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**CLOREXIDINA EM ENDODONTIA: UMA ANÁLISE BIBLIOMÉTRICA DOS 100  
ARTIGOS MAIS CITADOS**

Florianópolis

2024

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ARTIGOS MAIS CITADOS**

Dissertação submetida ao Programa de Pós-Graduação em Odontologia, Departamento de Odontologia da Universidade Federal de Santa Catarina para a obtenção do título de Mestre em Endodontia.

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O presente trabalho em nível de mestrado foi avaliado e aprovado por banca  
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Certificamos que esta é a **versão original e final** do trabalho de conclusão que foi  
julgado adequado para obtenção do título de Mestre em Odontologia.

Coordenação do Programa de Pós-Graduação

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Florianópolis, 2024

Dedico este trabalho à minha querida tia Edinha (*in memoriam*) .

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"Todas as substâncias são venenos, não existe nada que não seja veneno. Somente a dose correta diferencia o veneno do remédio."

Paracelso.

## RESUMO

O objetivo deste estudo foi identificar e analisar os 100 artigos mais citados sobre o uso de clorexidina em endodontia. Foi realizada uma busca bibliográfica na base de dados Web of Science Core-Collection (WoSCC) até setembro de 2023. O número de citações foi cruzado com as contagens de citações Scopus (S) e Google Scholar (GS). Os dados coletados incluem número e densidade de citações, autoria, ano e periódico de publicação, desenho e tema do estudo, palavras-chave, instituição e país de origem. A correlação de Spearman foi utilizada para determinar a correlação entre os números de citações de diferentes bases de dados e os fatores de impacto. O software VOSviewer foi utilizado para gerar mapas de rede colaborativos para autores e palavras-chave. O número de citações variou de 65 a 953 e os artigos foram publicados entre 1993 e 2022. Os desenhos e temas de estudo mais frequentes foram estudos laboratoriais (14%) e irrigantes endodônticos (69%), respectivamente. Gomes BPFA (13%) e Haapasalo M (12%) foram os autores com maior número de artigos. Os países com mais artigos foram Brasil (27%) e Estados Unidos (18%). A Universidade Estadual de Campinas (12%) e a Universidade Estácio de Sá (8%), ambas no Brasil, foram as instituições com mais artigos. Correlações positivas foram encontradas entre o número de citações nas três bases de dados. Os 100 artigos mais citados relacionados ao uso da clorexidina em endodontia foram publicados principalmente no Brasil, com foco em estudos laboratoriais relacionados ao uso da clorexidina como solução irrigante.

Palavras-chave: gluconato de clorexidina; endodontia; irrigante endodôntico; análise bibliométrica.

## ABSTRACT

The objective of this study was to identify and analyze the 100 most cited articles on the use of chlorhexidine in endodontics. A bibliographic search was carried out using the Web of Science Core-Collection (WoSCC) database until September 2023. The number of citations was cross-referenced with Scopus (S) and Google Scholar (GS) citation counts. The collected data include the number and density of citations, authorship, year and periodical of publication, study design and theme, keywords, institution, and country of origin. Spearman's correlation was used to determine the correlation between the citation numbers from different databases and impact factors. VOSviewer software was used to generate collaborative network maps for authors and keywords. The number of citations ranged from 65 to 953, and articles were published between 1993 and 2022. The most frequent study designs and themes were laboratory-based studies (14%) and endodontic irrigants (69%), respectively. Gomes BPFA (13%) and Haapasalo M (12%) were the authors with the largest number of articles. The countries with the most articles were Brazil (27%) and the United States (18%). Campinas State University (12%) and Estacio de Sá University (8%), both in Brazil, were the institutions with the most articles. Positive correlations were found between the number of citations in the three databases. The 100 most cited articles related to the use of chlorhexidine in endodontics were mainly published in Brazil, focusing on laboratory-based studies related to the use of chlorhexidine as an irrigating solution.

Keywords: chlorhexidine gluconate; endodontics; root canal irrigant; bibliometric analysis.



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## LISTA DE ABREVIATURAS E SIGLAS

WOS-CC	Web of Science Core Collection
S	Scopus
GS	Google Scholar
CHX	Clorexidina
NAOCL	Hipoclorito de sódio
EUA	Estados Unidos da América
OMS	Organização Mundial de Saúde
VOSVIEWER	Visualizing Scientific Landscapes

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## 1 CONTEXTUALIZAÇÃO

### 1.1 CLOREXIDINA

A persistência de microrganismos dentro do sistema de canais radiculares é a razão mais comum para explicar o fracasso do tratamento endodôntico (LIM et al., 2020). Assim sendo, a desinfecção desse sistema de canais é essencial para o sucesso do tratamento endodôntico (NASCIMENTO et al., 2014). Devido à complexidade do espaço endodôntico, para conseguir obter uma desinfecção adequada, é necessário fazer o preparo biomecânico do canal radicular, que inclui o uso de meios químicos, físicos e mecânicos durante o tratamento endodôntico (LIM et al., 2020).

Com relação aos métodos químicos, as soluções irrigadoras são utilizadas como auxiliares no preparo biomecânico, pois podem remover detritos e microrganismos das áreas que não são alcançadas mecanicamente, removendo-os antes de serem empurrados mais profundamente em direção apical (ASLANTAS et al., 2014; POGGIO et al., 2015). Assim, o uso de soluções irrigadoras neste processo é essencial para garantir a redução dos microrganismos (ÖNÇAĞ et al., 2003). Embora a população de microrganismos seja significativamente reduzida após o preparo químico-mecânico do sistema de canais radiculares, não é possível fazer a remoção total dos mesmos (POGGIO et al., 2015).

É importante ressaltar que os microrganismos se organizam em biofilmes na microbiota dental, o que representa um modo de crescimento protegido, que permite a sobrevivência em um ambiente hostil (MOHAMMADI; ABBOTT, 2009). As bactérias em tal ambiente diferem quando comparadas com suas formas planctônicas e são muito menos suscetíveis à ação antimicrobiana (MOHAMMADI; ABBOTT, 2009). Tem sido relatado que microrganismos cultivados em biofilmes podem ser de 2 a 1000 vezes mais resistentes do que a forma planctônica equivalente dos mesmos (HAJIHASSANI et al., 2022).

Tradicionalmente convencionou-se que as propriedades ideais de um irrigante endodôntico são: ser solvente de tecido orgânico e inorgânico, ter ação antimicrobiana, ser atóxico, possuir baixa tensão superficial e ser um bom lubrificante, no entanto, atualmente nenhuma solução atende a todos esses requisitos (POGGIO et al., 2011). Dentre as soluções irrigadoras, o hipoclorito de sódio (NaOCl) é a mais utilizada para o preparo químico-mecânico (ESTRELA et al., 2002). A boa aceitação desta solução para irrigação deve-se às suas excelentes propriedades, como: capacidade de dissolver tecidos orgânicos, efeito

antimicrobiano, possuir pH alcalino, promover o clareamento, ser desodorizante e ter baixa tensão superficial (GONÇALVES et al., 2016). Contudo, o NaOCl apresenta efeito citotóxico quando em contato com os tecidos periapicais e possui gosto e cheiro desagradáveis, além de manchar roupas (BUKHARI; BATO, 2016; GONÇALVES et al., 2016).

Em consequência disso, outras soluções têm sido estudadas como alternativa ao hipoclorito de sódio para serem utilizadas de forma mais biocompatível e com menos efeitos adversos, sendo a CHX uma das mais recomendadas (GOMES et al., 2013). O Gluconato de clorexidina (CHX) (1,1'-hexamethylene bi [5-(p-chlorophenyl) biguanide] di-D-gluconate) é um composto de biguanida de natureza catiônica que foi desenvolvido na década de 1940 pela Imperial Chemical Industries Co. de Macclesfield (Reino Unido), sendo comercializada desde 1954 para uso clínico (BROOKES et al., 2020). Sua atividade antimicrobiana de amplo espectro causa ruptura das membranas celulares de diferentes bactérias, vírus e fungos (GILBERT; MOORE, 2005). Atualmente essa substância vem sendo utilizada como agente desinfetante para limpeza de tecidos vivos e não vivos e pode ser utilizada como enxaguatório bucal antisséptico para prevenir o acúmulo de placa bacteriana (JANAKIRAM et al., 2020). Além disso, devido às suas propriedades antimicrobianas, sais de clorexidina estão disponíveis em várias formulações para diversas aplicações odontológicas, principalmente em procedimentos de cirurgia, periodontia e endodontia (BROOKES et al., 2020).

Quando comparadas às formas de apresentação da CHX a 2%, apesar de terem propriedades antimicrobianas, substantividade e biocompatibilidade semelhantes, o gel de CHX tem várias vantagens sobre a forma líquida (FERRAZ et al, 2007). O gel de CHX lubrifica as paredes do canal radicular, o que reduz o atrito entre a lima e a superfície da dentina, facilitando a instrumentação e diminuindo os riscos de quebra do instrumento dentro do conduto (FERRAZ et al, 2001). Ainda é relatado na literatura que, devido à tixotropia do gel de CHX, os detritos ficam em suspensão, reduzindo a formação da *smear layer*, o que não ocorre na apresentação líquida da clorexidina (FERRAZ et al., 2001; FERRAZ et al., 2007; GOMES et al., 2013).

A CHX pode ser utilizada no tratamento endodôntico como agente antimicrobiano durante o preparo do canal radicular, para desinfecção do campo operatório, acesso aos canais radiculares, irrigação, medicação intracanal, desinfecção de cones de guta-percha, retratamento endodôntico e regeneração pulpar (GOMES et al., 2013; GONÇALVES et al., 2016). Considerando sua versatilidade na endodontia, inúmeras pesquisas vêm sendo realizadas para investigar o uso atual e novas perspectivas da CHX em endodontia (MOHAMMADI;

ABBOTT, 2009; RUKSAKIET et al., 2020). Dessa forma, surge a necessidade de um estudo que analise quali-quantitativamente as principais características e o perfil científico dos estudos relacionados ao uso da CHX em endodontia. Assim, uma revisão bibliométrica com essa temática torna-se essencial.

## 1.2 REVISÃO BIBLIOMÉTRICA

A análise bibliométrica é um desenho de estudo baseado em informações quantitativas que avalia e delimita o perfil científico de um determinado campo do conhecimento (DOS ANJOS et al., 2023). Essa análise costuma agrupar um grande conjunto de estudos e extrair os principais dados, demonstrando dessa forma as principais tendências e exibindo as principais lacunas que precisam ser exploradas para um maior desenvolvimento da área em questão (LIMA et al., 2023). Nessa revisão são utilizadas técnicas e métodos bibliométricos para identificar, coletar e analisar dados bibliográficos, como o número de citações, frequência de publicações, autores mais produtivos, periódicos mais influentes e padrões de colaboração entre pesquisadores (SHEHANI et al., 2023).

