Atraumatic Restorative Treatment as public policy: a systematic review

Fábio Carneiro Martins (fabio.carneiro.martins@usp.br)
Universidade de São Paulo
Laura Regina Antunes Pontes
Universidade de São Paulo
Gabriela da Silva Martins Gonçalves
Universidade de São Paulo
Mariana Gabriel
Universidade de Mogi das Cruzes
Daniela Prócida Raggio
Universidade de São Paulo
Mariana Minatel Braga
Universidade de São Paulo
Antonio Carlos Frias
Universidade de São Paulo
Fernanda Campos de Almeida Carrer
Universidade de São Paulo

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Abstract

Background: This systematic review aimed to identify, describe, and analyze the global context of Atraumatic Restorative Treatment (ART) as public policy.

Methods: The inclusion criteria were: studies on public oral health policies, dental caries, or ART. The exclusion criteria were: clinical studies, specific interventions unrelated to the decision making of managers or policymakers, studies that report public oral health policies that do not use ART as a strategy for caries treatment. A literature search was conducted in PubMed, BVS, Epistemonikos, Health Systems Evidence, and Rx for change. There were no language restrictions. Data extraction was performed by two authors independently according to the stages and categories of a conceptual framework and organized in spreadsheets using Microsoft Excel 365. Of the 2253 eligible articles, 139 were duplicates, and 1680 were not included after reviewing the title and abstract. After assessing the full text, 414 articles were excluded.

Results: 20 articles were included in the current review. Nineteen were conducted in nine countries: South Africa (n = 3), Bolivia (n = 1), Cambodia (n = 2), Egypt (n = 2), Mexico (n = 2), Tanzania (n = 4), East Timor (n = 1), Tunisia (n = 1), and Zimbabwe (n = 3), and one in the Americas. Regarding local contexts, the studies reported a high prevalence of dental caries and a lack of access to restorative procedures in health services as common problems. Policy development processes were similar in some aspects, such as the presence of governments, conceptual use of scientific evidence, and induction by the World Health Organization. Regarding the barriers identified in the implementation stage, the lack of supplies to carry out the procedures and induction of the work process by managers were mentioned. As for the facilitators, permanent education and professional practice were mentioned. Cohort studies have shown promising results, with a survival rate greater than 80% after one year of follow up.

Conclusions: The findings of this systematic review indicate that the use of ART in public policies is a promising option for tackling common problems in several countries, however, its use is still in an early stage.

Background

Illness is a complex phenomenon that needs to be understood in terms of its biopsychosocial dimensions. Actions, programs, or policies that wish to interfere with the determinants of the health illness process must contemplate all these aspects. It is worth mentioning that since the Declaration of Alma-Ata in 1978, strategies to combat inequalities and achieve universal health coverage for the world population have been discussed[1,2].

Dental caries is a highly prevalent disease in all age groups. Therefore, targeted policies and programs that aim to decrease its prevalence in the population and the health inequities observed in its distribution are required. It is the most common irreversible chronic disease in childhood and cannot be healed by short-term pharmacological interventions[3]. There is also a lack of equitable public policies that guarantee access to oral health promotion, prevention, cure, and rehabilitation care to those who need it most since oral health is still considered less important in many health care systems around the world[4].

The Collaborating Center of the World Health Organization (WHO) in Nijmegen published in 2002 a document titled “The Basic Package of Oral Care” (BPOC)[5]. This reference proposes strategies to deal with most oral health needs of a population in primary health care. Atraumatic Restorative Treatment (ART) is a potential treatment.

ART was conceived by Joe E. Frencken and collaborators in the mid-1980s in Tanzania to be conducted in social spaces where there is no electricity, which made conventional dental treatments impossible. ART showed high quality and reliability for treating dental caries injuries, indicating that the technique should not be restricted to territories with these characteristics[6,7]. The ART approach has been widely disseminated worldwide by the WHO, which has recognized it as an appropriate and potentially impactful treatment since 1994.

Currently, ART is understood as a minimally invasive approach, which includes preventive, therapeutic, and restorative measures for dental caries[8], and is perfectly inserted in the modern philosophy of health care, which is characterized by maximum effort in health-promoting, preventive approaches and in carrying out, when necessary, minimally invasive procedures. In addition, its quality is supported by current and robust scientific evidence[9,10], as over the past decades, high quality research on ART has been developed, and several research groups have advocated its implementation in routine health services.

