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Caries management through the Atraumatic Restorative Treatment (ART) approach and glass-ionomers: update 2013

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The conception, of what was termed later, the Atraumatic Restorative Treatment (ART) approach, took place in 1985. From that date onwards, emphasis was placed on researching various aspects of ART in the fields of behavioural, clinical, laboratory and public health science with the aim to improve this caries management philosophy through constructing a strong foundation for its evidence-based use. This editorial presents the rationale and evidence of the ART approach, now 29 years later.

Atraumatic Restorative Treatment (ART) is a minimal intervention approach to both prevent dental caries and to stop its further progression. It consists of two components: the sealing of caries-prone pits and fissures, including those with enamel caries lesions (ART sealants), and restoring cavitated dentin carious lesions with sealant-restorations (ART restorations). The placement of an ART sealant involves the use 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 tissue with hand instruments only. This is followed by restoration of the cavity with an adhesive dental material that simultaneously seals any remaining pits and fissures that remain at risk.¹ In the early years, a medium-viscosity glass-ionomer was the material available. The application of this type of glass-ionomer to stress-bearing tooth surfaces led dental material manufacturers in the mid-nineties to develop a more wear-resistant glass-ionomer. These so-called high-viscosity glass-ionomers remain, for the moment, the most appropriate material for ART whether in hand-mixed or capsulated form. ART is less anxiety- and pain-provoking compared to the traditional restorative treatment, and the need for local anesthesia is relatively rare if the ART protocol is carried out correctly.² The ART approach enables caries control to be performed not only in the dental surgery but also in outreach situations (schools, homes, villages) since no electricity or running water is required for its delivery.

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How effective are ART sealants?

A sealant, in principle, is placed to allow easy plaque removal from pits and fissures systems otherwise difficult to clean. A sealant changes a morphological uneven surface into a smooth surface. The indication

for placing an ART sealant, in principle, is not different from that for placing a resin-based sealant. However, glass-ionomers are more hydrophilic in nature than resin-based materials. It is therefore logical to assume that a glass-ionomer rather than a resin-based material should be used in sealing caries-prone pits and fissures which cannot be kept absolutely moisture-free, such as in erupting molars or in children with behavior problems.

With the launch of high-viscosity glass-ionomers for use with ART sealants,³ the retention rate of glass-ionomer (ART) sealants has increased substantially in comparison to that of the low- and medium-viscosity glass-ionomers previously used.⁴ A meta-analysis concluded that the mean annual failure rate based on completely lost high-viscosity glass-ionomer ART sealants over the first three years was 9.3%.⁵ Despite the relatively high loss of sealant material, only 1% of surfaces progressed to a dentine caries lesion.⁵

The four systematic reviews and meta analyses, which have included high-viscosity glass-ionomer ART sealants, have concluded that there is no evidence that the dentine caries lesion-preventive effect of resin-based sealants is better than that of glass-ionomer-based sealants.⁶⁻⁹ This finding might, in part, be ascribed to the presence of remnants of glass-ionomer observed in the deeper parts of pits and fissure systems,¹⁰ preventing stagnation of cariogenic plaque in difficult-to-clean deep pits and fissures due to the excellent adhesion of glass-ionomers to enamel and the fact that the material fractures internally rather than at the enamel-sealant interface.¹¹

There is evidence that the ART sealant is a very effective carious lesion preventive treatment when placed both inside and outside the dental surgery.

How effective are ART restorations?

Contemporary treatment of cavitated dentine caries lesions is based on removing only the decomposed (previously named “infected”) dentine, because it serves no further purpose, while retaining demineralised (previously named “affected”) dentine because it can remineralise.¹ The cleaned cavity is restored with a biocompatible material that has optimum physical properties. Removing de-

composed dentine is most adequately achieved using a chemo-mechanical gel but this method takes a relatively long time to use. The next best effective method is through using a sharp metal hand excavator. The rotating metal dental drill has a tendency to over prepare the cavity.¹² A cavity whose opening has been enlarged using the drill, cleaned with a hand instrument and restored with an adhesive material is not considered ART nor should it be called “modified ART”.¹³

The first material used with ART was polycarboxylate cement but this was soon followed by the use of a medium-viscosity glass-ionomer cement in the late 1980s. Dental practitioners that wish to provide ART restorations that will have a long survival should select high-viscosity glass-ionomers that have an efficacy proven in clinical studies of long duration. But they should know about the physical strength of the material. The latest development in this area shows that by applying heat to setting high-viscosity glass-ionomers using a high intensity LED thermo-curing light, it is possible to substantially increase the material’s biaxial flexural strength.¹⁴

The effectiveness of ART restorations is assessed by their survival. The most recent meta-analyses on the performance of ART restorations concluded:⁵

- ART using high-viscosity glass-ionomer can safely be used in single-surface cavities in both primary and permanent posterior teeth;
- ART using high-viscosity glass-ionomer cannot be routinely used in multiple-surface cavities in primary posterior teeth;
- insufficient information is available for conclusions about ART restorations in multiple-surfaces in permanent posterior teeth, and in anterior teeth in both dentitions;

How do ART restorations compare to traditional restorations?

Systematic reviews and meta-analyses show that the longevity of ART restorations in primary teeth are not different from those produced using traditional methods using either amalgam^{15,16} or resin composite.¹⁷ Similarly, in comparing between ART and conventional restorations in primary teeth, there appears to be no difference in the longevity of

single-surfaces restorations in the permanent dentition.^{15,18}

Dentine caries lesion development at the margin of ART glass-ionomer restorations was reported to be low.¹⁹⁻²² This finding is supported by the results of the systematic review which showed that glass-ionomer had a higher caries-preventive effect than amalgam restorations in permanent teeth, with no difference in primary teeth.²³

We can conclude therefore that, for the moment, current evidence restricts the unconditional use of ART to the treatment of cavitated dentine caries lesions affecting single surfaces.

In summarizing the contribution of the ART approach to oral health since its conception, it is pleasing to write that the ART approach has been shown to be very effective in preventing caries lesion development and in stopping its progression. ART seal-

ants are as effective in preventing caries lesions as resin-based sealants but cover a wider range of applications. The use of ART results in comparatively small cavities, and in a high acceptance of preventive and restorative care by children. ART can be unconditionally used to treat single-surface tooth cavities in primary and permanent teeth. Because no electricity and running water is required, ART restorations can be placed both in outreach situations and in the dental surgery. The use of the term “modified ART” is completely incorrect. The comparison between ART and modified ART, as recently presented,²⁴ is false.

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