O objetivo principal da revisão bibliométrica é apresentar uma visão panorâmica da produção científica em uma área específica, permitindo que pesquisadores, instituições e tomadores de decisão avaliem a evolução do conhecimento em determinado campo, identifiquem tendências, lacunas e áreas de interesse crescente (AHMAD et al., 2019). Além disso, pode ajudar a identificar redes de colaboração e a visualizar a influência de um determinado trabalho ou autor dentro da comunidade científica (AHMAD et al., 2019). Para realizar uma revisão bibliométrica, é necessário utilizar bases de dados bibliográficas - sendo a Web of Science Core Collection a mais indicada – e então aplicar técnicas e métricas bibliométricas adequadas, como índices de citação (como o índice h ou o fator de impacto), análises de cocitação e coocorrência de palavras-chave (KOLAH & KHAZAEI, 2016). Com a finalidade de cruzar os dados e fazer uma análise de citações mais completa, utiliza-se outras bases para complementar os achados na WoS, sendo que neste estudo escolheu-se as bases de dados Scopus e Google Scholar.

A análise de citações é uma análise básica em que se contabiliza o número de vezes que um artigo, autor ou periódico foi citado em outras publicações, podendo ajudar a identificar trabalhos ou autores altamente influentes dentro de um campo de estudo (KUMAR, 2016). Já os índices de citação, são métricas que buscam quantificar o impacto de um artigo, autor ou

periódico com base no número de citações recebidas (TANG et al., 2014). O índice h (índice Hirsch) é um exemplo comum, serve para quantificar a produtividade e o impacto de pesquisadores baseando-se nos seus artigos mais citados, apesar de ter dificuldade de analisar aqueles em início de carreira ou com baixa produção (CAMACHO et al., 2023).

O fator de impacto de periódicos é uma medida que avalia a importância relativa de um periódico em função do número médio de citações recebidas pelos artigos publicados nesse periódico em um determinado período (GÓRSKI et al., 2021). Já a análise de citações é uma forma de análise bibliométrica que se concentra na investigação das citações presentes em artigos científicos ou outras publicações acadêmicas, visando entender como os trabalhos acadêmicos estão interconectados por meio de referências e citações cruzadas (CHIANG et al., 2020).

O avanço na construção de pesquisas científicas em uma determinada temática pode ser analisado através de um conjunto de métodos bibliométricos como a análise do número de citações (DONTHU et al., 2021). É considerado influente no avanço do conhecimento científico artigos que possuem alto número de citações (GARFIELD et al., 2019). Artigos que somam 100 citações ou mais, podem ser considerados “clássicos” em um campo específico da ciência (FEIJOO et al., 2014).

A análise bibliométrica auxilia os pesquisadores a identificar tendências de pesquisa, instituições, países, autores e periódicos mais prevalentes (CELESTE et al., 2016). Uma parcela dos artigos de revisão bibliométrica excluem artigos de editoriais e resumos de congresso por não serem estudos que passaram por uma revisão crítica por pares, o que pode comprometer a confiabilidade dos resultados (AHMAD et al., 2020; ARAKERI et al., 2021).

Inúmeras análises bibliométricas foram realizadas em endodontia (SHAMSZADEH et al., 2019; ORDINOLA-ZAPATA et al., 2020; BRITO et al., 2022; LIMA et al., 2023; DE ARAÚJO et al., 2022). No entanto, nenhuma revisão avaliou o perfil científico do uso da CHX dentro dessa especialidade odontológica.

## **2 JUSTIFICATIVA**

A clorexidina é amplamente utilizada em endodontia por suas propriedades antimicrobianas e de desinfecção. Contudo, atualmente, não existe um levantamento bibliométrico específico sobre o uso da clorexidina em endodontia. A falta de uma análise bibliométrica detalhada impede uma compreensão completa do desenvolvimento histórico e das tendências emergentes relacionadas ao tema. Assim sendo, essa análise bibliométrica visa delinear o perfil das publicações sobre o uso a clorexidina em endodontia, bem como nortear estudos futuros sobre esse tema.

### 3 OBJETIVOS

#### 3.1 OBJETIVO GERAL

Identificar e analisar as principais características dos 100 artigos mais citados sobre clorexidina em endodontia.

#### 3.2 OBJETIVOS ESPECÍFICOS

- Analisar os 100 artigos com maior número de citações publicados por autores nacionais e internacionais em periódicos de Odontologia, com a finalidade de destacar as principais características destes estudos;
- Verificar em cada artigo os seguintes parâmetros bibliométricos: título, número e densidade de citações, ano de publicação, autoria, país, periódico, temática e desenho do estudo;
- Comparar o número e densidade de citações entre os bancos de dados nas bases Web of Science, Scopus e Google Scholar e verificar se há discrepância entre os valores encontrados;
- Verificar a correlação entre o número de citações nas diferentes bases de dados (Web of Science, Scopus e Google Scholar);
- Verificar a correlação entre a o número de citações na Web of Science e o fator de impacto do periódico;
- Verificar a correlação entre a o número de citações na Web of Science e o ano de publicação do artigo;
- Criar e analisar as redes bibliométricas através do software VOSviewer comparando palavras-chave mais usadas e autores que mais publicaram.

#### 4 ARTIGO

O presente artigo foi submetido para a revista Brazilian Dental Journal e encontra-se em fase de revisão.

Chlorhexidine in endodontics: A bibliometric analysis of the top 100 most-cited articles

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## Chlorhexidine in endodontics: A bibliometric analysis of the top 100 most-cited articles

### Abstract

This review aimed to analyze the scientific profile of the 100 most-cited articles on the use of chlorhexidine (CHX) in endodontics. A bibliographic search was carried out using the Web of Science Core-Collection (WoSCC) database until September 2023. Citation counts were cross-referenced with Scopus (S) and Google Scholar (GS). Data encompassed citations, authorship, publication year, study design, themes, keywords, institutions, and countries of origin. Spearman's correlation assessed correlations between citation numbers and impact factors, while VOSviewer software generated collaborative network maps for authors and keywords. The number of citations ranged from 65 to 953, and articles were published between 1993 and 2022. The most frequent study designs and themes were laboratory-based studies (14%) and endodontic irrigants (69%), respectively. Gomes BPFA (13%) and Haapasalo M (12%) were the authors with the largest number of articles. The countries with the most articles were Brazil (27%) and the United States (18%). Campinas State University (12%) and Estacio de Sá University (8%), both in Brazil, were the institutions with the most articles. Positive correlations were found between the number of citations in the three databases. The 100 most-cited articles related to the use of chlorhexidine in endodontics were mainly published in Brazil, focusing on laboratory-based studies related to the use of chlorhexidine as an irrigating solution.

**Keywords:** Chlorhexidine gluconate, Endodontics, Root canal irrigant, Bibliometric analysis.

## Introduction

Chlorhexidine gluconate (1,1'-hexamethylene bi[5-(p-chlorophenyl) biguanide] di-D-gluconate) is a cationic biguanide compound developed in the 1940s by Imperial Chemical Industries Co. from Macclesfield (United Kingdom) and marketed since 1954 for clinical use (1). Its broad-spectrum antimicrobial activity leads to disruption of the cell membranes of different bacteria, viruses, and fungi. Currently, this substance is used as a disinfectant agent for living and non-living tissues and as an antiseptic mouthwash to prevent plaque accumulation (2). Furthermore, due to its antimicrobial properties, chlorhexidine salts are formulated for various dental applications, especially in surgery, periodontics, and endodontics procedures (1).

In endodontics, CHX can be applied as a liquid or gel, and serves as an antimicrobial agent during root canal preparation, disinfection of the operative field, access to root canals, irrigation, intracanal medication, disinfection of gutta-percha cones, endodontic retreatment, and in pulp regeneration process (3). CHX gel is formulated by a gel base (1% natrosol, a hydroxyethylcellulose, pH 6-9) and chlorhexidine gluconate (4), with a pH of 5.5 to 7.0 which is considered ideal. Despite presenting similar substantivity, antimicrobial properties and biocompatibility, the 2% CHX gel has numerous other advantages when compared to the solution, such as better lubrication of the conduit walls and reduces the formation of smears (5). The persistence of microbial infection in the root canal system, particularly in the periradicular area, is a key factor in endodontic therapy failure<sup>8</sup>. Microorganisms and dentin debris may persist in canal irregularities even after meticulous mechanical preparation, necessitating the use of auxiliary chemical substances (3). Considering the versatility of CHX, studies have investigated its current use and new perspectives in endodontics as an auxiliary chemical substance (6-7).

Bibliometric analysis is a quantitative study design that assesses and defines the scientific profile of a particular field of knowledge (8). This analysis aggregates numerous studies, extracting main data to showcase trends and identifying gaps for further development in the field (9). While several bibliometric analyses have been conducted in endodontics (9,10-12), none have specifically reviewed the scientific profile of CHX use in this dental specialty. Given the topic's relevance in endodontics, the study aims to analyze the scientific profile and define trends in CHX use in endodontics through bibliometric analysis.

## Methods

An electronic search was conducted on September 23, 2023, in the Web of Science Core Collection (WoSCC) database. The search strategy included terms related to endodontics and CHX: [All=(endodontic\* OR pulpectom\* OR pulpotom\* OR “pulp therap\*” OR “pulp treatment\*” OR “pulp capping” OR “endodontic treatment\*” OR “endodontic therap\*” OR “vital pulp therap\*” OR “dentin-pulp complex therap\*” OR “root canal treatment” OR “root canal therap\*” OR “root treatment” OR “canal treatment”) AND (“CHG” OR “chlorhexidine\*” OR “chlorhexidine gluconate” OR “chlorhexidine digluconate” OR “chlorhexidine hydrochloride”)]. No filters, date restrictions, or language limitations were applied. Conference articles and studies unrelated to the main theme were excluded.

Articles were selected based on the absolute number of citations, with the top 100 most-cited articles reviewed by three independent reviewers (CCL, LMA, and AOR). Disagreements were resolved by consensus with a fourth reviewer (JSR). The selected articles' citation counts were cross-checked with Scopus (S) and Google Scholar (GS) databases. In the case of citation ties, the position in the list was determined by the highest density (number of citations per year) in WoSCC.

Bibliometric data extracted from each article included title, contributing authors, year and journal of publication, number and density of citations, institution, country, and continent of origin (corresponding author), impact factor of the journal in 2022 (Journal Citation Reports), keywords, study design, and topic of study. Study designs were classified as systematic reviews, literature reviews, case reports, laboratory-based studies, observational studies, and clinical trials. Articles were grouped based on prevalent topics such as “endodontic irrigants”, “intra canal medication”, “regenerative endodontics”, “scientific state”, and “effect on MTA properties”.

A specific command of the Visualization of Similarities Viewer (VOSviewer, version 1.6.17.0, Netherlands) was used to identify and determine the number of occurrences of keywords and contributing authors. The other data were manually identified and counted. All data were double-checked by two independent reviewers. Additionally, VOSviewer was used to generate a graphical representation of existing bibliometric networks, identifying the connections among authors (only authors with at least two occurrences were included), as well as the most prevalent keywords (only keywords with at least three occurrences were included). In the networking analysis, the terms corresponding to the largest foci and fonts, and more evident colors (close to red) showed greater occurrence or correlation between the terms. On

the other hand, the lower the focus, font, or color tone (closer to yellow), the lower the occurrence of the associated term.

Spearman's correlation was applied to check for correlations between citation numbers in different databases, as well as between the WoSCC citations, impact factor, and year of publication. The Kolmogorov-Smirnov test confirmed non-normal data distribution, justifying the use of Spearman's correlation coefficient test was used. Statistical analysis was performed using the SPSS for Windows (SPSS, version 24.0; IBM Corp).

