

MINIMALLY INVASIVE DENTISTRY- A REVIEW**Kavita A Madan¹, Sachin Khatri², Sudhindra Baliga M³**

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ABSTRACT:

Dental caries is considered to be one of the rapidly progressive and the most prevalent disease condition amongst different population. Minimally invasive dentistry is a relatively new terminology in the field of dentistry which has suggested the appropriate changes in the past principles of conventional operative dentistry. It represents a newer and safer approach in management of decayed tooth by maximally preserving the tooth structure thereby minimally damaging it. This paper provides an overview on the recent concept of minimally invasive dentistry and the various techniques associated with the same.

Keywords: Caries risk assessment, Decay, Dental caries, Fluoride, Minimally Invasive Dentistry.

INTRODUCTION

Dental caries has been recognized worldwide although its prevalence and severity may vary in different populations. It is one of the most rapidly progressing disease and a common cause for the loss of mineralized tooth structure. It becomes very important on the part of the clinician to estimate the risk factors associated with it thereby planning a suitable preventive treatment procedures. Dental caries has been long recognized as an infectious disease requiring a susceptible host, cariogenic microflora and a diet high in refined carbohydrate to sustain that flora.¹ Minimally invasive dentistry is a modern medical approach for a successful management of such type of carious lesions thereby focusing on the the prevention and an early interception of the disease process. Father of MID was Mount and its further elaboration was done by Davis and Makinson.²

Initially during the GV Blacks era the original concept and approach for a successful management of dental caries was purely “surgical”. It was thought that the only effective method of eliminating the disease was to completely remove all of the

demineralised areas of tooth structure followed by rebuilding it with an intact restoration which resulted in excessive debilitating condition of the tooth.¹ Even the most smallest area required a standard amount of tooth structure removal. First truly scientific theory regarding dental caries was defined by Dr. W.D. Miller in 1890. It was the “chemico-parasitic” theory which indicated that dental caries is the decomposition of the tooth structure caused by bacterial acids present in the dental plaque.³

Due to limited technology the exact cause or the particular pathogens causing dental caries was not known and so “surgical model” continued to rule dentistry. Restorations done with the help of dental amalgam frequently caused recurrent caries and the alloy corroded rapidly.⁴ This led to the development of concept of ‘extension for prevention’

The present concept describes that in many cases a surgical approach may be unnecessary. There has been a new paradigm involving minimally invasive dentistry.¹

A recent policy document produced by World Dental Federation suggested few basic

principles that must be applied to fulfill the description of MID are:²

- 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 replacement of defective restoration
- Assess disease management outcomes at intervals

1.Early caries diagnosis: The first step of minimally invasive dentistry makes an early assessment of the patient’s caries risk by detection of caries through early diagnosis. It is truly said that only in the absence of the disease will restorative dentistry succeed. Primary focus being the control of the disease and only when such a control has been achieved it is possible to offer a longer repair of the damage. Initial lesions must be diagnosed as early as possible. Earlier studies suggest that the ‘gold standard tool’ required for the early detection of such lesions should have a high level of sensitivity (the ability to detect disease when it exists) and a high level of specificity (the ability to confirm the absence of disease). Such a tool has not yet been established.⁵ A wide range of chair side tests are available for the early detection of carious lesions including those such as saliva buffering capacity, pH, viscosity, flow and using various tests for oral bacteria levels.⁶ Radiographs hold reliability for the detection of interproximal caries, but at the same time are unreliable for the detection of occlusal surface caries. Many recent diagnostic methods such as Diagnodent, Fibre optic Trans Illumination (FOTI), Quantitative Light Induced Fluorescence (QLF), Dye Enhanced Laser Fluorescence (DELFL), Digital Radiology (DR) etc.^{7,8}

2.Classification of caries depth and progression:

For early detection of the carious lesion, a new classification has been put forward. This classification describes the carious lesions in terms of site and severity of the lesion. In 1990, Mount and Hume introduced a system which is based on the site where the carious lesion is detected i.e Site 1: carious lesions involving the pits and the fissures, Site 2: carious lesions present in the contact area, Site 3: carious lesions found in the cervical region of the tooth. According to the size of the lesion, the description given is simple accurate and very comprehensive.⁹

Site 0: The initial lesion at any site that can be identified but has not yet resulted in surface cavitation

Site 1: Smallest minimal lesion requiring operative intervention

Site 2: Moderate sized cavity. There is still sufficient sound tooth structure left

Site 3: Cavity needs to be modified and enlarged to provide some protection

Site 4: Cavity is now extensive following loss of a cusp

*Mount and Hume classification

Location	1=Minimal	2=Moderate	3=Advanced	4=Extensive
Site 1: Pits & 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

This system of classification offers advantage of overcoming the need for future modifications. It is an uncomplicated, simple and allows for a clear communication with a more accurate and a descriptive record keeping. This system definitely helps in identification and analysis of carious lesion and subsequently treating it in a best possible manner.

