

**TITLE: Atraumatic Restorative Treatment for Dental Caries: Clinical Effectiveness and Guidelines**

**DATE:** 10 September 2008

**RESEARCH QUESTIONS:**

1. What is the evidence for the clinical effectiveness and acceptability of atraumatic restorative treatment for prevention and treatment of dental caries?
2. What are the guidelines for atraumatic restorative treatment for prevention and treatment of dental caries?

**METHODS:**

A limited literature search was conducted on key health technology assessment resources, including PubMed, the Cochrane Library (2008, Issue 3), University of York Centre for Reviews and Dissemination (CRD) databases, ECRI, EuroScan, international health technology agencies, and a focused Internet search. Results include articles published between 2003 and August 2008 and are limited to English publications only. Filters were applied to limit the retrieval to systematic reviews, health technology assessments, meta-analyses, guidelines, randomized controlled trials, and non-randomized studies. Internet links are provided where available.

The summary of findings was prepared from the abstracts of the relevant information. Please note that data contained in abstracts may not always be an accurate reflection of the data contained within the full article.

**RESULTS:**

HTIS reports are organized so that the higher quality evidence is presented first. Therefore, health technology assessment reports, systematic reviews, and meta-analyses are presented first. These are followed by randomized controlled trials, observational studies, and evidence-based guidelines.

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The literature search identified one meta-analysis, six randomized controlled trials, five observational studies, and one guideline. No health technology assessments were identified. Additional references of potential interest are included in the Appendix.

### OVERALL SUMMARY OF FINDINGS:

The meta-analysis of van't Hof *et al.* (2006)<sup>1</sup> systematically investigated the longevity of atraumatic restorative treatment (ART) sealants and ART restorations. Twenty-eight studies were included in the analysis, and most participants in the studies were over 6 years old. The included studies appeared to be observational, with no control groups. Most studies reported on survival rates of the sealants and restorations, but not on caries prevention.

Outcomes reported:

- Single surface restorations: High-viscosity glass ionomer survival in primary teeth was 95% after one year and 86% after three years; and survival in permanent teeth was 97% after one year and 72% after six years. Mean annual failure rates were 4.7% for both primary and permanent teeth.
- Multiple surface restorations: High-viscosity glass ionomer survival was significantly lower ( $p < 0.0001$ ) than that of single surface restorations. Mean annual failure rate in primary teeth was 17%.

The authors concluded that single-surface ART restorations using high-viscosity glass ionomer showed high survival rates in primary and permanent teeth. They stated that medium-viscosity glass ionomer is not appropriate for ART restorations.

Six randomized controlled trials reported on ART restorations. van Germet-Schriks *et al.* (2008)<sup>2</sup> sought to verify which strategy was most effective in the treatment of dental decay, in a moderate to high caries child population. Children ( $n=380$ ), with a mean age of 6.1 years, were randomly assigned to one of four groups: full dental treatment, extractions only, ART restorations only, and no treatment.

Outcomes reported:

- ART restoration of primary teeth resulted in a caries increment from baseline dmft (decayed/missing/filled teeth) of 5.48 (SD 3.2) to 6.35 (SD 2.6) after two years ( $p < 0.001$ ).
- Extensive dental treatment, extractions only, and no treatment did not result in significant changes in the caries prevalence of children ( $p > 0.05$ ).

The authors concluded that the strategy of choice for oral health care programmes should be full dental treatment. However, extraction of severely decayed teeth is an effective treatment strategy when priorities are required due to situational, practical, or economic reasons. No conclusion was stated in the abstract about the appropriate use of ART restoration.

Frencken *et al.* (2007)<sup>3</sup> performed an RCT comparing ART to traditional amalgam (TA) in 681 grade 2 children in Syria. Eight dentists performed 1,117 single- and multiple-surface restorations.

Outcomes reported:

- Cumulative survival percentages of single-surface, non-occlusal ART restorations was statistically significantly higher than comparable TA restorations at 4.3, 5.3, and 6.3 years.
- After 6.3 years, survival of single-surface, non-occlusal ART posterior restorations ( $80.2 \pm 4.9\%$ ) was statistically significantly higher than occlusal posterior ART restorations ( $64.8 \pm 3.9\%$ ).

- After 6.3 years, there was no statistically significant difference in survival percentages between large (55.8±10%) and small (69.2±4.6%) single-surface posterior ART restorations.
- During the 6.3 year period, secondary caries were present in 2.3% of single-surface ART restorations, and in 3.7% of single-surface TA restorations.

The authors concluded that the ART approach is appropriate for use in school oral health programmes. They stated that an operator effect was observed for both ART and TA treatments, and secondary caries was a minor reason for the failure of ART restorations.