## Results

### Search results

The search strategy yielded a total of 1,256 articles, organized in descending order of the number of citations. To identify the top 100 most-cited articles related to the use of chlorhexidine in endodontics, the first 117 documents were analyzed, excluding 17 that did not address the proposed topic. After the selection process, the top 100 most-cited articles related to chlorhexidine in endodontics were identified (Supplementary Table 1).

### Citation analysis

The top 100 articles received a total of 12,751 citations in the WoSCC. The number of citations ranged from 65 to 953. Self-citations accounted for 4.3% ( $n = 550$ ) of WoSCC citations. Fifty-two articles were cited more than 100 times. In the other two databases, a greater number of citations were observed, with 16,245 (ranging from 77 to 1,203) in S and 38,930 (ranging from 123 to 2,483) in GS. There was a strong positive correlation between the number of citations in WoSCC/GS ( $Rho = 0.832$ ) and between S/GS ( $Rho = 0.895$ ). A very strong correlation was observed between WoSCC/S ( $Rho = 0.960$ ). However, a very weak positive correlation was observed between WoSCC/IF ( $Rho = 0.009$ ) and a very weak negative correlation between WoSCC/Year of publication ( $Rho = -0.137$ ).

The most-cited article with the highest citation density (13) (56,06) in the WoSCC (953 citations) was "Root canal irrigants", a literature review published in the Journal of Endodontics, accumulating a mean of 56.06 citations per year, being also the most-cited in S (1,203 citations) and GS (2,843 citations). The second most-cited article (14) in the WoSCC was titled "*Enterococcus faecalis*: Its Role in Root Canal Treatment Failure and Current Concepts in Retreatment", a literature review, published in the Journal of Endodontics,

accumulating a mean of 34.53 citations per year, being also the second most-cited in S (745 citations) and GS (1,680 citations). The third most-cited article (15) in the WoSCC (392 citations) was “A prospective study of the factors affecting outcomes of nonsurgical root canal treatment: part 1: periapical health”, an observational study, published in the *International Endodontic Journal*, accumulating an average of 32,67 citations per year, also being the third most cited in S (483 citations) and GS (960 citations).

#### Year of publication

The oldest article was published in 1993, titled “Antibacterial effects of various endodontic irrigants on selected anaerobic-bacteria” (16). The most recent article was published in 2020, titled “The Influence of *Enterococcus faecalis* as a Dental Root Canal Pathogen on Endodontic Treatment: A Systematic Review” (17). The 100 most-cited articles (64%) were published mainly in the decade 2003 to 2012. However, the decade with the highest number of citations was between 2013 and 2022. The description of the number of publications each year can be seen in Figure 1.

#### Contributing journals and impact factor

The journals in which the 100 most-cited articles were published are shown in Table 1. The *Journal of Endodontics* was the top one, with 58 articles (7,633 citations), followed by the *International Endodontic Journal* (24%) (3,076 citations) and *Oral Surgery, Oral Medicine, Oral Pathology, and Oral Radiology* (10%) (1,090 citations). According to the journal citation reports, the journals with the highest impact factor (IF) in 2022 linked to chlorhexidine in endodontics were linked: *International Endodontic Journal* (IF 5.0), *Journal of Endodontics* (IF 4.2), and *Oral Surgery, Oral Medicine, Oral Pathology, and Oral Radiology* (IF 2.9).

#### Study design and topics

Most articles were laboratory-based (68 articles; 7,778 citations), followed by interventional studies (14 articles; 1,242 citations), literature reviews (12 articles; 2,901 citations), case reports (2 articles; 218 citations), systematic reviews (2 articles; 146 citations), observational study (1 article; 392 citations), and interventional/laboratory (1 article; 74 citations). Most studies addressed the topic “endodontic irrigants” (69 articles; 8,739 citations), followed by “intra canal medication” (20 articles; 2,646 citations), “regenerative endodontics”

(7 articles; 779 citations), “scientific state” (2 articles; 312 citations) and “effect on MTA properties” (2 articles; 275 citations).

#### Countries and continents

A total of 22 countries contributed to the top 100 most-cited articles. Considering the number of publications per country, the top three countries were: Brazil with 27 articles and 2,781 citations, United States of America with 18 articles and 2,688 citations, and Canada with 12 articles and 1,360 citations. Among the continents with the most articles in the top 100 (Figure 2), North America stands out (30 articles), which consequently has the highest number of citations in WoSCC (4,048), S (5,041), and GS (11,754); followed by South America (27 articles; 2,781 citations), and Europe (24 articles; 3,709 citations).

#### Contribution institutions

A total of 54 institutions contributed to the top 100 most-cited articles. Table 2 shows the top 10 institutions with the highest number of publications. The top four belong to Campinas State University (Brazil) with 12 articles and 1,404 citations, Estacio de Sá University (Brazil) with 8 articles and 745 citations, University of British Columbia (Canada) with 7 articles and 861 citations, and University of Oslo (Norway) with 7 articles and 792 citations.

#### Contributing authors

A total of 314 authors contributed to the top 100 most-cited articles. In Supplementary Table 3, the top 10 authors with the highest number of publications are presented. Gomes BPF (1,493 citations) (State University of Campinas, Brazil) was the most frequent author with thirteen documents, followed by Haapasalo M (1,485 citations) (University British Columbia, Canada) Zaia AA (973 citations) (State University of Campinas, Brazil), and Siqueira JF (947 citations) (University of Estácio de Sá, Brazil) with nine documents each. The frequency they appear and the co-authorship relationship between them are represented in Figure 3. The names (3 or more occurrences) that are connected by bibliometric networks with the same color are authors who showed collaboration between the studies. Authors associated with the largest circles published a greater number of studies.

## Keywords

A total of 425 keywords were identified in the top 100 most-cited articles. The most prevalent was “Sodium-hypochlorite” (n = 52), followed by “Chlorhexidine” (n = 45), “In-vitro” (n = 39), and “Calcium hypochlorite” (n = 38). Figure 4 shows the most prevalent keywords and the relationship between them. Names written in a prominent font and corresponding to red/orange coloring are associated with the most frequent keywords. On the other hand, the names associated with the color green/blue correspond to the keywords with the lowest occurrence. Keywords with 5 or more occurrences were inserted in the image. Keywords present in the same cluster indicate collaboration between them in the same study.

## Discussion

It is undeniable that there has been a progressive use of chlorhexidine and its derivatives as an auxiliary chemical substance in endodontics. Due to this, numerous scientific studies can be observed in the literature investigating its use in endodontic treatment. However, no bibliometric review analyzing this topic was observed in the literature. Therefore, the objective of this study was to select and analyze the scientific profile of the 100 most-cited articles that address the use of chlorhexidine in endodontic applications. The most-cited articles were mainly of the laboratory type, developed mostly at the State University of Campinas (Brazil), normally addressing the use of CHX as an endodontic irrigant.

The number of citations can indicate the relevance of studies and is commonly used to assess their impact on the scientific community. In certain fields of research, an article with more than 100 citations can be considered a classic. Highlighting the relevance of the use of CHX in endodontics, it was observed that in this top 100, 52 articles obtained 100 or more citations in WoSCC, 74 in S and all articles received more than 100 citations in GS. Compared to other bibliometric analyses, this study identified a relatively low number of self-citations (9,18). Self-citation has been interpreted as “the hallmark of productive authors”, as the more articles an author publishes, the greater the probability of self-citation. On the other hand, unethical practices such as excessive and superfluous self-citation are frowned upon for artificially inflating metrics based on self-promotion.

The article with the highest number of citations was “Root canal irrigants”, a literature review published by Zehnder (2006) (13). In addition to being published 17 years ago, this article is a compilation of the different irrigating solutions used in endodontics, facts that justify

the highlight in the number of citations in this article. However, coincidentally, this study also led with the highest density of citations, which states that its merit in citations is not linked to its long years of publication but rather to the relevance and breadth of the subject covered. A bibliometric review carried out by Ordinola-Zapata et al (2020) to investigate research interests in endodontics, corroborates this result since the aforementioned article also occupied a prominent position among the most-cited (10). The largest number of publications among the 100 most-cited articles occurred in the decade between 2003-2012. As a result, the highest number of citations was observed in the following decade, between 2013-2022.

Launched in 1975, the Journal of Endodontics (JOE), the official journal of the American Association of Endodontists, was the journal that published the most studies related to CHX. According to the ISI Journal Report 2017 citation, JOE ranks 13th among 91 Dentistry, Oral Surgery, and Medicine journals (IF 4.2). This journal publishes the latest advances in endodontic techniques. The second place was taken by the International Endodontic Journal (IEJ). For more than 50 years, this journal has been committed to publishing innovative research and clinical reports in endodontics. The importance of these journals for the clinical and scientific community justifies their intense occurrence in this and other bibliometric analyses (8).

Laboratory research seeks to reduce the margins of error and control the environment in which a study will be carried out. This type of study is essential for the *in vitro* and *in vivo* testing of new techniques and drugs before application in humans (19). Considering the versatility of the use of CHX in endodontics and the increasing evolution and innovation of its use, this study design predominated among the 100 most cited. In contrast, only two systematic reviews were identified. Systematic reviews can have a strong influence on researchers and professionals, creating changes in clinical practice, and representing the most reliable evidence (26). A possible explanation for the reduced number of systematic reviews is that they are prepared, preferably using data collected from RCTs and they were not so frequent. Given this, the need for more clinical studies and consequently systematic reviews on the clinical use of CHX in endodontics is suggested.

The most studied topic of CHX in endodontics among the 100 most cited is an irrigating solution. Antibacterial irrigation is essential for treating endodontic infections. Sodium hypochlorite (NaOCl, 0.5%–5.25%) has been the substance most used as an irrigating solution in endodontics, with greater action observed in high concentrations. However, studies demonstrate that high concentrations of NaOCl have negative effects on vital tissue (20, 21).

Considering the low tissue irritation and substantivity of CHX, this substance has stood out as an efficient endodontic irrigant. However, CHX does not have tissue dissolution capacity when compared to NaOCl. Despite this, clinical studies comparing the antibacterial efficacy of NaOCl (2.5%–5.25%) with CHX (0.12%–2%) in the treatment of single-rooted teeth with primary infection have shown conflicting results (21,22). The fact that CHX is a strong candidate to replace the use of NaOCl as a solution for irrigation in endodontics justifies the highlight of the most-cited research evaluating this substance as a solution for endodontic irrigation.

According to the results of this bibliometric review, Brazil ranked first in research on Chlorhexidine. The most likely explanation for this data may be the fact that three Brazilian universities are among the top ten institutions with the highest number of publications. Furthermore, the State University of Campinas and the Estácio de Sá University, both based in Brazil, led the ranking among institutions, occupying first and second place, respectively. As well, there was an emphasis on Brazilian authors. Brazil and its institutions remain among the most-cited countries and with the highest number of publications in global dental research due to the commitment of professionals and government funding (23).

The most prominent author among the 100 most cited was Gomes BPFA, mainly researching the use of CHX as a solution for irrigation through laboratory studies and randomized clinical trials. Next was Haapasalo M, who carried out mostly laboratory research normally analyzing the use of CHX as an irrigating solution. Next, Zaia AA investigated the use of CHX as an irrigating solution through laboratory studies and Siqueira JF analyzed the use of CHX as an irrigating solution and intracanal medication through a randomized clinical trial and laboratory studies.

