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Major approaches to antiseptic management for endodontic treatment in the COVID-19 pandemic: a guideline

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Abstract

Introduction: In the COVID-19 pandemic scenario, in addition to the pathogenesis of SARS-CoV-2, microbial coinfection increases the difficulties of diagnosis, treatment, the prognosis of COVID-19, as well as it can worsen comorbidities and affect the risk of the life of patients. COVID-19 has had a profound impact on dentistry. In addition to endodontic treatment, a management protocol was suggested. **Objective:** To present the importance of effectively performing endodontic asepsis in the context of the COVID-19 pandemic, to elucidate that infection by the SARS-CoV-2 virus can lead to coinfection, worsening the conditions for endodontic treatment. **Methods:** The research was carried out from July 2021 to August 2021 and developed based on Scopus, PubMed, Science Direct, Scielo, and Google Scholar, following the Systematic Review-PRISMA rules. The quality of the studies was based on the GRADE instrument and the risk of bias was analyzed according to the Cochrane instrument. **Results:** A total of 70 articles were found involving the endodontic treatment and COVID-19. A total of 58 articles were evaluated in full and 39 were included and evaluated in the present study. It was found that ozone has high antimicrobial action. N-acetylcysteine (NAC) has a potent effect against endodontic biofilms. Calcium hydroxide is more effective as a root canal disinfectant in primary teeth than formocresol and camphorphenol. The association of 2% chlorhexidine followed by ozone gas for 24 seconds promoted the complete elimination of *Candida albicans* and *Enterococcus faecalis*. Low-intensity laser therapy has the property of oral sterilization, facilitating tissue healing and sterilization. Combining antimicrobial photodynamic therapy with antimicrobial irrigants may provide a synergistic effect. **Conclusion:** There are effective treatments for the sterilization of endodontic tissues, to avoid as much as possible the coinfection with SARS-CoV-2 and the consequent worsening of the infectious condition, highlighting calcium hydroxide, ozone therapy, and laser therapy.

Keywords: Endodontic treatment. Root canal. COVID-19. SARS-CoV-2. Coinfection. Antimicrobial agents.

Introduction

In the scenario of the COVID-19 pandemic, in addition to the pathogenesis of SARS-CoV-2, microbial coinfection increases the difficulties of diagnosis, treatment, and prognosis of COVID-19, as well as worsening comorbidities and affecting the risk of life for patients [1]. In this context, COVID-19 had a profound impact on dentistry, as most treatments were discontinued. The guidelines available for the treatment of dental emergencies are counseling, analgesia, and antimicrobials when indicated in the first instance. A suspect or COVID-19 positive patient needs treatment at designated emergency dental care centers. In focus on endodontic treatment, a management protocol was suggested, describing techniques to minimize the potential viral load and reduce the risk of COVID-19 transmission [2].

Added to this, a letter was published on the impact of COVID-19 in Dentistry [3], exploring the transmission routes, implications, and necessary controls in dental practice [4]. In addition, several global, national and dental organizations have issued guidelines, such as the American Dental Association, British Dental Association, and the WHO [5].

In the context of COVID-19 and co-infection, the biofilm as a microbial community with a self-produced matrix of extracellular polymeric substance (EPS) stands out [6,7]. These biofilms are extremely difficult to eradicate with antimicrobial agents [8]. In this sense, the endodontic disease is a biofilm-mediated infection, and it is necessary to eradicate the biofilm from the root canal [9]. The use of intracanal drugs to eliminate the biofilm and its bacteria within the root canals has been advocated [10,11]. Thus, chlorhexidine (CHX) and calcium hydroxide (CaOH2) have been widely used [12]. However, CHX is inactivated by physiological salts, decreasing its penetration and action against biofilms [13,14]. Furthermore, CaOH2 has low diffusibility and its antimicrobial efficacy is compromised by the buffering, increasing the resistance of Enterococcus faecalis [15-17].

