ISSN: 2581-5989

International Journal of Dental Science and Innovative Research (IJDSIR)

IJDSIR : Dental Publication Service

Available Online at: www.ijdsir.com

Volume – 1, Issue – 1, May - June - 2018, Page No. : 06 - 13

An Era from Extention for Prevention to Constriction with Conservation

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Type of Publication: Original Research Paper

Conflicts of Interest: Nil

Abstract

A change has occurred from G.V. Black's "Extension for prevention" to "Prevention of extension" .This could be made possible by the clinician with the help of various new techniques and materials. Thus, the concept of "minimally invasive dentistry" came into picture. It has given emphasis on preservation and remineralization of tooth structure. This has given invent to the various new material which mimic the natural tooth structure. This paper focuses on various techniques, equipments and materials which has made the clinician easy to conserve as much sound tooth structure as possible without consuming much time.

Keywords: Prevention**,** RMGI, Ozone,PRR, ART, Laser, Smart materials.

Introduction

Cavity preparation according to Black's concept of 'Extention for prevention' has now been changed to the principle of 'Constriction with Conservation'.[1] Martin et al in 2000 has given the term 'Minimal intervention', 'Minimally invasive', or 'Preservative dentistry' to the aforementioned concept.[1] The term "Minimal Intervention Dentistry" has been given to describe a new approach to the treatment of the disease of caries as it is a bacterial disease and must be treated as such.[2]

This Minimally invasive dentistry is defined as 'The maintenance and monitoring of oral health through continuous care, comprising comprehensive preventive management, a longitudinal approach to any necessary operative intervention'. Effective minimally invasive dentistry involves both patient specific as well as patient centered. "Extension for prevention" has given way to new paradigm of minimally invasive dentistry, which is modified from that described by Tyas & colleagues includes the following concepts:

1. Early caries diagnosis.
2. Classification of caries depth.
3. Assessment of individual caries risk (high, moderate, low).
4. Reduction of cariogenic bacteria to decrease risk of further demineralization and cavitation.
5. Arresting of active lesions.
6. The remineralization & monitoring of non cavitated arrested lesions.
7. The placement of restorations in teeth with cavitated lesions, using minimal cavity designs.
8. Repair instead of replacement of defective restorations.
9. Assessing disease management outcomes at pre-established intervals.[3]

As the pattern of attack of carious lesion and its progression through enamel and dentine has been understood since many years, its treatment modalities have also been dictated. However, surgical approach given by GV Black is now recognized as being too destructive to be used as the first line of defense. This approach is highly

inefficient because it does not lead to the elimination of cause of the disease rather it leads to a continuing process of replacement dentistry wherein the cavity just gets larger, and the restoration is subjected to an increasingly heavy load and the tooth gets weaker.[4]

There is no doubt that the old concept of "extension for prevention" is now being discarded but there is need for further investigation of cavity designs to take concept of "constriction with conservation" its place.[5,6,7] There is a basic problem in the concept of GV Black classification that it only identifies the position of a lesion and prescribes a cavity design irrespective of the size and extent of the lesion. This leads to standard amount of tooth structure removal whether involved with the disease or not. Thus resulting in large cavity preparation than needed and subsequent replacements will the material will still be larger.[8] This unsatisfactory work is taken into account with the proposed new classification, to the advantage of both the patient and to the profession.

Cavity Classification[9]

The classification table is illustrated below:

size / site	No cavity (0)	Minimal (1)	Moderate (2)	Enlarged (3)	Extensive (4)
Pit/fissure (1)	1.0	1.1	1.2	1.3	1.4
Contact area (2)	2.0	2.1	2.2	2.3	2.4
Cervical (3)	3.0	3.1	3.2	3.3	3.4

Lesion site:

Site 1- The pits and fissures on enamel smooth surfaces. It involves buccal pits on mandibular molars, lingual grooves on maxillary molars, and erosion lesions on the incisal edges of anterior teeth and occlusal surface of posterior teeth. It includes all the lesions of Black's class I classification.

Site 2- The contact area between any two teeth, anterior or posterior. This includes all the Black's class II, class III and class IV lesions.

Site 3- The cervical margin around the gingival tissue. It includes Black's class V lesions and also the exposed root surfaces on mesial and distal aspect due to gingival recession.

Lesion size

Size 0- Lesion show signs of demineralization but cavitation have yet not occurred.Size 1- Minimal lesion requiring operative intervention, just beyond healing by remineralization.

