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Non invasive treatment of dental caries in primary dentition

A Project Submitted to

The College of Dentistry, University of Baghdad, Department of Pedodontics and Preventive Dentistry in Partial Fulfillment for the Bachelor of pediatric dentistry

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Certification of the Supervisor

I certify that this project entitled Noninvasive treatment of dental caries in primary dentition was prepared by the fifth-year student Mohammed Faris Salman under my supervision at the College of Dentistry/University of Baghdad in partial fulfillment of the graduation requirements for the bachelor's degree in Dentistry.

Lect. Heba N. Yessin

Date:

Dedication

I dedicate my project work to my family. A special feeling of gratitude to my loving mother whose words of encouragement and push for tenacity ring in my ears.

To my beloved friends Aya and karrar

Acknowledgment

First, I thank "Allah" almighty for granting me the will and strength to accomplish this research and I pray that his blessings upon me may continue throughout my life, without "Allah", I would not have had the wisdom or the physical ability to do so...

Deep thanks to **Prof. Dr. Raghad Abdulrazzaq Al-Hashimi**. Deam of the College of Dentistry-University of Baghdad for support to accomplish this review.

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NaF	**Sodium Fluoride**
BPA	**Bisphenol A**
NaOCL	**Sodium Hypochlorite**

Introduction

Traditional methods of caries removal, such as burs and spoon excavators, tend to remove affected as well as infected dentin, because it is difficult clinically to distinguish between the two. Moreover, the use of the drilling as the conventional caries removal and cavity preparation method, other than being painful, can cause deleterious thermal and pressure effects on the pulp **(Maru *et al.*, 2015).**

For the past 20 years traditional operative dentistry has evolved towards a more conservative concept, the main objective of it is the increased preservation of dental tissue. New operative techniques for caries excavation and cavity preparation hade developed, offering less patient discomfort and less tissue removal **(Banerjee et al., 2000; Ricketts and Pitts, 2009).**

Minimally Invasive (MI) treatment can be defined as a conservative approach to control carious lesions with the aim of preserving as much as possible of dental tissues, the MI techniques range over a spectrum of options starting with prevention of the caries process through management of caries disease process to the actual intervention in the resulting carious lesion using both surgical and non-surgical procedures, in a detailed document of experts' consensus statement, an excellent definition of various levels of invasiveness in the available carious lesions management options the non-invasive, micro-invasive or minimally, and invasive strategies however, the authors stated that all of the suggested caries

categories can be managed in a minimally invasive manner **(Schwendicke *et al*., 2019).**

The minimally invasive options of caries management are gaining popularity specifically in pediatric dentistry, the fact that this technique of management is less invasive when compared to conventional treatment, less costly, less time consuming, and maybe more appealing to children and easier to be accepted in pre cooperative and uncooperative groups of children, are the reasons behind the attention given lately to such techniques **(Santamaría *et al*., 2018).**

Aims of the study

The aims of present project were to review the literature for the non- invasive treatment techniques in primary dentition and reveal in detail about the advantages, disadvantages, indications and contraindications of the materials and techniques used for non-invasive treatment in primary dentition.

Chapter One
Review of literature

1.Materials for noninvasive treatment of dental caries

1.1 Fluoride varnish

Fluoride varnishes are topical clinician-applied materials. It has been expansively used all over the world for more than three decades the caries- inhibiting effects of fluoride varnish in both primary and permanent teeth have been proven in several trials (Milsom et al., 2008).

Application of fluoride varnish is considered one of the non-invasive dental procedures that when applied regularly has the capability to prevent and/or arrest early childhood caries recently, the advancement in fluoride products led to several comparisons between fluoride varnish (sodium fluoride), sliver nitrate and silver diamine fluoride, the effectiveness of the use of each separately or in combination has been a major area of fluorides research, the use of 5% NaF showed higher efficacy when combined with silver nitrate or silver diamine fluoride **(Gill *et al*., 2009).**

1.1.1 Indications of fluoride varnish

According to **gill et al., (2009)** the indication of fluoride varnish included the following:

- Fluoride varnish is indicated for all children, adolescents and young adults.

- It is likely to be effective in adults who give cause for concern; those with active caries, dry mouth or special needs.
- The application of varnish forms an essential part of a preventive package which should emphasize dietary advice and twice daily brushing with a toothpaste containing an appropriate concentration of fluoride, as indicated by the prevention toolkit.

1.1.2 Contra-indications of fluoride varnish

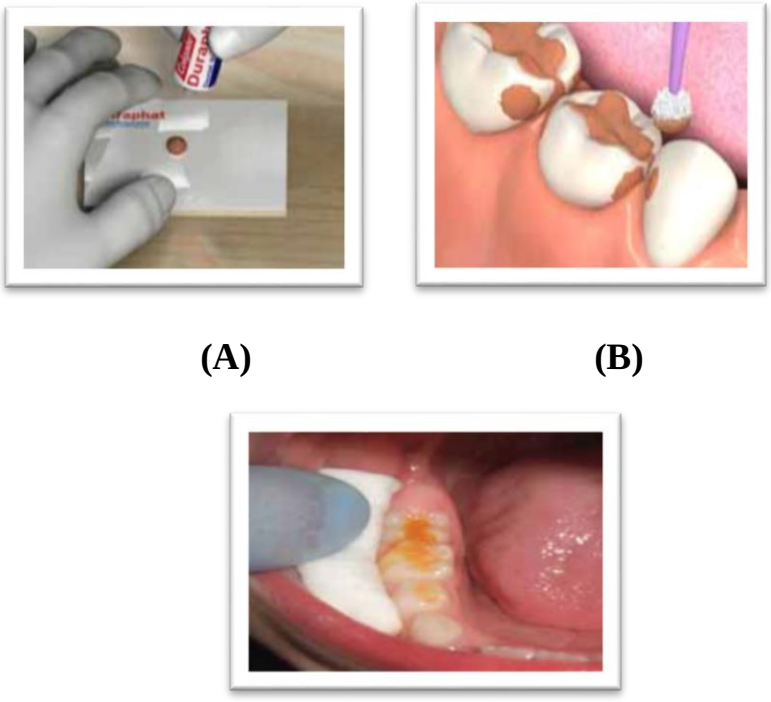
Colgate Duraphat varnish should not be applied to individuals with a history of allergy to any of the constituents. Its use is also contra-indicated in patients with ulcerative gingivitis, stomatitis or a history of severe bronchial asthma which has necessitated hospitalization **(Gill *et al*., 2009).**

1.1.3 Application of fluoride varnishes

The application of fluoride varnishes is not intended to adhere permanently to a tooth but should remain in contact with the surface for several hours. Toothbrushing or wiping and drying with cotton wool rolls or cotton gauze is sufficient to clean the teeth before varnish application; a prophylaxis is not essential **(Gill *et al*., 2009)**.

