

Minimal intervention dentistry: What is its clinical application and effectiveness in different continents? – A scoping review

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Abstract

The aim of minimal intervention dentistry (MID) is to maximize the preservation of dental tissues through the use of modern and effective techniques and procedures. The central objective of MID is to increase the functional life of dental elements and, consequently, the quality of life of the population. The present study aimed to analyze and map the diffusion and clinical application of MID in different continents around the world. To perform this scoping review, the PRISMA checklist was used, adopting the following: population – dentists; concept – effectiveness of MID; and context – continents. The following databases were used: PubMed, European Archives of Paediatric Dentistry, Scientific Electronic Library, Latin Literature American and Caribbean Association in Health Sciences, and SCOPUS. The following keywords were used in the searches: “pediatric dentistry,” “atraumatic restorative treatment,” “dental caries,” “child health,” and “glass ionomer cements” using “and” and “or” combined with “minimal intervention dentistry.” Studies published before 2010 as well as theses, dissertations, opinion articles, editorials, and guidelines, were excluded from the study. A total of 160 articles were obtained, and 17 articles were screened and selected for full reading. The analysis of the studies reveals the disparity in the use of minimal intervention techniques among continents due to a lack of knowledge of these techniques or lack of confidence in changing professional approaches, thus emphasizing the need for the dissemination and teaching of MID.

Keywords: Dental caries; glass ionomer cements; pediatric dentistry; review

INTRODUCTION

Abnormalities of the oral cavity, represented by periodontal diseases, caries, and tooth loss, affect approximately 45% of the global population. Painful symptoms, functional limitations of oral sensorimotor skills, and school and work absenteeism are consequences of oral disorders, which affect the quality of life of the population on all continents of the planet.^[1]

In addition, estimates from the WHO’s World Oral Health Report indicate that 3.5 billion people are affected by

oral pathologies, among which 2 billion adults and 514 million children are affected by dental caries, which is considered the most prevalent oral disease in the world.^[2]

Historically, caries have been treated using invasive surgical interventions, with complete removal of all carious tissue and subsequent restoration.^[3]

The scientific knowledge of contemporary dentistry associated with technological advances has systematically disrupted this philosophy of practice, replacing it with the model of minimal intervention dentistry (MID). Fundamentally, MID is characterized by the maximum preservation of original tissue when there is a need for procedures to treat an injury and/or disease.^[4]

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In particular, for caries lesions, from the perspective of MID, the following treatment strategies are used: early detection and evaluation of the risk and activity of the lesion; enamel and dentin remineralization; education and prevention measures and minimally invasive interventions; restorative repair and nonreplacement of restorations; and, finally, individualized treatment.^[5,6]

In addition to these strategies, MID considers the life expectancy of the global human population, given that the notable increase in life expectancy worldwide increases exposure to risk factors. Thus, MID contributes significantly to maintaining functional teeth throughout the life cycle of an individual.^[7]

Despite all the benefits of MID, there are no bibliographic analyses in the dental literature that identify, evaluate, and synthesize the use of MID at a global level and the effectiveness of clinical practice. As such, this study aimed to identify the main sources of scientific evidence regarding the effectiveness of MID in different continents, as well as to map concepts and issues that may justify the use or not of this philosophy as a clinical routine.

METHODS

This study was a scoping review seeking to locate, map, and summarize the main sources of scientific evidence on the issue: “Is MID effectively used in different continents?” This study was registered in the Oral Science Framework with DOI registry.

