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## **Atraumatic restorative treatment: A review**

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**Abstract**--Dental caries is a sugar-dependent disease that damages tooth structure and, due to loss of mineral components, may eventually lead to cavitation. Dental caries is the most prevalent disease worldwide and is considered the most important burden of oral health. To overcome the limitations of conventional restorative treatment, the Atraumatic Restorative Treatment (ART) was developed, mainly for treating caries in children living in under-served areas of the world where resources and facilities such as electricity and trained manpower are limited. ART is a minimally invasive approach which involves removal of decayed tissue using hand instruments only, without use of anaesthesia and electrically driven equipment, and restoration of the dental cavity with an adhesive material (glass ionomer cement (GIC), composite resins, resin-modified glass-ionomer cement (RM-GICs) and compomers). The ART approach so far has mainly used high-viscosity glass-ionomer as the sealant and restorative material.

**Keywords**--atraumatic restorative treatment (ART), glass-ionomer cement, adhesives, sealants.

**Introduction**

Currently, ART is defined as a minimally invasive care approach in preventing dental caries and stopping its further progression. It consists of two components: sealing cariesprone pits and fissures and restoring cavitated dentine lesions with

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sealant-restorations<sup>1</sup>. The placement of an ART sealant involves the application of a high-viscosity glass ionomer that is pushed into the pits and fissures under finger pressure. An ART restoration involves the creation of sufficient access to the cavity for the removal of soft, completely demineralised (decomposed) carious tooth tissues with hand instruments. This is followed by restoration of the cavity with an adhesive dental material which simultaneously seals any remaining pits and fissures that remain at risk. The placement of an ART sealant involves the application of a high-viscosity glass ionomer that is pushed into the pits and fissures under finger pressure.

Opening the cavity with rotating instruments, followed by cleaning it with hand instruments and restoring it with an adhesive restorative material, is not considered ART nor can calling it modified ART be justified<sup>2</sup>. Conventional glass polyalkenoate (ionomer) restorative cement (GIC) is the material of choice that has been used for ART and ITR. This is because of its fluoride-releasing properties, including its ability to bond to enamel and dentine, its pulpal biocompatibility, and its ease of manipulation<sup>3,4</sup>. Moreover, resin-modified glass ionomer cement (RMGIC) performed better than conventional glass ionomer in ART and ITR because of its increased wear resistance<sup>5</sup>.

## **Contents**

### **What is the ART Technique?**

A detailed description of the ART technique can be found in the work of Frencken et al.<sup>6</sup> It usually requires no anaesthetic, combines both restorative and preventive care, and causes minimal discomfort to patients. The technique has been tried extensively in field studies in developing countries and as a result has been adopted by many nations. The technique involves the removal of decalcified dental tissues using only hand instruments: the prepared cavity is then restored with glass-ionomer cement. Newer types of glass-ionomer cements developed specifically for ART are now available.<sup>7</sup>

### **Indications For Use**

ART is used in cases when routine dental treatment cannot be performed because of a lack of facilities or accessibility to a dental clinic.<sup>8</sup> In addition, ART can be used in schools as a community measure to control caries in a large number of children.<sup>9</sup> ART can be used in both primary and permanent teeth.<sup>10</sup>

### **Definition and Materials**

ART is a treatment strategy that requires trained personnel and suitable materials for its success.<sup>11,12</sup> ART is best performed using glass ionomer cement (GIC). GIC (such as Fuji IX, GC Int.) is a glass polyalkenoate cement that consists of calcium or strontium alumino-fluoro-silicate glass powder and water-soluble polymer.<sup>13,14</sup> Several factors led to the selection of GIC as a suitable material for ART. These factors included its fluoride-releasing properties, its ability to bond to enamel and dentine, its pulpal biocompatibility, and its ease of manipulation.<sup>3</sup> The fluoride-release from GIC seems to be advantageous for ART. Fluoride that is released

from GIC makes the tooth structures (enamel and dentine) more resistant to acidic invasion by bacteria.<sup>15,16</sup>