The high concentration of fluoride in varnishes requires that only a small amount should be applied: Primary dentition − up to 0.25 ml; Mixed dentition − up to 0.4 ml and Permanent dentition − up to 0.75 ml **(Gill *et al.*, 2009)**.

A quantity of varnish covering an area of 5 to 7 mm should be placed on the surface of a dispensing pad as in fig. (1) (A). After isolating the teeth in one of the lower quadrants with gauze or cotton wool rolls, the varnish is applied with a micro applicator, or a fine brush, to the sites where caries is most likely to initiate; the pits and fissures and approximal surfaces as in figure (1) (B). The color tint of the varnish facilitates its application and control as in figure (1) (C). Complete the lower arch before application to teeth in the upper arch **(Gill *et al.*, 2009)**.



(A) **(B)**

(C)

Figure (1) Fluoride varnish application. (A) dispensing (B) application (C) varnish applied to mixed dentition **(Gill *et al.*, 2009).**

1.1.4 Frequency of application

According to **Gill *et al*., 2009** the frequency of application as the following:

- All children, aged 3 years and over, and adolescents should receive applications of fluoride varnish twice yearly.
- All those giving greater concern, for example those with active caries, special needs or those wearing orthodontic appliances, should receive more frequent application.
- Adults giving cause for concern should also receive fluoride varnish two to four times a year.

1.1.5 Patient instructions

According to **Gill *et al*. (2009)** advice patients to:

- To eat and drink normally before attending.
- Not to brush the teeth or chew hard food for at least 30 minutes after varnish application.
- only soft foods and liquids should be consumed for the first four hours after application.

1.2 Silver Diamine Fluoride (SDF)

SDF is a topical fluoride solution that has been used for caries management. Unlike other fluoride products that prevent the formation of new caries, SDF is capable of efficiently halting the caries process **(Gao *et al.*, 2016)**.

Recently, this caries-arresting property of SDF has drawn much attention from dental clinicians and researchers. SDF has shown its clinical success on arresting the coronal caries of the

primary teeth of children, permanent teeth in teenagers, and root caries of the elderly **(Mei *et al.*, 2017)**.

1.2.1 Technique

Dry the affected area then place SDF on it then allow it to dry for one minute, finally rinse the area. Maximum dose is 25 μL (one drop) per 10 kg body wight. most effective result came from application of SDF semi-annually **(Horst *et al*., 2016)**.

1.2.2 Indication of Silver Diamine Fluoride

According to **Horst *et al*., (2016)** the indications of SDF include the following:

1. Extreme caries risk (Xerostomia or Severe Early Childhood Caries).
2. Treatment challenged by behavioral or medical management.
3. Patients with carious lesions that may not all be treated in one visit.
4. Difficult to treat dental carious lesions.
5. Patients without access to dental care.

1.2.3 Contraindication of Silver Diamine Fluoride

It is only contraindicated in patient with allergy to silver. Relative contraindications include any significant desquamative gingivitis or mucositis that disrupts the protective barrier formed by stratified squamous epithelium. Increased absorption and pain would be expected with contact. Heightened caution and use of a protective gingival coating may suffice **(Horst *et al*., 2016)**.

1.2.4 Advantages of Silver Diamine Fluoride

It is efficient, affordable, effective, and safe cariostatic agent and eliminate the need for anesthesia **(Khurshid et al., 2019).**

1.2.5 Disadvantage of Silver Diamine Fluoride

According to **Khurshid, *et al.*, (2019)** the disadvantages of SDF include the following:

1- SDF darkens carious lesions as seen in figure(2).

2- Even a small amount of SDF can cause a “temporary tattoo” to skin (on the patient or provider), like a silver nitrate stain or henna tattoo, and does no harm. Stain on the skin resolves with the natural exfoliation of skin, in 2-14 days.

Figure (2) Staining caused by silver diamine fluoride *(Khurshid et al., 2019)*.

1.3 Pit and fissure sealants

A sealant is a clear or opaque plastic material that is applied to the pits and fissures of teeth where decay occurs most often. The purpose of the sealant is to provide a physical barrier to occlude pits

and fissures and to protect them from bacteria and food. Because the sealant obliterates the deeper and more tortuous anatomy, it also facilitates oral hygiene efforts because the sealed tooth is easier to clean. Although sealants were introduced for preventing caries on occlusal surfaces, they are now considered active agents in controlling and managing initial caries lesions on occlusal surfaces and on approximal surfaces as well **(Spleith, 2010)**.

1.3.1 Types of Sealants

Three types of materials are utilized as sealants: resin, glass ionomer (traditional and resin-modified), and polyacid-modified resins.

1.3.1.1 Glass Ionomer Cement Sealants

Glass ionomer cements have been used as dental sealants. Studies have indicated that they do have the same effective retention rates as those of conventional sealants. It is most frequently used when providing the alternative restorative technique (ART), formerly referred to as the atraumatic restorative technique. This technique is defined as the nondefinitive restorative treatment procedure for caries prevention that involves removal of soft/demineralized tooth tissue using a hand instrument alone, followed by restoration of the tooth with an adhesive restorative material, such as a glass ionomer cement **(Seth, 2011)**

1.3.1.2 Sealants with Bonding Agents

Bonding agents or primers have been added to dental sealant systems. A clinical study conducted over 5 years reported a 50% reduction in occlusal sealant failure and a 66% reduction in buccal–

lingual sealant failure when bonding agents were used. It has been found that in the presence of contamination with saliva, use of bonding under the fissure sealant can reduce microleakage (Feigal *et al*., 2000; Askarizadeh *et al*., 2008).

1.3.1.3 Self-Etching Light-Cured Sealants

A new sealant has been introduced; it contains a self-etching additive, which allows placement of the sealant material after a tooth surface is cleaned by oil- free pumice and dried. After waiting for the etching to occur, the light is placed on the sealant.

This procedure is much faster than previous methods, and these sealants also include fluoride. A clinical study suggested that self-etched sealants had a significantly higher bonding strength than a traditional etch and then seal material. However, another study indicated that a self-etch sealant material provided lower bond strength and more marginal leakage than the control **(Gomes-Silva *et al*., 2008; Wadenya *et al*., 2009).**

1.3.1.4 Fluoride-Releasing Sealants

Fluoride releasing sealants are commonly used in dental treatment as a primary preventive measure against caries. Fluoride from the sealants reduces demineralization and enhances remineralization, thus helping to the prevent initiation and progression of caries **(Bravo, 2005).**

The properties of a fluoride containing sealant that the conventional sealants did not have are better retention rates when compared to the conventional, constant fluoride release for a prolonged period of time and the ability to function as a reservoir

of fluoride ion for enamel and to promote fluorapatite formation in enamel **(Arhakis, 2007)**.