To execute the scoping review, the guidelines proposed by Peters *et al.* (2020) were referenced.^[8] This scoping review complied with the guidelines of the preferred reporting items for systematic reviews and meta-analyses-Extension for Scoping Reviews to ensure methodological rigor.^[9] Based on the classic criteria of scoping reviews, the population, concept, and context (PCC) strategy was used to elaborate the guiding question, where *P* is dentists, *C* is the effectiveness of MID, and *C* is continents. To classify study designs, the Oxford center for evidence-based medicine was used as a reference.^[10]

To search for and select articles, the following databases were used: National Library of Medicine (PubMed), European Archives of Paediatric Dentistry, Scientific Electronic Library, Latin Literature American and Caribbean Association in Health Sciences, and SCOPUS. The search strategy included the following descriptors: “Pediatric dentistry,” “atraumatic restorative treatment,” “dental caries,” “child health,” and “glassionomer cements.” The descriptors were combined with the Boolean operators “AND” and “OR” and the term “minimal intervention dentistry” to retrieve articles potentially related to the guiding question. The inclusion criteria established were as

follows: articles in Portuguese and English. The stipulated period was from January 2010 to March 2023. Articles that did not pertain to the guiding question, duplicate articles, letters, editorials, dissertations, opinion articles, theses, and guidelines were excluded from the study.

Data extraction and analysis were conducted by the principal investigator, who read the titles, abstracts, and full articles; doubts were resolved by consensus on the basis of the research question. Doubts regarding the choice of selected articles were resolved by consensus among the authors.

RESULTS

A total of 160 articles were obtained. They were analyzed based on the title and abstract, resulting in 23 articles. These were examined to exclude duplicates (6), and 19 articles were screened based on the full text. After reading, 2 articles were excluded for not meeting the adopted criteria, resulting in 17 articles included in this study [Figure 1 and Table 1].

DISCUSSION

The promotion of oral health is one of the guiding principles of the new concepts of primary health care, and within this context, there are contemporary models for the diagnosis, prevention, and treatment of caries lesions. MID breaks from the traditional surgical-restorative model and focuses on the preservation of dental tissues, serving as a reference for public policies on oral health and a principle for clinical applicability in private practices.^[5,27]

However, MID is not fully understood and consolidated as a contemporary philosophy for the management of caries

