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ORIGINAL ARTICLE

Dental Professionals' Knowledge Towards Minimal Intervention Dentistry Regarding Caries Management in the Public Health Service in Vitória da Conquista, Brazil

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ABSTRACT

Objective: To evaluate the knowledge of dental professionals and attitudes regarding dental caries management according to minimal intervention dentistry (MID). **Material and Methods:** Sixty-four dentists working in the public health service of Vitória da Conquista, Brazil, were invited to answer an online questionnaire structured into four domains. Descriptive data analysis and the association between demographic aspects and knowledge about MID for caries management were performed by Fisher's exact test (α=5%). **Results:** Among the 53 respondents (82.8% response rate), 67.9% were women aged 31-40 years (39.6%), working in primary health care (75.5%) and general practice (64.2%). Although professionals claimed to know MID for caries management (81.1%), considering its performance in their clinical practice (58.5%), regular knowledge was verified (84.9%), which is associated with self-assessment of the benefit provided by the technique (p=0.013). Uncertainties regarding the use of fluoride to inactivate lesions and dental sealants for prevention and treatment were highlighted. Hesitancy in disagreeing with statements related to incorrect etiology and traditional caries management was also observed. The main barriers identified for MID use were insecurity and the unavailability of adequate instruments/materials in the service. **Conclusion:** Although professionals have demonstrated regular knowledge about the benefits of MID in managing dental caries lesions, there is a lack of knowledge and attitudes related to the technique and barriers to its use in clinical practice.

Keywords: Minimally Invasive Surgical Procedures; Conservative Treatment; Dental Materials.

Introduction

Dental caries is a biofilm-sugar dependent dysbiosis, characterized as a dynamic and multifactorial process resulting from an imbalance between demineralization and remineralization of dental tissues, associated with biological, behavioral, and psychological factors related to the environment [1]. Minimal Intervention Dentistry (MID) philosophy includes disease prevention, diagnosis, and control. It involves the patient being responsible for their health, an alternative to the traditional approach [2]. In some clinical situations, when prevention has failed, MID recommends choosing procedures based on maximum preservation of healthy tissues [3,4], including non-invasive, micro-invasive, invasive, or mixed approaches. When indicated, less invasive restorative clinical procedures recommend maximum preservation of the tooth structure, with selective removal of decayed tissue and repair of unsatisfactory restorations [5,6].

This approach's simplicity, reduction of treatment time, and greater cost-effectiveness make it very interesting in public service [7]. Moreover, professionals and patients present favorable opinions when well-informed and prefer MI therapies to treat dental caries [8]. Despite the MID approach's advantages, many professionals naturally resist change [8-10].

So far, few studies have evaluated dentists' knowledge and practice regarding MID in treating dental caries [9,11-18], and the majority have focused on atraumatic restorative treatment (ART). Thus, this study evaluated dentists' knowledge and attitudes regarding dental caries management, considering possible barriers and the need for updating and professional training.

Material and Methods

Study Design and Ethical Clearance

This cross-sectional study was approved by the Research Ethics Committee of the University of São Paulo - FOUSP (protocol No. 4.465.287/2020). According to the Brazilian Institute of Geography and Statistics in 2019 [19], Vitória da Conquista is a regional hub in the southwestern state of Bahia, with approximately 338,480 inhabitants. The municipality has seven dental care Units for Primary Care, 33 Units for Family Health, 1 Specialized Dental Center, and 1 Hospital [20].

Sampling

In 2021, 64 dentists worked in the service. Since the research was established as a convenience sample, all of them were invited to participate. Those who did not agree to participate or did not use a messaging application (WhatsApp) were excluded. All participants in this research received a link to access instructions and to sign the Informed Consent Form (ICF), agreeing to participate.