However, despite the intense scientific production on ART, little is known about its use for decision making by managers and the consequent inclusion in public oral health policies. Therefore, we developed this systematic review to identify studies that involve the use of ART as a public policy or government program to better understand the use of this technique in routine health care in municipalities, states, or countries around the world.

Conceptual framework on the theme studied

To better conduct this systematic review, we used two frameworks previously published: the first was the "3-i Framework: Interests, Ideas and Institutions" developed by François-Pierre Gauvin, from the National Center of Collaboration for Healthy Public Policies in Montréal, Québec[11], and the second was a framework designed for analyzing sustainable implementations in oral health, developed by D. Dwayne Simpson, from the Institute of Behavioral Research, Texas Christian University[12].

The first framework brings together three of the most common factors that political science literature uses to explain public policy development processes. Commonly referred to as the "3-i framework," it declares that development and policy choices are influenced by **interests**, which are defined by agendas of social groups, such as civil servants, managers, researchers, and politicians; **ideas**, which include scientific evidence, professional experience, dominant values and culture; and **institutions**, composed of formal and informal rules, norms, precedents and organizational factors that structure political behavior, that is, government structures, policy networks, and political legacies. The model was recently updated with **external factors** (such as political changes and the media) as a fourth aspect that also influences the decision making proccess[13].

The second framework, a framework for implementing sustainable oral health promotion interventions, focuses on four stages of implementing interventions, which show how the concepts present in each of them contribute as part of an integrated chain of events of key factors that sequentially influence the sustainability of an innovation/intervention in oral health[12]. In addition, it highlights the organization, readiness, and infrastructure of health systems as essential aspects for an implementation to be possible and that the availability of resources (financial, human, logistical) added to the management of organizational tensions will impact their sustainability.

From reading the two frameworks described, we synthesized the necessary elements in Table 1, which was used as the guiding thread of this work.

Table 1. Guiding synthesis for description and analysis of the studied interventions.

Stage	Categories	Relevant Aspects	Framework
Development	Context, decision making process, formulation	• Problem definition • Institutions (Government structures; policy networks; political legacies) • Ideas (Scientific knowledge/evidence; dominant values/culture in society) • Interests (agenda of social groups, civil servants, researchers, and politicians)	3-I + E
Implementation	Permanent education	• Regarding pilot projects: importance of leadership, flexibility, usefulness, adaptability, quality • Regarding courses: compatibility with the needs of professionals, accessibility, certification offer	A framework for implementing sustainable oral health promotion interventions
	Data on the implementation process and its impact (quantitative and qualitative data)	• Quantity and longevity of restorative procedures performed • Facilitators (Effectiveness, feasibility, versatility, availability of inputs, targets, monitoring, permanent education) • Barriers (turnover in management and health teams, resistance, low fidelity)	A framework for implementing sustainable oral health promotion interventions

Methods

Protocol and registration

The protocol for this systematic review was registered in PROSPERO - International Prospective Register of Systematic Reviews (ID: CRD42020181798) and can be accessed at https://www.crd.york.ac.uk/prospero/display_record.php?RecordID=181798.

Eligibility criteria

A broad research question was formulated: What is the current global scenario described in the scientific literature regarding the use of ART as a public policy?

It is worth mentioning that there is no single or better definition of what public policy is, but there are different meanings that guide the discussion to the locus where the clashes of interests, preferences, and ideas develop, that is, in governments. Therefore, we will consider public policy as the process by which governments translate their purposes into actions in search of results or changes in a known reality[14].

Regarding selection, there were no restrictions on the date of publication or language.

Inclusion criteria: Studies on public oral health policies, dental caries, or ART. Exclusion criteria: Clinical studies, specific interventions unrelated to the decision making of managers or policymakers, and studies that report public oral health policies that do not use ART as a coping strategy for dental caries.

