

Minimal Intervention Dentistry Procedures: a Ten Year Retrospective Study

Freitas MFL*/ Santos JM**/ Fuks A***/ Bezerra ACB****/ Azevedo TDPL*****

*Minimal Intervention Dentistry (MID) is an effective treatment approach with increasing acceptance among dental professionals. **Objective** – This study aimed to evaluate the MID impact on Dentistry by analyzing procedures performed on patients treated at a Pediatric Dentistry Graduate Program clinic which implemented MID. **Study design** – The number of procedures including sealants, modified atraumatic restorative treatment (mART), resin crowns, direct pulp capping, pulpotomy, pulpectomy, and deciduous/permanent extractions from 333 pediatric patients treated between the years 2001 to 2003 and 2008 to 2010 in Distrito Federal, Brazil were analyzed. Statistical analysis involved chi-square and G Williams tests. **Results** – 783 procedures were analyzed and demonstrated that there was a significant reduction of sealant placement in the last triennium when compared to the first one ($p < 0.0001$). Moreover, there was a significant increase in the amount of mART ($p < 0.0001$). This increase in mART procedures resulted in a significant reduction in procedures with pulp involvement: direct pulp capping ($p = 0.0014$), pulpotomy ($p = 0.0014$) and pulpectomy ($p = 0.0002$). **Conclusions** – Based on the results, MID represented a positive impact on the intervention on caries lesions in patients, mainly reflected by the significant reduction in the number of direct pulp capping, pulpotomy and pulpectomy.*

Keywords: Minimal Intervention Dentistry; Atraumatic Restorative Treatment; Pulp Therapy.

INTRODUCTION

Despite the marked decline in its prevalence among children and teenagers, dental caries remains a major oral health problem, and is still the major cause of tooth loss in Brazil.^{1,2}

The conventional treatment of carious lesions advocates complete excavation of all involved dentin, removing both infected and affected dentin until completely sound dentin is reached. By the end of 19th century, it was recommended that cavity preparations

should include all pits and fissures providing a safety margin to prevent the reappearance of the disease. This was known as “extension for prevention”.³⁻⁵ In regard to tissue excavation, Black stated: “The deeper portion should be freed of any remaining softened material with spoon excavators. In no case should any decayed and softened material be left. It is better to expose the pulp of the tooth than to leave it covered only with softened dentin”.⁶ It is interesting to note that in the past, tooth extraction was the most frequent procedure performed due to the lack of conditions, materials and equipment to provide a correct treatment.^{7,8}

The paradigms proposed by Black were employed in restorative dentistry for the main part of the 20th century. New knowledge of the pathogenesis of dental caries led to a change in treatment philosophy. The understanding that dental caries is a disease resulting from an imbalance in the demineralization/ remineralization process provided a new paradigm created in modern dentistry. This transition started in 1960, with the scientific revolution of Keyes & Fitzgerald’s historical research.⁹ In 2002, the World Dental Federation (FDI) published a policy advocating that caries be treated by minimal intervention. This document described the approaches to promote the minimally invasive technique in clinical research.¹⁰ In Brazil, this conservative approach known as the Minimal Intervention Dentistry (MID) or Health Promotion Dentistry was initially implanted in the 90’s.¹⁰ A follow-up of this document was recently reported reinforcing the FDI’s policy for managing dental caries by reducing the need for restorative therapy and placing an even greater emphasis on caries prevention.¹¹

Stella Maris Freitas Lima, DDS* - Post Graduate Student, Catholic University of Brasilia, Brazil – Pediatric Dentistry Department.

**Juliana Moura Santos, DDS, Private Practice, Brasilia, Brazil

***Anna B. Fuks, DMD, Professor Emeritus, Hadassah School of Dental Medicine, Department of Pediatric Dentistry, Jerusalem, Israel.

****Ana Cristina Barreto Bezerra, DDS, Professor, Post Graduate Department, Health Science Center, University of Brasilia, Brazil.

*****Tatiana Degani Paes Leme Azevedo,, DDS Professor, Catholic University of Brasilia, Brazil – Pediatric Dentistry Department.