Data Collection

A validated questionnaire was not identified to investigate the current topic, so a questionnaire adapted to the research objectives was made based on the scientific literature [9,12,18]. The self-administered questionnaire, created on the Microsoft Forms online platform (Microsoft Corp., Redmond, WA, USA), contained 51 closed questions and one open question and was divided into four domains: (1) demographic aspects; (2) knowledge about MI principles for the treatment of dental caries; (3) use of MI for the treatment of dental caries, (4) barriers to MID techniques in the public oral health service. Before completing the questionnaire, participants had no guidance or training regarding dental caries and MID. A pilot study was conducted with a convenience sample (n=6) composed of dentists who were not part of the leading research sample to verify the

need for the instrument adaptation before its application; four questions have been modified to make them more readable. Professionals were invited to voluntarily participate via messaging application (WhatsApp) between February 22 and March 8, 2021. Three messages were sent to participants, with intervals of four days. Four days after the last message was sent, participants who did not respond were considered sample losses.

Data Analysis

Data were exported to Microsoft Excel (Microsoft Corp., Redmond, WA, USA), and a descriptive analysis was carried out using the Statistical Package for the Social Sciences software, version 23 (IBM SPSS, Armonk, NY, USA). The Fisher's exact test was used to compare frequencies, as all contingency tables had expected frequencies below 5. A 95% confidence interval and 5% significance level were established. Practice and possible barriers were analyzed by frequency of responses, and for the open question, due to the possibility of diversity of responses, content analysis was performed, and responses were grouped into categories.

Results

A total of 53 dentists participated in this survey (response rate of 82.8%); 11 professionals did not respond to the questionnaire, which was considered a refusal to participate. Demographic aspects were compiled in Table 1. It was observed that participants had professional experience of 11 years or more (67.9%), with specialist training (66.0%). However, general practice was the most active area of participants (64.2%). Some professionals claimed that they had received prior information about MID for treating dental caries (81.1%), evaluating their knowledge as reasonable (45.3%). They considered MID techniques for managing dental caries a reality in their daily routine (58.5%), performing ART (77.4%).

Table 1. Demographic aspects of dentists in the public health service.

Variables	N	%
Sex		
Female	36	67.9
Male	17	32.1
Age		
20-30 years old	6	11.3
31-40 years old	21	39.6
41-50 years old	20	37.7
51 years old or more	6	11.3
Professional activity		
Public and private services	30	56.6
Only public service	23	43.4
Level of care in public health		
Primary	40	75.5
Secondary	12	22.6
Tertiary	1	1.9
Professional experience		
0-2 years	2	3.8
3-6 years	4	7.5
7-10 years	11	20.8
11 years or more	36	67.9
Academic degree		
Graduation	4	7.5
Specialist	35	66.0
Master	13	24.5
Doctorate	1	1.9
Clinical area		
General practice	34	64.2

As specialist	19	35.8
Did you receive information (knowledge) about MID for treating dental caries?		
Yes	43	81.1
No	8	15.1
I don't know	2	3.8
How would you rate your knowledge of MID for treating dental caries?		
Excellent	1	1.9
Good	14	26.4
Reasonable	24	45.3
Poor	13	24.5
None	1	1.9
Do you consider the MID technique for treating dental caries a reality in your work routine?		
Yes	31	58.5
No	20	37.7
I don't know	2	3.8
Do you perform atraumatic restorative treatment (ART)?		
Yes	41	77.4
No	12	22.6
I don't know	0	0.0

MID: Minimal Intervention Dentistry.

Once asked about the concept of caries disease, the answers given were: biofilm-dependent infectious disease (n=25; 47.2%); sugar-dependent biofilm dysbiosis (n=18; 34.0%); infectious disease (n=7; 13.2%) and sugar-dependent dysbiosis (n=3; 5.7%).

A higher frequency of regular knowledge regarding MID for managing dental caries among the participants was observed (84.9%), and perception of knowledge was associated with professional knowledge (p=0.013). Knowledge was not associated with factors such as sex, age, type of professional activity, public health care level, academic degree, clinical area, or access to prior information about MID or ART practice (Table 2).

Table 2. Demographic aspects of dentists in the public health service and their knowledge about MID for treating dental caries.

