

## Original Research

### Minimal Invasive Dentistry: An Update

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#### ABSTRACT:

MID is the modern medical approach to the management of caries, utilizing caries risk assessment, and focusing on the early prevention and interception of disease. The concept includes the use of all available information and techniques ranging from accurate diagnosis of caries, caries risk assessment and preservation to technical procedures in repairing restoration. The ultimate goal of minimal intervention is to extend the lifetime of the restored tooth with as little intervention as possible. The present review of literature brief the concept of minimal intervention in dentistry.

**Keywords:** Minimal Invasive Dentistry, MID, Minimal Invasion, Dental caries

Received: 12 August, 2021

Accepted: 18 September, 2021

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**This article may be cited as:** Burman A, Nair VVR, Sistla GS, Choudhary T, Gupta S, Bothra S. Minimal Invasive Dentistry: An Update. J Adv Med Dent Scie Res 2021;9(10):67-71.

#### INTRODUCTION

Dental caries is defined as the microbial disease of the calcified tissues of teeth that are characterized by demineralization of the inorganic substance and destruction of organic substance of tooth.<sup>1</sup> The rules for dentistry were invented in the late 1800's by Dr. G.V. Black, the father of modern dentistry. Among the foremost of his rules was the concept of "extension for prevention". The idea was to remove the possibility of further decay on the surface of the tooth already afflicted with caries. The act of making a restoration therefore usually involved the removal of a substantial amount of tooth structure, often several times more than was actually decayed. Hence, a lot of healthy tooth were destroyed in the process.<sup>2</sup>

Minimum Invasion Dentistry (MID) is defined as a philosophy of professional care, concerned with the

occurrence, early detection and earliest possible cure of disease on a micro level, followed by minimally invasive treatment in order to repair irreversible damages caused by such disease.<sup>1</sup>

The primary strength of minimal invasive dentistry is the involvement of patient in the conservative oriented, longitudinal approach for the preservation and maintenance of their dentition and oral health. The importance of these critical elements of minimal invasive dentistry is having the patient assume responsibility of their day-to-day care of their mouth, and to manage and control, the best of their ability, and the risk of disease.<sup>2</sup> The present review of literature brief the concept of minimal intervention in dentistry.

**Evolution of Minimal Invasive Dentistry (Table no. 1)**

Author	Milestone
<b>Hyatt (1923)</b>	Introduced Prophylactic Odontotomy which involved mechanical preparation of pits and fissures and filling them with amalgam. In this way the preparations would be more conservative than if prepared later with amalgam. <sup>3</sup>
<b>Bodecker (1929)</b>	Suggested "Fissure eradication"- Widening of fissures mechanically so that they would be less retentive to food particles. <sup>4</sup>
<b>Buonocore (1955)</b>	Developed Acid-etch technique for adhesion of resins <sup>1</sup>
<b>Bowen (1965)</b>	Developed Bis-GMA resin, which is the base of pit and fissure sealant <sup>5</sup>
<b>Goldman (1975)</b>	Made first commercial attempt for chemomechanical removal of caries <sup>6</sup>
<b>Richard J Simonsen and Stallard (1977)</b>	Demonstrated the concept of "Preventive Resin Restoration" <sup>7</sup>
<b>Whitehead and Wilson (1990)</b>	Used binocular magnification for the detection of caries <sup>6</sup>
<b>Hunt P.R (1990)</b>	Suggested the following principles in cavity preparation: Gaining access to the body of the lesion without being destructive, especially in approximal lesions. <ul style="list-style-type: none"> <li>• Removal of tooth structure that is infected and incapable of regeneration.</li> <li>• Avoiding the exposure of dentine unaffected by the caries process<sup>8</sup></li> </ul>
<b>Graham mount (1997)</b>	Proposed a new cavity classification to take into account the changes in caries activity. Carious lesion occurs in 3 sites on the crown or root of the tooth. (site-1, site-2 and site-3) with severity of lesion in 5 sizes ( size-0 to size-4). <sup>8</sup>

**PRINCIPLES OF MID<sup>9</sup>**

- Early caries diagnosis
- Classification of caries depth and progression
- Assessment of individual risk
- Optimal caries preventive measures
- Remineralization of early lesions
- Minimal surgical intervention of caries lesions
- Repair rather than a replacement of defective restoration
- Assess disease management outcomes at intervals.