Surprisingly, the most prevalent keyword was “sodium hypochlorite”. Since sodium hypochlorite is the most used irrigating solution in endodontics and that is why this solution is present in studies that address CHX as an irrigating solution, which were the majority of studies according to the most prevalent theme. Another possible cause may be the fact that CHX has different names in the literature such as gluconate, digluconate, and chlorhexidine acetate, “diluted” its forms of mention as a keyword among studies. Secondly, the term “chlorhexidine” was observed, which is associated with the main objective of the study, and then “in vitro”, corroborating the results of this study, which showed a predominance for laboratory studies.

The bibliometric analysis sheds light on the extensive body of research surrounding the use of chlorhexidine (CHX) in endodontics, offering insights into its scientific profile and

impact. While the majority of the top-cited articles focus on laboratory-based studies, particularly investigating CHX as an irrigating substance, this study presents several novel contributions. Firstly, it fills a notable gap in the literature by providing the first bibliometric review specifically addressing CHX use in endodontics, highlighting its prominence and relevance within the field. Moreover, the analysis underscores the enduring significance of CHX in endodontic research, as evidenced by the consistently high citation counts across different databases. Notably, the study identifies key authors, institutions, and journals driving research in this area, with notable concentrations in Brazil, signaling the country's significant contributions to global dental research. Furthermore, the prevalence of laboratory-based research underscores the need for more clinical studies and systematic reviews to bridge the gap between experimental findings and clinical practice. This study also highlights the ongoing debate regarding the comparative efficacy of CHX and sodium hypochlorite (NaOCl) as irrigating solutions, suggesting avenues for further investigation and potential clinical applications. Overall, the findings provide valuable insights that can inform future research directions, facilitate evidence-based practice, and ultimately enhance patient care outcomes in endodontics.

The detailed analysis of the main characteristics of the 100 most-cited articles constitutes one of the study's greatest strengths. Furthermore, no year or language filters were used, allowing a broad search in the literature. WoSCC is considered the most prestigious database for carrying out bibliometric studies. The decision to use only WoSCC as the basis for the main search can be considered a limitation of this study. However, this decision was based on other important bibliometric analyses in dentistry (24,25).

This bibliometric analysis not only sheds light on the extensive research regarding chlorhexidine (CHX) in endodontics but also highlights its significance and relevance within the field. Addressing a notable gap in the literature, this study represents the first bibliometric review specifically focusing on CHX use in endodontics, emphasizing its prominence. Furthermore, the enduring significance of CHX in endodontic research is evident from consistently high citation counts across various databases. Additionally, the prevalence of laboratory-based research underscores the necessity for more clinical studies and systematic reviews to bridge experimental findings with clinical practice. This study also brings attention to the ongoing debate surrounding the comparative efficacy of CHX and sodium hypochlorite (NaOCl) as irrigating solutions, suggesting avenues for further investigation and potential clinical applications. Overall, these findings offer valuable insights that can shape future

research directions, facilitate evidence-based practice, and ultimately improve patient care outcomes in endodontics. While the decision to solely use the WoSCC database may be viewed as a limitation, it was based on the precedence set by other important bibliometric analyses in dentistry, as WoSCC is considered the most prestigious database for such studies. Despite the emphasis on CHX, a limited number of observational studies and systematic reviews were identified, indicating potential areas for further research. This underscores the substantial interest in the utilization of chlorhexidine in endodontics, affirming the relevance of this review and indicating avenues for future exploration and clinical application.

### Conclusion

This bibliometric review provides insight into the current state and trends of research related to the use of chlorhexidine in endodontics. Based on the presented results, it is possible to perceive an increasing research interest in North America, although Brazil stands out as the country with the highest number of articles on the subject. Most works were published in the *Journal of Endodontics*, predominantly comprising laboratory-based research projects that primarily investigated chlorhexidine as an irrigating substance. Despite this emphasis, a limited number of observational studies and systematic reviews were identified concerning the use of chlorhexidine in endodontics, suggesting potential perspectives of research. Consequently, it is evident that there is substantial interest in the utilization of chlorhexidine in endodontics, underscoring the relevance of this review.

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### Conflict of interest

The authors declare no conflicts of interest.

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- 23- Siqueira JF Jr, Rôças IN, Paiva SS, Guimarães-Pinto T, Magalhães KM, Lima KC. Bacteriologic investigation of the effects of sodium hypochlorite and chlorhexidine during the endodontic treatment of teeth with apical periodontitis. *Oral Surg Oral Med Oral Pathol Oral Radiol Endod.* 2007 Jul;104(1):122-30. doi: 10.1016/j.tripleo.2007.01.027.
- 24- Rocha AO, Anjos LMD, Vitali FC, Santos PS, Bolan M, Santana CM, Cardoso M. Tooth Bleaching: A bibliometric analysis of the top 100 most-cited papers. *Braz Dent J.* 2023 Mar-Apr;34(2):41-55. doi: 10.1590/0103-6440202305290.
- 25- Mattos FF, Perazzo MF, Vargas-Ferreira F, Martins-Júnior PA, Paiva SM. Top 100 most-cited papers in core dental public health journals: bibliometric analysis. *Community Dent Oral Epidemiol.* 2021 Feb;49(1):40-46. doi: 10.1111/cdoe.12572.

## TABLES

Table 1 Top 100 most-cited articles ordered on WoSCC citations

Position	Papers	Number of citations (Citation density)		
		WoSCC	GS	S
1	Zehnder M. Root canal irrigants. <i>J Endod.</i> 2006 May;32(5):389-98. doi: 10.1016/j.joen.2005.09.014	953 (56,06)	2843 (167,24)	1,203 (70,76)
2	Stuart CH, Schwartz SA, Beeson TJ, Owatz CB. <i>Enterococcus faecalis</i> : its role in root canal treatment failure and current concepts in retreatment. <i>J Endod.</i> 2006 Feb;32(2):93-8. doi: 10.1016/j.joen.2005.10.049	587 (34,53)	1.680 (98,82)	745 (43,82)
3	Ng YL, Mann V, Gulabivala K. A prospective study of the factors affecting outcomes of nonsurgical root canal treatment: part 1: periapical health. <i>Int Endod J.</i> 2011 Jul;44(7):583-609. doi: 10.1111/j.1365-2591.2011.01872.x	392 (32,67)	960 (80,00)	483 (40,25)
4	Gomes BP, Ferraz CC, Vianna ME, Berber VB, Teixeira FB, Souza-Filho FJ. In vitro antimicrobial activity of several concentrations of sodium hypochlorite and chlorhexidine gluconate in the elimination of <i>Enterococcus faecalis</i> . <i>Int Endod J.</i> 2001 Sep;34(6):424-8. doi: 10.1046/j.1365-2591.2001.00410.x	265 (12,05)	945 (42,95)	356 (16,18)
5	Fuss Z, Tsesis I, Lin S. Root resorption--diagnosis, classification and treatment choices based on stimulation factors. <i>Dent Traumatol.</i> 2003 Aug;19(4):175-82. doi: 10.1034/j.1600-9657.2003.00192.x	253 (12,65)	847 (42,35)	330 (16,50)
6	Mohammadi Z, Abbott PV. The properties and applications of chlorhexidine in endodontics. <i>Int Endod J.</i> 2009 Apr;42(4):288-302. doi: 10.1111/j.1365-2591.2008.01540.x	234 (16,71)	759 (54,21)	335 (23,93)
7	Jeansonne MJ, White RR. A comparison of 2.0% chlorhexidine gluconate and 5.25% sodium hypochlorite as antimicrobial endodontic irrigants. <i>J Endod.</i> 1994 Jun;20(6):276-8. doi: 10.1016/s0099-2399(06)80815-0	228 (7,86)	733 (25,28)	273 (9,41)
8	Haapasalo HK, Sirén EK, Waltimo TM, Ørstavik D, Haapasalo MP. Inactivation of local root canal medicaments by dentine: an in vitro study. <i>Int Endod J.</i> 2000 Mar;33(2):126-31. doi: 10.1046/j.1365-2591.2000.00291.x	213 (9,26)	684 (29,74)	299 (13,00)
9	Trevino EG, Patwardhan AN, Henry MA, Perry G, Dybdal-Hargreaves N, Hargreaves KM,	210 (17,50)	497 (41,42)	255 (21,25)

	Diogenes A. Effect of irrigants on the survival of human stem cells of the apical papilla in a platelet-rich plasma scaffold in human root tips. <i>J Endod.</i> 2011 Aug;37(8):1109-15. doi: 10.1016/j.joen.2011.05.013			
10	Kogan P, He J, Glickman GN, Watanabe I. The effects of various additives on setting properties of MTA. <i>J Endod.</i> 2006 Jun;32(6):569-72. doi: 10.1016/j.joen.2005.08.006	205 (12,06)	503 (29,59)	260 (15,29)
11	Vianna ME, Gomes BP, Berber VB, Zaia AA, Ferraz CC, de Souza-Filho FJ. In vitro evaluation of the antimicrobial activity of chlorhexidine and sodium hypochlorite. <i>Oral Surg Oral Med Oral Pathol Oral Radiol Endod.</i> 2004 Jan;97(1):79-84. doi: 10.1016/s1079-2104(03)00360-3	193 (10,16)	679 (35,74)	257 (13,53)
12	Gomes BP, Souza SF, Ferraz CC, Teixeira FB, Zaia AA, Valdrighi L, Souza-Filho FJ. Effectiveness of 2% chlorhexidine gel and calcium hydroxide against <i>Enterococcus faecalis</i> in bovine root dentine in vitro. <i>Int Endod J.</i> 2003 Apr;36(4):267-75. doi: 10.1046/j.1365-2591.2003.00634.x	179 (8,95)	691 (34,55)	261 (13,05)
13	Athanassiadis B, Abbott PV, Walsh LJ. The use of calcium hydroxide, antibiotics and biocides as antimicrobial medicaments in endodontics. <i>Aust Dent J.</i> 2007 Mar;52(1 Suppl):S64-82. doi: 10.1111/j.1834-7819.2007.tb00527.x	178 (11,13)	652 (40,75)	244 (15,25)
14	Shen Y, Stojicic S, Haapasalo M. Antimicrobial efficacy of chlorhexidine against bacteria in biofilms at different stages of development. <i>J Endod.</i> 2011 May;37(5):657-61. doi: 10.1016/j.joen.2011.02.007	175 (14,58)	331 (27,58)	195 (16,25)
15	Vera J, Siqueira JF Jr, Ricucci D, Loghin S, Fernández N, Flores B, Cruz AG. One- versus two-visit endodontic treatment of teeth with apical periodontitis: a histobacteriologic study. <i>J Endod.</i> 2012 Aug;38(8):1040-52. doi: 10.1016/j.joen.2012.04.010	169 (15,36)	435 (39,55)	224 (20,36)
16	White RR, Hays GL, Janer LR. Residual antimicrobial activity after canal irrigation with chlorhexidine. <i>J Endod.</i> 1997 Apr;23(4):229-31. doi: 10.1016/S0099-2399(97)80052-0	161 (6,19)	503 (19,35)	205 (7,88)
17	Naenni N, Thoma K, Zehnder M. Soft tissue dissolution capacity of currently used and potential endodontic irrigants. <i>J Endod.</i> 2004 Nov;30(11):785-7. doi: 10.1097/00004770-200411000-00009	160 (8,42)	553 (29,11)	203 (10,68)
18	Ma J, Wang Z, Shen Y, Haapasalo M. A new noninvasive model to study the effectiveness of	153 (12,75)	306 (25,50)	173 (14,42)