Send all correspondence to

Tatiana Degani Paes Leme Azevedo
QS 07 Lote 1 EPTC – Águas Claras Zip Code 71966-700, Brasilia, Brasil

Phone: 55-61-33569612
55-61-91616538

E-mail: tdplazevedo@hotmail.com

The MID is a philosophy that comprises preventive measures, restorative and non-restorative therapies for dental caries.¹¹ It also involves the strategy of removing only the soft and yellowish demineralized tissues^{10, 12} from the surrounding walls of the cavity but not from the pulpal wall; this is only partially demineralized and not grossly infected (affected dentin). The affected dentin from the pulpal wall is harder and darker than the infected one, as a result of the formation of tertiary dentin amenable of remineralization.³ For this intervention, hand and rotatory instruments used in MID approaches aim to preserve sound tooth structure. In Brazil, this approach is named Modified Atraumatic Restorative Treatment (mART).¹³

There is already considerable evidence demonstrating the effectiveness of the MID approach to encourage dental professionals to adopt this contemporary technique.^{10, 11} Conversely, there are no comparative data in the literature regarding procedures performed following traditional dentistry and MID.^{4, 8, 14-16}

The aim of the present investigation was to evaluate the MID impact in clinical practice by analyzing procedures performed on patients of the Pediatric Dentistry Department of the Specialization Course of the Brazilian Dental Association Distrito Federal Section (ABO-DF), between the years of 2001 to 2003 and 2008 to 2010.

MATERIALS AND METHOD

The project was submitted and approved by the Human Research Ethics Committee from the Catholic University of Brasília, Brazil (CEP-UCB 029/2011). The study was based on a retrospective cohort quantitative analysis of 333 records data collected from all patients treated in the Pediatric Dentistry Specialization Course from ABO-DF between the years 2001 to 2003 and 2008 to 2010. These records were reviewed by two authors who were previously calibrated. Calibration was based on the World Health Organization criteria which have several purposes: a) ensure uniformity of interpretation, understanding and application of the criteria of the various diseases and conditions to be observed and recorded; b) ensure that each of the examiners can work consistently with the standards adopted; c) minimize variations between different examiners.¹⁷

The inclusion criteria encompassed the records of all the children treated at the Pediatric Dentistry Clinic. The exclusion criteria comprehended records containing incomplete medical history, missing/incomplete personal data, irrelevant procedures and emergency treatment with incomplete data. The following procedures were analyzed: sealants, modified ART, resin crown, direct pulp capping, pulpotomy, pulpectomy, primary and permanent extraction. To achieve the aim of the study a table has been formatted in a pilot study, with the definition of the required data by examining and refining the system for data management.

The data were numerically coded and entered into a computer equipped with *Microsoft Office Excel 2007*. Absolute and percentage distributions were analyzed by descriptive statistics. The information obtained was entered and stored for graphical and tabular presentation of the results. To analyze if there was a significant association in each procedure by triennium the procedures were divided into trienniums and analyzed by Chi-square with Yates correction and G Williams (with adaptations) tests with a significance level of 5% or less (p<0.05),

RESULTS

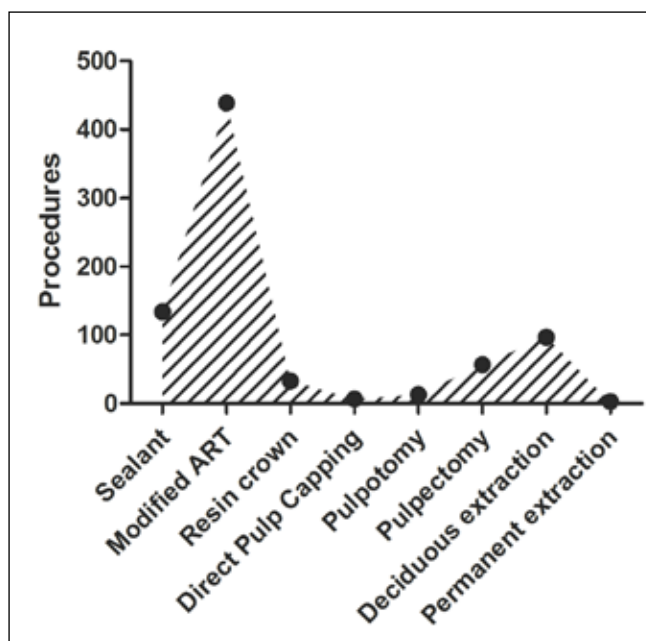
A total of 333 records were examined. However, according to the inclusion criteria, only 127 composed the final sample. These records demonstrated 783 procedures: 457 for the years 2001 to 2003 and 326 for 2008 to 2010 (Table 1). Table 1 demonstrates the numbers of collected data and profile of the sample by gender and mean age. The profile of the procedures over all the years of the study is presented in table 2. In figure 1 we can also observe that the most frequent procedure performed was mART.