Variables	Acknowledgment						p-value
	Satisfactory		Regular		Unsatisfactory		
	N	%	N	%	N	%	
Sex							
Female	3	8.3	31	86.1	2	5.6	0.205
Male	0	0.0	14	82.4	3	17.6	
Age							
20-30 years old	0	0.0	6	100.0	0	0.0	0.498
31-40 years old	0	0.0	19	90.5	2	9.5	
41-50 years old	2	10.0	15	75.0	3	15.0	
51 years old or more	1	16.7	5	83.3	0	0.0	
Professional activity							
Public and private services	2	6.7	23	76.7	5	16.7	0.123
Only public service	1	4.3	22	95.7	0	0.0	
Level of care in public health							
Primary	2	5.0	36	90.0	2	5.0	0.215
Secondary	1	8.3	8	66.7	3	25.0	
Tertiary	0	0.0	1	100.0	0	0.0	
Professional experience							
0-2 years	0	0.0	2	100.0	0	0.0	0.870
3-6 years	0	0.0	4	100.0	0	0.0	
7-10 years	0	0.0	9	81.8	2	18.2	
11 years or more	3	8.3	30	83.3	3	8.3	
Academic degree							
Graduation	0	0.0	4	100.0	0	0.0	0.110

Specialist	1	2.9	30	85.7	4	11.4	
Master	2	15.4	11	84.6	0	0.0	
Doctorate	0	0.0	0	0.0	1	100.0	
Clinical area							
General practice	2	5.9	31	91.2	1	2.9	0.111
As specialist	1	5.3	14	73.7	4	21.1	
Did you receive information (knowledge) about MID for treating dental caries?							
Yes	3	7.0	36	83.7	4	9.3	1.000
No	0	0.0	7	87.5	1	12.5	
I don't know	0	0.0	2	100.0	0	0.0	
How would you rate your knowledge of MID for treating dental caries?							
Excellent	1	100.0	0	0.0	0	0.0	0.013*
Good	2	14.3	11	78.6	1	7.1	
Reasonable	0	0.0	22	91.7	2	8.3	
Poor	0	0.0	12	92.3	1	7.7	
None	0	0.0	0	0.0	1	100.0	
Do you consider the MID technique for treating dental caries a reality in your work routine?							
Yes	3	9.7	26	83.9	2	6.5	0.494
No	0	0.0	17	85.0	3	15.0	
I don't know	0	0.0	2	100.0	0	0.0	
Do you perform atraumatic restorative treatment (ART)?							
Yes	3	7.3	36	87.8	2	4.9	0.104
No	0	0.0	9	75.0	3	25.0	
I don't know	0	0.0	0	0.0	0	0.0	
Total	3	5.7	45	84.9	5	9.4	

*Statistically Significant (Fisher's exact test).

Table 3 presents the statements formulated to assess dentists' knowledge of MID principles for dental caries management.

Table 3. Knowledge about MID principles for treating dental caries among dentists from the public health service.

Statement	Response							
	Completely Agree		Partially Agree		Disagree		Don't Know	
	N	%	N	%	N	%	N	%
There is a direct relationship between carious lesions and sugar intake.	21	39.6*	29	54.7	3	5.7	0	0.0
The eating habits of all patients should be evaluated.	46	86.8*	7	13.2	0	0.0	0	0.0
The risk of caries should be assessed for all patients.	48	90.6*	5	9.4	0	0.0	0	0.0
Carious lesion progression is inevitable.	0	0.0	4	7.5	49	92.5*	0	0.0
Fluoride is an essential agent for the tooth remineralization process.	28	52.8*	23	43.4	2	3.8	0	0.0
Children of all ages should brush their teeth using toothpaste with a fluoride concentration of 1,000-1,100 ppm, observing the amount to prevent dental caries.	22	41.5*	13	24.5	15	28.3	3	5.7
Active caries lesions can be inactivated only with fluorides and oral health education.	15	28.3*	28	52.8	9	17.0	1	1.9
Dental sealants are effective for preventing pit and fissure caries.	22	41.5*	28	52.8	3	5.7	0	0.0
Dental sealant should be used as a routine procedure for children with high caries risk.	26	49.1*	19	35.8	8	15.1	0	0.0
Pit and fissure sealant is effective in treating early carious lesions in permanent teeth.	6	11.3*	25	47.2	19	35.8	3	5.7
The conservative design of cavity preparations, in the form of a tunnel or box, should be prioritized.	14	26.4	13	24.5	22	41.5*	4	7.5
Caries are infectious and should always be treated in a restorative procedure.	1	1.9	32	60.4	20	37.7*	0	0.0