Size 2- Moderate or a little larger cavitations having sufficient sound tooth structure to support a plastic restorative material.

Size 3- Enlarged cavity that has extended to the stage where use of restorative material is must to support the remaining tooth structure through a protective cavity design.

Size 4- Extensive cavity having loss of bulk of tooth structure such as a cusp or an incisal edge.

The main advantage of this classification is that it overcomes for the further modification of Black's classification. Minimal cavity design such as Slot and Tunnel preparation are also taken into account.[9]

Slot preparations are used for lesions that are 2.5 mm less from the marginal ridge.[10,11] Glass ionomer, composite or amalgam are used for such preparation. If required, a preventive resin or glass ionomer restoration can be placed over the occlusal surface.[12] In cases where the lesions are more than 2.5 mm from the marginal ridge, a tunnel preparation is used. Initial access is gained through the fossa immediately medial to the marginal ridge.[13] It should not be under occlusal load. A small tapered cylindrical bur is used for the lesion, after which a long shanked bur is held in an upright position to increase the visibility. Small round burs and hand instruments are then used to complete the preparation. Glass ionomer is the material of

choice, as some of the demineralized inter proximal area is not removed, and inter proximal enamel is not beveled.

Minimally Invasive Techniques

1- Non-Invasive Techniques

Fluorides

Focuses on prevention of caries and conservation of demineralized but non-cavitated enamel and dentine. In these cases, elimination of bacteria and their by-products occur which aids in the remineralization process- Example- Fluorides. Fluoride is applied in the form of:

1. Professional topical application of fluoride (Solutions, Gels, Forms and Varnishes)[5]
2. Self- applied topical fluoride in the home[14]
3. Fluoride mouth rinses
4. Fluoride dentrifices
5. Fluoride uptake[15]

- Intra oral fluoride releasing device
- Use of fluoride complexes
- Use of fluoride containing polyelectrolyte's
- Role of surface active agents on fluoride-enamel interactions
- Self gelling liquid fluoride
- Additive protective effects of combination of fluoride and chlor hexidine

Preventive/Prophylactic Fissure Sealants

Simonsen and Stallard first reported the concept of prophylactic fissure sealants or preventive resin restoration in 1977[16]. Preventive resin restoration utilizes both the invasive as well as non- invasive treatment modalities for borderline or questionable caries. The preventive resin restoration is a natural extension of the occlusal sealants. It replaces the preventive approach of sealant therapy for caries - susceptible pits and fissures with the therapeutic restoration of incipient lesion with composite resin that occur on the same occlusal surface.

Types of preventive resin restoration as given by Simonsen are as follows: [16]

Type A

Type B and

Type C

Type A: Involves suspicious pits and fissures where caries removal is limited to enamel. Unfilled sealants are used in such condition.

Type B: Comprises of incipient lesions in dentin which are small and confined. Dilute composite resins are used.

Type C: Filled composite resins are used. Greater exploratory preparation of caries is needed. Also local anesthetic application and liner placement is required.

Technique of Preventive Resin Restoration

It is based on acid etch technique similar to those of sealant placement without the removal of caries. Deep stained pits and fissures are polished so as to remove stains. Higher retention rates are possible because of the fact that fissure enlargement results in increased surface layer for etching, thus eliminating organic material surface layer and a thicker sealant can be placed.

Ozone

Ozone is the non invasive technique to treat carious lesion. It has powerful antimicrobial property. Significant reduction of pathogenic bacteria associated with caries was seen in vitro. It can be used alone or in addition to other preventive or invasive measures.[17] Furthermore, quantitative reduction in the total amount of microorganisms was found in the oral cavity. Photo dissociation of ozone occur naturally into activated ions (O-), which in turn react with other oxygen molecules to form a transient radical anion (O3). Ozone then decomposes into hydroxyl radical. Thus, ozone oxidizes biomolecules such as cysteine, methionine, histidine, disrupting microbial cell wall in minutes leading to immediate cell lysis.[18] 10 sec to 20 sec time period is

sufficient to destroy microbes, a 40 sec treatment time covers all eventualities.

Advantages are as follows

It is a non-invasive technique and does not induce fear. It is painless and involves no drilling. Complications are rare and less follow up are needed.

Conclusion:

It is of great advantage in dentistry but not a remedy for every problem.