The results demonstrated that there was a significant reduction of sealant placement in the last triennium when compared to the first one (p<0.0001). Moreover, there was a significant increase in the amount of mART (p<0.0001). This increase in mART procedures resulted in a significant reduction in procedures with

Table 1. Sample profile with distribution of records by inclusion and exclusion criteria, gender and mean age of patients with standard deviation by gender.

	2001-2003	2008-2010	Total
Records			
Examined	208	125	333
Included	71	56	127
Gender			
Female	27	30	57
Male	44	26	70
Mean age			
Female	6.04 (±2.77)	6.53 (±2.37)	
Male	6.39 (±2.84)	5.48 (±2.0)	

Figure 1. Distribution of all procedures performed over the years presented in absolute frequency.



pulp involvement: direct pulp capping (p=0.0014), pulpotomy (p=0.0014) and pulpectomy (p=0.0002). There was no significant difference in crown resin restorations (p=0.1120) nor in the deciduous extraction (p=0.1607). The use of the statistical test for permanent tooth extractions showed inconclusive results due to low number of cases presented (table 2).

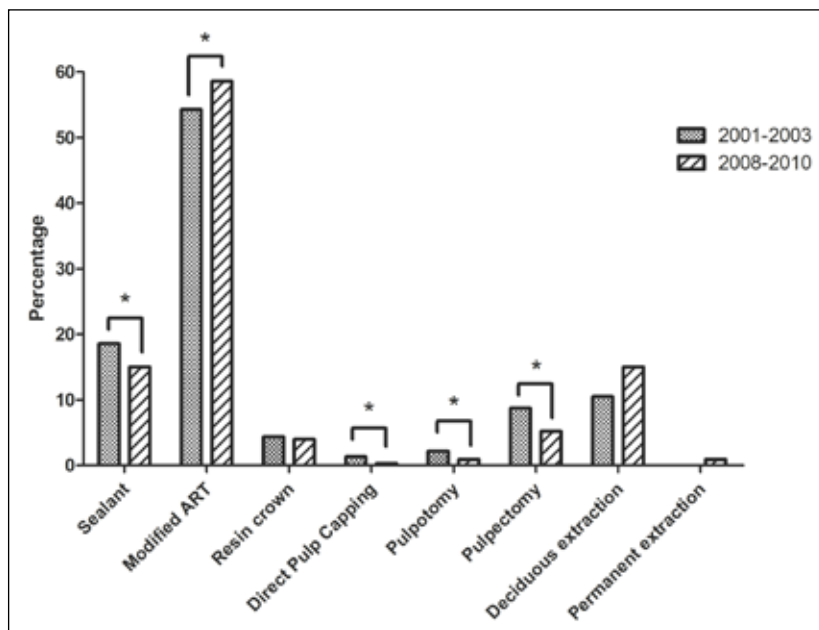
These differences between the procedures can be easily visualized in the figure 2.

Table 2. Distribution of all procedures performed by both triennia presented in absolute and relative frequency, and the p-value.

	2001-2003	2008-2010	P value
Sealants	85 (18,6%)	49 (15,0%)	<0.0001
Modified ART	248 (54,3%)	191 (58,6%)	<0.0001
Resin Crowns	20 (4,4%)	13 (4,0%)	0.1120
Direct pulp capping	6 (1,3%)	1 (0,3%)	0.0014
Pulpotomy	10 (2,2%)	3 (0,9%)	0.0014
Pulpectomy	40 (8,7%)	17 (5,2%)	0.0002
Extraction primary	48 (10,5%)	49 (15,0%)	0.1607
Extraction permanent	0 (0%)	3 (0,9%)	*
Total	457 (100%)	326 (100%)	783

*Inconclusive results due to low number of cases presented.

Figure 2. Distribution of procedures by both triennia (2001 to 2003 and 2008 to 2010) presented in relative frequency in which each procedure is compared by the years.



*Represents significative difference between the triennia.