1.3.1.5 Moisture-Resistant Sealants

A moisture-resistant sealant material, that is not composed of glass ionomer cement is available. This material is composed of acrylic resin and does not contain Bisphenol A (BPA) **(Ahovuo-Saloranta *et al*., 2008)**.

1.3.1.6 Colored versus Clear Sealants

Both clear and colored sealants are available. Colored sealants vary from translucent (clear) to white, yellow, and pink. Some manufacturers sell both clear and colored sealants in either the light-curing or auto polymerizing form. The selection of a colored versus a clear sealant is a matter of individual preference. The colored products permit a more precise placement of the sealant with the visual assurance that the periphery extends halfway up the inclined planes. Both the patient and the operator placing the sealant can more accurately monitor retention. A clear sealant, however, could be considered more acceptable **(Hiremath, 2011).**

Some clinicians prefer the clear sealants because they are more discrete than white sealants. Others prefer the white sealants because they are easier to monitor at recall appointments. On the other hand, some clinicians seem to prefer the clear sealants because it is possible to see under the sealant to detect whether a carious lesion is active or advancing. However, no clinical study has comprehensively compared these issues. Some pit-and-fissure sealants actually change color as they become light polymerized.

Color change has not been fully investigated and seems to have only a relative advantage to the dental provider **(Baruah, 2017)**.

1.3.2 Pit and fissure sealants indications

According to **Sreedevi, (2020)** the indications of pit and fissure sealants include:

• The fossa (shallow depression) selected for sealant placement is well isolated from another fossa with a restoration.

• The area selected is confined to a fully erupted fossa even though the distal fossa is impossible to seal because of inadequate eruption.

• The selected tooth has an intact occlusal surface when the contralateral tooth surface (surface of tooth in opposite arch) is carious or restored; teeth on opposite sides of the arches usually are equally prone to caries.

• An incipient lesion exists in the pit-and-fissure area as shown in figure (3).

• Sealant material can be flowed over a conservative class I composite or amalgam to improve the marginal integrity and into the remaining pits and fissures to prevent further recurrent decay.

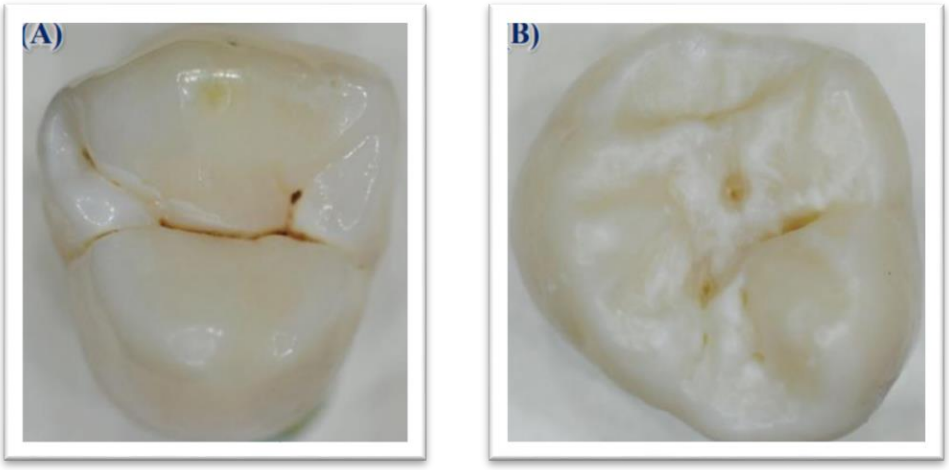


Figure (3) Examples of early, non-activated incipient caries. The premolar exhibits distinct, dark brown early caries (A), while the molar exhibits white demineralization around the pits and fissures and light brown discoloration within the pits and fissures (B). Both of these teeth would be candidates for sealants and would not require mechanical preparation prior to sealant placement **(Nowak, 2019).**

1.3.3 Pit and fissure sealants contraindications

According to **Harris, (2014)** the contraindications of pit and fissure sealants include:

• Patient behavior does not permit use of adequate dry field techniques throughout the procedure.

• An open, frank, carious lesion exists on the same tooth.

• Caries exist on other surfaces of the same tooth in which restoration will disrupt an intact sealant.

• A large occlusal restoration is already present.

1.3.4 Pit and fissure sealants application

For sealant retention, the surface of the tooth must have a maximum surface area, have deep, irregular pits and fissures, be clean, and for most sealant materials, be absolutely dry at the time

of sealant placement and uncontaminated with saliva residue. These are the four commandments for successful sealant placement, and they cannot be violated **(Harris, 2014)**.

1.3.4.1 Surface Cleanliness

The ability of sealants to resist the introduction of caries is determined to a great extent by the integrity of enamel sealant interface such that it prevents microleakage at its periphery; otherwise, the carious process might be supported and continues under the sealant. This in turn depends upon an optimal clinical technique by the dentist; therefore, evaluation should not be limited only to the physical, chemical, or biological acceptance of the material used as a fissure sealant, but emphasis should be placed also on the technique for cleaning and preparing the tooth surface to accept the sealant placement **(Agrawal *et al*., 2012)**.

Methods used to clean the tooth surface include air polishing, use of hydrogen peroxide, polishing with pumice, brushing with a nonfluorinated toothpaste, and use of laser. A clinical study by Agrawal in 2012 concluded that round bur was the most successful cleaning and preparing technique, and that air polishing and air abrasion produced significantly lesser microleakage than the traditional pumice slurry, bristle brush, and longer etching time **(Kanellis *et al*., 2000; Sol *et al*., 2000; Agrawal *et al*., 2012)**.

1.3.4.2 Preparing the Tooth for Sealant Application

The preliminary steps for the light-activated and the auto polymerized resins are similar up to the time of application of the resin to the teeth. After the selected teeth are isolated, they are

thoroughly dried. If a liquid etchant is being used, it is dabbed on the tooth with a small resin sponge or cotton pellet held with cotton pliers. More commonly, a gel etchant would be placed directly on the tooth by the supplied syringe/canula delivery system. Following the manufacturer's direction for etch time is important; typically, 20 to 30 seconds of enamel-etching time is recommended. The etched tooth is then rinsed and dried. the surface area is greatly increased by the acid etch then apply the sealant **(Harris, 2014)**.

