

# MOVING FROM OPERATIVE TO PREVENTIVE TREATMENT IN DENTAL CARIES MANAGEMENT

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**Abstrak:** Prinsip preparasi kavitas dari Black yang menekankan “perluasan untuk pencegahan” telah dipraktekkan oleh para dokter gigi selama lebih dari 100 tahun. Banyak dokter gigi masih berpendapat bahwa karies gigi dapat dirawat dengan upaya restorasi gigi yang terkena. Pada kenyataan pengeboran dan selanjutnya penambalan gigi hanya menghilangkan gejala, tanpa menghentikan penyakit tersebut secara menyeluruh. Dewasa ini, pemeliharaan struktur gigi yang sehat harus menjadi tujuan utama pada setiap perawatan gigi karena proses terjadinya karies gigi dan mekanisme kerja fluorida sebagai agen pencegah karies semakin dipahami. Oleh karena itu “pencegahan untuk perluasan” merupakan motto baru yang lebih tepat untuk menggantikan “perluasan untuk pencegahan”. Minimum Intervention Dentistry (MID) merupakan pendekatan baru penanganan karies gigi yang diawali dengan proses identifikasi dan perawatan pencegahan dan selanjutnya upaya restorasi yang seminimal mungkin. Berpatokan pada konsep MID maka perawatan karies gigi telah mengalami pergeseran dari intervensi restorasi menjadi intervensi pencegahan, sehingga di masa mendatang intervensi restorasi mungkin tidak akan digunakan lagi.

**Kata kunci:** karies gigi, pencegahan, demineralisasi dan remineralisasi

**Abstract:** For more than a hundred years, Black’s principles of cavity preparation, which emphasized “extension for prevention”, have been widely practiced by dentists. Most dentists have believed that dental caries could be controlled by restoring a decayed tooth. However, drilling and filling only reduce symptoms, without eradicating the disease. Today, preservation of a healthy tooth structure must be the main objective of every dental treatment because the process of dental caries, and the role of fluoride as an anti-caries agent, have been understood. Thus, *prevention for extension* is the appropriate term to replace *extension for prevention*. Minimum Intervention Dentistry (MID) is a new approach in managing dental caries which consider identification and preventive treatment first, and then restoration with minimal invasive treatment. MID’s concept encourages dentistry “to move” from operative surgical to preventive treatment in the management of dental caries. Thus, almost totally eliminating operative intervention in the future.

**Keywords:** dental caries, prevention, demineralization and remineralization

Dental caries and periodontal disease are probably the most common chronic disease in the world. Although dental caries has affected humans since prehistoric time, the prevalence of this disease has greatly increased in this modern time on a world-wide basis, which is an increase strongly associated with dietary change.<sup>1</sup> The mouth

contains a wide variety of bacteria, but only a few specific species of bacteria are believed to cause dental caries; *Streptococcus mutans* and *Lactobacilli* are among them.<sup>2</sup>

Dental caries, an infectious<sup>3</sup> transmissible disease,<sup>4</sup> is also known colloquially as tooth decay or dental cavities<sup>2</sup> that are

caused by *Streptococcus mutans*. It occurs in three phases: 1) initial interaction of bacteria with tooth surface mediated by adhesins; 2) accumulation of the bacteria in a biofilm, and the production of glucose and glucans by the bacterial enzyme, glucosyl-transferase; and 3) formation of lactic acid, resulting in localized dissolution and destruction of calcified tissues.<sup>5</sup>

Dental caries is a dynamic process,<sup>3</sup> and is not completely irreversible as previously thought.<sup>6</sup> The caries process must also be thought of as a dynamic alteration between demineralization and remineralization. This represents a competition between the pathologic factors (such as bacteria and carbohydrates) and the protective factors (such as saliva, calcium, phosphate, and fluoride).<sup>3</sup>

In the past, dentistry's approaches to caries treatment were surgically removing diseased tissues and replacing them with dental restorative materials.<sup>7</sup> For a long time the profession has accepted that dental caries should be treated mechanically rather than biologically.<sup>8</sup> Up to the present, time the profession has used a classification of cavities that were proposed by G.V. Black over one hundred years ago.<sup>9</sup> Traditionally, the management of dental caries by dental surgeons was an *extension for prevention* surgical approach, based on Black's cavity design.<sup>10</sup> The classification was designed before the widespread use of radiographs; thus, lesions were not diagnosed until they were visible to the naked eye and therefore, by modern standards, were relatively large.<sup>9</sup> The remaining crown of the tooth could be severely weakened and the end result was often a continuum of replacement dentistry leading to further weakening with a potential loss of vitality.<sup>8</sup>