DISCUSSION

The MID is more than just a technique: it is a treatment philosophy aiming to extend the life span of the tooth by restoring it with the minimal intervention possible. In this approach the disease is initially treated and later followed by surgical intervention, promoting quality of life for the patient.^{4, 5, 7, 18} The treatment is based on the preservation of the vitality of pulp tissue, avoiding radical treatment of the pulp.³

A correct diagnosis is primordial for this intervention. The management philosophy comprises disease control, remineralization of the early lesions, reduction of the number of cariogenic bacteria, repair of defective restorations instead of replacement and minimal surgical intervention in cavitated lesions. This approach follows the contemporary dentistry context: “minimal intervention and maximum preservation of sound tooth tissue”^{2, 5, 10, 18}

This retrospective cohort study represented a group of patients who have received dental treatment for carious lesions. This type of study allows checking the changes in the form of treatment over time and was the method chosen to achieve the objective proposed. In order to evaluate the impact of the MID philosophy, in the present study samples were selected from the period 2001 to 2003. This period corresponded to the initial years in which the MID began to be discussed and best reformulated by the international literature. Dentistry courses were implemented in the country, using material and instrumental improvement research.^{10, 14, 19, 20} In addition, improvement in dental adhesive technology provided means for conservative cavity design.^{18, 20} To create a comparative level with the procedures currently performed, samples were selected from the period 2008 to 2010 (Table 1).

The present investigation revealed that the most frequent procedure performed on patients at the specialization course was mART (Table 2, Figure 1). There was also a significant increase in the amount of mART in the last triennium compared to first one (Table 2, Figure 2). Based on MID, mART has emerged as an alternative replacement for conventional treatment, reducing the incidence of tooth extractions^{4, 7, 15} with less intervention discomfort.²¹ The increase of this procedure reflected a significant reduction in direct pulp capping, pulpotomy and pulpectomy procedures (Table 2, Figure 2).

Even when the invasive approach is inevitable, it is advisable to perform techniques that aim to halt the disease progression and to maintain the integrity of the pulp with minimal intervention possible.^{7, 15} This philosophy is based on the execution of MID procedures, leading to a decreased occurrence of accidental pulp exposures, reducing the need for direct pulp capping, pulpotomy or pulpectomy (Table 2, Figure 2). Besides, the preservative and conservative dentistry technique mART is a painless intervention that can be performed without local anesthesia, reducing patient’s fear and anxiety. In addition, it reduces the need of endodontic treatment and extractions, increasing tooth survival.^{21, 22}

The results of the present study also revealed that there was a significant reduction in the amount

of sealants placed over the last three years compared to the first ones (Table 2, Figure 2). The Council of Dental Research advocated in 1985 that sealants should be applied universally, especially in molars, within 3 or 4 years after the eruption²³. Treatment with sealants has undergone a redefinition based on newer protocols of patient risk. The significant reduction in sealant placement in the last three years is explained by the greater use of evidence-based dentistry, which recommends the placement of sealants only in real need cases.²⁴ There is evidence that properly placed sealants may interfere in caries development for over a decade.⁵ Treatment with sealants has undergone a redefinition based on newer protocols of patient risk.²⁵ With a correct recommendation, sealant placement can be a benefit to the economy and to the health care.

The results of this study revealed that the impact of MID procedures promotes a progressive decrease in traditional restorative dentistry over the years. It is possible that with an effective approach and knowledge of the material, reaching the purpose of maximum preservation of the dental structures will become a reality.^{7,8,13} Glass ionomer is biocompatible, resistant to moisture, to desiccation and to chemical attack, bonds to enamel and dentin, can be manipulated without special instruments, has good marginal sealing and releases fluoride.²⁶ In other words, the concepts of preventive and minimal intervention dentistry should have an impact in all dental specialties and the post and undergraduate curriculum in dentistry.^{19,27}

It could be concluded that the aim of the minimum invasive approach was achieved, extending to a maximum the life of a tooth by restoring with minimal intervention and maximum preservation of sound tooth tissue.^{2,10} This evidence emerged from better knowledge of pathogenesis of caries, better techniques and materials performance, resulting in high-quality preventive and restorative care even for high risk for caries.²⁸ The present study confirmed that MID had a positive impact in patients management,⁵ promoting a significant reduction in pulp therapies and recognizes caries as a reversible disease increasing conditions for oral health promotion mainly in underserved communities.²²

CONCLUSIONS

Based on the results, MID represented a positive impact on the intervention on caries lesions in patients, mainly reflected by the significant reduction in the number of direct pulp capping, pulpotomy and pulpectomy..

