)_2$ limitations, 2% chlorhexidine digluconate gel (CHX) has emerged as an alternative.[16,19,20] It has shown excellent antibacterial efficacy *in vitro*[20] and a residual activity for up to 2 weeks or more.[20] However, *in vivo*, liquid CHX resulted in bacterial load increase.[16]

Treatment outcome may also be influenced by interindividual variability. This is even more evident when individuals from different geographical locations are analysed.[21–24]

The present randomized clinical trial aimed at comparing the efficacy of chemomechanical cleaning alone and in combination with 2 intracanal dressings by 3 atmospheres of culture. To the best of our knowledge, this is the first report on the study of the microbiological microenvironment in root canals of Portuguese Patients.

Materials and methods

Study adhered to Helsinki Declaration. Protocol was approved by the Ethics Committee of health Sciences Faculty of Fernando Pessoa University and an informed consent was obtained.

Using stringent criteria as described by others,[25] sample included 69 subjects (35 women/34 men; mean 49.7 years) with 69 single-teeth (18 central and 16 lateral maxillary incisors, 10 mandibular and 10 maxilar premolars, 9 maxilar and 6 mandibular canines). From those, 26 were only necrotic and 43 had AP. All were chemomechanically prepared and randomly divided into two groups: calcium hydroxide paste ($Ca(OH)_2$) or 2% chlorhexidine digluconate gel (CHX). The random order of assignment was previously generated, using Excel-generated random numbers, which were concealed in opaque, sealed, serially numbered envelopes and applied to participants as they entered the trial. $Ca(OH)_2$ (Sigma–Aldrich, Sintra, Portugal) was manufactured with sterile saline solution (SSS) and CHX was prepared by a private Pharmacy and maintained at