**EARLY CARIES DIAGNOSIS**

To stop caries as early as possible, future caries risk and present caries activity should be established. Caries risk may be assessed from a number of predictors such as Streptococcus mutans levels, salivary buffering capacity and flow rate baseline caries prevalence as well as fissure retentiveness.<sup>10</sup>

The development of new diagnostic aids is based on the need for increased detection sensitivity to allow lesions to be identified as early as possible. The new diagnostic tools are classified on the basis of the physical principles that underpin them. The most prominent include transillumination (Diagno.cam, Kavo®) and fluorescence systems (DIAGNOdent, Kavo®; CS 1600 Kodak; VistaCamiX, DürrDental®; SoproLife, Acteon®).<sup>11</sup>

**CLASSIFICATION OF CARIES DEPTH AND PROGRESSION**

A new classification of the carious lesion was proposed by Mount and Hume in 1997. This new system defines the site, extent, and complex of a cavity and at the same time encourages a conservative approach to the preservation of natural tooth structure. This new system is designed to utilize the healing capacity of the lesion.<sup>12</sup> (**Table no. 2**)

Location	1=Minimal	2=Moderate	3= Advanced	4= Extensive
Site 1: Pits and fissures	1.1	1.2	1.3	1.4
Site 2: Proximal surfaces	2.1	2.2	2.3	2.4
Site 3: Cervical surfaces	3.1	3.2	3.3	3.4

**ASSESSMENT OF INDIVIDUAL RISK**

Risk is the probability that some harmful event will occur. Caries risk is defined as "the probability of future caries disease development." American Academy of Pediatric Dentistry recognizes that caries-risk assessment and management protocols can assist clinicians with decisions regarding treatment and are essential elements of contemporary clinical care for infants, children, and adolescents.

It includes both primary and secondary disease. There are some factors, which are related for the assessment of individual risk. Direct factors are the amount of plaque, type of bacteria, type of diet, frequency of carbohydrate intake, saliva secretion, saliva buffer capacity, and exposure to fluorides. Indirect factors, which may help to assess individual risk, are socioeconomic circumstances and general health of the child. Identification of caries risk at early stage can be done by recording patient history, clinical

examination, nutritional analysis, salivary analysis and by using accurate caries diagnostic methodologies.<sup>13</sup>

#### OPTIMAL CARIES PREVENTIVE MEASURES

“Prevention is better than cure”. Increasingly, the attention of dental profession has been directed towards prevention of dental caries by taking various measures which includes:<sup>14</sup>

- Tussling caries inducing microorganisms:
  - Bisguanides-chlorhexidine
  - Triclosan
  - Delmophinol hydrochloride
  - Replacement therapy: cariogenic bacteria replaced by non cariogenic bacteria.
  - Blocking plaque build up: develop substance that inhibit glycosyl transferase, interfere with adhesion & co-aggregation of bacteria & an effective antibacterial agent.
- Modifying diet:
  - Addition of preservative with enhanced antibacterial activity e.g. essential oil components like thymol, cinnamic acid, carvacrol.
  - Addition of natural demineralization inhibitors e.g. fluorides in drinking water.
  - Increase consumption of protective food component like Polyphenols in oat, hulls, cheese & milk. - Calcium phosphate complex of casein phosphopeptides in milk
  - Sugar substitutes
- Increasing resistance of teeth to decay
  - Fluoride & pit & fissure sealant
  - Remineralising agent-amorphous calciumphosphate
  - LASER.
  - Augmenting host resistance by recombinant DNA technology.

#### REMINERALIZATION OF EARLY LESIONS

It is possible to arrest and reverse the loss of minerals associated with caries at an early stage, before cavitation. In early carious lesions, there is subsurface demineralization of the enamel. As caries progresses into dentin, the surface of the enamel eventually cavitates; Once cavitation begins, it becomes difficult to control plaque accumulation.<sup>15</sup> Remineralization delivery methods materials include toothpastes, mouth rinses, gels, pastes, chewing gums, lozenges, foods, and beverages.<sup>16</sup> Various remineralising agents include:

- Casein Phosphopeptide-Amorphous Calcium Phosphate (CPP-ACP)
- Combination of CPP-ACP and fluoride
- Novamin
- TiF4 technology
- Resin infiltration technology
- Tricalcium phosphate
- Nano hydroxyapatite
- Enamelon

#### MINIMAL SURGICAL INTERVENTION OF CARIES LESIONS

Conservation of tooth structure using minimally invasive cavity preparations is possible because adhesive materials do not require the incorporation of mechanical retention features. Biomimetic potential including the release of fluoride, calcium and phosphate ions can be of value in enhancing remineralization potential of the carious lesion. Several materials that can be used are GIC, composites etc. Minimal surgical intervention possibilities have been further expanded by the introduction of certain technologies.