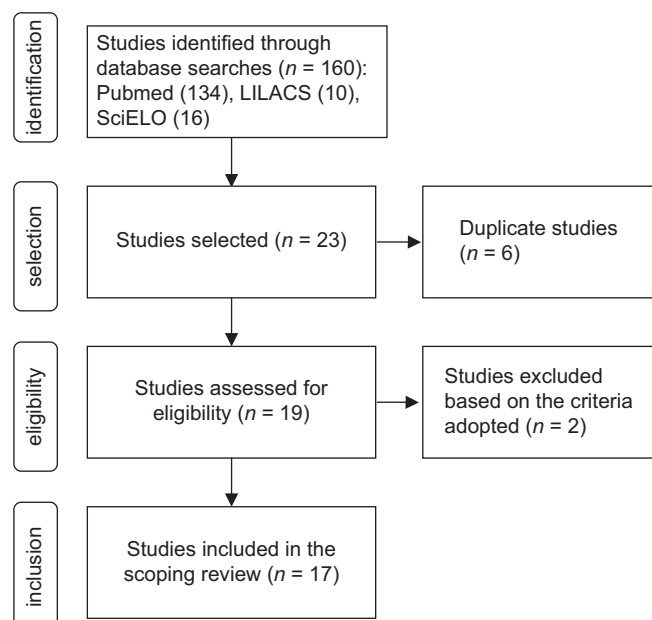


Figure 1: Flowchart

Table 1: Synoptic Table

| Title | Author, year and country | Objective | Conclusion | Study design | Level of evidence |
|--|--|--|--|---|-------------------|
| ART as an oral health promotion strategy in primary care ^[11] | Guiotoku <i>et al.</i> (2013) Brazil | To observe the performance of ART in the treatment of dental caries in patients unable to undergo conventional dental treatment due to fear, anxiety, or other causes | ART is a safe and a traumatic alternative | Cross-sectional study | 2B |
| Minimum intervention dentistry in resource-challenged practice environments ^[12] | Arotiba <i>et al.</i> (2020) Africa | To highlight the principle strategies to implement MID in general dental practice and educational measures | MID is the current global gold standard for dental caries management | Systematic review (systematic review) | 2A |
| Evolution of the dental technique of atraumatic restorative treatment ^[13] | Coelho <i>et al.</i> (2020) Brazil | To deepen the knowledge about the history and evolution of the technique so that dental surgeons perform it with more confidence | The use of ART is plausible in both public and private services, as the technique preserves healthy tissues and reduces more invasive procedures such as endodontics and extractions | Systematic review | 1A |
| Minimum intervention dentistry in the US: An update from a cariology perspective ^[14] | Fernández <i>et al.</i> (2020) United States | To highlight efforts in education and clinical practice in the United States in the last decade to promote caries control strategies based on the philosophy of minimal intervention | Dental educators in the United States have assumed responsibility for promoting the best evidence in cariology, including the principles of minimal intervention | Systematic review | 2A |
| Can MID help in tackling the global burden of untreated dental caries? ^[15] | Bernabé and Marcenes 2020) United Kingdom | To determine whether minimal intervention dentistry can help address the global burden of untreated dental caries | MID can play an important role in providing cost-effective and patient-centered dental care for the entire population | Systematic review without meta-analysis | 2A |
| SDF Versus ART in Paediatric Dental Caries Management: A Systematic Review and Meta-analysis ^[16] | Wakhloo <i>et al.</i> (2021) India | To analyze the findings of RCTs comparing SDF and ART in the prevention of active caries in deciduous teeth and first permanent molars in children | There is insufficient evidence to compare SDF and ART in the prevention of caries in deciduous teeth, especially in the first permanent molars | Systematic review (systematic review) | 1A |
| EPG in MID: Findings from a Dental Practice-based Research Network ^[17] | Kakudate <i>et al.</i> (2020) Japan | To quantify the EPG between dental practice and evidence on the effectiveness of MID among dentists in Japan and to examine the hypothesis that the work characteristics of each dentist have a significant association with the EPG | Japanese dentists showed average agreement with the published evidence, indicating that there is an EPG in the MID in Japanese dental practices | Cross-sectional study (cross-sectional study) | 3B |
| MID for managing carious lesions into dentine in primary teeth: Umbrella review ^[18] | BaniHani <i>et al.</i> (2022) United Kingdom | To analyze the published evidence on minimal intervention in the control of caries in deciduous teeth | There is an evident need to reinforce the importance of MID in the management of caries in deciduous teeth as the first treatment option in the dental care protocol | Umbrella review | 1A |
| MID for a child patient. The current landscape ^[19] | Lewis (2022) | Provide a brief overview of the evidence related to MID for the treatment of dental caries in pediatric dentistry | MID offers a holistic, evidence-based, minimally invasive, and cost-effective approach that benefits patients and dentists | Integrative review | 1A |
| A scoping literature review on minimum intervention dentistry for children with dental caries ^[20] | Dawett <i>et al.</i> (2022) United Kingdom | To describe the literature related to MID for children with caries and identify research gaps | Most of the articles found were opinion articles; therefore, there is a lack of evidence on the effectiveness of MID | Scoping review | 2B |
| Minimal intervention procedures: evaluating how much pediatric dentists really know about this field ^[21] | Amorim Junior <i>et al.</i> (2022) Brazil | To determine if pediatric dentists have truly high knowledge about minimal intervention procedures | Pediatric dentists consider themselves up-to-date on minimal intervention strategies, regardless of their degree and place of training | Cross-sectional study | 3B |

Contd...

Table 1: Contd...

