

Awareness Regarding Minimally Invasive Dentistry among Dentists of Karachi

Sara Ikram Khan, Shama Asghar, Adeena Abid, Farwah Aftab

ABSTRACT:

The objective of this study was to assess awareness of dental practitioners of Karachi regarding minimally invasive dentistry.

Study design and Setting: It was a cross sectional study based on questionnaire, conducted in 6 different dental hospitals of Karachi. The sample included dentists who were actively practicing clinical dentistry in Karachi. Specialists were excluded from the study

Methodology: A study questionnaire was distributed to the participants which comprised of demographic details, professional data and Likert-Scale based questions to assess respondent's agreement level related to caries activity, assessment, detection and treatment.

Results: Out of the 151 questionnaires distributed, 119 were analysed with an overall response rate of 78.8%. From the total 67.2% dentists were received training in MID through some means in which 36% received training in MID by lectures and clinical training both while 32.8% had no training in MID. MID techniques like ART and sandwich technique was found to be effective by 65% and 50.4% respectively. The 58.8% participants were agreed that caries risk assessment (CRA) should be done in every patient and 55.5% dentists were agreed that restoration should be planned according to patient's assessment

Conclusion: General Dental Practitioners were not completely aware of the concepts and application of minimally invasive procedures and had little knowledge regarding caries detection methods and lacked in implementation of MID techniques in their daily practice.

Keywords: Caries detection, Minimally Invasive Dentistry, Remineralization, Tooth Preservation.

INTRODUCTION:

Minimally invasive dentistry is a modern approach to conserve healthy tooth structure¹. It focuses on prevention of caries, remineralization, and minimal intervention by the dentist². Today with the help of scientific developments and technology, we are better able to understand and manage the caries process³.

In recent years, adhesive dentistry has flourished and has shifted the traditional GV Black's caries management model of "extension for prevention" to "minimally invasive"⁴. The main objective of this approach is early identification and elimination of the causative factors to prevent and treat caries. In contrast to traditional methods, the minimally invasive approach has shown control over dental caries by application of preventive measures, minimal cavity

preparations, use of adhesive materials and evidence-based decision-making.⁵

There are four main principles of the Minimally Invasive Approach. First is "recognition" of potential risk factors at an early stage through lifestyle analysis and caries detection methods. Second is "Reduction" or elimination of caries risk factors by diet modification and lifestyle changes. Third is "Regeneration" by arresting and reversing the demineralization process. Fourth is "Repair" of carious tissue by using conservative approach for caries removal⁶.

The usual visual, tactile and radiographic methods are unable to detect early caries activity but with the advanced caries detection methods like lasers and fluoroscopy, it has become easier for us to detect early carious lesions and decrease proliferation of decay into dentinal tissue^{7,8}. The MID approach utilizes conservative techniques like air abrasion, lasers and hand instrumentation in Atraumatic Restorative Technique (ART) to remove infected layer of dentine and arrest further demineralization^{9,10,11}. MID advocates use of adhesive materials which require less tooth preparation and re-mineralizing topical agents like fluoride varnishes and fluoride tooth pastes for prevention.^{4,12}

In Pakistan dental caries is the most widespread childhood disease^{13,14,15}. This is due to lack of awareness regarding oral health and excessive consumption of refined carbohydrates. Implementation of Minimally Invasive approach in Pakistan would be helpful in reduction of caries burden by early detection and intervention; In addition, simple preventive procedures are less costly. Indeed the rationale of this study

Sara Ikram Khan
Senior Lecturer
Bahria University Medical and Dental College, Karachi
Email: saraikramkhan90@gmail.com

Shama Asghar
Associate Professor
Bahria University Medical and Dental College, Karachi

Adeena Abid
Final Year Student
Bahria University Medical and Dental College, Karachi

Farwah Aftab
Final Year Student
Bahria University Medical and Dental College, Karachi

Received: 07-12-2018
Accepted: 17-09-2019

was to find out the awareness and practice of MID among dental practitioners of Pakistan as to formulate the training in MID according to the outcome of the study; which ultimately decrease the caries burden. Therefore, the objective of this study was to assess the awareness of dental practitioners of Karachi regarding minimally invasive dentistry.