3.Assessment of individual risk: ‘The probability of future caries disease development’ is called as caries risk. The disease could be a primary disease and a secondary disease. This is the most important part of minimally invasive dentistry which performs the assessment of the individual caries risk. For a proper assessment of a lesion a combination of visual appearance, location, tactile sensation and gingival health may pave a road for an easy diagnosis. Caries prediction becomes a very important and an inseparable part of clinical decision which can be applied on a daily basis. Many factors may contribute in the identification of the caries risk. Eg: Salivary pH, oral hygiene of the individual, bacterial count etc.² “Cariogram” an interactive validated program is used for assisting the clinicians for the motivation of the patients worldwide. Cariogram gives an illustrated caries risk instructions graphically with the interaction of different factors. In addition, it also demonstrates the “chance to avoid new caries” in the future and to what extent the various factors will affect this chance.¹⁰

4.Optimal caries preventive measures: There are 3 ways by which optimal caries prevention in a patient with moderate to high caries risk. Miller suggested in 1890 that optimal caries prevention can be achieved by dietary modification, Chemotherapeutic agents and antimicrobial approach.

Diet counseling mainly includes modifying ones one diet through sugar substitutes which is a very important factor in managing carious lesion development. The ones who are not exposed to the fluoride agents and at the same time is at a higher risk dental caries would definitely have dietary benefits.² The total sugar intake which could be cariogenic to an individual can be reduced by substituting it with the sugar substitutes. Most common sugar free products are also available in the market such as Sorbitol and Xylitol. Many long term studies have concluded that by using xylitol in the form of sugar free chewing gums may help in progression of dental caries.^{11,12}

Fluoride containing agents- there are many methods through which fluoride can be systemically provided to the general population. Eg: water, salt or milk fluoridation. Fluorides at the same time can be professionally applied as well, or self application devices are also available. The use of fluoride have drastically reduced the prevalence of dental caries and at the same time led to decrease in its progression.²

Ozone gas- Ozone gas is a tri-atomic state of di-oxygen. Gaseous ozone when infused into early caries lesions causes bacterial death.¹³

Chlorhexidine agents- Chlorhexidine(CHX) containing agent causes a change in the oral microflora. It is available as mouthwash, gel, varnish. When CHX in the form of varnish is used, it has efficiently showed an inhibitory effect on caries. Therefore it can be considered as an option for a high caries risk patients.^{14,2}

5.Remineralization of early lesions:

Fluoride is well known for its remineralization potential, which is available for topical application of gel/foam, mouthwash, varnish, in toothpastes. Hydroxyapatite from the enamel when combines with fluoride forms a caries resistant product called as fluorapatite which is resistant to dissolution in acid produced by microorganisms.¹⁵

Casein phosphopeptide-amorphous calcium phosphate agents (CPP-ACP)- It is a type of remineralizing agent and the complex occurs naturally which binds with the calcium (Ca⁺⁺) and phosphate(PO₄⁻) ions of the tooth structure. Acidic environment favors CPP to release Ca⁺⁺ and PO₄⁻ ions in the oral cavity to compensate for the acidic environment thereby leading to remineralization of the tooth structure. Vehicles delivering CPP-ACP complex include gels, dentrifices and chewing gums. Studies have shown that CPP-ACP + fluoride are able to reduce caries more significantly than CPP-ACP or fluoride alone.¹⁶

NovaMin[®] or calcium sodium phosphosilicate is a bioactive glass composed of minerals. It

has an ability to release calcium, phosphorous, sodium and silicon ions when it comes in contact with body fluid. The end product is the formation of a mineralized layer which is acid resistant.¹⁶

6.Minimal surgical intervention of caries lesions: whenever the surgical intervention is required it should be as minimum as possible. Minimally invasive techniques such as atraumatic restorative technique which involves removal of the tooth tissue with the help of hand instrument can be incorporated. Also the use of a chemical agent or gel in the form of Chemomechanical caries removal too can be incorporated for a minimum intervention. Fissurotomy is also an ultraconservative dental treatment approach. In the present era, air abrasion and lasers have been successfully came up for restoring the carious process by minimally damaging the tooth structure.¹⁷

Also adhesive dental materials are also available in the market which has made it possible to conserve the tooth structure as they do not require any mechanical retention. These materials can be enlisted as Glass ionomer cement which has an added advantage of adhesion to tooth structure with the release of fluoride at the same time. Composite is also one of such a material in which the resin binds to the enamel thereby minimizing the extent of the cavity preparation. Laminate technique offers advantage of the physical properties of GIC and composite.¹⁸

7.Repair rather than replacement of defective restoration: In earlier times when amalgam ruled dentistry, in cases of fractures/lost restorations the whole restoration was to be removed and replaced again. This lead to future loss and weakening of the crown. Replacing a restoration must always be based individual patient risk of development of new carious lesions.¹⁸

8.Assess disease management outcomes at intervals- Recall at various interval should be done to reduce the recurrence of caries.⁵

CONCLUSION

Minimally invasive dentistry has completely changed the old philosophy of the conventional operative dentistry. The time has come to move from an era of “Extension for Prevention” to the present era of “Prevention of Extension”. Because of the availability of new materials, many different techniques and instruments we can definitely bring MID in our day to day practice.

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