	dentin disinfection by using confocal laser scanning microscopy. <i>J Endod.</i> 2011 Oct;37(10):1380-5. doi: 10.1016/j.joen.2011.06.018			
19	Dunavant TR, Regan JD, Glickman GN, Solomon ES, Honeyman AL. Comparative evaluation of endodontic irrigants against <i>Enterococcus faecalis</i> biofilms. <i>J Endod.</i> 2006 Jun;32(6):527-31. doi: 10.1016/j.joen.2005.09.001	146 (8,59)	499 (29,35)	203 (11,94)
20	Neelakantan P, Subbarao C, Subbarao CV, De-Deus G, Zehnder M. The impact of root dentine conditioning on sealing ability and push-out bond strength of an epoxy resin root canal sealer. <i>Int Endod J.</i> 2011 Jun;44(6):491-8. doi: 10.1111/j.1365-2591.2010.01848.x	145 (12,08)	250 (20,83)	138 (11,50)
21	Basrani BR, Manek S, Sodhi RN, Fillery E, Manzur A. Interaction between sodium hypochlorite and chlorhexidine gluconate. <i>J Endod.</i> 2007 Aug;33(8):966-9. doi: 10.1016/j.joen.2007.04.001	143 (8,94)	506 (31,63)	188 (11,75)
22	Spratt DA, Pratten J, Wilson M, Gulabivala K. An in vitro evaluation of the antimicrobial efficacy of irrigants on biofilms of root canal isolates. <i>Int Endod J.</i> 2001 Jun;34(4):300-7. doi: 10.1046/j.1365-2591.2001.00392.x	138 (6,27)	427 (19,41)	172 (7,82)
23	Clegg MS, Vertucci FJ, Walker C, Belanger M, Britto LR. The effect of exposure to irrigant solutions on apical dentin biofilms in vitro. <i>J Endod.</i> 2006 May;32(5):434-7. doi: 10.1016/j.joen.2005.07.002	134 (7,88)	520 (30,59)	182 (10,71)
24	Leonardo MR, Tanomaru Filho M, Silva LA, Nelson Filho P, Bonifácio KC, Ito IY. In vivo antimicrobial activity of 2% chlorhexidine used as a root canal irrigating solution. <i>J Endod.</i> 1999 Mar;25(3):167-71. doi: 10.1016/s0099-2399(99)80135-6	133 (5,54)	424 (17,67)	188 (7,83)
25	Rosenthal S, Spångberg L, Safavi K. Chlorhexidine substantivity in root canal dentin. <i>Oral Surg Oral Med Oral Pathol Oral Radiol Endod.</i> 2004 Oct;98(4):488-92. doi: 10.1016/j.tripleo.2003.07.005	133 (7,00)	404 (21,26)	161 (8,47)
26	Haapasalo M, Qian W, Portenier I, Waltimo T. Effects of dentin on the antimicrobial properties of endodontic medicaments. <i>J Endod.</i> 2007 Aug;33(8):917-25. doi: 10.1016/j.joen.2007.04.008	132 (8,25)	332 (20,75)	162 (10,13)
27	Kuruvilla JR, Kamath MP. Antimicrobial activity of 2.5% sodium hypochlorite and 0.2% chlorhexidine gluconate separately and combined,	129 (5,16)	472 (18,88)	176 (7,04)

	as endodontic irrigants. <i>J Endod.</i> 1998 Jul;24(7):472-6. doi: 10.1016/S0099-2399(98)80049-6			
<b>28</b>	Portenier I, Haapasalo H, Rye A, Waltimo T, Ørstavik D, Haapasalo M. Inactivation of root canal medicaments by dentine, hydroxylapatite and bovine serum albumin. <i>Int Endod J.</i> 2001 Apr;34(3):184-8. doi: 10.1046/j.1365-2591.2001.00366.x	126 (5,73)	343 (15,59)	152 (6,91)
<b>29</b>	Ferraz CC, Gomes BP, Zaia AA, Teixeira FB, Souza-Filho FJ. In vitro assessment of the antimicrobial action and the mechanical ability of chlorhexidine gel as an endodontic irrigant. <i>J Endod.</i> 2001 Jul;27(7):452-5. doi:10.1097/00004770-200107000-00004	126 (5,73)	454 (20,64)	180 (8,18)
<b>30</b>	Gernhardt CR, Eppendorf K, Kozlowski A, Brandt M. Toxicity of concentrated sodium hypochlorite used as an endodontic irrigant. <i>Int Endod J.</i> 2004 Apr;37(4):272-80. doi: 10.1111/j.0143-2885.2004.00804.x	125 (6,58)	401 (21,11)	150 (7,89)
<b>31</b>	Galler KM, Buchalla W, Hiller KA, Federlin M, Eidt A, Schiefersteiner M, Schmalz G. Influence of root canal disinfectants on growth factor release from dentin. <i>J Endod.</i> 2015 Mar;41(3):363-8. doi: 10.1016/j.joen.2014.11.021	124 (15,50)	292 (36,50)	165 (20,63)
<b>32</b>	Chang YC, Huang FM, Tai KW, Chou MY. The effect of sodium hypochlorite and chlorhexidine on cultured human periodontal ligament cells. <i>Oral Surg Oral Med Oral Pathol Oral Radiol Endod.</i> 2001 Oct;92(4):446-50. doi: 10.1067/moe.2001.116812	119 (5,41)	331 (15,05)	145 (6,59)
<b>33</b>	Ercan E, Ozekinci T, Atakul F, Gül K. Antibacterial activity of 2% chlorhexidine gluconate and 5.25% sodium hypochlorite in infected root canal: in vivo study. <i>J Endod.</i> 2004 Feb;30(2):84-7. doi: 10.1097/00004770-200402000-00005	117 (6,16)	401 (21,11)	142 (7,47)
<b>34</b>	Erdemir A, Ari H, Güngüneş H, Belli S. Effect of medications for root canal treatment on bonding to root canal dentin. <i>J Endod.</i> 2004 Feb;30(2):113-6. doi: 10.1097/00004770-200402000-00013	117 (6,16)	346 (18,21)	145 (7,63)
<b>35</b>	Siqueira JF Jr, Rôças IN, Santos SR, Lima KC, Magalhães FA, de Uzeda M. Efficacy of instrumentation techniques and irrigation regimens in reducing the bacterial population within root canals. <i>J Endod.</i> 2002 Mar;28(3):181-4.	117 (5,57)	466 (22,19)	159 (7,57)

	doi: 10.1097/00004770-200203000-00009.			
36	Siqueira JF Jr, Batista MM, Fraga RC, de Uzeda M. Antibacterial effects of endodontic irrigants on black-pigmented gram-negative anaerobes and facultative bacteria. <i>J Endod.</i> 1998 Jun;24(6):414-6. doi: 10.1016/S0099-2399(98)80023-X	116 (4,64)	417 (16,68)	156 (6,24)
37	Tay FR, Pashley DH, Loushine RJ, Weller RN, Monticelli F, Osorio R. Self-etching adhesives increase collagenolytic activity in radicular dentin. <i>J Endod.</i> 2006 Sep;32(9):862-8. doi: 10.1016/j.joen.2006.04.005	116 (6,82)	256 (15,06)	124 (7,29)
38	Yesilsoy C, Whitaker E, Cleveland D, Phillips E, Trope M. Antimicrobial and toxic effects of established and potential root canal irrigants. <i>J Endod.</i> 1995 Oct;21(10):513-5. doi: 10.1016/s0099-2399(06)80524-8.	115 (4,11)	379 (13,54)	140 (5,00)
39	Kontakiotis EG, Filippatos CG, Tzanetakakis GN, Agrafioti A. Regenerative endodontic therapy: a data analysis of clinical protocols. <i>J Endod.</i> 2015 Feb;41(2):146-54. doi: 10.1016/j.joen.2014.08.003	112 (14,00)	261 (32,63)	145 (18,13)
40	Siqueira JF Jr, Sen BH. Fungi in endodontic infections. <i>Oral Surg Oral Med Oral Pathol Oral Radiol Endod.</i> 2004 May;97(5):632-41. doi: 10.1016/S1079210404000046	110 (5,79)	389 (20,47)	138 (7,26)
41	Stojicic S, Shen Y, Qian W, Johnson B, Haapasalo M. Antibacterial and smear layer removal ability of a novel irrigant, QMiX. <i>Int Endod J.</i> 2012 Apr;45(4):363-71. doi: 10.1111/j.1365-2591.2011.01985	108 (9,82)	347 (31,55)	154 (14,00)
42	Onçağ O, Hoşgör M, Hilmioğlu S, Zekioğlu O, Eronat C, Burhanoglu D. Comparison of antibacterial and toxic effects of various root canal irrigants. <i>Int Endod J.</i> 2003 Jun;36(6):423-32. doi: 10.1046/j.1365-2591.2003.00673.x	107 (5,35)	369 (18,45)	142 (7,10)
43	Siqueira JF Jr, de Uzeda M. Intracanal medicaments: evaluation of the antibacterial effects of chlorhexidine, metronidazole, and calcium hydroxide associated with three vehicles. <i>J Endod.</i> 1997 Mar;23(3):167-9. doi: 10.1016/S0099-2399(97)80268-3	107 (4,12)	377 (14,50)	135 (5,19)
44	Wang Z, Shen Y, Haapasalo M. Effectiveness of endodontic disinfecting solutions against young and old <i>Enterococcus faecalis</i> biofilms in dentin canals. <i>J Endod.</i> 2012 Oct;38(10):1376-9. doi: 10.1016/j.joen.2012.06.035	106 (9,64)	295 (26,82)	142 (12,91)

45	Stojicic S, Shen Y, Haapasalo M. Effect of the source of biofilm bacteria, level of biofilm maturation, and type of disinfecting agent on the susceptibility of biofilm bacteria to antibacterial agents. <i>J Endod.</i> 2013 Apr;39(4):473-7. doi: 10.1016/j.joen.2012.11.024	104 (10,40)	213 (21,30)	116 (11,60)
46	Chávez de Paz LE, Bergenholtz G, Svensäter G. The effects of antimicrobials on endodontic biofilm bacteria. <i>J Endod.</i> 2010 Jan;36(1):70-7. doi: 10.1016/j.joen.2009.09.017	104 (8,00)	244 (18,77)	119 (9,15)
47	Guneser MB, Akbulut MB, Eldeniz AU. Effect of various endodontic irrigants on the push-out bond strength of biodentine and conventional root perforation repair materials. <i>J Endod.</i> 2013 Mar;39(3):380-4. doi: 10.1016/j.joen.2012.11.033	103 (10,30)	322 (32,20)	132 (13,20)
48	Santos JN, Carrilho MR, De Goes MF, Zaia AA, Gomes BP, Souza-Filho FJ, Ferraz CC. Effect of chemical irrigants on the bond strength of a self-etching adhesive to pulp chamber dentin. <i>J Endod.</i> 2006 Nov;32(11):1088-90. doi: 10.1016/j.joen.2006.07.001	102 (6,00)	285 (16,76)	132 (7,76)
49	Ohara P, Torabinejad M, Kettering JD. Antibacterial effects of various endodontic medicaments on selected anaerobic bacteria. <i>J Endod.</i> 1993 Oct;19(10):498-500. doi: 10.1016/S0099-2399(06)81490-1	100 (3,33)	302 (10,07)	124 (4,13)
50	Portenier I, Haapasalo H, Orstavik D, Yamauchi M, Haapasalo M. Inactivation of the antibacterial activity of iodine potassium iodide and chlorhexidine digluconate against <i>Enterococcus faecalis</i> by dentin, dentin matrix, type-I collagen, and heat-killed microbial whole cells. <i>J Endod.</i> 2002 Sep;28(9):634-7. doi: 10.1097/00004770-200209000-00002	100 (4,76)	271 (12,90)	121 (5,76)
51	Nagata JY, Gomes BP, Rocha Lima TF, Murakami LS, de Faria DE, Campos GR, de Souza-Filho FJ, Soares Ade J. Traumatized immature teeth treated with 2 protocols of pulp revascularization. <i>J Endod.</i> 2014 May;40(5):606-12. doi: 10.1016/j.joen.2014.01.032	100 (11,11)	224 (24,89)	85 (9,44)
52	Basrani B, Santos JM, Tjäderhane L, Grad H, Gorduysus O, Huang J, Lawrence HP, Friedman S. Substantive antimicrobial activity in chlorhexidine-treated human root dentin. <i>Oral Surg Oral Med Oral Pathol Oral Radiol Endod.</i> 2002 Aug;94(2):240-5. doi: 10.1067/moe.2002.124002	99 (4,71)	320 (15,24)	136 (6,48)