METHODOLOGY:

It was a cross sectional study based on questionnaire, conducted in 6 different dental hospitals of Karachi. Sample size was calculated as 11% of dentists¹⁶ had a great deal of knowledge about minimally invasive dentistry. The calculated sample size was 151. The sample included dentists who are actively practicing clinical dentistry in Karachi. Specialists and dentists working outside Karachi were excluded from the study. Ethical approval was obtained by the ethical review committee of Bahria University Medical and Dental College. Study period was from March 2018 to September 2018. All forms were filled with prior written informed consent was taken. The questions were distributed into three sections which included demographics and awareness and attitude of dentists towards principles of minimally invasive dentistry. It was pilot tested on 15 dental practitioners who were excluded from the sample. No changes were made to the questionnaire after pilot testing. The first part of the questionnaire was about dentist's demographic data. The second and third portion comprised of 5 point Likert-Scale (Strongly Agree=1, Agree=2, Not sure=3, Disagree=4, Strongly Disagree=5) based questions to evaluate respondent's agreement level, their knowledge and attitude related to caries activity in relation to diet, re-mineralization with fluoride and sealants, caries risk assessment, conservative cavities, treatment planning and effectiveness of minimally invasive techniques like Atraumatic Restorative Technique (ART), Sandwich technique, fluoride varnishes and fluoride tooth pastes. Data was collected by the researcher. The responses in Agreement (Always/Mostly) and Disagreement (Sometimes/Rarely/Never) had been analyzed together. The responses of attitude in Agreement (Always/Mostly) and Disagreement (Sometimes/Rarely/Never) have been calculated together. Data entry was done on IBM statistics version 20. Frequency and percentages were used for descriptive data. Pearson Chi Square test with a significance level of p value <0.05 was used to analyze association between training in MID and attitude towards MID principles in diagnosing and treating dental caries.

RESULTS:

From the total 151 distributed questionnaires; 125 returned the filled forms. Out of the collected forms 6 forms were discarded due to incomplete information thereby 119 questionnaires were included for data analysis. Over all response rate was 78.8%. Demographic data of our study showed 53.8% of our sample comprised of males and 46.2%

were female general practitioners. Only 7.6% of the participants were of age 35 and above while majority of our participants were between 26-30 years of age. The results showed that 41.2% of the respondents had a professional experience between 5-10 years while only 11% had professional experience above 10 years. There was no significant difference found between GDP's professional experience and training in minimally invasive dentistry ($p>0.05$). Age and gender did not show any positive association with practice of MID principles ($p>0.05$). (Table 1). Regarding training of GDPs in minimally invasive dentistry, 67.2% of the respondents received training in Minimally invasive dentistry through some means 32% of the GDPs received no training in MID. (Figure 1).

Regarding awareness of Minimally Invasive Dentistry, 96% of the GDPs were of the agreement that carbohydrates in diet have a direct effect on dental caries and 92% believe that fluoride is vital for remineralization process. 58.8% of the dentists agreed that Caries Risk Assessment (CRA) should be done in every patient and treatment provided should be based on patient's assessment. 32% of the respondents do not practice conservative cavity preparation techniques like box and tunnel-Table 2. In relation to methods preferred by GDPs to diagnose and detect caries, 49.6% of the GDPs use sharp explorer to detect caries which is not in agreement with the concepts of minimally invasive dentistry. Caries detection with blunt instrument and use of magnification were significantly related to MID training with $p = 0.00$ and $p=0.04$ respectively. The most widely used method for detection was using radiographs preferred by 91% of the dentists while 42% also use magnification for detection of dental caries. 88% of the GDPs do not use newer methods of caries detection like Electronic Caries Monitor, Fiber-Optic Transillumination or lasers in their practice.

