Alternative Restorative Therapy: An ‘ART’ in Conservative Treatment

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ABSTRACT
The number of studies investigating atraumatic restorative treatment (ART) approach has increased in recent years. This tissue preservative treatment approach appears to be less traumatic and is, therefore, more patient-friendly than conventional caries treatments. The investigations have shown that the ART approach is effective for the management of single-surface cavities in both deciduous and permanent dentitions. There appears to be no difference in survival results between ART restorations and amalgam restorations. This article gives a brief overview of ART.

Keywords: Atraumatic restorative treatment, Conventional treatment, Glass-ionomer cement, Tooth preservation.


INTRODUCTION
The need to develop a new approach to oral care for use in economically less developed countries was most strikingly reinforced by World Health Organization’s (WHO) regional advisor for oral health for the African region SA. Thorpe, in his keynote address at the seventh meeting of the Southern and Eastern African section of (IADR), held in Harare in 1992. He commented that: ‘More than 90% of dentinal lesions in Africa go untreated’. Implied in Thorpe’s statement is that, because restorative care is not available to the majority of Africans, teeth are left to decay to the extent that they become painful and have to be removed. In common with most economically less developed countries and regions, extraction is the predominant oral care procedure performed by both dentists and dental therapists.1

The prevalence of dental caries has shown changing patterns in different parts of the world. The WHO global data bank indicates improvements in most industrialized nations and deterioration for most developing countries, where it is becoming a public health problem. Dental caries is virtually left untreated in the majority of populations in these economically underdeveloped countries, often leading to many large painful cavities. If any treatment is provided at all, it is in the form of extraction. The main reason for not providing care revolves around the need for expensive dental equipment and extensively trained personnel. There has been a general lack of appropriate techniques to allow primary healthcare under conditions that provide no electricity or dental equipment.2

The atraumatic restorative treatment (ART) technique for dental caries is an innovative, largely pain free, minimal intervention approach for treating carious teeth, particularly in countries where highly trained dentists and electricity needed for clinical equipment are not readily available or affordable.3 The ART technique is based on removing infected tooth material, using only hand instruments and filling the subsequently clean cavity with adhesive material, such as glass-ionomer. The development has led to a shift from the concept of ‘disease’ (filling holes in teeth) toward that of ‘health’ (trying to preserve the teeth and gums through small intervention and oral health promotion activities).

The technique was developed in Tanzania in the mid 1980s and has also been field tested in north-eastern Thailand now for more than 3 years.1,2

HISTORY
Minimal or small cavity design was proposed by black almost 100 years ago, when he meticulously developed and tested the principles for restorative management of dental caries. It was advised that for artificial restorations to be successful, they must be very minutely (accurately) performed.2,4 Cavities must be absolutely dry and clean when restorations are placed and the restorations must hermetically seal the cavities if recurrences of decay are to be prevented. Extension for prevention only applies to
smooth surfaces, never to occlusal surfaces. Extension of cavity should be done to secure smooth margins of the restoration.\textsuperscript{3,5}

This tooth preservation method was followed by the development of the sealant­restoration or preventive resin restoration and the preventive glass­ionomer restoration, thereby starting the current movement for tooth preservation.\textsuperscript{1}

The WHO adopted ART as a principle theme on World Health Day for the opening session of the year of oral health in April 1994. Since then, interest in ART from all parts of the world has been overwhelming. The ART field trials are in progress in 11 countries and a further 17 countries have plans to begin them.\textsuperscript{2}

\textbf{New Approach for Controlling Dental Caries}

The treatment approach that can provide curative care to disadvantaged populations is called ‘ART’. The ART consists of an elementary technique of caries removal using hand instruments only, combined with the use of a modern restorative material with adhesive characteristics.

Currently, glass-ionomers that leach fluoride and minimize the onset of secondary caries, are used. The often cited disadvantages of glass-ionomers, namely low wear resistance and strength, are minimized because the cavity preparations of the ART technique usually result in relatively small restorations. Furthermore, new glass-ionomers with improved wear resistance and strength are being developed specifically for the ART technique.\textsuperscript{6}

\textbf{PRINCIPLES OF ART}\textsuperscript{2}

The two main principles of ART are as follows:

- Removing carious tooth tissues using hand instruments only, and
- Restoring the cavity with a restorative material that sticks to the tooth.