## **Principles of Application**

### **Patient Positioning**

A comfortable patient/operator position should be adopted to meet individual patient needs—for example, it may be necessary to lie the patient flat on the bed/couch or prop him/her into a suitable sitting position. The technique can be adapted to suit any working position, as long as there is suitable access to the oral cavity and both patient and operator are comfortable. An adequate light source is mandatory.<sup>17</sup>

### **Operative Procedure**

- Isolate the tooth to be restored with cotton wool rolls.
- Clean the tooth with water and cotton wool pledgets.
- Widen the entrance to the lesion (if small to begin with) with hand instruments (hatchets).
- Remove all carious tissues with an excavator.<sup>17</sup>
- Clean the cavity and occlusal surfaces with cotton wool pledgets and water.
- Provide pulpal protection with calcium hydroxide liner if necessary.<sup>17</sup>
- Condition the cavity walls and occlusal surfaces of the tooth according to the manufacturer's instructions.
- Mix the glass-ionomer cement according to instructions and insert the material into the cavity, overfilling slightly.
- Apply pressure with a gloved finger to the occlusal surface of the tooth, thus condensing the restoration (finger-press technique).<sup>17</sup>
- Check for correct occlusion.
- Remove any excess material with a carver or similar flat plastic instrument.
- Readjust the bite if necessary, making sure that the occlusal fissures are sealed.<sup>17</sup>
- Apply Vaseline to the restoration to protect the glass-ionomer during the initial setting reaction.
- Instruct the patient to avoid eating for about an hour to allow the material to set completely. For approximal restorations, use the Mylar strips as well as the wedges to reproduce the missing approximal surface.<sup>17</sup>

### **Case Selection of Cavities Treatable With ART**

It is obvious that the cavity size, selection of restorative material, clinical skills and knowledge of the dental practitioner will determine the success of a restoration, whether conventional, ART or any other cavity cleaning method is used.<sup>17</sup> The meta-analysis showed that the highest survival rates for ART restorations using high-viscosity glass-ionomers were observed in single-surface cavities in both permanent and primary teeth, while high-viscosity glass-ionomer ART restoration survival rates of multiplesurface cavities in primary teeth needed further improvements.<sup>17</sup>

## **Does the ART Technique Have a Role in Modern Practice?**

The principles of the ART technique are not new. One of the cornerstones of the traditional management of a patient with multiple carious lesions is to stabilize the carious process by excavating all the lesions and placing zinc oxide-based dressings. The ART technique is based on scientific findings and advocates that this practice is carried out properly: hence the time involved in carrying out a single restoration may be up to 20 minutes.<sup>18,19</sup> The teeth are then restored using a modern, adhesive, fluorideleaching material (glass-ionomer cement).

### **ART In Young Children**

ART has been suggested to be the most logical and appropriate tertiary preventive measure for managing severe early childhood caries (S-ECC), not only for children in disadvantaged communities but also for those attending private practice facilities. It was thought that ART would avoid the need for major restorative dental care under either local or even general anaesthesia.<sup>20</sup>

### **ART in the Elderly**

From its onset, one of the indications for the appropriate use of the ART approach concerned the elderly, particularly those living in institutions and those who are homebound.<sup>21</sup> Unfortunately, very few studies have investigated the potential of ART in providing dental care to these people. One of the studies was carried out amongst, on average, 75-year-old subjects who were homebound because of physical, mental or emotional problems.<sup>22</sup> The majority of carious lesions presented were so extensive that restorative care for these elderly people was no longer possible. After 1 year, 79 % of the ART restorations placed were considered successful. ART was well received, and the recipients were very satisfied with the care provided at home.<sup>22</sup>