Minimally Invasive techniques like Atraumatic Restorative Technique (ART) and Sandwich Technique was found to be effective by 65% and 50.4% of the respondents respectively in order to preserve remaining tooth structure. Training in MID had significant effect on utilization of ART technique by dentists with p value of 0.03. 96.6% of the GDPs reported fluoride varnishes to be effective in preventing dental caries while 88.2% of GDPs think that fluoride toothpaste is effective for preventing caries. (Table 3).

DISCUSSION:

Minimally invasive dentistry aims to adopt methods of caries prevention and reduction of cariogenic bacteria by dietary modification, early detection and remineralization of initial lesions followed by minimal intervention of cavitated lesions¹⁷. Minimally invasive dentistry is an approach adopted by dental practitioners to maintain long lasting oral health focused primarily on prevention of caries, risk assessment and treatment according to patient's individual requirement.

Figure 1. Training in Minimally Invasive Dentistry

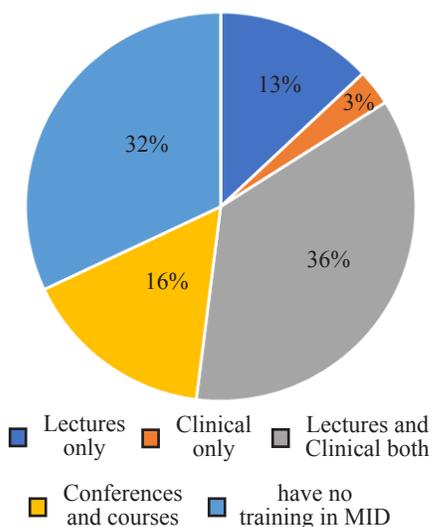


Table 1: Demographic Characteristics in correlation with training in MID

Age of Dentist	Received Training in MID		P-value (<0.05)
	Yes (n=80)	No (n=39)	
21-25 years	30%	28.21%	0.700
26-30 years	45%	53.85%	
31-35 years	16.25%	12.82%	
>35 years	8.75%	5.13%	
Professional Experience			
< 5 years	40%	61.54%	0.100
5-10 years	45%	33.33%	
>10 years	15%	5.13%	
Gender			
Male	62.5%	35.90%	0.06
Female	37.5%	64.10%	

Patient education and focus on prevention especially in high risk population is vital for caries prevention. This study revealed that more males have received training in MID than female however age and gender did not affect their awareness about minimally invasive dentistry which is in accordance with a study conducted in Saudi Arabia⁴ and India¹⁷. Studies conducted in India^{17,18} show that 84.7% of dentists in Puducherry and 97% dentists in Karnataka had adequate awareness about principles of MID which is greater than 67.2% in our study, 59.4% in Brazil¹⁹ and 40.9% in Saudi Arabia⁴. Implementation of MID can only be effective in our practice if the four principle elements of recognition, reduction, regeneration and repair are integrated into our thought process⁶. It is evident that 96% of our respondents understand the direct relationship of carbohydrates with dental caries which is proven by extensive scientific data evidence on carbohydrates consumption as a necessary factor for development of caries²⁰. WHO strongly recommends sugar control throughout one's life that is less than 10% of

total energy intake.²⁰ 92.4% dentists in our study believe in the role of fluoride in replacing lost hydroxyapatite crystals and converting them into fluorapatite which are more resistant to caries.