To treat caries disease, all contaminated tissue must be removed to eradicate microorganisms.	3	5.7	31	58.5	19	35.8*	0	0.0
Cavitated and active carious lesions in areas that are difficult to clean must be restored.	45	84.9*	8	15.1	0	0.0	0	0.0
Inactive carious lesions (cavitated or not) do not require restorative treatment except for reasons of form, function, sensitivity, or aesthetics.	21	39.6*	21	39.6	11	20.8	0	0.0
Atraumatic restorative treatment (ART) can be used in both dentitions.	29	54.7*	15	28.3	6	11.3	3	5.7
Atraumatic restorative treatment restorations (ART) can often be used in children at high risk of caries and in patients with multiple carious lesions.	37	69.8*	12	22.6	4	7.5	0	0.0
Atraumatic restorative treatment (ART) is the definitive treatment.	3	5.7*	29	54.7	18	34.0	3	5.7
Atraumatic restorative treatment (ART) is the same as adequacy of the oral environment.	17	32.1	18	34.0	18	34.0*	0	0.0

*Correct responses.

Tables 4 and 5 show the frequency of applying MID and the absolute and relative frequencies of responses related to possible barriers to performing MID, respectively.

Table 4. Attitudes regarding using the MI technique for treating dental caries among dentists from the public health service in their work routine.

Statement	Response							
	Always/ Almost Always		Sometimes		Never/ A Few Times		I Don't Know	
	N	%	N	%	N	%	N	%
Oral hygiene instruction, including demonstration of correct tooth brushing and flossing techniques and frequent reinforcement for patient motivation, is a routine in my clinical practice.	43	81.2	9	17.0	1	1.9	0	0.0
I routinely use the clinical probe (blunt tip) to detect caries lesions.	11	20.8	18	34.0	24	45.3	0	0.0
I routinely use the rounded probe ("ball point") to detect caries lesions.	15	28.3	13	24.5	25	47.2	0	0.0
I diagnose carious lesions using visual inspection.	34	64.1	14	26.4	5	9.4	0	0.0
I take radiographs for caries detection.	23	43.4	25	47.2	5	9.4	0	0.0
I use a tooth separator to detect interproximal carious lesions when in doubt.	7	13.2	9	17.0	37	69.8	0	0.0
When planning caries treatment, I consider its extension, the presence of cavitation, and the possible cleaning potential.	49	92.5	2	3.8	2	3.8	0	0.0
I prefer to remove decayed tissue with a drill than to use manual sharp instruments.	23	43.4	18	34.0	12	22.6	0	0.0
I do selective removal of decayed tissue.	38	71.7	7	13.2	7	13.2	1	1.9
I consider that monitoring the patient is essential to providing care based on minimal intervention.	42	79.2	6	11.3	3	5.7	2	3.8

Table 5. Barriers to performing the MID technique for treating dental caries according to dentists from the public health service.

Variables	Response					
	Yes		No		I Don't Know	
	N	%	N	%	N	%
Trust, acceptance, and security						
Do you believe in the effectiveness of MID techniques for treating caries?	28	52.8	16	30.2	9	17.0
Would you allow the MID technique to be performed on yourself?	47	88.7	2	3.8	4	7.5

Do you feel confident about performing MID techniques in your clinical practice?	23	43.4	23	43.4	7	13.2
Support						
Do you consider that you have adequate material support to carry out MID techniques in your clinical practice?	47	88.7	4	7.5	2	3.8
Do you consider that you have adequate instrumental support to perform MID techniques in your clinical practice?	18	34.0	27	50.9	8	15.1
Do you have the rounded tip probe ("ball point") available for use in the service?	16	30.2	32	60.4	5	9.4
Do you consider your assistant trained to help you with MID techniques?	37	69.8	16	30.2	0	0.0
Do you feel encouraged to perform MID in your work routine?	24	45.3	21	39.6	8	15.1
Interest						
Would you like to receive theoretical training on MID techniques for managing dental caries?	48	90.6	4	7.5	1	1.9
Would you like hands-on training on MID techniques for managing dental caries?	45	84.9	5	9.4	3	5.7

Only a few professionals (n=15; 28.3%) sent their answers in the open space. Respondents were anonymized. Results were organized into seven empirical categories, namely: (1) technique limitation, (2) material support, (3) clinical expertise, (4) demand, (5) patient acceptance, (6) self-indulgence, and (7) not classified.