Information sources

A literature search was conducted on PubMed, Biblioteca Virtual em Saúde- BVS, Epistemonikos, Health Systems Evidence, Rx for change, and the Cochrane Library databases. To complete the search, we sent an invitation via email so that key informants (researchers who participated in the idealization and implementation of ART in research programs or projects) could report experiences via a form created with the *Google Forms* tool. The last search was conducted on March 5, 2021.

Search strategies

The details of the search strategies used are described in Table 2.

Table 2. Search strategy.

Database	Search	Number of articles found
PubMed	(((((("oral care"[Title/Abstract] OR "salud oral"[Title/Abstract]) OR "oral health care"[Title/Abstract]) OR "oral health"[MeSH Terms]) OR "oral health"[Title/Abstract]) OR "public policy"[MeSH Terms]) OR "public policy"[All Fields]) OR "community dentistry"[All Fields] OR "government"[Title/Abstract] OR "public health"[Title/Abstract] OR "health system"[Title/Abstract]) AND (((((("atraumatic restorative treatment"[Title/Abstract] OR "dental treatment"[Title/Abstract]) OR "ART approach"[Title/Abstract]) OR "Atraumatic Restorative Treatment (ART)"[Title/Abstract]) OR "ART restorations"[Title/Abstract]) OR "dental atraumatic restorative treatment"[MeSH Terms])	2048
BVS	tw:((tw:(public policy)) OR (tw:(oral health)) AND (tw:(atraumatic restorative treatment)))	187
Epistemonikos	(title:((title:(oral health) OR abstract:(oral health)) OR (title:(oral care) OR abstract:(oral care)) AND (title:(atraumatic restorative treatment) OR abstract:(atraumatic restorative treatment))) OR abstract:((title:(oral health) OR abstract:(oral health)) OR (title:(oral care) OR abstract:(oral care)) AND (title:(atraumatic restorative treatment) OR abstract:(atraumatic restorative treatment))))	14
Health Systems Evidence	Public Policy AND dental caries	1
Rx for change	Public Policy AND Atraumatic Restorative Treatment	2
Other sources (Key informants)	Not applicable	1
Total		**2253**

Studies selection

The titles and abstracts of the articles selected in the electronic search were exported from the databases and organized in Microsoft Excel 365. Two reviewers (FCM; GSMG) performed the calibration with 9,14% of the sample in the initial search (n = 206); Cohen Kappa's coefficient was 0.81. The inclusion and exclusion phases occurred independently, and in cases of disagreement, we reached a consensus. A third reviewer did not need to participate.

Data collection

The extraction of qualitative and quantitative data of interest was conducted by two authors independently (FCM; LRAP), according to the stages and categories of the conceptual framework (Table 1) and organized in spreadsheets using Microsoft Excel 365. The data were also described and analyzed from the same perspective, stages, and categories.

We combined the results of qualitative data related to the “development” stages. The experiences were subdivided into the following categories:

1. Experiences that stopped in the introduction stage were not implemented or were not consolidated as a policy;

2. Unstable experiences;

3. Sustainable experiences.

Risk of bias

No risk of bias analysis was performed. This review aimed to synthesize, contextualize, describe, and subjectively analyze the experiences of countries rather than evaluate the design of the studies.

Results

Selection and general characteristics of the studies

Figure 1 illustrates the study selection process. Of the 2253 articles selected through the database and key informants, after removing 157 duplicates, 1662 were excluded based on the inclusion criteria and 414 by the exclusion criteria.

Twenty studies were selected, of which nineteen were conducted in nine countries, South Africa (n = 3)[15–17], Bolivia (n = 1)[18], Cambodia (n = 2)[29,20], Egypt (n = 2) [21.22], Mexico (n = 2)[23,24], Tanzania (n = 4)[25–28], East Timor (n = 1)[29], Tunisia (n = 1)[30], and Zimbabwe (n = 3)[31–33] and the other one contained data on the integration of ART in the health systems of countries in the Americas[34], based on the opinions of key informants.

As for the year of publication, studies from 1996 to 2016 were included. Nineteen studies were published in English, and one in Spanish. Case studies and experience reports (n = 3), cross-sectional studies (n = 5), cohort studies (n = 8), case-control studies (n = 2), one narrative literature review (n = 1), and one thesis (n = 1) were included.