In our study 98.3% of the dentists agreed that Caries Risk Assessment (CRA) should be performed in every patient. In UK¹⁶ 70% of dentists in carried out CRA on patients which is greater than 26% in Japan²¹. 91% of dentists in UK affirmed that CRA has an influence on their treatment planning which is similar (91.6%) to the result of our study. Caries Risk Assessment is the basis of minimally invasive dentistry as not only it helps in diagnosis and treatment planning but also highlights the probability of developing caries in an individual. CRA if regularly done in patients can help in preventing caries and even arresting the ongoing caries cycle. Visual and tactile examinations were the most common means of diagnosing. Dental explorers over frequently used in diagnosing dental caries as shown in our study where 49.6% of the dentists use sharp explorers for caries detection. It is now an established from different studies that a sharp explorer can cause irreversible damage to the demineralized early lesion and may augment caries progression²². In contrast, a blunt ended explorer as preferred by 63% of the dentists in our study was better as it causes less ultrastructural damage to the tooth^{22,23} and was significantly associated with MID training in our study.

The principles of minimally invasive dentistry also emphasize usage of newer detection methods like laser fluoroscopy, dye staining, electronic caries monitor etc. which can help dentists save tooth from unnecessary destruction by removing unaffected tissues²⁴. In our study 88% of the dentists have either never used these advanced caries detection methods or use it occasionally which is less than a similar study conducted in India¹⁸ where 96.9% of the dentists don't use new detection methods in daily practice. Majority (91%) of the dentists in our study, rely on radiographs for caries detection which over the years have found to be an accurate method in diagnosing proximal lesions and dentinal caries²⁵. Minimally invasive dentistry advocates usage of techniques like Atraumatic Restorative Technique (ART), sandwich technique and fluoride varnishes for preventive care. ART prevents further progression of caries and prevents formation of new lesion. "The latest meta-analysis on ART sealants showed a weighted mean survival percentage of fully and partially retained ART/HVGIC sealants after 1, 2, 3, 4, 5 and 6 years by 79%, 69%, 68%, 62%, 63% and 59% respectively"²⁶. Similarly sandwich technique which is a combination of GIC and Composite also provide anti-cariogenic effect together with strength and esthetics of composite²⁷. In our study 65% of the dentists think that ART is an effective technique to stop caries progression and this opinion was significantly correlated with dentists who had received training in MID. Daily fluoride uses in the form of tooth pastes, rinses or topically applied varnishes have

Table:2 Knowledge about MID among the participants. N=119

Knowledge towards MID principles	Strongly Agree (%)	Agree(%)	Not sure(%)	Disagree (%)	Strongly Disagree (%)
Carious lesions and intake of refined carbohydrates are directly related	58%	38.7%	4%	0%	0%
Fluoride aids in tooth remineralization	57.1%	35.3%	2.5%	5%	0%
Pit and fissure sealants are effective in caries prevention	81.5%	18.5%	0%	0%	0%
All patients should go through Caries Risk Assessment (CRA)	58.8%	39.5%	0.8%	0.8%	0%
Tunnel and box preparations are effective cavity designs.	16%	63%	10.9%	10.1%	0%
Restorations and techniques should be according to patient's caries risk assessment	3.1%	55.5%	7.6%	0.8%	0%

Table 3: Attitude of participants regarding application of MID principles in detection of caries and clinical practice.

Attitude of participants regarding application of MID principles in detection of caries		Received training in MID		P value
Application of MID Principles in Diagnosing dental caries**		YES(n)	NO(n)	
Do you use of a sharp explorer for caries detection?	Always/Mostly	40	19	0.200
	Sometimes/Rarely/Never	40	20	
Do you use of a blunt instrument for caries detection?	Always/Mostly	49	26	0.00*
	Sometimes/Rarely/Never	31	13	
Do you use magnification (e.g. loupes) for caries detection?	Always/Mostly	29	21	0.04*
	Sometimes/Rarely/Never	51	18	
Use of radiographs for caries detection.	Always/Mostly	72	34	0.500
	Sometimes/Rarely/Never	9	4	
Do you use newer methods of caries detection like QLF, ECM, IRLF, FOTI	Always/Mostly	8	5	0.200
	Sometimes/Rarely/Never	72	34	
Attitude of participants about various clinical MID procedures in Clinical Practice				
How effective is ART (Atraumatic Restorative Treatment)?	Very effective/Effective	74	38	0.03*
	Ineffective/Very Ineffective	06	1	
How effective is Sandwich Technique (Glass Ionomer + Composite)	Very effective/Effective	79	39	0.100
	Ineffective/Very Ineffective	01	0	
Do you think remineralization with fluoride varnish or any other topical fluoride products is effective?	Very effective/Effective	76	39	0.300
	Ineffective/Very Ineffective	04	0	
Do you think remineralization with high concentration fluoride toothpaste at home Is effective?	Very effective/Effective	71	37	0.500
	Ineffective/Very Ineffective	11	0	