- **Preventive Resin Restoration (PRR):** PRR is indicated in teeth with minimal teeth and fissures decay. In this minimal cavity preparation is required to prevent unnecessary removal of healthy tooth structures for retention. If the decay is limited to enamel then no local analgesia is required. After etching, rinsing and drying the cavity is condensed with a normal composite or GIC.<sup>11</sup>
- **Atraumatic Restorative Technique (ART):** ART approach involves the removal of only soft, demineralised tooth tissue with hand instruments, followed by filling the cleaned cavity & associated pits & fissures with adhesive restorative materials.<sup>17</sup>
- **Air –Abrasion:** This method of cutting teeth seemed to dramatically reduce the problems of heat generation, vibration and other mechanical stimulation resulting in relatively pain-free procedures when compared with drill. There have been reports to indicate that there were no significant differences in pulpal response between air abrasion and high speed bur preparation using copious water spray.<sup>18</sup>
- **Chemomechanical caries removal:** Chemomechanical caries removal (CMCR) is a minimally invasive technique of eliminating infected dentin using specific chemical agents and hand instruments. The method of caries removal is based on chemical dissolution. It is mainly indicated to overcome the use of burs and local anaesthesia, causing less discomfort to patients, preserving healthy dentin structure, thereby complying by the concept of minimal intervention dentistry (MID).<sup>19</sup>
- **Smart Bur:** One of the goals of conservative dentistry is to develop a method to remove caries infected dentin while preserving caries affected dentin. The smart prep bur appears to be the instrument to offer straight forward and efficient means of achieving this goal. Smart prep instrument is a medical grade polymer that safely and effectively removes decayed dentin leaving healthy dentin intact. Polymer bur is a unique rotary instrument which is constructed from a medical-grade polyetherketone-ketone, and it selectively removes

decayed dentine without cutting the healthy dentine. This property is based on the hardness of the instrument being lower than the hardness of the healthy dentine. In addition, this minimally invasive excavation has the advantage of fewer dentin tubules being cut and thereby, less pain sensations being triggered compared to using conventional burs.<sup>20</sup>

- **Mini-box or slot type preparation:** Slot preparation as advocated by Wilson and McLean, which involves the removal of the marginal ridge but do not include the occlusal pits and fissures. Proximal approach is a rather unusual design because access is dependent upon the presence of a rather large size 3 lesion in the adjacent tooth. Though unusual, it is very conservative of tooth structure and will lead to preservation of the marginal ridge.<sup>21</sup>

### REPAIR RATHER THAN A REPLACEMENT OF DEFECTIVE RESTORATION

Repair has become increasingly more popular over the last two decades as the concept of "Minimal Intervention Dentistry" (MID) has become rooted in the practice. According to many authors repair, refurbishment and monitoring restoration defects increase the survival time of restorations significantly. Replacement dentistry<sup>7</sup> leads to:

- Weakening of tooth structure by increasing the surface area of the cavity
- The increased surface area tends to make more complex form of restoration
- Larger restorations which usually have a shorter life span than their predecessors
- Possible damage to adjacent teeth.

Decision to repair rather than replace a restoration always must be based on patient's risk of developing caries, conservative approach of the repair and professional's judgment of benefit versus risk.<sup>22</sup>

### ASSESS DISEASE MANAGEMENT OUTCOMES AT INTERVALS

Recall at various intervals should be done to reduce the recurrence of caries.

### CONCLUSION

Minimally Invasive Dentistry (MID) emphasizes conservative caries management strategies resulting in less destruction of tooth structure. The principles of MID seek to convert an active lesion into an inactive or arrested lesion, thus aiding the defence and healing processes in dentin and pulp before restorative procedures are attempted. With the development of new dental restorative materials and advances in adhesive dentistry, a better understanding of the caries process and the tooth's potential for remineralization and changes in caries prevalence and progression, the management of dental caries has evolved from G.V Black's "extension for prevention" to "minimally invasive".

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