Also, N-acetylcysteine (NAC), a derivative of the amino acid l-cysteine, is a potent thiol-containing antioxidant that serves as a precursor of glutathione synthesis [18]. Also, NAC reduces the production of EPS, reducing bacterial adhesion to surfaces, which makes it difficult to install mature biofilms. Thus, NAC has antibacterial and antibiofilm effects against oral pathogens such as *Prevotella intermedia* [19] and *E. faecalis* [20] in endodontic infections [21].

Furthermore, ozone also stands out as an important endodontic antiseptic [22,23]. Ozone acts on glycolipids, glycoproteins, or certain amino acids, which are present in the cytoplasmic membrane of microorganisms [24,25]. In this sense, there is the production of ozonides that have antimicrobial effects [23,25]. Some authors have demonstrated that ozone therapy has similar results compared to NaOCl in reducing various species of bacteria [26-29]. Added to this, the application of laser in endodontics stands out as an important tool to reduce or eliminate endodontic infection bacteria [30]. Low-intensity laser therapy has been used in dentistry to promote analgesia, modulation of inflammation, and tissue healing [30].

Therefore, the present study aimed to present the importance of effectively performing endodontic asepsis in the context of the COVID-19 pandemic, to elucidate that infection by the SARS-CoV-2 virus can lead to coinfection, worsening the conditions for treatment endodontic.

Methods

Study Design

The rules of the Systematic Review-PRISMA Platform (Transparent reporting of systematic reviews and meta-analysis-HTTP://www.prisma-statement.org/) were followed [31].

Results and Development

Data sources and research strategy

The search strategies for this systematic review were based on the keywords (MeSH Terms): "Endodontic treatment. Root canal. COVID-19. SARS-CoV-2. Coinfection. Antimicrobial agentes". The research was carried out in July 2021 to August 2021 and developed based on Scopus, PubMed, Science Direct, Scielo, and Google Scholar. Also, a combination of the keywords with the booleans "OR", "AND", and the operator "NOT" were used to target the scientific articles of interest.

Study Quality and Bias Risk

The quality of the studies was based on the GRADE instrument [32] and the risk of bias was analyzed according to the Cochrane instrument [33]. Two independent reviewers (1 and 2) carried out research and study selection. Data extraction was performed by reviewer 1 and fully reviewed by reviewer 2. A third investigator decided on some conflicting points and made the final decision to choose the articles.