been proven effective in preventing caries by literature²⁸ which agrees with the results of our study where 74.8% and 75.6% of the dentists think that fluoride use in daily routine can arrest caries as well as prevent development of new

lesion. The limitation of the study was a small sample size including dentists of only one city. A more comprehensive sample size would provide more information of overall knowledge and application of MID by practitioners of

Pakistan. It is recommended that with the advances in newer caries detection methods, restorative options and better understanding of caries process we can shift the mindset of our clinicians to adopt techniques that preserve natural tooth structure. Concepts of minimally invasive dentistry are based on scientific evidence and needs to be incorporated into the thought process of dentists in our country by making it part of the dental curriculum, conducting educational seminars and workshops for training dentists in MID. In addition, patient education regarding modification of diet, life style and oral health maintenance will play a vital role for the success of minimally invasive dentistry.

CONCLUSION:

It was concluded that GDPs from Karachi had inadequate awareness regarding the concepts and application of minimally invasive procedures, caries detection methods and lacked in implementation of MID techniques in their daily practices.

REFERENCES:

- Ericson D, Kidd E, McComb D, Mjör I, Noack MJ. Minimally invasive dentistry—concepts and techniques in cariology. *Oral Health Prev Dent.* 2003;1(1):59-72.
- Ericson D. What is minimally invasive dentistry? *Oral Health Prev Dent.* 2004;2:287-92.
- Mital P, Mehta N, Saini A, Raisingani D, Sharma M. Recent advances in detection and diagnosis of dental caries. *J Evo Med Dent Sci.* 2014;3(1):177-92.
- Shah AH, Sheddi FM, Alharqan MS, Khawja SG, Vohra F, Akram Z, Faden AA, Khalil HS. Knowledge and attitude among general dental practitioners towards minimally invasive dentistry in Riyadh and Alkharj. *J Clin Diagn Res.* 2016;10(7):ZC90.
- Oliveira DC. "Minimally invasive dentistry approach in dental public health." MS (Master of Science) thesis, University of Iowa, 2011. <https://doi.org/10.17077/etd.ri6w529b>
- Walsh LJ, Brostek AM. Minimum intervention dentistry principles and objectives. *Aus Den J.* 2013;58:3-16.
- Mohanraj M, Prabhu VR, Senthil R. Diagnostic methods for early detection of dental caries-A review. *Int J PedodRehabil.* 2016;1(1):29-36.
- Gomez: Detection and diagnosis of the early caries lesion. *BMC Oral Health* 2015; 15(Suppl 1):S3.
- Jingarwar MM, Bajwa NK, Pathak A. Minimal intervention dentistry—a new frontier in clinical dentistry. *J Clin Diagn Res.* 2014 ;8(7):ZE04.
- Leon A, Ungureanu L, Puca C. Air Abrasion: Interdisciplinary Modern Technologies— Approach to Minimally Invasive Treatment of Dental Caries, Proceedings of the International Conference on Interdisciplinary Studies (ICIS 2016) - Interdisciplinarity and Creativity in the Knowledge Society, Valentina Mihaela Pomazan, IntechOpen, DOI: 10.5772/65419.
- Sambashiva RP, Pratap KM, Nanda KK, Sandya PS. " Drill-less" dentistry-the new air abrasion technology. *Ind J Dent Advanc.* 2011;3(3):598-602.