| Title | Author, year and country | Objective | Conclusion | Study design | Level of evidence |
|---|--|---|--|--|-------------------|
| MID mainstream or unconventional option? Study exploring the impact of COVID-19 on pediatric dentists' views and practices of MID for managing carious primary teeth in children across the United Kingdom and European Union ^[22] | Banihani <i>et al.</i> (2022) United Kingdom | To explore the techniques used by dentists in the United Kingdom and in the European Union to treat caries lesions in deciduous teeth as well as to evaluate the use of minimal intervention by them in the pre-, trans-, and post-COVID period | There is still a significant percentage of DCs reluctant to use MID | Cross-sectional study (cross-sectional study) | 1B |
| Best clinical guidance for treating deep carious lesions in primary teeth: An EAPD policy document ^[23] | Duggal <i>et al.</i> (2022) United Kingdom | To develop a guide to assist professionals in the management of dental caries in children | It was not possible to develop guidelines using best practices and methods | Systematic review | 2A |
| Survival Analysis and Cost Effectiveness of SMART and Atraumatic Restorative Treatment Occlusal Restorations in Primary Molars: A randomized controlled trial ^[24] | Aly <i>et al.</i> (2023) Egypt | To evaluate and compare the clinical performance and cost-effectiveness of SMARTs and ARTs in deciduous molars during a 12 months' follow-up period | Although SMART and ART have comparable clinical performance and survival in single-surface occlusal restorations in primary molars, SMART is less time-consuming and more economical | Randomized study (randomized controlled study) | 1B |
| Non-invasive therapies based on high-concentration fluorides for root caries lesions ^[25] | León (2022) Chile | To discuss the need for the public health system to use MID to increase tooth longevity | The public health system is not sufficiently prepared to deal with oral health problems | Narrative review | 5 |
| Did the use of minimum interventions for caries management change during the COVID-19 pandemic? ^[26] | Souza <i>et al.</i> (2023) Brazil | To evaluate, through an online questionnaire, changes in the behavior of dental surgeons in Brazil regarding the use of minimal intervention in regard to the management of dental caries in the period before and during the pandemic | The use of minimal intervention for caries management in Brazil did not change during the pandemic period | Cross-sectional study | 3B |
| Knowledge, attitudes, and practice of dentists on MID: A systematic review and meta-analysis ^[4] | de Moura <i>et al.</i> (2023) Brazil | To evaluate the knowledge, attitudes, and practice of dentists regarding MID | The knowledge of dentists on MID topics is acceptable, and attitudes and practices need to be improved | Systematic review | 1A |

ART: Atraumatic restorative treatment, MID: Minimal intervention dentistry, SDF: Silver diamine fluoride, EPG: Evidence-practice gap, RCTs: Randomized controlled trials, SMART: Silver modified ART

lesions.^[4,22] Thus, mapping the use of MID in different continents is conducive to understanding, evaluating, and summarizing the current incorporation of this philosophy.^[13,15,19,20,25]

In addition, this study may stimulate the clinical practice of MID, considering all the benefits that MID has for the world population.^[4,11-13,15,20,21,24,26]

In general, the synthesis of the results from the articles selected for the scoping review clearly demonstrates that MID is used on several continents, with strong evidence of its clinical efficacy.^[23,24,26]

Notably, a significant percentage of DCs are still reluctant to adhere to MID, either due to lack of knowledge of MID, clinical insecurity, or resistance to changes in professional approaches, among other associated factors.^[11,22]

Recent research shows that parental preference for the treatment of their children also falls within the framework of limitations for acceptance of MID.^[28]

Considering the bibliographic productions in the databases used for this scoping review, only 17 were consistent with the guiding question and aligned with the PCC. In principle, this finding indicates that to date, there is a remarkable need for publication on the subject. However, when considering the strength of evidence of the selected articles, most reveal strong levels of scientific evidence, with a predominance of categories 1A, 1B, and 2A according to the criteria defined by the Oxford Centre for Evidence-based Medicine.^[14]

The geographical mapping of bibliographic production distinguishes the Americas^[4,11,13,14,21,26] and Europe^[15,18-20,22,23] as leaders in investigations about MID. Asia^[16,17,27] and Africa^[12,24] have a considerable number of publications on the subject, indicating that researchers in these areas have

an interest in the subject. Among the countries that publish the most on the subject, the United States, Brazil, and the United Kingdom stand out with the highest number of publications.

The increasing number of articles on these continents emphasizes the relevance and growing interest in the subject. However, it is important to note a marked discrepancy in terms of applicability and results.