Discussion

This study evaluated the knowledge and attitudes of dentists about MID in dental caries management, considering possible barriers and the need for professional updating or training. It was restricted to one municipality, and a self-administered and non-validated questionnaire was used as a convenience sample in a cross-sectional study. Thus, there is no possible generalization of results. However, anonymity allowed participants to be honest and straightforward. The participants claimed previous knowledge about the approach (81.1%) and considered performing it in their work routine (58.5%). However, 84.9% of the sample presented a regular level, confirmed by some inconsistent answers with the underpinning evidence, showing that the previous information acquired was insufficient for knowledge or behavior change.

Knowledge was not associated with academic degrees, professional experience, or access to prior information about MID or ART practice in this study. These results may show resistance in professionals to change and practice MID philosophy as an alternative to the traditional approach [9,10]. In the study by Mirsiaghi et al. [15], 149 dentists from the United Kingdom found a positive correlation between knowledge and academic degrees, but the fact was not clearly elucidated by the authors. In the present study, professionals with more than seven years of professional experience have received prior information about the technique, which are factors that did not affect awareness about MID. On the other hand, English researchers found an association between time of professional activity (time of graduation) with better results, mainly among those who had graduated three years before [15]. Controversially, Saudi researchers have compared dentists with and without previous training on MID for dental caries management and observed that training significantly improved their knowledge [9]. Studies that evaluated this relationship found that previously trained professionals had acquired knowledge during recent graduation or through continued education [9,18]. The National Curriculum Guidelines for undergraduate Dentistry courses in Brazil establish the alignment of teaching with science innovations [21]. It is encouraging to notice MID as a required part of the curriculum at the undergraduate level since dentists are familiar with MID but did not have MID principles during their Bachelor of Dental

Surgery studies. Furthermore, to achieve an effective MID clinical practice, updates, and training courses for these professionals must be provided [22].

Regarding the current concept of caries disease, almost half of the sample incorrectly marked "biofilm-dependent infectious disease." The result is understandable, considering that dental caries was accepted as an infectious disease for some time. However, studies have better elucidated this concept, and currently, dental caries is regarded as a multifactorial dysbiosis triggered by sugar consumption, which is also related to biological, behavioral, and psychosocial conditions. Thus, microorganisms' presence is insufficient for disease development [1,23]. Most dentists agree that all patients should be evaluated for caries risk and eating habits. Despite the limited scientific evidence supporting the role of assessing the risk of caries in predicting new carious lesions [24,25], such procedures allow dentists to provide individualized preventive advice to the patient [5].

Fluoride was considered an essential agent in the dental remineralization process, but only a few participants (28.3%) agreed with its action to inactivate caries lesions. Fluoride acts in the dental remineralization of both dentitions, with strong evidence for its post-eruptive topical effect. Its use can be at home or professionally, depending on a regular and periodic use protocol to achieve the objective of inactivating dental caries progression. When inactive, the lesion can be considered a "scar" not necessarily requiring restorative treatment [4,8].

There were uncertainties related to the effectiveness of dental sealants in preventing pits and fissure caries and treating initial caries lesions in permanent teeth. In the randomized clinical trial by Hesse et al. [26] involving deciduous molars with occlusal carious lesions in the outer half of the dentin, sealing was as effective as composite resin restoration in reducing disease progression. However, the frequency of retreatments was significantly higher for sealed lesions. Factors such as the morphology of the occlusal surface, physicochemical properties of the dental enamel, viscosity of the material used, and quality of the application technique are essential to ensure the good performance of this material. For the sealant to properly play its role, each step of the proposed protocol should be carefully followed. The tooth surface should be clean, moisture-free, and adequately prepared to receive the indicated material [27,28].