Preservation of a healthy set of natural teeth for each patient should be the objective of every dentist in this modern time. As cited in Murdoch and Mc Lea, Miles summarized that the loss of even a part of a human tooth should be considered "a serious injury", and that dentistry's goal should be to preserve the natural health of tooth

structures.<sup>7</sup>

The history of dentistry demonstrates a commitment of life-long learning.<sup>11</sup> Today's understanding of the cause and progress of dental caries has changed to such an extent that entirely new ways of managing dental caries as a disease needs to be looked at and considered.<sup>12</sup> It is suggested that knowledge has advanced to a stage where the disease can be handled biochemically and behaviourally with a high level of success. The origins of the disease are well understood, and a far more effective approach is to prioritize prevention, but to heal the early stage lesion if prevention has not been entirely successful.<sup>8</sup>

It has been recognized for over five decades that fluoride may have both beneficial and potentially harmful effects on dental health.<sup>13</sup> Widespread use of fluoride has been a major factor in the decline of the prevalence and severity of dental caries (i.e. tooth decay) in this modern time. Fluoride is the ionic form of the fluorine element, the 13<sup>th</sup> most abundant element in the earth's crust. Fluoride concentrated in plaque and saliva inhibits the demineralization of sound enamel and enhances the remineralization of demineralized enamel.<sup>14</sup>

One treatment philosophy that is gaining in popularity around the world is Minimum Intervention Dentistry (MID).<sup>13</sup> This MID is a modern approach to the management of oral diseases, and its principles are very simple: identifying, preventing, and restoring.<sup>11</sup> In MID, fluoride is a main factor that is used in both preventive and control treatment.

The aim of this paper is to provide the understanding that dental caries is a dynamic process that can actually be reversed. Thus, in preventive treatment, dentists treat patients with only a minimal intervention technique.

## A NEW CAVITY CLASSIFICATION
















This cavity classification used by the profession, is called Black classification. G.V. Black identified this classification.<sup>9</sup> Traditional cavity preparations were design-

ed at a time when carious lesions were mostly diagnosed at more advanced states,<sup>7</sup> because, in general, radiographs were not used. Therefore, a cavity was not diagnosed until it was large enough to be identified with the naked eye. There have been many changes and much progress in the understanding of caries, as well as other forms of the progressive loss of tooth structure. The

inherent limitations of the present classification are far too rigid for simple modification, and it is suggested that it is time to get serious about reviewing the concept.<sup>9</sup>

In the modern understanding of adhesion and remineralization, it is no longer necessary to remove all unsupported demineralized enamel around the cavity margin. The concept of self cleansing areas has been

**Table 1.** Caries classification and treatment option for Minimal Intervention Dentistry based on Mount and Hume.<sup>8,15</sup>

Site	Size				
	0 (no cavity)	1 (minimal)	2 (moderate)	3 (enlarged)	4 (extensive)
<b>1</b> (pit and fissure or other smooth surfaces)	 <b>1.0</b> fissure seal	 <b>1.1</b> Minimal intervention (caries removal, sealent or GI)	 <b>1.2</b> Equivalent to Black class 1 (caries removal internal remin with GI, GI or composite or amalgam (lamination))	 <b>1.3</b> Requires protection of remaining tooth structure, caries removal internal remin with GI, GI or composite or amalgam (lamination)	 <b>1.4</b> Lost cusp or similar, caries removal internal remin with GI, GI or composite or amalgam (lamination)
<b>2</b> (contact area with adjacent teeth)	 <b>2.0</b> External remin*	 <b>2.1</b> Beyond remin, caries removal, open access(GI or composite), tunnel(GI), box or slot (GI or composite or amalgam)	 <b>2.2</b> Moderate involvement, caries removal internal remin with GI, GI or composite or amalgam (lamination)	 <b>2.3</b> Requires protection of remaining tooth structure, caries removal internal remin with GI, GI or composite or amalgam (lamination)	 <b>2.4</b> Bulk loss of tooth surfaces, vital pulp therapy, internal remin with GI, review for GI or composite or amalgam (lamination)
<b>3</b> (cervical one third of the crown or following gingival recession, the exposed root)	 <b>3.1</b> External remin*	 <b>3.1</b> External and internal remin and/ or minimal intervention (caries removal, GI or composite)	 <b>3.2</b> More extensive, caries removal internal remin with GI, GI or composite or amalgam (lamination)	 <b>3.3</b> Approximal root surfaces, caries removal internal remin with GI, GI or composite or amalgam (lamination)	 <b>3.4</b> Two or more surfaces, vital pulp therapy, internal remin with GI, review for GI or composite or amalgam (lamination)