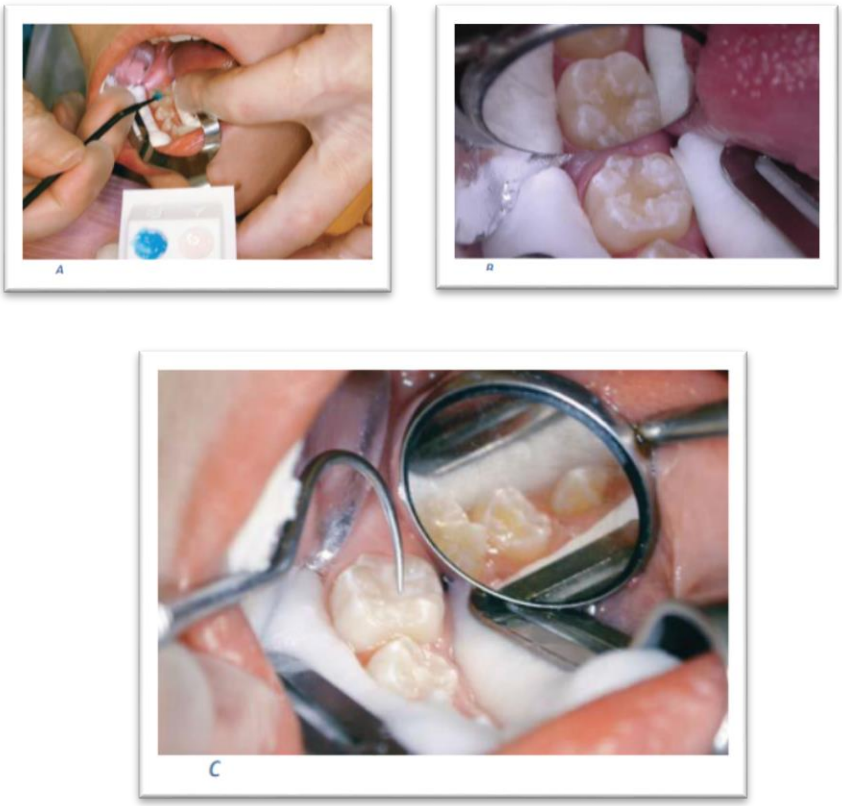


Figure (4): Sealant placement. (A)Gel etchant is applied to teeth, including the lingual cusp on the first molar(B) Etched surface has a "frosty" appearance(C)Application of resin-based sealant **(Harris, 2014).**

1.4 Chemo-mechanical Caries Removal (CMCR)

Chemo-mechanical caries removal is a minimal invasive technique that eliminates infected dentine via a chemical agent. Papain, owing to its proteolytic nature causes disruption of degraded collagen fibrils that helps easy removal of the caries and has both bacteriostatic and bactericidal action **(Tripathi *et a*l, 2014)**.

1.4.1 Indications of CMCR

According to **Jingarwar *et al.*, (2014)** the indications of CMCR include:

- Exposed buccal lesions.
- Very deep carious lesions (potential pulp exposure may be reduced) as well as the treatment of the uncooperative pediatric patient or the older.
- Cervical or root caries.
- Frightened child.

1.4.2 Contraindications of CMCR

According to **Jingarwar *et al*, (2014)** the contraindications of CMCR include:

- Sessions that necessitate short treatment time.
- Pit and fissure caries that are not deep where rotary preparation will suffice to remove caries with little discomfort and the removal of hard tissue part of the lesion.

1.4.3 Types of chemo-mechanical technique

1.4.3 1. Enzyme of chemo-mechanical technique

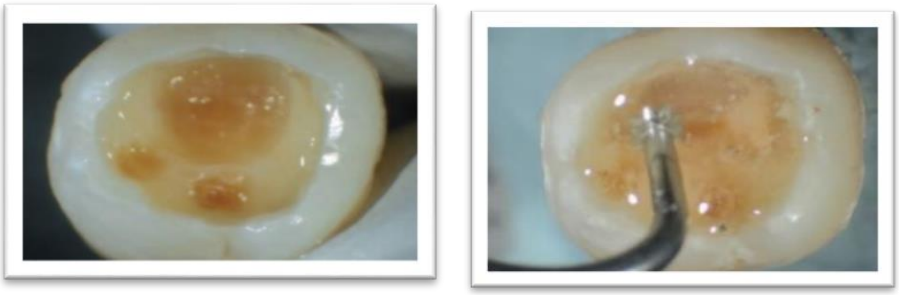
Enzymatic Papain is a proteolytic enzyme. It has bactericide, bacteriostatic and anti-inflammatory characteristics, similarly to the human pepsin, papain that demonstrated acts only in infected tissue because infected tissue lack a plasmatic anti-protease called a1-anti-trypsin, a1- antitrypsin is present only in sound tissue and it inhibits protein digestion. The absence of a1-anti-trypsin in infected tissue allows papain to break the partially degraded collagen molecules. Papain facilitates the cleaning of both necrotic tissues and secretions, as a result, it decreases the time required for tissue recovery and does not damage the sound tissues around the lesion. it derived from fruits of green papaya **(Candido *et al.*, 2003; Mandelbaum *et al*., 2003; Bussadori et al., 2006).**

1.4.3.2Caridex and Carisolv of chemo-mechanical technique

Caridex is a developed from a formula made of N-monochloroglycine and amino butyric acid, it was presented as a two-bottle system; the first contained sodium hypochlorite and the second, glycine, amino-butyric acid, can be use special non-cutting hand instruments offering greater tactile sensitivity to the operator, thus permitting selective infected and affected dentine removal **(Yip *et al.*, 2000).**

Carisolv was introduced as the latest variation of the NaOCl-based chemo-mechanical agents the chemical structure and the mechanism of action of carisolv gel was like caridex, except that

the Mon aminobutyric acid was replaced by three different amino acids (glutamic, leucine and lysine). The chemical result of these processes is a breakdown of degraded collagen characteristically found in the demineralized portion of a carious lesion. The gel only softens the carious dentine, while healthy tissue is unaffected. The degraded collagen has an open structure and is therefore more susceptible to penetration by carisolv and this dentin can be easily scraped off. An example of minimally invasive (MI) caries excavation using carisolv gel figure (5**) (Hamama *et al.*, 2014; Jingarwar *et al.*, 2014).**



(A) **(B)**

Figure (5). (A) initially clear, slightly viscous Carisolv (B) prepared cavity with affected dentine **(Banerjee, 2013)**.