Selectively Invasive Interventions

Glass ionomer materials as sealants

There was a quest for material which releases fluoride landed up into glass ionomer cement. This fluoride releasing property of glass ionomer cement gives it an extra benefit to the retentive blocking of the fissure. However, no data has been found which supports the use of glass ionomer sealants in preference to resin sealant. (Simonsen, 2002)16. Whether the development of the resin-modified glass-ionomer (RMGI) cements can challenge the resin sealants in terms of retention remains a question. RMGI wears markedly more than the resin sealant even after having high fatigue bond strength. However, fissures sealed with glass ionomer are more resistant to demineralization even after macroscopic sealant loss. This is due to the combined effect of fluoride released by glass ionomer and residual material at the bottom of the fissures. Simonsen (1996) indicated that retention of resin based sealants is better than glass ionomer cement but prevention of caries remains the same.

Atraumatic Restorative Treatment (ART)

As the name suggests this treatment procedure is atraumatic to the tooth. Word atraumatic means it provide minimal or no trauma to the tooth. The procedure involves the removal of soft and demineralized tooth tissue, with the help of hand instruments alone, followed by restoration with an adhesive restorative material, usually glass-ionomer cement. This technique is recommended by the World Health Organization for bringing dental treatment to people who would not normally have access to dental care. It was also developed as a means of treating dental caries in areas where extraction would otherwise prevail. This has stressed for achieving the goal of retaining as many teeth as possible for all people, also called as "**Teeth for life**".

The technique follows the concept of minimal intervention over extension by hand excavation of carious lesion and not using electrically driven equipments.[19] It is not used in the presence of abscess or fistula near the carious tooth, also when pulpal involvement is present. The technique cannot be performed in chronically inflamed and inaccessible cavities (carious lesion that cannot be reached by hand instrument).[20]

Chemo-mechanical caries removal[21]

Chemomechanical caries removal is the best method for caries excavation, and the removal agents are either sodium hypochlorite (NaOCl)- or enzyme-based. The NaOCl-based agents include Caridex and Carisolv, and the enzyme-based agents include Papacarie and Biosolv.

The currently available chemomechanical caries removal methods are viable alternatives to conventional rotary instrument methods .It is extremely useful in very anxious, disabled and paediatric patients. However, as a means of conserving caries-affected dentine, chemomechanical caries removal is more successful than conventional rtary instruments.

Caridex and Carisolv

In 1976, Goldman & Kronman, reported the removal of carious material chemically by using N-monochloroglycine (NMG, GK-101)[22]. After consequetive modifications the caridex system, containing N-

monochloro D, L-2-amin-obutyrate (NMAB, GK-101E), was introduced[23]. Carious dentine is softened by NMAB (GK-101E) and readily removed by lightly abrading its surface with the help of applicator tip. In deciduous teeth, addition of urea to the solution significantly improves carious dentine excavation as compared with some control solution without urea[24-25.]

Carisolv gel was then introduced and is specifically designed for non-cutting hand instruments to abrade the carious dentine surface. This gel consists of two carboxy methycellulose based gels: a red gel containing 0.1M amino acids (glutamic acid, leucine and lysine), NaCl, NaOH, erythrosine (added in order to make the gel visible during use); and a second containing sodium hypochlorite (NaCl – 0.5% w/v). Both are thoroughly mixed in equal parts at room temperature and then applied, onto the exposed carious dentine to leave a hard, caries free cavity. The solution has a pH of around 11 & it is said that positively and negatively charged groups on the amino acids become chlorinated and disrupt the collagen cross linkage in the matrix of carious dentine. The gel consistency allows the active molecules access to dentine for a longer period of time than the irrigating solution in caridex system. The gel also has a mechanical lubricating action for the hand instrument which will further enhance the removal of soft tissue.[26]

Comparison of Caridex and Carisolv[27]

	Caridex	Carisolv
Solution I	1% NaOCl	0.5% NaOCl
Solution II	0.1M aminobutyric 0.2 acid, glycerine	0.1M glutamic acid/ leucine/lysine
	0.1M NaCl	Carboxymethyl cellulose
	0.1M NaOH	
Dye	-	Erythrocin (pink)
pH	11	11
Physical properties	Liquid	Gel
Volume needed	100-500ml	0.2-1.0 ml
Time required	5-15 mins	5-15 mins
Equipment required	Applicator unit	None
Instruments	Applicator tips	Specially designed
Time remaining after mixing	1 hour	20 minutes

Papacarie

Proteolytic agent(papain) and sodium hypochlorite can be used to degrade the partially demineralized and altered dentin matrix (infected dentin), thus facilitating its removal and preventing damage to the affected dentine. The papain enzyme is a plant derived cysteine protease of broad proteolytic activity. The papain gel breaks down the partially degraded collagen molecules & contributes to the degradation and elimination of the "mantle" fibrin formed by the carious process. This selective interaction is due to lack of an antiprotease (1-anti-trypsin), which inhibits protein digestion in sound collagen based tissues[28-30]. A new papain based chemomechanical caries removal agent is – Carie Care.