The reasons for using hand instruments rather than electric rotating handpieces are as follows: \textsuperscript{2,7}

- It makes restorative care accessible to all population groups.
- The use of a biological approach, which requires minimal cavity preparation that conserves sound tooth tissues and causes fewer traumas to the teeth.
- The low cost of hand instruments as compared to electrically driven dental equipments.
- The limitation of pain that reduces the need for local anesthesia to a minimum and reduces psychological trauma to patients.
- Simplified infection control. Hand instruments can easily be cleaned and sterilized after every patient.

The reasons for using glass-ionomer are: \textsuperscript{1}

- As the glass-ionomer sticks chemically to both enamel and dentine, the need to cut sound tooth tissue to prepare the cavity is reduced.
- Fluoride is released from the restoration site to prevent and arrest caries.
- It is rather similar to hard oral tissues and does not inflame the pulp or gingiva.

The ART can be applied when there is a cavity involving the dentin and is accessible to hand instruments. The ART should not be used when:

- There is presence of swelling (abscess) or fistula (opening from abscess to the oral cavity) near the carious tooth.
- The pulp of the tooth is exposed.
- Teeth have been painful for a long time and there may be chronic inflammation of the pulp.
- There is an obvious carious cavity, but the opening is inaccessible to hand instruments.
- There are clear signs of a cavity, e.g. in a proximal surface, but the cavity cannot be entered from the proximal or the occlusal directions.

\textbf{DESCRIPTION OF THE ART TECHNIQUE}

As with any other oral treatment procedure, ART requires a proper patient-to-operator position. This requirement usually is not a problem in a dental surgery, but requires particular attention in other working environments.\textsuperscript{8}

Since its inception, the ART technique has undergone revisions aimed at improving the basic technique. Unlike many other restorative procedures, usually there is no need to give local anesthesia when using the ART technique because temperature-induced pain from using a drill is avoided. Because the technique mainly involves the removal of decalcified tooth tissue, pain can be minimized, and often does not occur at all. Thus, fear of dental procedures is reduced.\textsuperscript{2,9}

\textbf{Atraumatic Restorative Treatment Techniques}

According to the ‘ART—WHO manual (1994)’,\textsuperscript{2} before actually starting the ART, the following preparations should be made:

- Set up a good working environment.
- Know the essentials of the glass-ionomer cement (GIC).
- Know how to select the proper instruments and to maintain infection control.

\textbf{Work Position Setting}\textsuperscript{2,10}

Oral healthcare tasks often require precise work and high levels of control and are performed in restricted
situations. The position of both the operator and patient is very important in achieving a very successful restoration.

A description of the most appropriate position for both oral examination and treatment is as follows:

**Operator’s Work Posture and Position**

A desirable position for the operator is one in which the body is in a static position, with the back straight, and the hands and fingers that control the work brought to a midline position.

**Chairside Assistant Position**

The assistant works at the left side of the operator and does not change position relative to the patient. The assistant sits as close to the patient support as possible, facing the operating point. The assistant’s head should be 10 to 15 cm higher than the operator so that the assistant can see the operating field and can pass the instruments when needed.

**Patient’s Position**

A patient lying on the back on a flat surface will provide safe and secure body support as well as comfort and stable position for lengthy periods of time. The comfort of the patient also depends on the correct head rest which can be made of soft foam or rubber ring with a cover. The patient can assist the operator by tilting or turning the head and opening the mouth wide enough to provide access to the area of operation. These three movements need to be varied to improve access and vision during oral care procedure.

**Essential Instruments and Materials**

The essential instruments and materials needed to carry out the ART have been listed in Tables 1 and 2.

**Treatment Material**

The material used for restoring cavities and sealing surfaces is the glass-ionomer cement. A brief description of the properties, characteristics and working mechanism of glass-ionomer as a restorative material are discussed hereby.