<b>53</b>	Vahdaty A, Pitt Ford TR, Wilson RF. Efficacy of chlorhexidine in disinfecting dentinal tubules in vitro. <i>Endod Dent Traumatol.</i> 1993 Dec;9(6):243-8. doi: 10.1111/j.1600-9657.1993.tb00280.x	97 (3,23)	344 (11,47)	130 (4,33)
<b>54</b>	Ari H, Erdemir A, Belli S. Evaluation of the effect of endodontic irrigation solutions on the microhardness and the roughness of root canal dentin. <i>J Endod.</i> 2004 Nov;30(11):792-5. doi: 10.1097/01.don.0000128747.89857.59.	97 (5,11)	323 (17,00)	126 16,63)
<b>55</b>	Heling I, Chandler NP. Antimicrobial effect of irrigant combinations within dentinal tubules. <i>Int Endod J.</i> 1998 Jan;31(1):8-14	96 (3,84)	376 (15,04)	119 (4,76)
<b>56</b>	Siqueira JF Jr, Rôças IN, Paiva SS, Guimarães-Pinto T, Magalhães KM, Lima KC. Bacteriologic investigation of the effects of sodium hypochlorite and chlorhexidine during the endodontic treatment of teeth with apical periodontitis. <i>Oral Surg Oral Med Oral Pathol Oral Radiol Endod.</i> 2007 Jul;104(1):122-30. doi: 10.1016/j.tripleo.2007.01.027	96 (6,00)	262 (16,38)	120 (7,50)
<b>57</b>	Komorowski R, Grad H, Wu XY, Friedman S. Antimicrobial substantivity of chlorhexidine-treated bovine root dentin. <i>J Endod.</i> 2000 Jun;26(6):315-7. doi: 10.1097/00004770-200006000-00001	95 (4,15)	305 (13,26)	116 (5,04)
<b>58</b>	Portenier I, Waltimo T, Ørstavik D, Haapasalo M. The susceptibility of starved, stationary phase, and growing cells of <i>Enterococcus faecalis</i> to endodontic medicaments. <i>J Endod.</i> 2005 May;31(5):380-6. doi: 10.1097/01.don.0000145421.84121.c8	94 (5,22)	257 (14,28)	115 (6,39)
<b>59</b>	Schuurs AH, Gruythuysen RJ, Wesselink PR. Pulp capping with adhesive resin-based composite vs. calcium hydroxide: a review. <i>Endod Dent Traumatol.</i> 2000 Dec;16(6):240-50. doi: 10.1034/j.1600-9657.2000.016006240.x	93 (4,04)	245 (10,65)	117 (5,09)
<b>60</b>	Shin SY, Albert JS, Mortman RE. One step pulp revascularization treatment of an immature permanent tooth with chronic apical abscess: a case report. <i>Int Endod J.</i> 2009 Dec;42(12):1118-26. doi: 10.1111/j.1365-2591.2009.01633.x	93 (6,64)	273 (19,50)	116 (8,29)
<b>61</b>	Estrela C, Estrela CR, Decurcio DA, Hollanda AC, Silva JA. Antimicrobial efficacy of ozonated water, gaseous ozone, sodium hypochlorite and chlorhexidine in infected human root canals. <i>Int Endod J.</i> 2007 Feb;40(2):85-93. doi: 10.1111/j.1365-2591.2006.01185.x	91 (5,69)	338 (21,13)	131 (8,19)

<b>62</b>	Waltimo TM, Orstavik D, Sirén EK, Haapasalo MP. In vitro susceptibility of <i>Candida albicans</i> to four disinfectants and their combinations. <i>Int Endod J</i> . 1999 Nov;32(6):421-9. doi: 10.1046/j.1365-2591.1999.00237.x	91 (3,79)	361 (15,04)	129 (5,38)
<b>63</b>	Law A, Messer H. An evidence-based analysis of the antibacterial effectiveness of intracanal medicaments. <i>J Endod</i> . 2004 Oct;30(10):689-94. doi: 10.1097/01.don.0000129959.20011.ee	91 (4,79)	360 (18,95)	122 (6,42)
<b>64</b>	Rôças IN, Siqueira JF Jr. Comparison of the in vivo antimicrobial effectiveness of sodium hypochlorite and chlorhexidine used as root canal irrigants: a molecular microbiology study. <i>J Endod</i> . 2011 Feb;37(2):143-50. doi: 10.1016/j.joen.2010.11.006	91 (7,58)	218 (18,17)	113 (9,42)
<b>65</b>	Zamany A, Safavi K, Spångberg LS. The effect of chlorhexidine as an endodontic disinfectant. <i>Oral Surg Oral Med Oral Pathol Oral Radiol Endod</i> . 2003 Nov;96(5):578-81. doi: 10.1016/s1079-2104(03)00168-9	91 (4,55)	385 (19,25)	117 (5,85)
<b>66</b>	Vianna ME, Horz HP, Gomes BP, Conrads G. In vivo evaluation of microbial reduction after chemo-mechanical preparation of human root canals containing necrotic pulp tissue. <i>Int Endod J</i> . 2006 Jun;39(6):484-92. doi: 10.1111/j.1365-2591.2006.01121.x	89 (5,24)	266 (15,65)	114 (6,71)
<b>67</b>	Gomes BP, Vianna ME, Sena NT, Zaia AA, Ferraz CC, de Souza Filho FJ. In vitro evaluation of the antimicrobial activity of calcium hydroxide combined with chlorhexidine gel used as intracanal medicament. <i>Oral Surg Oral Med Oral Pathol Oral Radiol Endod</i> . 2006 Oct;102(4):544-50. doi: 10.1016/j.tripleo.2006.04.010	89 (5,24)	291 (17,12)	120 (7,06)
<b>68</b>	Bui TB, Baumgartner JC, Mitchell JC. Evaluation of the interaction between sodium hypochlorite and chlorhexidine gluconate and its effect on root dentin. <i>J Endod</i> . 2008 Feb;34(2):181-5. doi: 10.1016/j.joen.2007.11.006	86 (5,73)	271 (18,07)	109 (7,27)
<b>69</b>	Basrani B, Tjäderhane L, Santos JM, Pascon E, Grad H, Lawrence HP, Friedman S. Efficacy of chlorhexidine- and calcium hydroxide-containing medicaments against <i>Enterococcus faecalis</i> in vitro. <i>Oral Surg Oral Med Oral Pathol Oral Radiol Endod</i> . 2003 Nov;96(5):618-24. doi: 10.1016/s1079-2104(03)00166-5	86 (4,30)	304 (15,20)	113 (5,65)
<b>70</b>	Sunde PT, Tronstad L, Eribe ER, Lind PO, Olsen I. Assessment of periradicular microbiota by	85 (3,70)	202 (8,78)	92 (4,00)

	DNA-DNA hybridization. <i>Endod Dent Traumatol.</i> 2000 Oct;16(5):191-6. doi: 10.1034/j.1600-9657.2000.016005191.x			
71	Okino LA, Siqueira EL, Santos M, Bombana AC, Figueiredo JA. Dissolution of pulp tissue by aqueous solution of chlorhexidine digluconate and chlorhexidine digluconate gel. <i>Int Endod J.</i> 2004 Jan;37(1):38-41. doi: 10.1111/j.1365-2591.2004.00749.x	85 (4,47)	330 (17,37)	128 (6,74)
72	Arias-Moliz MT, Ferrer-Luque CM, Espigares-García M, Baca P. Enterococcus faecalis biofilms eradication by root canal irrigants. <i>J Endod.</i> 2009 May;35(5):711-4. doi: 10.1016/j.joen.2009.01.018	85 (6,07)	265 (18,93)	115 (8,29)
73	Shen Y, Qian W, Chung C, Olsen I, Haapasalo M. Evaluation of the effect of two chlorhexidine preparations on biofilm bacteria in vitro: a three-dimensional quantitative analysis. <i>J Endod.</i> 2009 Jul;35(7):981-5. doi: 10.1016/j.joen.2009.04.030	83 (5,93)	182 (13,00)	91 (6,50)
74	Rossi-Fedele G, Dođramaci EJ, Guastalli AR, Steier L, de Figueiredo JA. Antagonistic interactions between sodium hypochlorite, chlorhexidine, EDTA, and citric acid. <i>J Endod.</i> 2012 Apr;38(4):426-31. doi: 10.1016/j.joen.2012.01.006	80 (7,27)	219 (19,91)	99 (9,00)
75	Hauman CH, Love RM. Biocompatibility of dental materials used in contemporary endodontic therapy: a review. Part 1. Intracanal drugs and substances. <i>Int Endod J.</i> 2003 Feb;36(2):75-85. doi: 10.1046/j.1365-2591.2003.00631.x	78 (3,90)	407 (20,35)	110 (5,50)
76	Menezes MM, Valera MC, Jorge AO, Koga-Ito CY, Camargo CH, Mancini MN. In vitro evaluation of the effectiveness of irrigants and intracanal medicaments on microorganisms within root canals. <i>Int Endod J.</i> 2004 May;37(5):311-9. doi: 10.1111/j.0143-2885.2004.00799.x	76 (4,00)	258 (13,58)	98 (5,16)
77	Manzur A, González AM, Pozos A, Silva-Herzog D, Friedman S. Bacterial quantification in teeth with apical periodontitis related to instrumentation and different intracanal medications: a randomized clinical trial. <i>J Endod.</i> 2007 Feb;33(2):114-8. doi: 10.1016/j.joen.2006.11.003	76 (4,75)	206 (12,88)	96 (6,00)
78	Alves FR, Almeida BM, Neves MA, Moreno JO, Rôças IN, Siqueira JF Jr. Disinfecting oval-shaped root canals: effectiveness of different	75 (6,25)	193 (16,08)	94 (7,83)