Selective Drilling Fissurotomy

Advancement in the enameloplasty sealant technique is the invention of fissurotomy bur system. In this technique, the shape and size of the burs are designed to treat pit and fissure lesions. The head length is 2.5mm so as to cut just below the DEJ and no further. The tapered shape of the bur engages only few dentinal tubules and is designed to minimize heat buildup and vibration. Traditional cutting

burs remove more enamel and get access into the cavity well beyond the DEJ.

Air Abrasion

It is a pseudo-mechanical method of caries removal involving bombardment of tooth surface with high-velocity Aluminum oxide particles, carried in a stream of air[31].The coarseness of the abraded surface is directly proportional to the size of the abrasive particle – harder and larger the size of the particles, greater is the roughness in the final finish due to high kinetic energy[32-33].

Comparison between conventional "extension for prevention" dentistry and micro Dentistry[34]

Rotary drill	Air abrasion
Deep angular cavity preparation	Remove only affected tooth material
Designed to retain filling material	Adhesive-bonded restorations
Amalgam fillings	New recognition of key
Rudimentary understanding of tooth material	Anatomic structural features of teeth

Conclusion

An exciting new world of materials and technologies is revolving around the dentistry making it more affective for the individual. However, therapeutic methods for the control of disease are available which are supposed to be the first line of defense. Several existing methodologies enable successful management of dental caries by risk assessment. The successful use of these technologies would require extensive retraining of clinical dentists. And this will dramatically change the way a dentist diagnose, intervene, treat and manage caries with major benefits to the oral health of patients.

References

[1]. Shobha Tandon -Textbook of Pedodontics. 2nd edition, 312-314.

[2]. Thylstrup and Fejerskov, eds -Textbook of clinical cariology. Copenhagen: Munksgaard. 1994.

[3]. Tyas MJ, Anusavice KJ, Frencken JE and Mount GJ- Minimal intervention dentistry: a review. FDI Commission Project 1-97. Int Dent J 2000; 50(1): 1-12.

[4]. Black GV. A Work on Operative Dentistry: The Technical Procedures in Filling Teeth. Chicago: Medico Dental Publishing Company; 1908.

[5]. Hunt PR. Micro-conservative restorations for approximal carious lesions. J. Am. Dent. Assoc. 1990; 120: 37 -40.

[6]. Knight GM. The tunnel restoration- nine years of clinical experience using capsulated glass-ionomer cement. Aust. Dent. J. 1992; 37: 245-251.

[7]. Arrow P, Riordan PJ. Retention and caries preventive effects of a GIC and a resin based fissure sealant. Commun. Dent. Oral Epidemiol. 1995; 23: 282-285.

[8]. Reynolds EC, Walsh LJ. Additional aids to the remineralisation of tooth structure. In: Preservation and Restoration of Tooth Structure. 2nd Ed. Eds Mount & Hume, Knowledge Books and Software, Brisbane, 2005, Chapt. 8.

[9]. Mount G and Hume W- A revised classification of carious lesions by site and size. Quintessence Int 1997; 28(5).

[10]. Mount GJ, Hume WR. Basic principles for cavity design. In: Mount GJ, Hume WR, editors. Preservation and restoration of tooth structure. Sandgate (Qld): Knowledge Books and Software; 2005. p. 145–62.

[11]. Mount GJ, Hume WR. Vital pulp therapy. In: Mount GJ, Hume WR, editors. Preservation and restoration of tooth structure. Sandgate (Qld): Knowledge Books and Software; 2005. p. 299–308.

[12]. Nicholson JW. Evidence-based approach to minimal restorative intervention for early carious lesions. Tex Dent J 2003; 120(10):960–9.

[13]. Mount GJ. Glass-ionomer materials. In: Mount GJ, Hume WR, editors. Preservation and restoration of tooth

structure. Sandgate (Qld): Knowledge Books and Software; 2005. p. 163–98.