Results and syntheses of the studies according to the conceptual framework (Table 1**).**
Stage 1 - Development

Regarding the **definition of the problem**, the studies described the following: high prevalence of dental caries in 100% of the countries; lack of access to restorative services in eight of the nine countries; 3. inequities related to access (lack of human resources in remote areas, rural or peripheral to urban centers), in 100% of countries, and performing mutilating procedures (preventable tooth extractions) in seven of the nine countries.

Regarding the **institutions**, as described in Table 3, the studies report that in most countries (77.7%), government structures were present, with the involvement of their ministries of health or local coordination in the development stage. However, few studies have reported political networks (11.1%) and political legacies (44.4%).

Regarding **ideas**, all studies report the influence of scientific evidence or the knowledge of researchers, but the type of evidence used is unclear. The WHO is strongly perceived as an essential inducer (**external factor**) of the choice of ART as a policy and has been reported in all experiences.

Finally, regarding interests, in all countries, there were reports of interest by researchers and politicians. However, the participation of health service workers (33.3%) and social groups (only reported in Bolivia) is low.

Table 3 Development: local context and decision making process

	Institutions			Ideas	Interests				External factors	
Country	Government structures	Policy networks	Political legacies	Scientific knowledge/evidence	Social groups	Public service workers	Researchers	Politicians	WHO induction	Sources of consultation
Experiences that stopped (or are still) in the development stage										
Egypt	X			X		X	X	X	X	Introduction of the ART approach in Egypt: intentions, clinical effects, and perceived barriers.
East Timor				X			X		X	Opportunities in oral health policy for East Timor.
n (%)	1 (50)	0	0	2 (100)		1 (50)	2 (100)	1 (50)	2 (100)	
Unstable experiences										
South Africa				X			X		X	Implementation of the ART approach in South Africa: an activity report.
Tanzania	X			X			X		X	Atraumatic restorative treatment (ART): the Tanzanian experience.
Tunisia	X		X	X			X	X	X	Atraumatic Restorative Treatment and glass ionomer sealants in Tunisian children: survival after 3 years.
Zimbabwe	X			X			X	X	X	Atraumatic Restorative Treatment and glass ionomer sealants in a school oral health program in Zimbabwe: evaluation after 1 year.
n (%)	3 (75)	0	1 (25)	4 (100)	0	0	4 (100)	2 (50)	4 (100)	
Sustainable experiences										
Bolivia	X		X	X	X		X	X	X	El tratamiento restaurador atraumático (TRA) como parte de un paquete básico de servicios de salud oral en el área rural de Bolivia.
Cambodia	X		X	X		X	X	X	X	Dental nurse training in Cambodia - a new approach.
Mexico	X	X	X	X			X	X	X	Implementation and preliminary evaluation of an ART

										strategy in Mexico: a country example.
n (%)	3 (100)	1 (33.3)	3 (100)	3 (100)	1 (33.3)	1 (33.3)	3 (100)	3 (100)	3 (100)	
Total N (%)	**7 (77.7)**	**1 (11.1)**	**4 (44.4)**	**9 (100)**	**1 (11.1)**	**2(22.2)**	**9 (100)**	**6 (66.6)**	**9 (100)**	

Stage 2 - Implementation

2.1 Permanent education

Regarding continuing education, we identified the absence of pilot projects in all interventions. According to Table 1, the aspects that guarantee the effectiveness of preparatory courses and constant updating, as well as the professionals' adherence to the activities, are accessibility, which involves the release of professionals to attend training, and compatibility with professionals' needs, focusing on the work process according to their settings, and certification offer, which guarantees professional career progression, as described in Table 4.

Table 4. Permanent Education - Characteristics of the courses reported in the studies

	N (%)	**Countries**
Accessibility	3 (100)	South Africa, Cambodia, Mexico
Compatibility with professionals' needs	2 (66.6)	Cambodia, Mexico
Certifications offered by Teaching and Research Institutions	1 (33.3)	South Africa
Total countries	**3**	

Another study described the same component in a particular way to assess the perception of policymakers in American countries[34], using a questionnaire. It reported that all respondents (Chile, Ecuador, El Salvador, Honduras, Mexico, Nicaragua, Panama, Paraguay, Peru, Uruguay, and the United States) claimed to have had courses in their countries and that in 88.2% of those countries, at least two opportunities. The authors reported that ART is included in the agenda of dental schools in Argentina, Bolivia, Brazil, Ecuador, Mexico, Peru, and Venezuela.