\*remin= remineralization

discarded; removal of all affected dentine from the axial wall of the cavity is strictly contraindicated because of the possibility of inhibiting remineralization and healing.<sup>9</sup>

Because all cavities, by today's standards, are large,<sup>9</sup> it has been proposed that the Black classification of cavity designs can be replaced by a new classification system advocated by Mount and Hume.<sup>7</sup> A new caries classification describes dental caries by site (1=pit and fissures, 2= contact area, 3= cervical) and by size (from 0 to 4). (Table 1).<sup>15</sup>

## CONCEPT OF MINIMUM INTERVENTION DENTISTRY

### Identification

The first step of MID requires the assessment of a patient's caries risk.<sup>6</sup> It will make the patient more aware of his dental health through education thus an applicable preventive treatment plan can be instigated.<sup>16</sup> Historically, oral health problems were noted when a negative clinical outcome effect became visible, including frank cavitated carious lesions and loosening of teeth with apparent bone loss.<sup>11</sup>

Through a series of demineralization and remineralization cycles, the tooth alternately loses and gains calcium and phosphate ions, depending on the microenvironment. When the pH is less than 5.5, subsurface enamel or dentine will demineralize. Fluoride enhances the uptake of calcium and phosphate ions and can form fluorapatite. Fluoroapatite demineralizes with a pH of less than 4.5, making it more resistant to demineralization from an acid challenge than from hydroxiapatite. In early carious lesions, there is a subsurface demineralization of the enamel. As caries progresses into dentine, the surface of the enamel eventually cavitates. Once cavitation occurs, it becomes difficult to control plaque accumulation. In areas of difficult access, the plaque also may hinder the availability of calcium, phosphate, and fluoride ions, which in turn may decrease the potential for remineralization.<sup>7</sup>

As time progressed and dentists gained a better understanding of the caries processes, visible clinical signs of white spot enamel lesions offered early indications of patients who were at greater risk for dental problems. Nowadays, clinicians realize that recognition tools are diagnostic tools that allow dentists to gather data that support early intervention and determine clinical decisions. These tools are based on a collective understanding of the caries process and the stages of its progression.<sup>11</sup>

Diagnostic tools include those that are specific to saliva, bacteria, acid production, and ion deficiencies (fluoride, calcium, and phosphate), which have been associated with increased caries risk. Mechanical tools, on the other hand, can evaluate tooth demineralization directly. These tools include laser fluorescence, quantitative light fluorescence, translumination, and digital radiography.<sup>11</sup> Identification in diagnostic tools includes the following:

### Analysis of saliva

An analysis of saliva may provide some important information about appropriateness of secretion rates and the buffering capacity, as well as numbers of both *Streptococcus mutans* and *Lactobacilli*. While bacterial counts may be helpful in assessing populations, they may not be accurate for an individual patient. However, knowing what constitutes the high values for the numbers of colony-forming units (CFU) may provide helpful information in identifying high-risk patients.<sup>1</sup> Several testing kits are available commercially, including GC Saliva Check (GC America, Alsip, etc), which assess unstimulated and stimulated saliva flow rates and pH, as well as the buffering capacity.<sup>10</sup>

### Evaluation of caries activity

Several caries activity tests have been developed to help in detecting the presence of oral conditions associated with an increased risk of caries. For individual patients, currently no single caries activity test can predict caries with a high degree of

certainty. Because many of these tests rely on samples of salivary bacteria, the reliability on such a test is limited because bacteria in the saliva may not necessarily represent the bacteria in the plaque. Another test that measures the plaque index (amount of plaque present) supplemented with an analysis of diet and saliva, has more promise for accuracy than any single caries activity test. Dental radiographs also provide useful information in diagnosing carious lesions.<sup>1</sup>