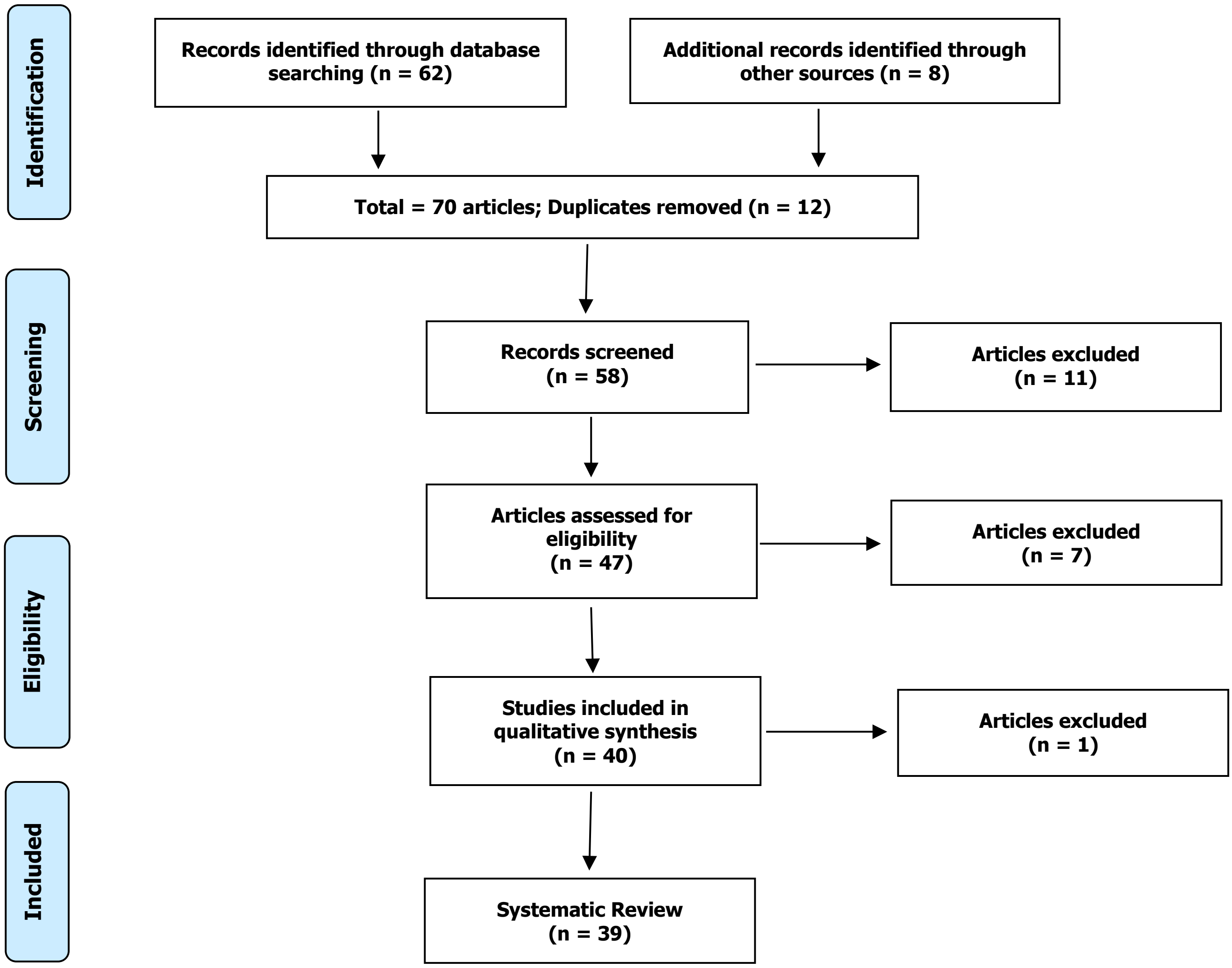
Results and Discussion

A total of 70 articles were found involving the endodontic treatment and COVID-19. Initially, duplication of articles was excluded. After this process, the abstracts were evaluated and a new exclusion was performed, removing articles that did not include the theme of this article. A total of 58 articles were evaluated in full and 39 were included and evaluated in the present study (**Figure 1**).

Considering the Cochrane tool for risk of bias, the overall assessment resulted in 3 studies with a high risk of bias and 4 studies with uncertain risk. The domains that presented the highest risk of bias were related to the number of participants in each study addressed, and the uncertain risk was related to the endodontic treatment and coinfection. Also, there was an absence of the source of funding in 2 studies and 1 study did not disclose information about the conflict of interest statement.

The removal of bacterial biofilm from the root canal system is essential for the management of endodontic disease, especially during the COVID-19 pandemic period, it was found that ozone has a high antimicrobial action [27]. A significant decrease in oral cell cytotoxicity was observed with ozone gas compared to 2.25% NaOCl and 2% chlorhexidine gluconate [28]. Furthermore, N-acetylcysteine (NAC) has a potent effect against

Figura 1. Flow Chart of Study Eligibility.



endodontic biofilms formed by *Actinomyces naeslundii*, *Lactobacillus salivarius*, *Streptococcus mutans*, and *Enterococcus faecalis* [21].