The training was described with a different focus (dissemination to large-scale public service professionals was not reported) in two other countries. In Tanzania[25], training was provided by universities or external institutions. In Zimbabwe[31], only professionals who participated research projects were involved and performed follow up of the procedures.

2.2 Quantitative data

Five cohort studies monitored ART restoration survival as described in Table 5. There were also available data from ART sealants, but we chose not to include them, as it was not the purpose of this review.

Table 5. Quantitative data - restoration survival rates

Studies that follow the ART restorations in single surfaces:

Primary teeth

Study title and year of publication	Country	Total procedures performed n	Sample loss %	Evaluation criteria	Survival rate after one year of follow up %	Survival rate after two years of follow up %	Survival rate after two to three years of follow up %
Atraumatic restorative treatment and glass-ionomer sealants in a school oral health programme in Zimbabwe: evaluation after 1 year (1996)	Zimbabwe	316	32.6	ART codes and criteria for assessing restorations and sealants/criteria for diagnosing carious lesions in ART studies	93.4		
Three-year survival of one-surface ART restorations and glass-ionomer sealants in a school oral health programme in Zimbabwe (1998)	Zimbabwe	297	35.8	ART codes and criteria for assessing restorations and sealants/criteria for diagnosing carious lesions in ART studies	95.7	92	85.3
ART restorations and glass ionomer sealants in Zimbabwe: survival after 3 years (1998)	Zimbabwe	297	38.6	ART codes and criteria for assessing restorations and sealants/criteria for diagnosing carious lesions in ART studies	98.6	93.8	88.3
The implementation and preliminary evaluation of an ART strategy in Mexico: a country example (2009)	Mexico	314	10	ART codes and criteria for assessing restorations and sealants/criteria for diagnosing carious lesions in ART studies	80.2		
The atraumatic restorative treatment (ART) strategy in Mexico: two-years follow up of ART sealants and restorations (2013)	Mexico	291	0	ART codes and criteria for assessing restorations and sealants/criteria for diagnosing carious lesions in ART studies	82.1	74	
Atraumatic restorative treatment and glass ionomer sealants in Tunisian children: survival after 3 years (2002)	Tunisia	97	41.2	ART criteria	88.6	49.1	64.0

Studies that follow the ART restorations in single surfaces:

Permanent Teeth

The implementation and preliminary evaluation of an ART strategy in Mexico: a country example. (2009)	Mexico	96	8.4	ART codes and criteria for assessing restorations and sealants/criteria for diagnosing carious lesions in ART studies	87.5		
The atraumatic restorative treatment (ART) strategy in Mexico: two-years follow up of ART sealants and restorations. (2013)	Mexico	74	0	ART codes and criteria for assessing restorations and sealants / Criteria for diagnosing carious lesions in ART studies	86.5	80.9	
Atraumatic restorative treatment and glass ionomer sealants in Tunisian children: survival after 3 years (2002)	Tunisia	126	31.8	ART criteria	88.1	56.1	45.7

2.3 Qualitative data

Regarding facilitators and barriers, four cross-sectional studies (questionnaires) assessed the perceptions of professionals and users of health services. Another seven studies (case studies, experience reports, and cohort) that contained data from the perceptions of patients and researchers were also included. Data identified by these studies as barriers or facilitators are presented in Table 6.