Laser caries detection, using "DIAG-NOdent" (Kavo) to quantify the amount of organic material in the pits and fissures, allow us to differentiate between stain and decay. This early detection allows the practitioner to easily remove the decay before it has compromised the tooth due to increased dentinal decay proliferation and the resulting undermining of healthy enamel and structural compromise. The early detection will allow the dentists to remove decay without compromising the structural integrity of the tooth, and to restore that tooth with a long lasting, esthetic, and functional material.<sup>8</sup>

### **Understanding the patient's current health, diet, and giving appropriate guidance**

Knowing certain factors pertaining to the patient's history can assist in the diagnosis of caries and identification of high-risk patients. Such factors include age, gender, fluoride exposure, smoking habits, alcohol intake, medications, dietary habits, economic and educational status, and general health. The increase of smoking, alcohol consumption, usage of medications, and sucrose intake results in increasing the risks of caries development. Children and elderly adults have higher risk. Decreased fluoride exposure, lower economic status, lower educational attainment, and poor general health also increase the risks.<sup>1</sup>

### **PREVENTION**

In the noncavitated lesion, to take ad-

vantage of the tooth's capacity to remineralize, one must first alter the oral environment, to tip the balance in favor of remineralization and away from demineralization.<sup>7</sup> Prevention means "to prevent"<sup>16</sup> and oral hygiene is the primary prevention against dental caries.<sup>2</sup> The primary goal of a caries prevention program should be to reduce the numbers of cariogenic bacteria.<sup>1</sup> For the MID concept, this means education and practical oral hygiene guidance, promoting measures to halt the progress of caries, and actively promote remineralization of tooth structure.<sup>16</sup> Non-specific preventive strategies, such as education about the risk of excessive frequency of eating, the use of fluoride in the diet and in dentifrices, education about the benefits of fastidious daily tooth cleaning, are still appropriate.<sup>8</sup> Prevention includes the following:

#### **Plaque removal**

Daily removal of plaque by dental flossing, tooth brushing, and rinsing is the single best measure for preventing both caries and periodontal diseases. Mechanical plaque removal by brushing and flossing has the advantage of not eliminating the normal oral flora. Plaque removal in high-risk patients should be done frequently. Flossing, brushing, and thorough rinsing after every meal is indicated for this group. Patients without active diseases do not need intensive intervention in their self-care program.<sup>1</sup>

#### **Promotion of remineralization using fluoride materials**

Fluoride is often recommended to protect against dental caries.<sup>2</sup> Fluoride in trace amounts increases the resistance of tooth structure to demineralize, and is, therefore, a particularly important consideration for caries prevention. When fluoride is available during cycles of tooth demineralization, it is a major factor in reducing caries activity.<sup>1</sup> Fluoride ions increase the resistance of the hydroxyapatite in enamel and dentine to dissolution by plaque acids<sup>17</sup> by forming fluorapatite.<sup>5</sup>

Fluoride, a cornerstone on modern preventive dentistry, exerts its anti-caries effect by three different mechanisms.<sup>10</sup> First, the presence of the fluoride ion greatly enhances the precipitation of calcium and phosphate ions present in saliva into the structure of fluorapatite. This insoluble precipitate replaces the soluble salts containing manganese and carbonate that were lost because of bacterial-mediated demineralization. This exchange process results in the enamel becoming more acid resistant. Second, incipient, noncavitated, carious lesions are remineralized by the same process. Third, fluoride has antimicrobial activity. In low concentrations, fluoride ions inhibit the enzymatic production of glucosyltransferase. This glucosyltransferase prevents glucose from forming extracellular polysaccharides, and this reduces bacterial adhesion and slows ecologic succession. The intracellular polysaccharides formation is also inhibited, and this prevents storage of carbohydrates by limiting microbial metabolism between the host's meals. Thus, the duration of caries attack is limited to periods during and immediately after eating.<sup>1</sup>

### **Delivery systems for fluoride**

#### ***Fluoridation of water supplies***

The availability of fluoride to reduce caries risk is primarily achieved by fluoridated community water systems.<sup>1</sup> Fluoridation of water supplies, where possible, remains the most effective public health measure for the prevention and treatment of dental decay. This is attributable to the fact that water is a dietary component required and used by everyone, and, therefore, benefits for all sectors of the community.<sup>18</sup> When fluoridated water is the main source of drinking water, a low concentration of fluoride is routinely introduced into the mouth. Some of this fluoride is taken up by dental plaques; some is transiently present in saliva, which serves as a reservoir of plaque fluoride; and some is loosely held on the enamel surfaces.<sup>14</sup>