REFERENCES

- Roncalli AG. National oral health survey in 2010 shows a major decrease in dental caries in Brazil. *Cad Saude Publica* 27: 4-5, 2011.
- Roncalli AG, Silva NN, Nascimento AC, et al. Relevant methodological issues from the SBBrazil 2010 Project for national health surveys. *Cad Saude Publica* 28: s40-57, 2012.
- Mount GJ. A new paradigm for operative dentistry. *Aust Dent J* 52: 264-270; quiz 342, 2007.
- Tyas MJ, Anusavice KJ, Frencken JE, et al. Minimal intervention dentistry--a review. FDI Commission Project 1-97. *Int Dent J* 50: 1-12, 2000.
- Wolff MS, Allen K & Kaim J. A 100-year journey from GV Black to minimal surgical intervention. *Compend Contin Educ Dent* 28: 130-134; quiz 135, 152, 2007.
- Bjorndal L. The caries process and its effect on the pulp: the science is changing and so is our understanding. *Pediatr Dent* 30: 192-196, 2008.
- Topaloglu-Ak A, Eden E & Frencken JE. Managing dental caries in children in Turkey--a discussion paper. *BMC Oral Health* 9: 32, 2009.
- Kikwilu EN, Frencken J & Mulder J. Impact of Atraumatic Restorative Treatment (ART) on the treatment profile in pilot government dental clinics in Tanzania. *BMC Oral Health* 9: 14, 2009.
- Keyes PH. The infectious and transmissible nature of experimental dental caries. Findings and implications. *Arch Oral Biol* 1: 304-320, 1960.
- Burke FJ. From extension for prevention to prevention of extension: (minimal intervention dentistry). *Dent Update* 30: 492-498, 500, 502, 2003.
- Frencken JE, Peters MC, Manton DJ, et al. Minimal intervention dentistry for managing dental caries - a review: report of a FDI task group. *Int Dent J* 62: 223-243, 2012.
- Topaloglu-Ak A, Eden E, Frencken JE, et al. Two years survival rate of class II composite resin restorations prepared by ART with and without a chemomechanical caries removal gel in primary molars. *Clin Oral Investig* 13: 325-332, 2009.
- Massara MLA & Bönecker M. Modified ART: why not? *Braz Oral Res* 26: 187-189, 2012.
- Kikwilu EN, Frencken JE, Mulder J, et al. Dental practitioners' attitudes, subjective norms and intentions to practice atraumatic restorative treatment (ART) in Tanzania. *J Appl Oral Sci* 17: 97-102, 2009.
- Frencken JE & Leal SC. The correct use of the ART approach. *J Appl Oral Sci* 18: 1-4, 2010.
- Momoi Y, Hayashi M, Fujitani M, et al. Clinical guidelines for treating caries in adults following a minimal intervention policy--evidence and consensus based report. *J Dent* 40: 95-105, 2012.
- World Health Organization (WHO), Geneva, 1993.
- Banerjee A. Minimal intervention dentistry: part 7. Minimally invasive operative caries management: rationale and techniques. *Br Dent J* 214: 107-111, 2013.
- Pitts N. Preventive and minimal intervention dentistry in the undergraduate curriculum. *J Dent* 39 Suppl 2: S41-48, 2011.
- Cardoso MV, Neves AA, Mine A, et al. Current aspects on bonding effectiveness and stability in adhesive dentistry. *Aust Dent J* 56 Suppl 1: 31-44, 2011.
- Goud RS, Nagesh L, Shoba F, et al. Assessment of Discomfort Experienced by School Children While Performing 'ART' and 'MCP'-An Experimental Study. *J Dent (Tehran)* 9: 229-237, 2012.
- Frencken JE. Evolution of the the ART approach: highlights and achievements. *J Appl Oral Sci* 17 Suppl: 78-83, 2009.
- Gibson WA. Human subjects in dental research: coping with the regulations. Council on Dental Research. *J Am Dent Assoc* 110: 243-246, 1985.
- Beauchamp J, Caufield PW, Crall JJ, et al. Evidence-based clinical recommendations for the use of pit-and-fissure sealants: a report of the American Dental Association Council on Scientific Affairs. *J Am Dent Assoc* 139: 257-268, 2008.
- Weintraub JA. Pit and fissure sealants in high-caries-risk individuals. *J Dent Educ* 65: 1084-1090, 2001.
- Bonifacio CC, Kleverlaan CJ, Raggio DP, et al. Physical-mechanical properties of glass ionomer cements indicated for atraumatic restorative treatment. *Aust Dent J* 54: 233-237, 2009.
- Frencken JE, Makoni F & Sithole WD. ART restorations and glass ionomer sealants in Zimbabwe: survival after 3 years. *Community Dent Oral Epidemiol* 26: 372-381, 1998.
- Zanata RL, Navarro MF, Barbosa SH, et al. Clinical evaluation of three restorative materials applied in a minimal intervention caries treatment approach. *J Public Health Dent* 63: 221-226, 2003.