2. Mechanical technique of caries Removal

2.1Air abrasion

Air-abrasion is a dental operative technique used for the removal of enamel and dentine during cavity preparation, units are capable of minimally invasive tooth preparation using aluminum oxide (α-alumina) **(Banerjee and Watson, 2002; Banerjee *et al.*, 2011; Banerjee, 2013).**

2.1.1Advantages of air abrasion

According to **Banerjee *et al*., 2000; Imran *et al*., (2011)** the advantages of air abrasion include:

- Less need for anesthesia (no needles).
- Reduced patient apprehension.
- Rapid cutting (efficient, effective).
- Precise (controlled cutting, pinpoint accuracy).
- Less heat, noise, and vibration.
- Better bonds (increased bond strength to all materials).
- Can work in all four quadrants within the same appointment, increasing office efficiency.
- Minimally invasive access conserves and preserves sound tooth structure.

2.1.2 Disadvantage of air abrasion

Air abrasion did not gain much attention because it lacked the ability to accurately prepare cavity margins and there were concerns regarding the dust particles affecting the eyes of the patients and the dentists **(Boyde, 1984)**.

2.1.3 Contraindications of air-abrasive treatment

The contraindications of air-abrasive treatment According to **Rainey, (2002)** comprised :

1. Severe dust allergy.
2. Asthma.
3. Chronic pulmonary disease.
4. Recent extraction.

5. Oral surgery.

6. Any open wound, lesion, or sore, or sutures in the mouth

7. Recent periodontal surgery or advanced periodontal disease with a compromised periodontal attachment.

8. Recent placement of orthodontic appliances with resulting oral abrasions.

9. Sub-gingival caries removal.

10. Any condition that would place the patient at greater risk for emphysema by using compressed air in the mouth.

2.1.4 Therapeutic use of air abrasion

According to **White and Eakle, (2000)** the Therapeutic use of air abrasion include:

1. Removal of superficial enamel defects – these are much easier with the air abrasives since they result in removal of less tooth structure than the drill.

2. Air abrasion is an excellent tool for detection of pit and fissure caries when clinical, radiographic, and patient risk factors make pit and fissure caries suspect, air abrasion can be used to remove the organic debris and determine if caries is present. use of burs for this procedure would remove far more sound enamel than the few micrometers removed with air abrasion as in figure (6).

3. Air abrasion can also be used for the removal of pit and fissure surface stain on enamel before placement of a resin-based composite restoration or porcelain veneers.

4. Teeth where the caries is restricted only to a small section of the tooth can also be prepared using air abrasives for conservation of

sound tooth structure, box-preparations for Class II cavities can also be prepared.

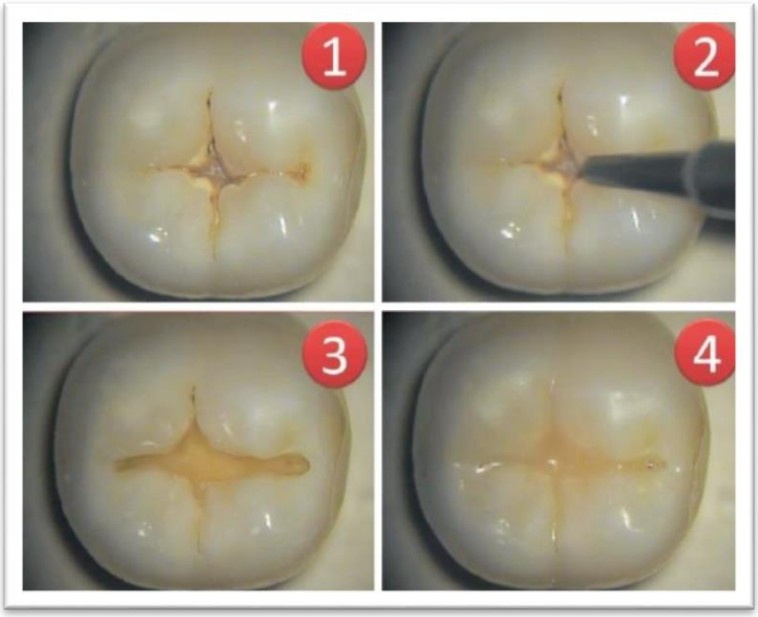


Figure (6) Air abrasion used to remove pit and fissure caries and then restoration with composite **(White and Eakle, 2000).**

5. Reduce the micro-leakage of the sealants because it provides a very rough enamel surface which improves the retention of bonding materials.

6. Removal of existing restorations – the particles of the air abrasives can be used at higher pressures for removal of old amalgam restorations for replacing them or for removal and repair of composites, glass ionomers, and porcelain restorations as in figure (7).

7. The use of local anesthesia while working in dentin may be avoided because of their cooling action through high pressure air.

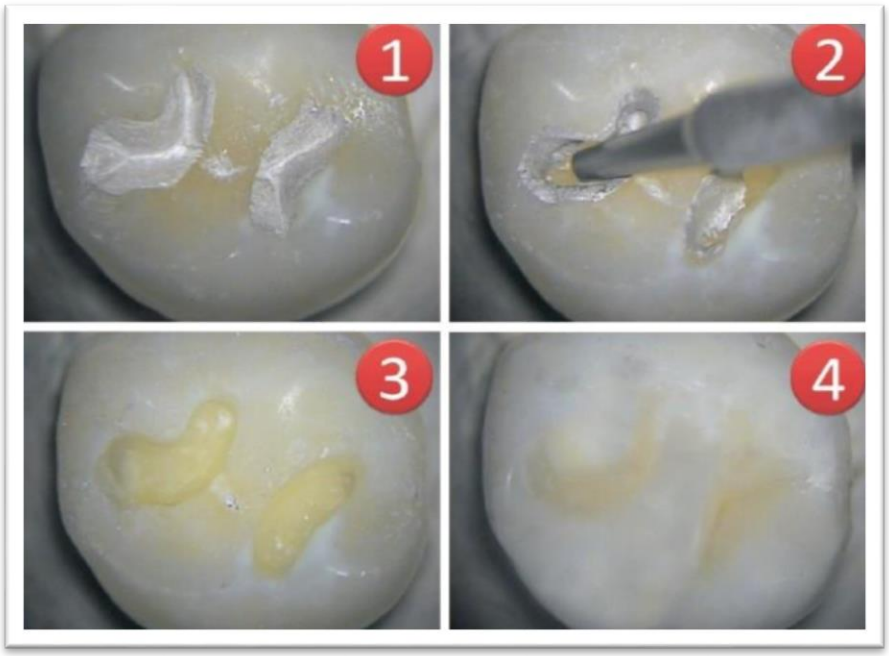


Figure (7) Air abrasion used to remove old amalgam restoration (White and Eakle,2000).