Studies cite the need to publish more evidence about the results of the use of minimal intervention so that it is more safely applied by dentists.^[16-20,22,23]

The results of studies confirm the idea that there is sufficient evidence for the safe use and full implementation of MID by DCs.^[4,11-14,21,24,26]

MID was conceived as a philosophy of care, and in a way, this concept is confirmed by studies conducted on different continents, where MID is treated as a model of education, prevention and conservative treatment.^[13,16,21]

Although MID can and should be applied to all dental specialties, children seem to be the focal object of this philosophy. This is probably because the treatment alternatives proposed in MID are considered more “friendly,” alleviating patient fear and anxiety and reducing discomfort, characteristics exhibited by this population, resulting in a greater degree of cooperation, which consequently results in a shorter clinical care time.^[27,29]

Within this scenario, with advancements in and the study of MID in pediatric patients, in the future, new generations of professionals will be able to incorporate preventive dentistry, centered around the use of MID techniques, with greater safety and dexterity in all age groups, including the elderly population, thus improving quality of life.^[25]

Despite being recognized and adopted on a global scale, the MID conceptual approach differs by the regional characteristics and needs of each country. These needs are linked to professional knowledge, the sociocultural conditions of the populations, the epidemiological profile of the population, and the curriculum bases of dental education in different countries.^[15] Thus, in the Latin American region, with particular emphasis on Brazil, MID is recommended in dental clinics and considered a safe and effective technique.^[13] On the other hand, in the European region, represented especially by the United Kingdom, the clinical application of MID is recommended with relative restrictions, arguing that there is a lack of scientific evidence that attests to the real effectiveness of this model.^[22] A similar scenario is observed in the Asian region, particularly in Japan, where 40% of dental

professionals do not agree with the scientific evidence supporting MID.^[17]

Some clinical dentists adopt a posture of resistance to this modality of oral health care,^[22] as it is relatively unknown^[4] and cannot overcome long-lasting and classic attitudes toward dentistry practices.

In addition, MID challenges DSs to change the way they act and acquire new behaviors and habits.^[21,23,27]

There is an urgent need for researchers to fill gaps in knowledge about MID and organize a clear and objective transfer of knowledge that reaches the largest possible number of professionals working in routine dental clinics. Such actions will promote significant advances in the quality and scope of dental care.^[4,17]

In this line of reasoning, some countries strongly seek to stimulate and expand scientific evidence and encourage the clinical practice of MID. Researchers and clinicians have implemented atraumatic restorative treatment, either at the private level or in public policies, and these measures are based on the principles of minimal intervention.^[11,13,15,25]

The use of MID in Brazil is fully recognized and effectively applied by MDs^[26] given that randomized clinical trials show excellent results, in addition to showing that approximately 76% of Brazilian MDs have satisfactory knowledge about MID^[13] and 90% have up-to-date knowledge.^[21] Currently, MID is systematically addressed in academic subjects, and the integration of MID as a mandatory subject in curricula is being discussed.^[4]

A study conducted on the African continent proposed to implement this approach through methods that include training in laboratory simulation environments, clinical practices, professional evaluations, and even formal exams. Similarly, research implemented in North America reinforces the idea that the teaching of cariology in the basic curriculum structure should be based on the known principles of MID and studied worldwide.^[12,14]

The novelty of this study does not exempt it from limitations common to scoping reviews, i.e. the quality of the available evidence was not assessed. However, in an attempt to circumvent this limitation, the Oxford Centre for evidence-based analysis was used to categorize the level of scientific evidence by study type.^[10]

CONCLUSION

The mapping of bibliographic productions on the global use of MID allows inferring that this treatment philosophy, although employed on different continents, requires

academic institutions and public policies to support and defend its incorporation into clinical practice and academia.

Researchers and clinicians should encourage and accept these changes in patient care on the basis of scientific evidence.

In this context, the existing disparity in the implementation of the MID approach among different continents is mainly due to the lack of safety and the lack of knowledge on the part of dentists regarding this technique. This suggests that expanding awareness, providing in-depth education, and disseminating information are essential to reduce this discrepancy and drive the acceptance and wider application of MID in all global dental settings. There is a continued need to strengthen and improve education in MID, aiming to align dental professionals with the most current and effective trends in clinical practice.

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Conflicts of interest

There are no conflicts of interest.

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