	supplementary approaches. <i>J Endod.</i> 2011 Apr;37(4):496-501. doi: 10.1016/j.joen.2010.12.008			
<b>79</b>	Barbosa CA, Gonçalves RB, Siqueira JF Jr, De Uzeda M. Evaluation of the antibacterial activities of calcium hydroxide, chlorhexidine, and camphorated paramonochlorophenol as intracanal medicament. A clinical and laboratory study. <i>J Endod.</i> 1997 May;23(5):297-300. doi: 10.1016/S0099-2399(97)80409-8	74 (2,85)	239 (9,19)	87 (3,35)
<b>80</b>	Abdullah M, Ng YL, Gulabivala K, Moles DR, Spratt DA. Susceptibilities of two <i>Enterococcus faecalis</i> phenotypes to root canal medications. <i>J Endod.</i> 2005 Jan;31(1):30-6. doi: 10.1097/01.don.0000136205.80807.5a	74 (4,11)	254 (14,11)	86 (4,78)
<b>81</b>	Dametto FR, Ferraz CC, Gomes BP, Zaia AA, Teixeira FB, de Souza-Filho FJ. In vitro assessment of the immediate and prolonged antimicrobial action of chlorhexidine gel as an endodontic irrigant against <i>Enterococcus faecalis</i> . <i>Oral Surg Oral Med Oral Pathol Oral Radiol Endod.</i> 2005 Jun;99(6):768-72. doi: 10.1016/j.tripleo.2004.08.026	74 (4,11)	298 (16,56)	106 (5,89)
<b>82</b>	Alghamdi F, Shakir M. The Influence of <i>Enterococcus faecalis</i> as a Dental Root Canal Pathogen on Endodontic Treatment: A Systematic Review. <i>Cureus.</i> 2020 Mar 13;12(3):e7257. doi: 10.7759/cureus.7257	73 (24,33)	177 (59,00)	87 (29,00)
<b>83</b>	Lambrianidis T, Kosti E, Boutsoukis C, Mazinis M. Removal efficacy of various calcium hydroxide/chlorhexidine medicaments from the root canal. <i>Int Endod J.</i> 2006 Jan;39(1):55-61. doi: 10.1111/j.1365-2591.2005.01049.x	73 (4,29)	249 (14,65)	106 (6,24)
<b>84</b>	Sen BH, Safavi KE, Spångberg LS. Antifungal effects of sodium hypochlorite and chlorhexidine in root canals. <i>J Endod.</i> 1999 Apr;25(4):235-8. doi: 10.1016/S0099-2399(99)80149-6	73 (3,04)	234 (9,75)	86 (3,58)
<b>85</b>	Gonçalves LS, Rodrigues RC, Andrade Junior CV, Soares RG, Vettore MV. The Effect of Sodium Hypochlorite and Chlorhexidine as Irrigant Solutions for Root Canal Disinfection: A Systematic Review of Clinical Trials. <i>J Endod.</i> 2016 Apr;42(4):527-32. doi: 10.1016/j.joen.2015.12.021	73 (10,43)	196 (28,00)	91 (13,00)
<b>86</b>	Vianna ME, Horz HP, Conrads G, Zaia AA, Souza-Filho FJ, Gomes BP. Effect of root canal procedures on endotoxins and endodontic pathogens. <i>Oral Microbiol Immunol.</i> 2007 Dec;22(6):411-8.	73 (4,56)	187 (11,69)	97 (6,06)

	doi: 10.1111/j.1399-302X.2007.00379.x			
87	Kishen A, Sum CP, Mathew S, Lim CT. Influence of irrigation regimens on the adherence of <i>Enterococcus faecalis</i> to root canal dentin. <i>J Endod.</i> 2008 Jul;34(7):850-4. doi: 10.1016/j.joen.2008.04.006	71 (4,73)	196 (13,07)	85 (5,67)
88	Ring KC, Murray PE, Namerow KN, Kuttler S, Garcia-Godoy F. The comparison of the effect of endodontic irrigation on cell adherence to root canal dentin. <i>J Endod.</i> 2008 Dec;34(12):1474-9. doi: 10.1016/j.joen.2008.09.001	71 (4,73)	209 (13,93)	94 (6,27)
89	Stowe TJ, Sedgley CM, Stowe B, Fenno JC. The effects of chlorhexidine gluconate (0.12%) on the antimicrobial properties of tooth-colored ProRoot mineral trioxide aggregate. <i>J Endod.</i> 2004 Jun;30(6):429-31. doi: 10.1097/00004770-200406000-00013	70 (3,68)	224 (11,79)	84 (4,42)
90	Kaufman AY, Keila S, Yoshpe M. Accuracy of a new apex locator: an in vitro study. <i>Int Endod J.</i> 2002 Feb;35(2):186-92. doi: 10.1046/j.1365-2591.2002.00468.x	69 (3,29)	246 (13,71)	83 (3,95)
91	Ayhan H, Sultan N, Cirak M, Ruhi MZ, Bodur H. Antimicrobial effects of various endodontic irrigants on selected microorganisms. <i>Int Endod J.</i> 1999 Mar;32(2):99-102. doi: 10.1046/j.1365-2591.1999.00196.x	69 (2,88)	295 (12,29)	92 (3,83)
92	Johal S, Baumgartner JC, Marshall JG. Comparison of the antimicrobial efficacy of 1.3% NaOCl/BioPure MTAD to 5.25% NaOCl/15% EDTA for root canal irrigation. <i>J Endod.</i> 2007 Jan;33(1):48-51. doi: 10.1016/j.joen.2006.08.007. Erratum in: <i>J Endod.</i> 2007 Feb;33(2):186	69 (4,31)	235 (14,69)	81 (5,06)
93	Nagata JY, Soares AJ, Souza-Filho FJ, Zaia AA, Ferraz CC, Almeida JF, Gomes BP. Microbial evaluation of traumatized teeth treated with triple antibiotic paste or calcium hydroxide with 2% chlorhexidine gel in pulp revascularization. <i>J Endod.</i> 2014 Jun;40(6):778-83. doi: 10.1016/j.joen.2014.01.038	69 (7,67)	165 (18,33)	85 (9,44)
94	Sena NT, Gomes BP, Vianna ME, Berber VB, Zaia AA, Ferraz CC, Souza-Filho FJ. In vitro antimicrobial activity of sodium hypochlorite and chlorhexidine against selected single-species biofilms. <i>Int Endod J.</i> 2006 Nov;39(11):878-85. doi: 10.1111/j.1365-2591.2006.01161.x	68 (4,00)	271 (15,94)	96 (5,65)
95	Ari H, Erdemir A. Effects of endodontic irrigation solutions on mineral content of root canal dentin	67 (3,72)	181 (10,06)	80 (4,44)

	using ICP-AES technique. <i>J Endod.</i> 2005 Mar;31(3):187-9. doi: 10.1097/01.don.0000137643.54109.81			
<b>96</b>	Arias-Moliz MT, Ferrer-Luque CM, González-Rodríguez MP, Valderrama MJ, Baca P. Eradication of <i>Enterococcus faecalis</i> biofilms by cetrimide and chlorhexidine. <i>J Endod.</i> 2010 Jan;36(1):87-90. doi: 10.1016/j.joen.2009.10.013	67 (5,15)	130 (10,00)	79 (6,08)
<b>97</b>	Siqueira JF Jr, Paiva SS, Rôças IN. Reduction in the cultivable bacterial populations in infected root canals by a chlorhexidine-based antimicrobial protocol. <i>J Endod.</i> 2007 May;33(5):541-7. doi: 10.1016/j.joen.2007.01.008	67 (4,19)	207 (12,94)	87 (6,08)
<b>98</b>	Rodrigues CT, de Andrade FB, de Vasconcelos LRSM, Midená RZ, Pereira TC, Kuga MC, Duarte MAH, Bernardineli N. Antibacterial properties of silver nanoparticles as a root canal irrigant against <i>Enterococcus faecalis</i> biofilm and infected dentinal tubules. <i>Int Endod J.</i> 2018 Aug;51(8):901-911. doi: 10.1111/iej.12904	66 (13,20)	123 (24,60)	77 (15,40)
<b>99</b>	Gomes BP, Martinho FC, Vianna ME. Comparison of 2.5% sodium hypochlorite and 2% chlorhexidine gel on oral bacterial lipopolysaccharide reduction from primarily infected root canals. <i>J Endod.</i> 2009 Oct;35(10):1350-3. doi: 10.1016/j.joen.2009.06.011	66 (4,71)	153 (10,93)	89 (6,36)
<b>100</b>	Schäfer E, Bössmann K. Antimicrobial efficacy of chlorhexidine and two calcium hydroxide formulations against <i>Enterococcus faecalis</i> . <i>J Endod.</i> 2005 Jan;31(1):53-6. doi: 10.1097/01.don.0000134209.28874.1c	65 (3,61)	280 (15,56)	87 (4,83)

Table 2. Top 10 journals that contributed to the 100 most-cited articles on chlorhexidine in endodontics

Source Title	Number of papers	Number of citations	Impact factor* (2022)
Journal of Endodontics	58	7,633	4.2
International Endodontic Journal	24	3,076	5.0
Oral Surgery Oral Medicine Oral Pathology Oral Radiology	10	1,090	2.9
Dental Traumatology	5	628	2.5
Australian Dental Journal	1	178	2.1
Cureus Journal of Medical Science	1	73	1.2
Oral Microbiology And Immunology	1	73	0.0

Table 3. Top 10 institutions with the highest number of papers among the 100 most cited

Institution	Country	Number of papers	Number of citations
Campinas State University	Brazil	12	1,404
Estacio de Sa University	Brazil	8	745
University of British Columbia	Canada	7	861
University of Oslo	Norway	7	792
University of Texas	USA	6	1,537
Selcuk University	Turkey	4	384
University of Toronto	Canada	3	314
University of São Paulo	Brazil	3	261
Eastman Dent Inst	United Kingdom	2	466
University of Zurich	Switzerland	2	280

Table 4. Top 10 authors with the most papers among the 100 most cited

Authors	Number of papers between 100 most-cited	Number of citations between 100 and most-cited	Number of papers in WoSCC	Number of citations in WoSCC	H-Index
Gomes BPF A	13	1,493	258	7,749	48
Haapasalo M	12	1,485	238	10,448	59
Zaia AA	9	973	140	4,341	39
Siqueira JF	9	947	242	13,211	65
Ferraz CCR	7	974	148	5,196	39
Vianna ME	7	843	34	1,750	22
Shen Y	6	729	164	6,257	47
De Souza FJ	5	497	31	943	13
Orstavik D	5	624	75	4,234	37
Rocas IN	5	446	63	1,295	22

## FIGURE LEGENDS

Figure 1. Distribution of the number of publications over the years.

Figure 2. Distribution of the origin of CHX publications around the world.

Figure 3. Main groups/authors that have researched CHX. Names written in a larger font and associated with the largest points are the most frequent authors. Authors associated with blue points are related to older studies and those closer to yellow are related to more recent studies, as the scale indicates.

Figure 4. Frequency and interaction of the main keywords associated with the study. Terms associated with larger points and written in a larger font appeared more often. The lines joining the points indicate the relationship and use of these words in the same studies. Points with the same color indicate greater collaboration between the terms.