2.2 Sonic abrasion and ultrasonic abrasion

Sonic and ultrasonic tips have been declared useful for precise and controlled removal of both caries and unsupported hard tissue free of caries. Sonic and ultrasonic instruments remove caries by abrading hard and soft dental tissues with oscillating diamond-coated tips, both oscillating abrasion systems are cooled with a water spray **(Sheets and Paquette,2002)**.

Sonic abrasion the sonic tips also execute low-frequency (6000Hz) elliptic oscillations generated by an air scaler insert. Ultrasonic abrasion the ultrasonic tips carry out high-frequency

linear oscillations, ranging from 6500 to 40000Hz, powered by piezo-driven inserts **(Stefano *et al.*, 2018)**.

2.2.1Advantages of sonic and ultrasonic abrasion

According to **Weisrock et al, (2011)** the advantages of sonic and ultrasonic abrasion include:

- Preservation of the adjacent proximal surface.
- Preservation of the marginal ridge (slot and tunnel cavity).
- Using the same sonic hand-piece as for periodontal scaling, natural aesthetics preserved.
- Initial penetration with diamond burs for ultrasonic.
- Minimizing or eliminating noise, vibration, heat and pressure.

2.2.2 Disadvantages of sonic and ultrasonic abrasion

According to **Tassery *et al.*, (2013)** the disadvantages of sonic and ultrasonic abrasion include:

- The effectiveness of the device depends on the hardness of the dental tissue.
- operator-dependent, the outer carious dentine is better removed with a round steel bur mounted on a low-speed motor or with a manual excavator for ultrasonic.
- Proximal surface is more difficult to preserve in comparison to the sonic device, in regard to the effectiveness of the ultrasonic vibrations.
- requires specific type of water cooled hand-piece for sonic.

2.2.3 Therapeutic use of sonic and ultrasonic abrasion

2.2.3.1 Occlusal mini-cavities:

The sono-abrasive preparation of the occlusal pits and fissures. can be obtained by a working tip convoluted to remove caries, if the fissures involved by caries the bur ball or 'champagne cork' shaped tip of small diameter can be used. If the pit involved by caries and the caries extends beyond the dentino-enamel junction (DEJ), the round bur which had multi-blade carbide tips for excavating carious dentine can be used as in figure (8) **(Neves *et al*., 2011).**

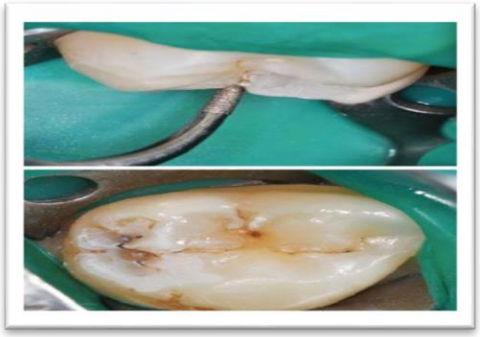


Figure (8) Sonic for pits and fissures caries **(Neves et al, 2011).**

2.2.3.2 Approximal mini-cavities:

The sono-abrasion preparation of the small approximal cavities. We can use a round diamond bur to open the enamel of the tooth mesial or distal, the bur tip simultaneously creates the 'mini-cavity' and finishes the cervical and proximal edges as in figure (9) The main advantage of this technique is the prevention of iatrogenic damage to the adjacent tooth **(Hugo *et al*., 2001)**.

Figure (9) Approximal mini-cavities preparation **(Hugo *et al.*, 2001).**

2.2.3.3 Cervical mini-cavities:

Direct access in the cervical third of the buccal and lingual surfaces for a hemispherical instrument allows the selective removal of enamel or dentine that cannot be retained, while preserving the periodontal tissue. The tip can be used in the embrasure area if the lesion extends inter-proximally and sonic abrasion is suitable for treating cervical lesions that generally have relatively hard secondary tissue surfaces, Sonic abrasion does not prevent the formation of smear layer, however, some studies have reported open

tubules with no smear after treatment with it as in figure (10) **(Yazici *et al.*, 2002).**

Figure (10) Cervical mini-cavities preparation **(Yazici *et al.*, 2002).**

2.2.3.4 Treatment of altered enamel smooth surfaces:

Sono-abrasion is a technique for selectively eliminating unsightly defects of enamel structure while preserving adjacent healthy tissue. These surface micro-preparations then require to be protected by directly or indirectly bonded partial veneers, which provide a good aesthetic integration for a minimal loss of tissue **(Decup and Lasfargues, 2014)**.

2.2.3.5 Treatment of advanced lesions:

The concept of minimal intervention dentistry can now be applied to any act of restorative dentistry which is based on preservation of tissue and facilitates hard tissue and pulp self-repair **(Decup and Lasfargues, 2014)**.

2.2.3.6 Aesthetical restorative dentistry:

Another indication for sono-abrasion is the preparation and finishing of the visible margins of cosmetic ceramic or indirect composite restorations. Sonic and ultrasonic techniques can be used for spot elimination of tissue defects, preparation and finishing of cervical margins and recontouring restorations **(Decup and Lasfargues, 2014)**.

2.3 Atraumatic restorative treatment (ART)

ART is defined as a minimal intervention care approach with the aim of preventing the development of carious lesions and of stopping their progression into dentine. A second aim is to restore dentine carious lesions in a minimally invasive way **(Frencken, 2017)**.

2.3.1 Advantages of ART

According to **Fejerskov *et al.*, (2009)** the advantages of ART include:

1. Reducing dental anxiety in children and the population at large, and most probably.
2. Reducing the level of stress in dentists when treating children.
3. Little or no pain or discomfort to the patient, even without anesthesia.
4. Substantial period, sealants may have a long-lasting caries-preventive effect.
5. Prevention of caries and gingivitis, through tooth brushing using affordable fluoride-containing toothpaste or operative and caries preventive management, removes only useless tooth tissue which

minimizes damage to adjacent tooth surfaces when compared with the use of rotary instruments.

2.3.2 Indications of ART

Indication of ART consists of two components according to **Frencken, (2017)** include:

1. A preventive atraumatic restorative treatment (ART sealant).
2. A restorative atraumatic restorative treatment (ART restoration).

ART sealant involve sealing and infiltration of non-cavitated carious lesions, along with the strong evidence on the use of sealants to prevent dental caries in children at different risk levels, this simple dental procedure is also effective to stop lesion progression, sealants impair nutrient acquisition from the oral environment by invading bacteria which results in a reduction in the number and viability of microorganisms under the material over time, thus arresting the lesion **(Ahovuo *et al.*, 2004 ; Oong *et al.*, 2008 ; Frencken *et al.*, 2012).**

Recently, a new system of lesion infiltration has been developed to seal proximal lesions in a tri-dimensional fashion using a low-viscosity light curing resin **(Meyer *et al.*, 2012)**.