The optimal fluoride level for public water supplies is about 1 ppm. At 0.1 ppm

or less, the preventive effect of fluoride is lost. The caries rate gets higher in population that is lacking in sufficient fluoride exposure. On the other hand, excessive fluoride exposure (10 ppm or more) results in fluorosis, a brownish discoloration of enamel, termed mottled enamel.<sup>1</sup>

#### ***Fluoridated salt***

Administration of fluoride via salt intake is an alternative where the local situation is not suitable for water fluoridation.<sup>18</sup> Some countries have introduced controlled fluoridated salt as a means of reducing the prevalence of dental caries among their respective populations. Studies have produced consistent data indicating its effectiveness in reducing dental decay.<sup>18</sup> Related to the optimum concentration of fluoride in salt needed to reduce the incidence of dental caries, it must take into account the level of salt intake and the concentration of fluoride in drinking-water in individual geographical areas; however, 200 mg of fluoride/kg of salt has been suggested to be a minimum value.<sup>13</sup>

#### ***Fluoridated milk***

Fluoridated milk has been used as a fluoride source, especially for young children through school programs.<sup>18</sup> The administration of fluoridated milk to children is considered to be a suitable means of increasing their intake of fluoride.<sup>13</sup> Numbers of studies have shown it to be effective.<sup>18</sup>

#### ***Fluoride toothpaste***

Of all the delivery systems in use at present time, fluoride toothpaste has been the subject of the most comprehensive testing. A wide range of well-controlled studies has been carried out and almost all of these have demonstrated considerable reductions in dental decay resulting in greatly improved oral health.<sup>18</sup> Brushing twice a day is a reasonable social norm that is both effective and convenient for most people's daily routines, and this practice has become a basic recommendation for caries prevention.<sup>14</sup> Children who begin using fluoride

toothpastes at age <6 years are at higher risk for enamel fluorosis, because their swallowing reflexes are not always well controlled. Therefore, they should be supervised during brushing, and use only a small amount (e.g. pea-sized portion) of toothpaste.<sup>18</sup> The types of toothpastes include:

- Standard toothpastes usually contain 1000-1450 ppmF. They also contain mild abrasives (such as calcium phosphates, calcium carbonate, and silica) which give the toothpastes their cleaning power. Common ingredients include sodium fluoride, triclosan (which kills germs), and sodium lauryl sulphate (which helps the toothpaste to mix with water).
- Children's toothpastes contain only around 500 ppmF
- Sensitive toothpastes contain around 1450 ppmF; they contain salts of strontium, a chemical substance that is similar to calcium
- Whitening toothpastes contain around 1450 ppmF as well as mild abrasives that may help to remove stains on the tooth surface
- High fluoride toothpastes contain higher concentrations of sodium fluoride (about 2800 ppmF). They are recommended for patients who have high risks of tooth decay<sup>19</sup>

**Fluoridated supplements**

Dietary fluoride supplements in the form of tablets, lozenges, or liquids (including fluoride-vitamin preparations) have been used throughout the world since the 1940s. Most supplements contain sodium fluoride as the active ingredient.

Tablets and lozenges are manufactured with 1.0, 0.5, or 0.25 mg fluoride. To maximize the topical effect of fluoride, tablets and lozenges are intended to be chewed or sucked for 1-2 minutes before being swallowed. For infants, supplements are available as a liquid and used with a dropper.<sup>14</sup>

**Fluoride mouth rinses**

Fluoride mouth rinse is a concentrated solution intended for daily or weekly use. The fluoride from mouth rinse, like that from toothpaste, is retained in the dental plaque and saliva to prevent dental caries. The most common fluoride compound used in mouth rinse is sodium fluoride. Over-the-counter solutions of 0.05% sodium fluoride (230 ppm fluoride) for daily rinsing are available for use by people aged >6 years.<sup>14</sup> Fluoride mouth rinsing is not recommended for children under 6 years of age.<sup>18</sup>

**Fluoride gels**

Professionally applied gels are indicated for individuals at risk of dental decay.<sup>18</sup> Fluoride gel is often formulated to be highly acidic (pH of approximately 3.0). The duration of application for this treatment is 4 minutes. In clinical practice, applying fluoride gel for 1 minute rather than 4 minutes is common, but the efficacy of this shorter application time has not been tested in human clinical trials. Since the usages of such applications are relatively infrequent, generally at 3 to 12 month intervals, fluoride gel poses little risk for enamel fluorosis, even among patients aged < 6 years. Such gels are available as acidulated phosphate fluoride 1.23% (12.3 ppm)