### **Patients With Medical or Physical Disability**

Most patients in this group undergo dental treatment under local anaesthesia. However, a minority may require expensive and lengthy general anaesthetic sessions and some may have long waiting periods before treatment. The ART technique could be suitable for providing restorative care in these patients. The procedures could be carried out in the patient's home, in hospital or in the dental surgery. Use of the technique in the patient's home would require only minor adaptations (provision of a suitable light source). There is therefore an overwhelming role for the application of the ART technique (with some modification) for disabled patients. Patients would benefit from receiving restorative care when it is needed, rather than waiting for a general anaesthetic session usually for extraction of a few more grossly broken-down teeth.<sup>23</sup>

### **Other Potential Areas of Application**

These include stabilization of caries in patients with multiple lesions and emergency visits to the surgery or home visits by the dentist. The techniques can readily be combined with educational programmes and may be carried out by

adequately trained dental auxiliaries. This expanded role for dental therapists would be within the scope of the recent GDC guidelines detailing the scope of work for therapists.<sup>23</sup> Training of therapists in the ART technique would be a useful addition to the services provided by the dental team.<sup>23</sup>

### **ART versus ITR**

Despite the similarities between ART and ITR, there are certain aspects that make the two approaches different. In most of the cases that ART has been used, there was no plan to replace it with a more definitive treatment. This is because of the fact that the indications for its use stated that it was used when there were obstacles to reaching dental care units. Therefore, there were also most probably obstacles to replacing it with a more definitive treatment. ART is performed in areas lacking facilities and is often mistakenly interpreted as a permanent restoration.<sup>24</sup> On the other hand, ITR was developed as a temporary approach that would be replaced with a more definitive restoration, and hence it is named ITR. ITR should be replaced with a more definitive restoration within six months of the placement to ensure its maximum benefit is attained and to reduce the risk of failure.<sup>25</sup>

### **Advantages and Limitations of the ART Technique**

#### **Advantages**

- There is no threatening dental equipment.
- The technique is biologically friendly and conserves sound tooth tissue.<sup>25</sup>
- It can be readily available as it involves inexpensive hand instruments which can be taken to everyone (senior citizens, medical, mentally or physically impaired patients, rural communities).
- It does not always involve the use of local anaesthetics as mostly necrotic and infected carious dentine is removed.
- It exploits the beneficial properties of glass-ionomer cements (adhesion; fluoride release, remineralization of softened non-infected dentine and inhibition of organisms in residual caries).<sup>25</sup>
- Ease of repair of restorations (if necessary).

#### **Limitations**

- The technique is best suited for one-surface restorations.
- Inadequate physical and mechanical properties of glass-ionomer cements may influence the longterm survival of the restorations.<sup>25,26</sup>
- Hand mixing of the glass-ionomer cements may result in alterations of the powder to liquid ratio, resulting in weaker restorations.
- The average time of a proper restoration can be up to 20 minutes.
- Non-acceptance of the technique by oral healthcare workers.
- The relative ease of the technique may result in inadequate removal of caries by inexperienced operators, which may lead to unintentional neglect. This emphasizes the great need for training in the technique.<sup>25</sup>

## Conclusion

The ART technique has a definitive place in modern dentistry: for example, most practitioners are already using the technique whenever they place a temporary restoration in a tooth. But an important role playing factor is that success requires the additional step of ensuring adequate caries removal, and training in the use of the technique is essential to avoid claims of supervised neglect by not carrying out the procedure thoroughly. Guidelines are needed for recalling or reviewing patients that have undergone such restorations, in order that the carious lesions may be reassessed clinically and radiographically. Nervous patients who benefit from the technique should be gradually introduced to conventional treatment techniques. In conclusion, as Holmgren and Frencken<sup>26</sup> stated, 'ART has served as a catalyst for a new way of thinking about oral health care. While oral health promotion through prevention remains the essential foundation of oral health, the ART approach is an important corner stone in the building of global oral health'.<sup>26</sup>

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