ART selants can be use also with non-cavitated occlusal carious lesions sealed with a high-viscosity glass-ionomer sealant in a non-clinical setting ART sealant was effective in avoiding lesion progression over a period of 6 years. It has been claimed that a composite resin sealant is highly sensitive technique, requiring strict

moisture control during placement with the use of rubber dam **(Bishara *et al.*, 2002; Giacaman *et al.*, 2018)**.

ART can be used also with several non-cavitation measures by cleaning the occlusal surfaces with a toothbrush and fluoridated toothpaste, application of a fluoride varnish, application of a chlorhexidine varnish, the most appropriate measure depends on the ability of the child and parent to co-operate with the cleaning regimen. In certain countries, primary healthcare workers have been trained in ART and appear to produce good results **(Yee, 2001; Fejerskov *et al.*, 2009).**

ART restorations involve the creation of sufficient access to the cavitated dentine carious lesion for removal of soft, completely demineralized (decomposed) carious tissue with hand instruments. This action is only needed if the cavity is small. The cavity is then cleaned and restored with an adhesive dental material that simultaneously seals any remaining at-risk pits and fissures as in figure (11) **(Holmgren *et al.*, 2013; Frencken, 2017).**

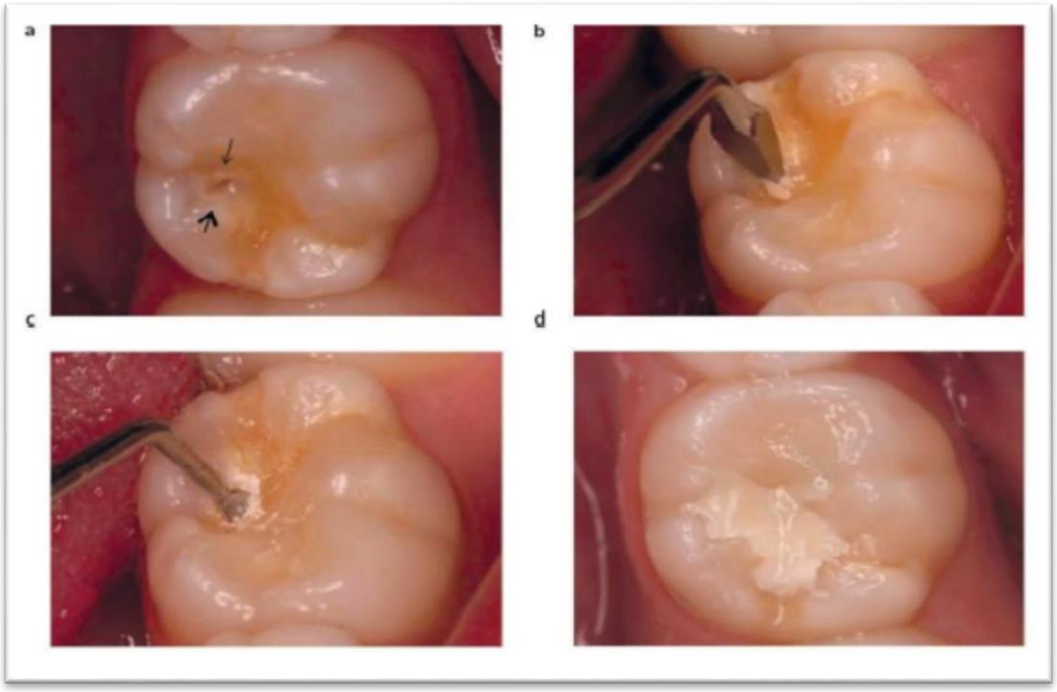


Figure (11) ART restoration method **(Frencken, 2017).**

Chapter Two

Conclusion

1. The preservation of the remaining tooth substance is more important than the meticulous replacement of that which has been lost.
2. The profession of dentistry has a better understanding of prevention of dental diseases along with the technical advancement in the bioactive and adhesive materials but there is reluctance in a wide group of dental professionals to use these techniques the reason for this reluctance can be attributed to lack of knowledge and adequate training to use such procedures.
3. A major factor affecting the decision to use such treatment techniques is the cost and of the equipment and the consumable materials and items.

References

- Ahovuo-Saloranta A., Hiiri A., Nordblad A., MÄKELÄ M., Worthington H. V. (2008). Pit and fissure sealants for preventing dental decay in the permanent teeth of children and adolescents. Cochrane Database of Systematic Reviews.
- Agrawal A., Shigli A. (2012). Comparison of six different methods of cleaning and preparing occlusal fissure surface before placement of pit and fissure sealant: An in vitro study. Journal Of Indian Society of Pedodontics and Preventive Dentistry. 30 (1).
- Arhakis A., Damianaki S., Toumba J. (2007). Pit and Fissure Sealants: Types, Effectiveness, Retention, and Fluoride Release: A Literature Review. Balkan Journal of Stomatology.
- Banerjee A, Watson T F, Kidd E A. (2000). Dentine caries excavation: a review of current clinical techniques. Br Dent J; 188: 476–482
- Banerjee A, Watson TF. (2002). Air abrasion—its uses and abuses. Dental Update; 29:340.
- Banerjee A, Thompson ID, Watson TF. (2011).Minimally invasive caries removal using bio-active glass air-abrasion. Journal of dentistry. 1;39(1):2-7.
- Banerjee (2013)., british dental journal; 214: 107-111 3.
- Baruah Q., Thumpala K., Singh S., Baruah K., Tiwari R., Dixit H. (2017). A Review on Pit and Fissure.

- Bishara SE, Oonsombat C, Ajlouni R, Denehy G. (2002).The effect of saliva contamination on shear bond strength of orthodontic brackets when using a self-etch primer. Angle Orthod.;72(6):554–557.
- Boyde A. (1984). Air polishing effects on enamel, dentine, cementum and bone.; 156:287-91.
- Bravo M., Montero J., Bravo J., Baca P., Llodra C. (2005). Sealant and fluoride varnish in caries: A randomized trial. J Dent Res. 84 (12).
- Decup F, Lasfargue JJ. (2014). Minimal intervention dentistry II: part 4. Minimal intervention techniques of preparation and adhesive restorations. The contribution of the sono-abrasive techniques. British dental journal. Apr;216(7):393.
- Feigal R., Musherure P., Gillespie B., Levy-Polack M., Quelhas I., Hebling J. (2000). Improved sealant retention with bonding agents: a clinical study of two-bottle and single-bottle systems. Journal of Dental Research. 79 (11).
- Fejerskov, Ole, and Edwina Kidd, eds. (2009). Dental caries: the disease and its clinical management. John Wiley & Sons.
- Frencken JE, Holmgren CJ. Atraumatic restorative treatment for dental caries. Nijmegen: STI Book BV, 1999.
- Frencken JE, Pilot T, Songpaisan Y, Phantumvanit P. (1996). Atraumatic restorative treatment (ART): rationale, technique and development. J Public Health Dent; 56: 135–40.