The glass-ionomer cements (GICs) were introduced to the profession by Wilson and Kent in 1971; they provided adhesion to both enamel and dentin through an ion exchange with the additional benefit of a continuing fluoride release throughout the life of the restoration. Acceptance of the early versions was slow because of perceived problems with water exchange, poor color range and a lack of translucency. The new Fuji IX glass-ionomer cement is being widely used in the ART of caries control in developing countries; developed in 1990s and successfully manufactured since then by GC Corporation for the ART. The Fuji IX GIC exploits self-cure and caries inhibiting properties of GIC at minimal resources, and Fuji IX GP is one of these specially designed formulations that can be handled in field conditions. Main advantages of the material, no shrinkage on setting and native adhesion to dentine, are as typical for GIC. It exhibits efficient antibacterial activity. High viscosity on mixing due to large preset ratio of powder to liquid provides with reasonable mechanical strength and low moisture sensitivity, which are otherwise known poor attributes of GICs. High concentration of fluoride in the glass formulation provides beneficial fluoride release over time that could be extended or regulated via exposing to fluoride containing media, e.g. toothpastes, fluoridated water, etc.³,¹⁵

Due to its fast setting, easy handling and good performance, this material now widely dominates in the ART

<table>
<thead>
<tr>
<th>Table 1: Instruments used in ART</th>
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<tbody>
<tr>
<td>Mouth mirror</td>
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<tr>
<td>Explorer</td>
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<tr>
<td>Pair of tweezers</td>
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<tr>
<td>Dental hatchet</td>
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<tr>
<td>Spoon excavator (small)</td>
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<tr>
<td>Spoon excavator (medium)</td>
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<td>Spoon excavator (large)</td>
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<tr>
<td>Applier/carver</td>
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<tr>
<td>Glass slab or paper mixing pad</td>
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<td>Spatula</td>
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<table>
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<th>Table 2: Materials used in ART</th>
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<tbody>
<tr>
<td>Cotton wool roll</td>
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<tr>
<td>Cotton wool pellet</td>
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<tr>
<td>Clean water</td>
</tr>
<tr>
<td>Glass-ionomer restorative material</td>
</tr>
<tr>
<td>Liquid, powder and measuring spoon</td>
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<tr>
<td>Dentin conditioner</td>
</tr>
<tr>
<td>Petroleum jelly</td>
</tr>
<tr>
<td>Wedge</td>
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<tr>
<td>Plastic strip</td>
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<tr>
<td>Articulation paper</td>
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<tr>
<td>Others</td>
</tr>
<tr>
<td>Examination gloves</td>
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<tr>
<td>Mouth mask</td>
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<tr>
<td>Operating light</td>
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<tr>
<td>Operation bed/headrest extension</td>
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<tr>
<td>Stool</td>
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<tr>
<td>Methylated alcohol</td>
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<tr>
<td>Pressure cooker</td>
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<tr>
<td>Instrument forceps</td>
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<tr>
<td>Soap and towel</td>
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<tr>
<td>Sheet of textile</td>
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<tr>
<td>Sharpening stone and oil</td>
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</tbody>
</table>
A study for the effects of GIC restorations on demineralization and remineralization of enamel and dentin lesion, it was concluded that the fluoride released from GIC or the decreased permeability as a result of hypermineralization causes lower susceptibility of the dentin of the cavity walls.3

**Anticariogenic property:** Glass-ionomer cement presents a broad anticariogenic effect and may be of value in preventing secondary caries, even under conditions of high caries risk.3

**Longevity:** The clinical longevity of GIC was shown to be very acceptable and appeared to be equal or superior to that of other direct restorative materials.3

**Physical properties:** A study done for measuring the compressive, tensile and shear bond strengths to enamel and dentin of a conventional ART-GIC (Fuji IX) and two resin modified GICs (Fuji plus, and advance) reported that Fuji IX had the highest compressive strength and the resin modified advance had the lowest strength.2,3

**Antimicrobial action:** The GIC restorative margins have been found to have lower levels of *Streptococcus mutans* and plaque, which suggests that plaque formed on GIC restorations has less potential to induce recurrent caries. Studies link the antibacterial effect to fluoride ion release, which reduces the plaque’s acidogenicity that does not favor *S. mutans*. The fluoride release from GICs is greatest in the first few days after placement, after which it decreases to a constant level over a prolonged period.3

For obtaining antibacterial GICs for ART based on Fuji IX, incorporation of 1% chlorhexidine diacetate has been shown to give appropriate antibacterial, physical and bonding properties while not affecting mechanical properties, bonding abilities or setting time.
the treatment of single-surface dentinal lesions in both deciduous and permanent dentitions. It is concluded that the ART approach is beneficial in improving the oral health of many, not only in developing but also in more advanced countries.

REFERENCES