Table 6. Barriers and facilitators

Barriers		
	Studies N (%)	**Countries where the included studies report barriers**
Barriers perceived by health team professionals		
Finance	5 (83.3)	Cambodia, Mexico, Tanzania
Lack of supplies	4 (66.5)	Americas, Cambodia, Mexico, Tanzania
Lack of induction by managers	3 (50)	Americas, Tanzania
Technical ability	1 (16.6)	Tanzania
Resistance to change	2 (33.3)	Americas, Tanzania
Total	**6 studies**	
Barriers perceived by health service users		
Common sense that ART is of inferior quality	2 (100)	Americas, Tanzania
Lack of knowledge	1 (50)	Americas
Total	**2 studies**	
Barriers perceived by researchers		
Lack of supplies	3 (60)	South Africa, Cambodia, Mexico
Lack of human resources	2 (40)	South Africa, Cambodia
Common sense of health professionals	2 (40)	South Africa, Tunisia
Common sense of health service users	1 (20)	South Africa
Total	**5 studies**	
Facilitators		
	Studies N (%)	**Countries where the included studies report facilitators**
Facilitators perceived by health professionals		
Perception through the practice of ART in routine and positive experiences	3 (100)	Americas, Cambodia, Tanzania
Permanent education	2 (66.6)	Mexico, Cambodia
Coverage increase	1 (33.3)	Americas
Total	**3 studies**	
Facilitators perceived by health service users		
Favorable opinion after knowing about ART	1 (50)	Americas
Satisfaction with the treatment received	1 (50)	Bolivia
Treatment fear/anxiety reduction	1 (50)	Bolivia

Total	**2 studies**	
Facilitators perceived by researchers		
Coverage increase	1 (33.3)	Bolivia
Permanent Education	2 (66.6)	Bolivia, Cambodia
Have availability of necessary supplies in health services	1 (33.3)	Cambodia
Total	**3 studies**	

Discussion

Nine experiences that evaluated ART implementation steps as public policy were identified and reported in 20 articles. It is not known whether the technique has been used (in specific actions and research projects, without the involvement of decision makers for inclusion in the political agenda, or if the strategy is used as a policy but without evaluation and publication of the results in the scientific literature), in addition to the experiences presented, managers affirm that ART is included in national oral health policies in countries such as Brazil, Chile, Ecuador, Peru, Uruguay, and in the agenda of dentistry schools in countries such as Argentina, Brazil, Ecuador, Peru, and Venezuela[34].

Regarding the context for implementing ART in public oral health policies, studies share common problems, such as the high prevalence of dental caries and the lack of access to restorative procedures in health services, aggravated by inequities in access, which reinforces social differences. Another problem recognized by the scientific literature is the difficulty in moving users to perform treatments for caries lesions with shallow and medium cavities when there is still no report of pain. The scientific literature mentions dental consultations scheduled when patients study or work, fear of losing their jobs, misery, and lack of information as the primary causes of absenteeism[35–37]. The late treatment of oral health problems results in unnecessary and preventable treatments, as long as there are strategies for situational diagnosis and early interventions, in addition to measures to promote health and prevent these problems.

ART, designed to be used in places with no access to conventional procedures, is an essential and safe approach to the problems identified by the studies included in this review, as it can be performed in alternative social spaces, such as schools, in collective actions. It seems to have a lower cost than the conventional dental practice[7]. In addition, it is within the scope of minimal intervention dentistry, which focuses on maintaining oral health throughout the life cycle through preventive and minimally invasive care[8,38].

Regarding the institutions, there were government structures reported in most countries, with their ministries of health or local coordination in the formulation stage. However, while the studies cite the presence of institutions, few describe their role in decision making and planning for implementation. In addition, few studies have reported on networks and political legacies. Therefore, little is known about the intrinsic characteristics of public oral health programs or policies in which ART is inserted as a routine health service.

Regarding ideas, although all studies reported the influence of scientific evidence or the knowledge of researchers, the type of evidence used is unclear. Still, conceptual use seems to have occurred generally (to provide a general understanding of a given topic), rather than instrumentally (with specific intentions of using scientific evidence to solve well-defined problems)[39]. It is worth highlighting that since the 1990s the WHO has widely disseminated the results of research through the production of materials that translated the scientific evidence produced[5,40], as an important external inducer of the use of ART, having been reported in all experiments.

The instrumental use of scientific evidence can contribute to developing more solid and sustainable policies in the long term. Still, there are several reasons for underuse, such as 1. The evidence competes with other factors in the policy-making process; 2. the evidence is not valued; 3. the evidence is not relevant; 4. the evidence is not easy to use (the results were not effectively communicated or were not available when decision makers needed it, and 5. decision makers do not have mechanisms to facilitate the use of evidence)[41,43].