Also, a meta-analysis study analyzed the effectiveness of calcium hydroxide compared to formocresol (FC) and camphorphenol (CP) in root canal disinfection of primary teeth. A total of 16 randomized controlled trials of 3,047 primary teeth were included in this meta-analysis showed that there were significant differences in clinical efficacy between calcium hydroxide and FC in root canal disinfection of primary teeth and endodontic emergencies between appointments after disinfection for 7 days. Furthermore, there were significant differences in clinical efficacy between calcium hydroxide and CP in root canal disinfection of primary teeth. Therefore, calcium hydroxide was shown to be more effective as a root canal disinfectant in primary teeth than FC and CP [34].

Also, a study evaluated the antibacterial effect of 0.5% metronidazole, 2% chlorhexidine, and normal saline irrigant solutions against *Enterococcus faecalis* bacteria in the treatment of root canals of 60 primary anterior teeth in children. The bacterial count of *E. faecalis* decreased in all groups, however, these differences were statistically insignificant. Therefore, 0.5% metronidazole and 2.0% chlorhexidine had similar antibacterial action against *E. faecalis* [35].

Besides, a total of 16 randomized trials were analyzed to compose a meta-analysis study. The clinical efficacy of calcium hydroxide was compared to formocresol in 12 studies and the pooled data indicate that calcium hydroxide was significantly better in terms of clinical efficacy (OR = 3.37; 95% CI 2.54 to 4.48) and was associated with a significant reduction in an emergency between visit visits (OR = 0.26; 95% CI 0.16-0.42). Calcium hydroxide has been compared to camphorphenol in seven studies and is significantly superior in its clinical efficacy (OR = 5.50; 95% CI 3.36 to 8.98) [36].

In addition, a study analyzed whether irrigation with sodium hypochlorite, chlorhexidine, and ozone gas, alone or in combination, were effective against *Enterococcus* *faecalis* and *Candida albicans*. A total of 220 recently extracted single-leg teeth were inoculated with *Candida albicans* and *Enterococcus faecalis*. The formulations tested were sodium hypochlorite at 1, 3 and 5%, chlorhexidine at 0.2% and 2%, and ozone gas applied for different periods. The combination of 5% sodium hypochlorite and 2% chlorhexidine with gaseous ozone was also evaluated. Sodium hypochlorite, chlorhexidine, and ozone gas alone were ineffective in the complete elimination of microorganisms. The association of 2% chlorhexidine followed by ozone gas for 24 seconds promoted the complete elimination of *Candida albicans* and *Enterococcus faecalis* [37].

One study evaluated the effectiveness of irrigation of periodontal pockets with ozonized water and 0.2% chlorhexidine gluconate as an adjunct to scaling and root planning in the management of chronic periodontitis. A total of 20 patients aged 30-60 years with chronic periodontitis were included. Irrigation was performed after 2 weeks of scaling and root planing on the same day with ozonized water and 0.2% chlorhexidine gluconate for two and a half minutes. Both groups showed improvement in clinical parameters. When the comparison was made between the two groups, the ozonized water showed a slightly better improvement than the chlorhexidine group. Therefore, subgingival irrigation with ozonized water is beneficial over conventional therapeutic modalities. Ozonized water restricts the formation of dental plaque and reduces the number of subgingival pathogens, thus treating periodontal diseases [38].

Furthermore, in the field of laser therapy, it was analyzed that low-intensity laser therapy has the property of oral sterilization, facilitating tissue healing after surgical procedures [39-42]. Besides, new alternative treatment modalities have been proposed, including high-power lasers and antimicrobial photodynamic therapy (aPDT). Thus, a systematic review study evaluated the outcome of root canal disinfection to the effectiveness of various treatment modalities. The study concluded that the combination of aPDT with antimicrobial irrigants may provide a synergistic effect. However, there is a lack of a standardized protocol [41].

Conclusion

There are effective treatments for sterilization of endodontic tissues, to avoid as much as possible the coinfection with SARS-CoV-2 and the consequent worsening of the infectious condition, highlighting calcium hydroxide, ozone therapy, and laser therapy.

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Data sharing statement

No additional data are available.

Conflict of interest

The authors declare no conflict of interest.

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