FIGURES

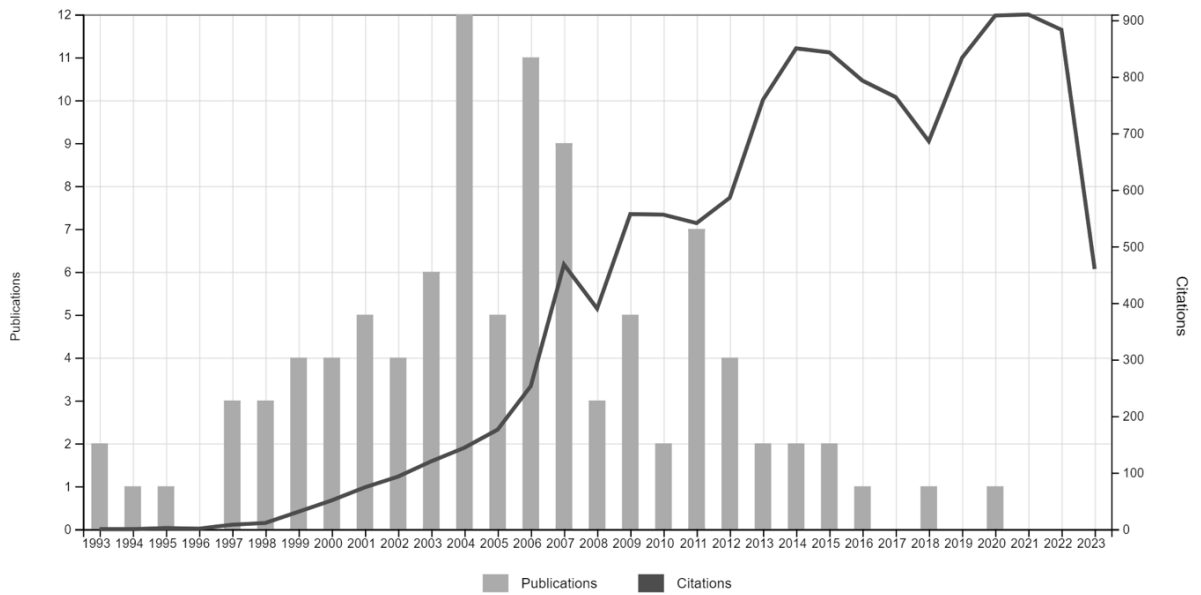


Figure 1. Distribution of the number of publications over the years.

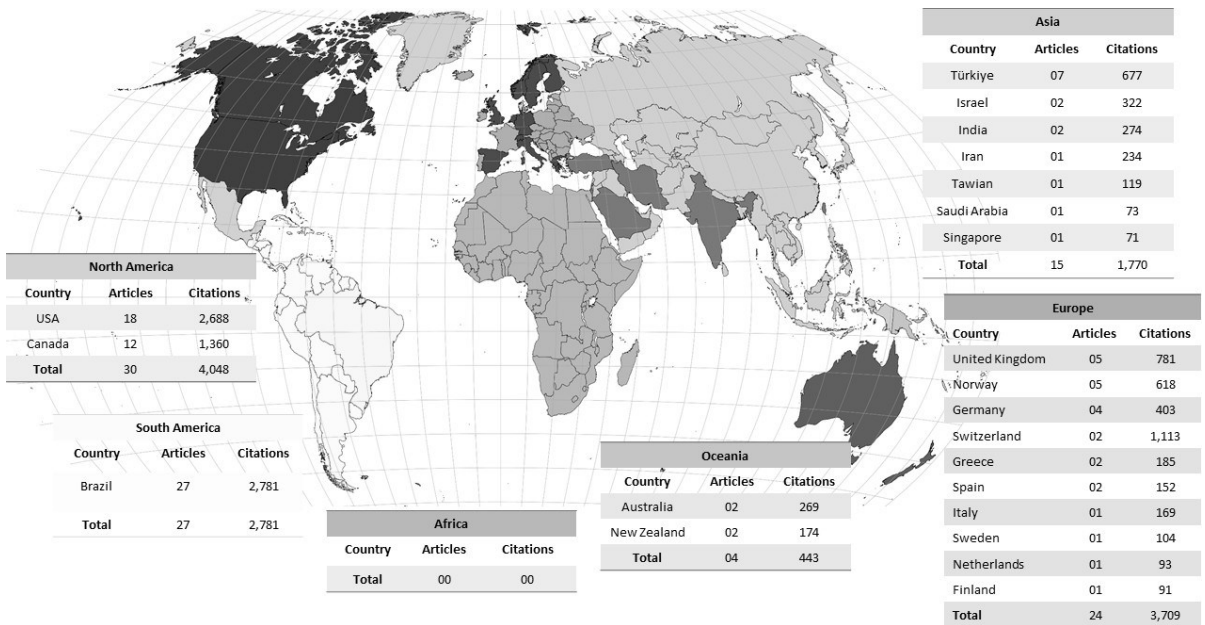


Figure 2. Distribution of the origin of CHX publications around the world.

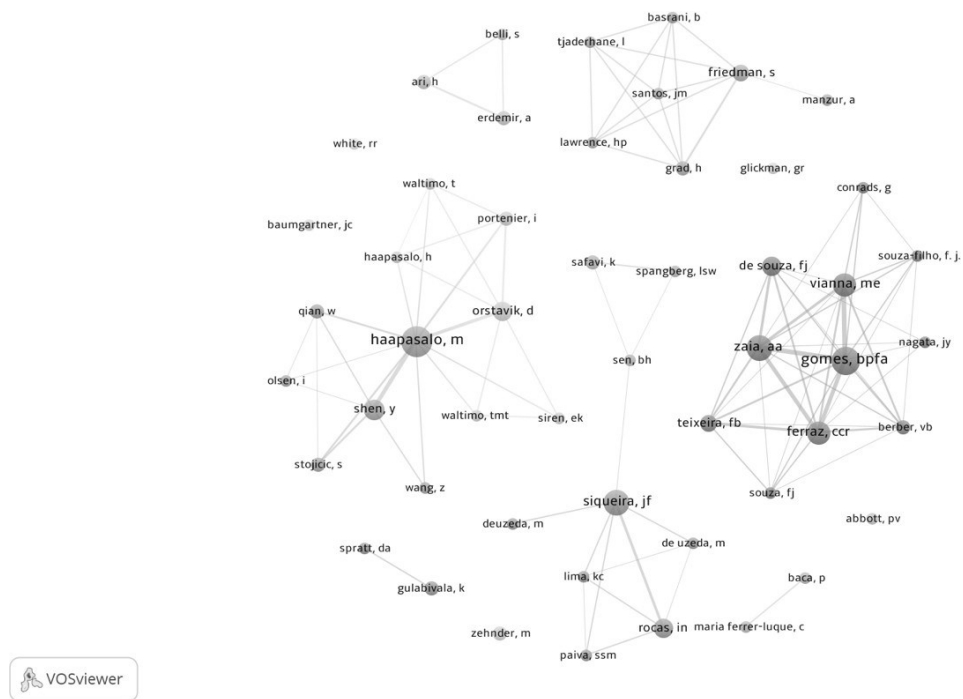


Figure 3. Main groups/authors that have researched CHX. Names written in a larger font and associated with the largest points are the most frequent authors. Authors associated with blue points are related to older studies and those closer to yellow are related to more recent studies, as the scale indicates.

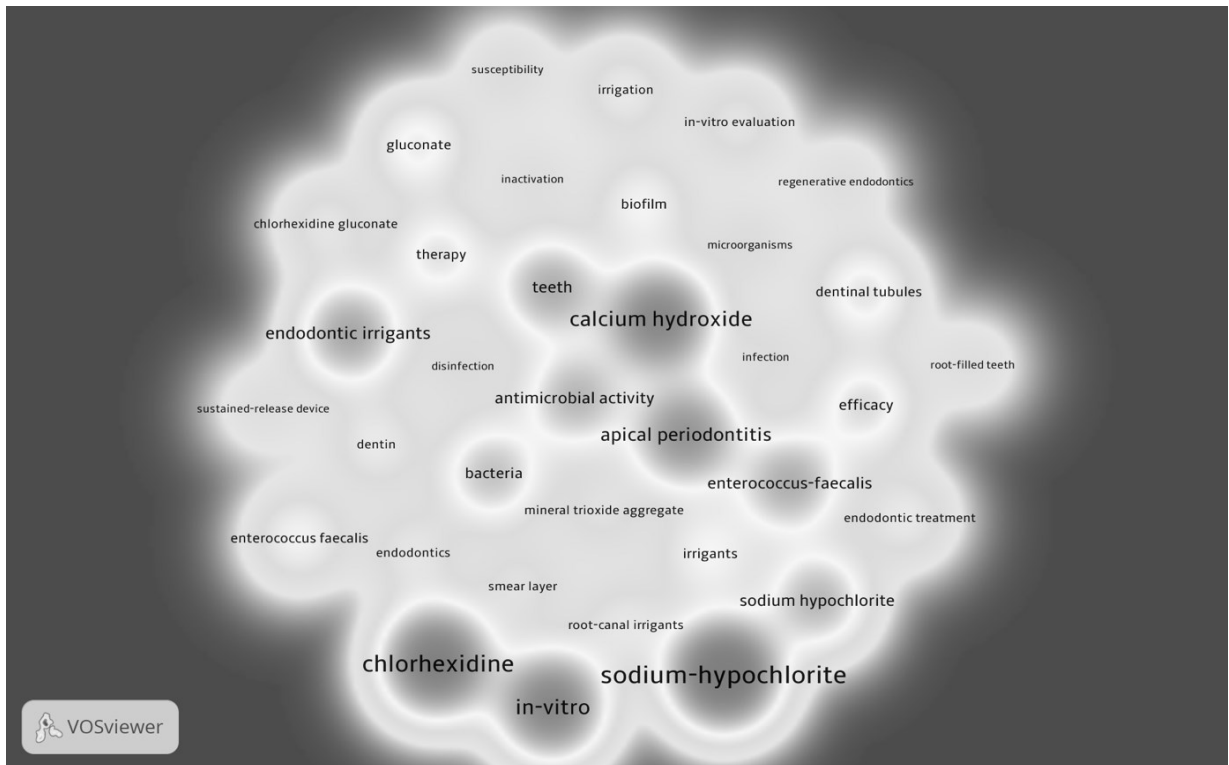


Figure 4. Frequency and interaction of the main keywords associated with the study. Terms associated with larger points and written in a larger font appeared more often. The lines joining the points indicate the relationship and use of these words in the same studies. Points with the same color indicate greater collaboration between the terms.

## 5 CONSIDERAÇÕES FINAIS

Esta revisão bibliométrica fornece informações sobre o estado atual e as tendências das pesquisas relacionadas ao uso da clorexidina em endodontia. Com base nos resultados apresentados, é possível perceber um crescente interesse de pesquisa na América do Norte, embora o Brasil se destaque como o país com maior número de artigos sobre o tema. A maioria dos trabalhos foi publicada no *Journal of Endodontics*, compreendendo predominantemente projetos de pesquisa laboratorial que investigaram principalmente a clorexidina como solução irrigadora. Apesar dessa ênfase, um número limitado de estudos observacionais e revisões sistemáticas foram identificados sobre o uso da clorexidina em endodontia, sugerindo potenciais perspectivas de pesquisa. Conseqüentemente, é evidente que há um interesse substancial na utilização da clorexidina em endodontia, ressaltando a relevância desta revisão.

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