Finally, in all countries, there were reports of interest by researchers and politicians. However, there is also a lack of information about the role of these actors in decision making processes. Bolivia was the only country where the presence of social groups, such as schoolteachers and the children's families, were reported in relation to the implementation of ART as an intersectoral policy, with health education, supervised toothbrushing, and restorative treatments in the school environment[18]. This seems to explain the weakness observed in most ART implementations as a policy. That is, as research related to the instrumental use of evidence for well-informed decision making argues for the participation of representatives of all actors involved in this process, as happens, for example, in deliberative dialog and the synthesizing of scientific evidence, which offer feasible political options for facing well-defined problems[43].

All countries increased access to health services after implementation[15,24,28], especially in municipalities with a low human development index (HDI), as in the case of Mexico[23,24], or in rural or remote areas, as in Bolivia[30]. However, although the treatment was designed to be conducted in territories where there was no access to conventional treatment, in countries where studies were conducted to evaluate the quality and longevity of restorations, such as Mexico[24] and Zimbabwe[31–33], results were close to those of systematic reviews involving controlled clinical trials.

The survival rates were very high, which indicates that ART, if correctly indicated and performed, can be routine in health services, regardless of electricity, HDI, or location. It is worth mentioning that the criteria used in the included studies evaluated the presence of complete restoration or wear that did not require repair, but in the context of large-scale implantation, the presence of restorative material with failures that need repair can be considered a success, if there is no active caries lesion or recurrence. In addition, in cases of fracture or total loss of the restoration, if the carious lesion is paralyzed, it can also be a positive result because more invasive treatments are avoided. However, only follow-ups of occlusal cavities were performed by the researchers and in only two countries[23,24,31–33]. The difficulty of monitoring patients in routine care is understood, especially in the context of implementation, in which professionals are still adapting to new practices. Still, efforts are needed to include the monitoring of procedures performed on teeth with one or more tooth surfaces injured as routine in health services.

Regarding the barriers identified in the implementation, the lack of supplies (dental instruments and restorative materials) to perform the procedures and induction by the service managers (through stipulation of targets, monitoring, financial resources) seems to have more influence than the other barriers mentioned.

One of the studies conducted in Cambodia[20] pointed out that after years of offering well-structured courses to train dental nurses who would work in remote provinces in the country, little was done concerning restorative treatments. During the execution of the research, a health unit received the necessary inputs, received quarterly visits by members of the Ministry of Health, and goals were agreed upon. At the same time, there was no interference in the other, which resulted in a significant increase in minimally invasive restorative treatments in this unit. Therefore, it seems that permanent education alone, although fundamental for updating and changing professionals' perceptions, is not enough for new practices to be established. Political instability, lack of support in institutions, and lack of engaged and participative leadership were identified as determining factors in cases where ART was not consolidated as a sustainable public policy[28].

In addition to the common barriers reported, it is worth highlighting an important finding in a study conducted in Bolivia, as information related to the dosage of components of glass ionomer cement for handling under extreme environmental conditions is not described in detail in technical profiles of manufacturers (in the case of Bolivia, altitudes well above sea level and relative air humidity ranging from 20% to more than 90%). This can be related to obtaining an adequate viscosity, resistance, and adherence of the products, which can negatively impact the quality of the results[18]. In the case of Bolivia, the material handling protocols were defined based on a consensus with a committee of experts.

As for the facilitators, the findings show that permanent education and professional practice enhance the use of ART as routine practice in health services and the availability of inputs and induction by managers, as already discussed. In addition, regarding service users, there seems to be high satisfaction with the approach and reduction of fear/anxiety in dental treatments[18]. The scientific literature corroborates these findings since the first clinical studies with ART reported greater comfort and acceptance of patients, especially children, as they do not receive dental anesthesia, rubber dam isolation, and use of bur. Another factor that contributes to acceptance is the possibility of performing treatments in schools, where children are, in general, less anxious than those treated in clinics or dental offices[8].

Despite the high performance of the technique, that has been scientifically proven over the last decades, the implementation of ART as a policy has only been identified in developing countries, that are in most cases without universal health systems. Therefore, it was not possible to evaluate its implementation in better structured healthcare systems, which could guarantee conditions for the sustainability of ART with less structural difficulties.