[14]. Albrektsson TO, Bratthall D, Glantz P & Lindhe J- Tissue preservation in caries treatment. J Dent Res 2010: 205-219.

[15]. SG Damle– Textbook of Pediatric Dentistry, 3rd edition.

[16]. Simonsen R- Pit and Fissure sealants: Review of the literature. J Clin Pediatr Dent 2002; 24(5): 393 – 414.

[17]. Stockleben and Carsten- HealOzone - A Revolution in Dentistry, In: Ozone: The Revolution in Dentistry, Edward Lynch edition. Quintessence Int, UK 2004: 215-241.

[18]. Bayson, Aylin, Lynch and Edward- The use of ozone in dentistry & medicine. Primary dental care April 2005; 12(2): 47-52.

[19]. Frencken JE, Songpaisan Y, Phantumvanit P, Pilot T- An atraumatic restorative treatment (ART) technique: evaluation after one year. International Dental Journal; 1994, 44(5): 460-464.

[20]. Anusavice K- Does ART has a place in preservative dentistry? Community Dent Oral Epidemiol 1999; 27(6): 442-448.

[21]. H Hamama, C Yiu and M Burrow- Current update of chemo mechanical caries removal methods. Australian Dental Journal Volume 59, Issue 4, pages 446–456, December 2014.

[22]. M Goldman, JH Kronman. A preliminary report on a chemomechanical means of removing caries. J Am Dent Assoc. 1976; 93(6): 1149–1153.

[23]. SG Schutzbank, J Galaini, JH Kronman, M Goldman, RE Clark. A comparative invitro study of GH-101 & GK-101E in caries removal. JDR. 1978; 57(9-10):861–864.

[24]. HK Yip, AG Stevenson, JA Beeley. An improved reagent for chemo mechanical removal of dental caries in permanent & deciduous teeth: an invitro study. J Dent. 1995; 23(4):197–204.

[25]. HK Yip, AG Stevenson, JA Beeley. Chemomechanical removal of dental caries in deciduous teeth: further studies in vitro. BDJ. 1999; 186(4 spec.no):179–182.

[26]. D Ericson, R Bornstein, B Gotrick, H Raber, M Zimmerman. Clinical multicentre evaluation of a new method for chemomechanical caries removal. Caries res. 1998; 32(3):308.

[27]. McComb D- Systematic review of conservative operative caries management strategies. J Dent Educ 2004; 65(10): 1154-1161.

[28]. J Thomas, SM Partridge. The chemistry of connective tissues. 5. The elastase activity of proteolytic enzymes. Biochemical Journal. 1960; 74:600–607.

[29]. SK Bussadori, LC Castro, AC Galvao. Papain gel: A new chemomechanical caries removal agent: JCPD.2005; 30(2):115–119.

[30]. ML Flindt. Allergy to alpha-anaylise & papain. Lancet. 1979; 30; 1(8131):1407–1408.

[31]. RB Black. Technic for non-mechanical preparations of cavities & prophylaxis. J Am Dent Assoc.1945; 32: 955–965.

[32]. HD Norton. The 'airdent' Machine: Some personal observations. Br Dent J. 1951; 91:268–269.

[33]. HD White, FA Peyton. Effects of air abrasive in prophylaxis. J Am Dent Assoc. 1954; 49(2):155–163.

[34]. Rainey T. Air abrasion: An emerging standard of care in conservative operative dentistry. Dent Clin North Am 2002; 46: 171-184.

[35]. G Horning. Clinical use of air powder abrasive. 1987;Compend cont educ Dent 19878:652–661.

[36]. AD Walmsley, AR Williams, Core L. The air powder dental abrasive unit – an evaluation using a model system. J Oral Rehabil. 1987; 14(1):43–50.

[37]. A Boycle. Air polishing effects on enamel dentine & cement. Br Dent J. 1984; 156(8):287–291.

[38]. PS Newman, RA Silverwod, AE Dolby. The effects of an airbrasive instrument on dental hard tissues, skin and oral mucosa. Br Dent J. 1985; 159(1):9–12.

[39]. RM Lubow, RL Cooley. Effect of air-powder abrasive instrument on restorative materials. Journal of prosthetic dentistry. 1986; 55: 462–465.

[40]. AG Nielson, JR Richards, RB Wolcott. Ultrasonic dental cutting instrument: I. J Am Dent Assoc.1955; 50(4):392–399.