**Table 2.** Dietary fluoride supplement dosage schedule<sup>3</sup>

Age of child	Fluoride dosage (milligrams per day) at fluoride in water concentration of		
	<0,3 ppm	0,3 to 0,6 ppm	>0,6 ppm
Birth to 6 months	None	None	None
6 months to 3 years	0,25	None	None
3 years to 6 years	0,5	0,25	None
6 years to 16 years	1	0,50	None

fluoride, sodium fluoride 0.9% (9.04 ppm) fluoride, and stannous fluoride 0.15% (1 ppm) fluoride preparations.<sup>14</sup>

### **Fluoride varnish**

Highly concentrated fluoride varnish is painted directly onto the teeth. Fluoride varnish is not intended to adhere permanently; this method holds a high concentration of fluoride in a small amount of material in close contact with the teeth for many hours. Fluoride varnish has some practical advantages (e.g., ease of application, non-offensive taste, and use of smaller amounts of fluoride than required for gel applications). Such varnishes are available as sodium fluoride 2.26% (2.26 ppm) fluoride or difluorsilane 0.1% (1 ppm) fluoride preparations.<sup>14</sup>

### **Diet and xylitol gums**

Dietary sucrose has two important detrimental effects on plaque. First, frequent ingestion of foods containing sucrose provides a stronger potential for colonization of *Streptococcus mutans*, enhancing the caries potential of the plaque. Second, mature plaque exposed frequently to sucrose rapidly metabolizes it into organic acids, resulting in a profound and prolonged drop in pH. Caries activity is most strongly stimulated by the frequency, rather than the quantity of ingested sucrose.<sup>1</sup>

Nonfermentable dietary sweeteners, such as xylitol, sorbitol, aspartame, saccharine, are recommended wherever possible. Polyols such as xylitol are "anti-cariogenic," as shown by decreased acid fermentation by *Streptococcus mutans*.<sup>10</sup> Xylitol is a natural five-carbon sugar obtained from birch trees<sup>1</sup> and it is a sweetener that looks and tastes like sucrose but is not fermented by cariogenic bacteria.<sup>20</sup>

It is usually recommended that a patient chews for 5 to 30 minutes, a piece of xylitol gum after eating and snacking. Chewing any sugar-free gum after meals reduces the acidogenicity of plaque because chewing stimulates salivary flow, which

improves the buffering of the pH drop that occurs after eating.<sup>1</sup>

### **Pit and fissure sealants**

Although fluoride treatment is most effective in preventing smooth surface caries, they are less effective in preventing pit and fissure caries. Sealants have three important preventive effects. First, sealants mechanically fill pits and fissures with an acid-resistant resin. Second, since the pits and fissures are filled, sealants deny *Streptococcus mutans* and other cariogenic organisms's preferred habitats. Third, sealants render the pits and fissures easier to be cleaned by tooth brushing and mastication.<sup>1</sup>

The use of sealants is an effective preventive treatment for caries. Indications for the use of sealants are to: (1) prevent caries in newly erupted teeth, (2) arrest incipient caries, (3) prevent odontopathogenic bacterial growth in sealed fissures, and (4) prevent infection of other sites. They should be used on the pits and fissures of patients at high risk for caries as an alternative to restorations.<sup>1</sup>

### **CONTROL**

Even though diagnostic and preventive measures have been improved and more widely used, the repair of destruction caused by the carious process is still necessary for many patients.<sup>1</sup> "Control" means "treatment of caries and maintenance of restored teeth."<sup>16</sup> When the MID's concept is applied, restoration is the last resort.<sup>11</sup> With the MID's concept, only the active caries area is removed (where remineralisation is not possible)<sup>7</sup> and this is a rationale behind the cavity classification system proposed by Mount and Hume.<sup>16</sup>

In accordance with the new paradigm, primary and permanent teeth are restored with minimally invasive restorative protocol and biomimetic materials.<sup>11</sup> Minimally invasive treatment is comprised of aspects in cavity preparation (e.g. air abrasion, laser treatment, and sono-abrasion), caries remo-



val (e.g. selective caries removal, laser treatment) and cavity restoration (e.g. Atraumatic Restorative Treatment, Preventive resin restoration, sandwich restorations).<sup>8</sup> Minimizing the amount of tooth structure removed during cavity preparation preserves natural tooth structure and that means that dentists can rely less on restorative materials. When restorative materials are needed, biomimetic materials that replicate the natural characteristic of enamel, dentin, and cement produce better clinical outcomes.<sup>11</sup>