- Guzmán-Armstrong S, Chalmers J, Warren JJ. White spot lesions: Prevention and treatment. *Am J OrthodDentofac Orthop.* 2010;138(6):690-6.
- Mohiuddin S, Nisar N, Dawani N. Dental caries status among 6 and 12 years old school children of Karachi city. *J Pak Dent Assoc.* 2015;24(1):39-45.
- Umer MF, Farooq U, Shabbir A, Zofeen S, Mujtaba H, Tahir M. Prevalence and associated factors of dental caries, gingivitis, and calculus deposits in school children of Sargodha district, Pakistan. *J Ayub Med Coll Abbottabad.* 2016;28(1):152-6.
- Mubarak S, Hayat A, Akbar S. Prevalence of Dental Caries of One Grade School Children in Karachi. *Pak Oral & Dent J.* 2016;36(1):116-8.
- Mirsiaghi F, Leung A, Fine P, Blizard R, Louca C. An investigation of general dental practitioners' understanding and perceptions of minimally invasive dentistry. *Br Dent J.* 2018;225(5):420-4.
- Rayapudi J, Usha C. Knowledge, attitude and skills of dental practitioners of Puducherry on minimally invasive dentistry concepts: A questionnaire survey. *J Conserv Dent.* 2018;21(3):257-62.
- Sushanth V, Bhate P, Imranulla M, Kalra D, Kumar N, Prashant G. Assessment of knowledge, attitude, and practice regarding preventive options in oral care among dentists in Davangere city, Karnataka: A cross-sectional study. *Dent Med Res* 2015;3:20-5.
- Katz CR, de Andrade MD, Lira SS, Ramos Vieira EL, Heimer MV. The concepts of minimally invasive dentistry and its impact on clinical practice: a survey with a group of Brazilian professionals. *Int Dent J.* 2013 ;63(2):85-90
- Sheiham A, James WP. Diet and dental caries: the pivotal role of free sugars reemphasized. *J Dent Res.* 2015;94(10):1341-7.
- Kakudate N, Sumida F, Matsumoto Y, Yokoyama Y, Riley III JL, Gilbert GH, Gordan VV. Dentists' decisions to conduct caries risk assessment in a Dental Practice-Based Research Network. *Community Dent Oral Epidemiol.* 2015;43(2):128-34.
- Mattos-Silveira J, Oliveira MM, Matos R, Moura-Netto C, Mendes FM, Braga MM. Do the ball-ended probe cause less damage than sharp explorers? —An ultrastructural analysis. *BMC oral health.* 2016;16(1):16-39.
- Ismail AI. Visual and visuo-tactile detection of dental caries. *J Dent Res.* 2004;83:C56–66.
- Ntovas P, Loubrinis N, Maniatakos P, Rahiotis C. Evaluation of dental explorer and visual inspection for the detection of residual caries among Greek dentists. *J Conserv Dent.* 2018;21(3):311-18.
- Keenan JR, Keenan AV. Accuracy of dental radiographs for caries detection. *Evid Based Dent.* 2016;17(2):17-43.
- De Amorim RG, Frencken JE, Raggio DP, Chen X, Hu X, Leal SC. Survival percentages of atraumatic restorative treatment (ART) restorations and sealants in posterior teeth: an updated systematic review and meta-analysis. *Clin Oral Investig.* 2018;22(8):2703-25.
- Murdoch-Kinch CA, McLEAN ME. Minimally invasive dentistry. *The J Am Dent Assoc.* 2003;134(1):87-95.
- Marinho VCC, Higgins JPT, Sheiham A, Logan S. One topical fluoride (toothpastes, or mouthrinses, or gels, or varnishes) versus another for preventing dental caries in children and adolescents. *Cochrane Database of Systematic Reviews* 2004, Issue 1. Art. No.: CD002780. DOI: 10.1002/14651858. CD002780.pub2