There was hesitation in disagreeing with statements related to the traditional management of the disease, such as: "Caries is an infectious disease, and should always be treated in a restorative manner," and "To treat the disease, all contaminated tissue must be removed to eradicate microorganisms." A better understanding of the lesion initiation and control process allowed for its treatment with remineralization or sealing strategies to prevent its progression. However, data from a systematic review showed that many professionals continue to perform the removal of non-cavitated lesions limited to the tooth enamel [29].

Traditional invasive dental caries treatment seemed common to professionals since a statement involving prioritizing the conservative design of cavity preparations, such as tunnel or box, obtained a high percentage of agreement or doubt. In contrast, another statement that there is no need for restorative treatment for inactive carious lesions, except for form, function, sensitivity, or aesthetics, led professionals to doubt or disagree. Unnecessarily invasive interventions are concerning since they reduce dental longevity, overload, and burden the patient [30]. As for ART, only 5.7% completely agreed with it as a definitive treatment, while 32.1% indicated that it could be (wrongly) considered the same as temporary fillings for preparing the oral cavity. This finding can be explained as procedures are very similar, such as the lack of need for local anesthesia and rotary instruments and the use of the same restorative material (glass ionomer cement). Still, ART restorations are considered definitive [6], with no re-intervention needs.

Conflicting data related to MID in the clinical practice reveals that the technique is not a completely established activity in the dentistry routine. On the one hand, they demonstrated the use (always/almost always) of some of the MID principles, such as selective carious tissue removal (71.7%). Still, many dentists indicated that they preferred to perform it with rotary instruments (43.4%). Selective removal is the treatment of choice for both dentitions in shallow and deep dentin cavities, in which different excavation criteria are adopted to preserve remineralizable tissue. For this, the professional must consider the tactile sensation, and the use of manual curettes might be less damaging [23].

Limitations related to insufficient material support and high patient demand were found. Half of the sample reported a lack of adequate instruments, confirmed when many respondents pointed out the unavailability of a "ball-point" probe for diagnosis or when they expressed their opinions in the qualitative part of the questionnaire. These aspects can impact the service effectiveness. Likewise, the investigation by Mickenautsch et al. [31] on factors that inhibited the use of ART by public service dentists in South Africa found the high workload and inadequate supply of materials/tools as the most significant reasons for not applying it in practice. To improve the oral health service, the authorities must hire more dentists and support staff and ensure sufficient availability of materials, instruments, and functional dental equipment [31]. Although 45.3% of respondents reported feeling encouraged to perform MID in their work routine, more than half of the sample indicated insecurity about performing it. Furthermore, they showed good acceptance and interest in MID since many people would allow the technique to be performed on themselves and would like to receive theoretical and practical training (90.6% and 84.9%, respectively). Training is essential to make professionals more confident in applying MID, especially for those who had received training a long time ago [13,15].

Future studies should include questions about MID educational interventions in more detail. For example, finding out what was included in the prior teaching received would have been informative. The authors recommend implementing MID principles through courses, training, and qualifications for public service professionals at all levels of care as a strategy for MID to be widely applied.

Conclusion

Public service dentists in Vitória da Conquista, Brazil, regularly knew about minimal intervention dentistry. In clinical practice, conventional methods for managing dental caries, such as the conservative design of cavity preparations or the use of drills for caries tissue removal, are still used. The main barriers to minimal intervention dentistry are insufficient dental material support, high patient demand, and insecurity about performing the technique.

Authors' Contributions

TVM	https://orcid.org/0000-0001-7923-7657	Conceptualization, Formal Analysis, Investigation, Data Curation, and Writing - Original Draft.
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DPR	https://orcid.org/0000-0002-0048-2068	Conceptualization, Methodology, Data Curation, Writing - Review and Editing and Supervision.

All authors declare that they contributed to a critical review of intellectual content and approval of the final version to be published.

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Conflict of Interest

The authors declare no conflicts of interest.

Data Availability

The data used to support the findings of this study can be made available upon request to the corresponding author.

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