Adhesive dental materials make it possible to conserve tooth structure by using minimally invasive cavity preparations, because adhesive materials do not require the incorporation of mechanical retention features. The material used in MID is glass ionomer. As cited from Hallgren et al. by Wilding, glass ionomer cements have been shown to release fluoride for a period up to 6 months.<sup>17</sup>

### **Atraumatic Restorative Treatment (ART)**

Atraumatic Restorative Treatment (ART) uses manual excavation of dental caries, which eliminates the need of anesthesia and the use of expensive equipment, and restores the cavity with glass ionomer, an adhesive material that binds to the tooth structure and releases fluoride as it stimulates remineralization. Selected teeth for ART are prepared by removing decay with hand instruments. Then they are restored with FUJI IX, GC glass ionomer (GC, Chicago, Ill) with the press finger technique that automatically places sealants on the occlusal tooth surface. Lopez et. al concluded that ART needed to be considered as a preventive and treatment modality for caries in communities with no dentists.<sup>21</sup>

### **Preparation with high-speed hand pieces**

A high-speed hand piece and small burs are used to prepare the cavity. Clinical studies of these conservative restorations have shown 70 percent survival at an average of seven years.<sup>7</sup>

### **Preparations with air abrasion**

Air abrasion is a technique that uses kinetic energy to remove carious tooth structure.<sup>7</sup> Air abrasion is used to remove the areas of decay in pits and fissures, and to prepare cavities for restoration with adhesive materials.<sup>22</sup> A powerful narrow stream of moving aluminium oxide particles is directed against the surface to be cut. When these particles hit the tooth surface, they abrade it, without heat, vibration, or noise. The particles exit at the tip of the handpiece, so it is an end-cutting device. It has been proposed that air abrasion technology can be used to both diagnose early occlusal-surface lesions and treat them with minimal tooth preparation.<sup>7</sup>

### **DISCUSSION**

In the restorative era, the decision process for managing caries is centered on an almost unconscious planning of which surface to fill and with what kind of material. Classical restorative treatment of dental caries only removes surgically the carious tissue and does not halt the disease itself. As cited from the NHS centre by Pitts, once a restoration is placed, the tooth is likely to be subjected to a series of replacement restorations. On the other hand, restorations have been shown to fail by a number of factors, such as inadequate preparation, marginal failure of the restoration of the tooth leading to secondary caries at approximal sites, which are the principal problems.<sup>23</sup>

Minimum Intervention Dentistry (MID) is the modern medical approach of dental caries management, where restoration of a tooth becomes the last treatment decision rather than a first consideration.<sup>16</sup> The goal of MID is to initially stop the progress of dental caries with preventive caries management, and to empower patients (through information, skills, and motivation) to be in charge of their own oral health.<sup>24</sup> As cited from Mertz-Fairhurst et al. by Bresciani, MID were more favorable than conventional treatments in 10 years of

studies.<sup>25</sup>

However, many dentists are no longer taking only a narrow surgical view, but seeking to apply preventive treatment as the first step to halt the progress of dental caries. As cited from Heidmann by Pitts, in Northern Europe, an overtly preventive philosophy has existed for many years. For example, in the Nordic public dental services, recommendations to be circumspect with operative intervention have long been in place.<sup>23</sup>

As cited from Kidd and Nvyad by Pitts, dentists can and should help their patients preventively in controlling caries and managing their oral health by using a meticulous caries detection, lesion assessment, and diagnosis. Thus, this management will change the face of routine clinical practice. As cited from Fejerskov and Nyvad by Pitts, primary caries prevention will be an important activity at the community, group, and individual level. Thus, the realization that a need for many fillings can be avoided, will be very attractive for many patients.

## CONCLUSION

Preventive treatment care should be more clinically effective than traditional operative care. In MID, dentists give motivation and education that can increase society's scientific understanding about the dental caries process and how this process can be stopped; thus, caries can be prevented and controlled more effectively. With the MID concept, dentists seek to prevent dental caries at the earliest stages and their process in order to avoid invasive treatment. Therefore, the patients only require minimum intervention from the dental profession.

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