- Frencken JE, Leal SC, Navarro MF. (2012). Twenty-five-year atraumatic restorative treatment (ART) approach: A comprehensive overview. Clin Oral Investig.;16(5):1337–1346.
- Frencken JE. (2017). Atraumatic restorative treatment and minimal intervention dentistry. British dental journal. Aug;223(3):183.
- Gao SS, Zhao IS, Hiraishi N, Duangthip D, Mei ML, Lo ECM, and Chu CH. (2016). Clinical trials of silver diamine fluoride in arresting caries among children a systematic review. JDR clinical and translational research. 1, 201 – 210.
- Gill et al, (2009). "The Application of Fluoride Varnish in the Prevention and Control of Dental Caries ".
- Gomes-Silva M., Torres P., Contente G., Oliveira M., Palma-Dibb G., Borsatto C. (2008). Bond strength of a pit-and-fissure sealant associated to etch-andrinse and self-etching adhesive systems to saliva-contaminated enamel: individual vs. simultaneous light curing. Brazilian dental journal, 19 (4).
- Hamama HH, Yiu C, Burrow M. (2014). Current update of chemomechanical caries removal methods. Australian dental journal;59(4): 446-56.
- Harris N., Garcia-Godoy F., Nathe C. (2014). Primary Preventive Dentistry. 8 th Edition. United States. Pearson Education Limited.
- Hiremath S. (2011). Textbook of Preventive and Community Denstiry. 2nd Edition. New Delhi. Elsevier.

- Holmgren CJ, Roux D, Domejean S. Br Dent J. (2013). Minimal intervention dentistry: part 5. Atraumatic restorative treatment (ART)–a minimum intervention and minimally invasive approach for the management of dental caries.;214(1):11–18.
- Horst J, Ellenikiotis H, and Milgrom P.(2016). UCSF Protocol for Caries Arrest Using Silver Diamine Fluoride: Rationale, Indications and Consent. Journal of the California Dental Association. 44, 16 - 28.
- Hugo B, Stassinakis A, Hofmann N, Schmitz B, Klaiber B (2001). In vitro study of marginal quality of small approximal composite fillings.; 111: 19–27.
- Jingarwar MM, Bajwa NK, Pathak A. JCDR. (2014). Minimal intervention dentistry–a new frontier in clinical dentistry. Journal of clinical and diagnostic research: Jul;8(7): ZE04.
- Kanellis J., Warren J., Levy S. M. (2000). A comparison of sealant placement techniques and 12-month retention rates. Journal of public health dentistry. 60 (1).
- Khurshid Z, Najeeb N, Zafar M, and Sefat F. (2019). In Advanced dental biomaterials. Duxford: Woodhead Publishing, an imprint of Elsevier. 675 - 699.
- Mandelbaum SH, Santis EP, Mandelbaum MHS. (2003). Cicatrization: current concepts and auxiliary resources – PartII. A Bras Dermatol; 78(5):525–542.

- Maru P, Shakuntala B and Nagarathna C. (2015). Caries Removal by Chemomechanical (Carisolv™) vs. Rotary Drill: A Systematic Review. The Open Dentistry Journal. 9, 462 - 472.
- Mei M, Ito L, Cao Y, Li QL, Lo EC, and Chu CH. (2013). Inhibitory effect of silver diamine fluoride on dentine demineralisation and collagen degradation. Journal of dentistry. 41, 809 - 817.
- Meyer-Lueckel H, Bitter K, Paris S. (2012). Randomized controlled clinical trial on proximal caries infiltration: Three-year follow-up;46(6):544–548.
- Milsom et al, (2008). "The incidence of dental caries in the primary molar teeth of young children receiving National Health Service funded dental care in practices in the North West of England.
- Molars" (2018): 2.5-year outcomes of a randomised clinical trial.; 51:605-614.
- Neves A, Coutinho E, De Munck J, Van Meerbeek B. (2011). Caries-removal effectiveness and minimal-invasiveness potential of caries-excavation techniques: a micro-CT investigation. J Dent; 39: 154–162.
- Nowak A., Christensen J., Marby T., Townsend J., Wells M. (2019). Pediatric dentistry: infancy through adolecense. 6th Edition. China. Elsevier.

- Policy on interim therapeutic restorations (ITR). (2008). American Academy on Pediatric Dentistry Council on Clinical Affairs. 30.
- Ricketts D N, Pitts N B. (2009). Novel operative treatment options. Monogr Oral Sci; 21: 174–187.
- Santamaría et al, (2018). "Alternative caries management options for primary.
- Schwendicke et al, (2019)." When to intervene in the caries process?" An expert Delphi consensus statement. Clin Oral Investig.
- Sheets CG, Paquette JM. (2002). Ultrasonic tips for conservative restorative dentistry. Dent Today; 21:102.
- Sreedevi A., Mohamed S. (2020). Sealants, Pits and Fissures. StatPearls.
- Stefano Cianetti, Iosief Abraha, Stefano Pagano, Eleonora Lupatelli, Guido Lombardo, (2018). Sonic and ultrasonic oscillating devices for the management of pain and dental fear in children or adolescents that require caries removal: a systematic review. BMJ Open;8: e020840.
- Tassery H, Levallois B, Terrer E, Manton DJ, Otsuki M, Koubi S, et al, (2013). Use of new minimum intervention dentistry technologies in caries management; 1:40–59.
- Tripathi RS, Pathak K, Pharm Dev Technol. (2015). Nov;20(7):801-811.

- Weisrock G, Terrer E, Couderc G, et al, (2011). Naturally aesthetic restorations and minimally invasive dentistry. J Minim Interv Dent; 4:23–35.
- Yazici A R, Ozgunaltay G, Dayangac B. (2002). A scanning electron microscopic study of different caries removal techniques on human dentin. Oper Dent; 27: 360–366. ultrasonic tips.
- Yee R. An. (2001). ART field study in western Nepal. Int Dent J; 51: 103–8.
- Yip H K, Stevenson A G, Beeley J A. (2000). Chemochemical caries removal: a review of the techniques and latest developments. British Dental Journal.;188(8):427–30.