Finally, at the beginning of 2020, the WHO declared the spread of COVID-19 to be pandemic. The COVID-19 has had a particular impact on dentistry. Studies indicate sites of the oral cavity as possible entries of the coronavirus and that angiotensin receptors present in salivary gland ducts can be the primary target of pathogenic cellular invasion[44,45]. Moreover, as may dental procedures generate aerosols, such procedures and practices are being reconsidered. Faced with this scenario, aggravated by the scarcity of personal protective equipment, lack of clear biosafety protocols, the need to preserve health teams and reduce risks of contamination by users, health systems around the world initially suspended elective procedures in dentistry, with urgent and emergency maintenance only, as recommended by several institutions and local governments[46–50].

In this context, Minimal Intervention Dentistry deserves even more attention from researchers, health service managers, and policymakers. It enables other types of health care that are not restricted to operative procedures[38]. In addition, non-generating aerosol procedures, such as ART, are necessary for the resumption of oral health in the trans and post-pandemic periods. New policies and programs must be well-structured for developing and implementing ART in routine dental care.

Conclusions

There is sufficient scientific evidence for the use of ART as a modern and safe strategy for preventive and restorative care. In the context of public policies, the approach is still at an early stage and there seems to be a gap between knowledge of ART and its implementation. Therefore, efforts are needed to reduce this gap so that practices that meet the modern philosophy of health care, as is the case with ART, do not stay only on the political agenda globally, but also widespread, and integrated in public health systems.

Abbreviations

Atraumatic Restorative Treatment (ART)

World Health Organization (WHO)

Human development index (HDI)

Declarations

. Ethics approval and consent to participate

Not applicable

. Consent for publication

Not applicable

. Availability of data and materials

All data generated or analysed during this study are included in this published article [and its supplementary information files].

. Competing interests

The authors declare that they have no competing interests

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. Authors' contributions

FCM contributed with conceptualization, methodology, investigation, data curation, formal analysis, all tables, figure, writing, review & editing - main manuscript. LRAP contributed with methodology, investigation, data curation, Table 3, review & editing - main manuscript GSMG contributed with methodology, investigation, data curation. MG contributed with conceptualization, methodology, formal analysis, review & editing - main manuscript. DPR contributed with methodology, formal analysis, review & editing - main manuscript, supervision. MMB contributed with methodology, formal analysis, review & editing - main manuscript, supervision. ACF contributed with conceptualization, formal analysis, review & editing - main manuscript. FCAC contributed with conceptualization, methodology, investigation, formal analysis, writing, review & editing - main manuscript, supervision

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Figures

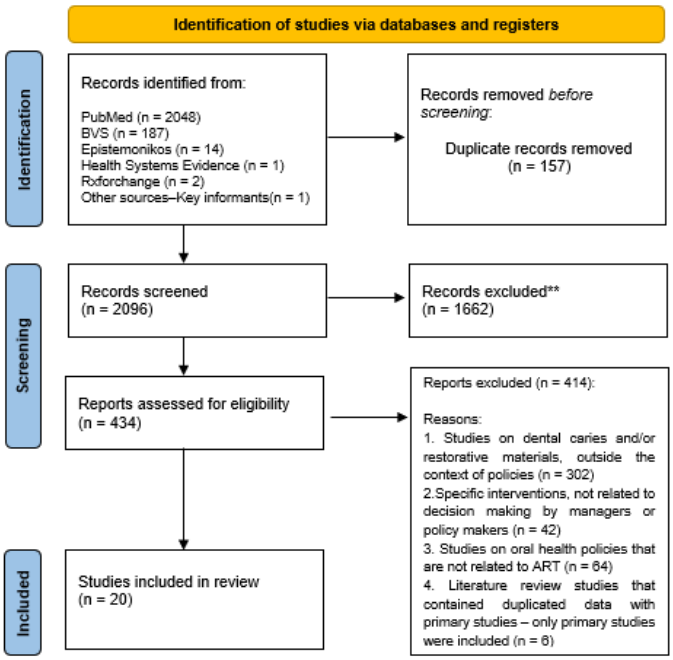

Figure 1

PRISMA Flow Diagram

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