Beirut *et al.* (2006)<sup>4</sup> performed an RCT comparing the caries-preventive effect of glass ionomer sealants using ART, with composite resin sealants. One hundred and three children, with a mean age of 7.8 years were randomly divided into the two groups, with either a high-viscosity glass ionomer (ART procedure) or a light-polymerized composite resin sealant material placed in 180 fully erupted first molars.

Outcomes reported:

- After five years, 88% of glass ionomer and 86% of composite resin sealants did not survive.
- Between two and three years, development of dental lesions was diagnosed in 3% of the glass ionomer teeth and in 13% of the composite resin teeth.
- After three, four, and five years, relative risk of dental lesion development in glass ionomer compared with composite resin restorations was 0.22 (0.06-0.82), 0.32 (0.14-0.73), and 0.28 (0.13-0.61) respectively.

The authors concluded that high-viscosity glass ionomer sealants using ART had a caries-preventive effect 3.1 to 4.5 times higher than that of composite resin sealants after three to five years, and had a four times higher chance of preventing caries once the sealant material disappeared, over a one- to three-year period.

Lo *et al.* (2006)<sup>5</sup> compared the survival rates of root restorations placed by ART with those using conventional technique in 103 elderly adults in Hong Kong. High-strength glass ionomer was used with the ART procedure, while light-cured resin-modified glass ionomer was used with the conventional approach. Eighty-four conventional and 78 ART restorations were placed, using random allocation.

Outcomes reported:

- After 12 months, survival rates were 87.0% for ART restorations, and 91.7% for conventional restorations ( $p > 0.05$ ).

The authors concluded that survival rates of both types of restorations were high.

Mhaville *et al.* (2006)<sup>6</sup> performed a randomized trial with 217 dentally naïve children (age 7.5 years, SD 0.57) to assess the effectiveness of three treatment methods (ART, Carisolv™, and rotary instruments) for caries removal and sealing capability of hand-mixed glass ionomer in proximal caries in deciduous molars. Four operators were utilized. No timeframe was reported.

Outcomes reported:

- There was no statistically significant difference in residual caries between the three treatments ( $p < 0.05$ ).
- There was significant operator difference for the preparation time in the treatment methods ( $p = 0.015$ ).
- Children's behaviour did not seem to influence residual caries and marginal gaps.

The authors concluded that no preparation method was superior to another, but methods were sensitive to operator effects.

Mandari *et al.* (2003)<sup>7</sup> reported on an RCT comparing three minimally invasive restorative treatments for managing dental caries in occlusal surfaces, using non-gamma-2 amalgam and low-viscosity glass ionomer materials. The three groups were conventional treatment in a university setting, modified-conventional in a field setting, and ultraconservative (ART) in a field setting. A split-mouth design was used in 152 children (no ages given), with 430 matched contralateral pairs of permanent molars.

Outcomes reported:

- After six years, successes for ART restorations were 68.6%, for conventional restorations were 74.5%, and for modified conventional restorations were 75.8%. These differences were reported to be not statistically significant.
- After six years, success of occlusal ART restorations with glass ionomer was 67.1%, and occlusal conventional restorations with amalgam were 74% (not statistically significant).

The authors concluded that the ART approach using glass ionomer performed as well as conventional restorative methods using electrical equipment and amalgam for treating dental lesions in occlusal surfaces after six years.

Five observational studies were identified by the literature search. Dulgergil *et al.* (2005)<sup>8</sup> compared a combined ART fissure sealant/restoration and fluoride varnish with no treatment, in 27 children (no ages reported) in Turkey.

Outcomes reported:

- After one year, mean caries increment (delta dmft) was  $0.26 \pm 0.43$  for the test group, and  $1.91 \pm 1.53$  for the control group ( $p < 0.0001$ ).
- After one year, more lesions in the control group progressed to cavitation than in the test group.

The authors concluded that this technique (a combined preventive-operative method) appears successful for the treatment of dental lesions and for retarding and preventing initial caries on pits and fissures of permanent teeth. They stated it could be beneficial in rural districts or areas where other routine dental preventive care is not possible or where there is inadequate compliance in hygiene.

Hu *et al.* (2005)<sup>9</sup> compared clinical performances of glass ionomer cement restorations of root surface caries using conventional methods or ART. One dentist performed 72 conventional and 74 ART restorations on 15 patients who had received cervicofacial radiation therapy, and two assessors evaluated the restorations.

Outcomes reported:

- After two years, successes were 66.2% for ART and 65.2% for the conventional method; not clinically or statistically significant ( $p > 0.50$ ).
- Restoration dislodgement accounted for 82.8% of failures.
- Teeth with three or more restored cervical surfaces accounted for 79.3% of failures.

The authors concluded that the ART method was equally as effective as conventional methods for root surface caries restoration.

Lopez *et al.* (2005)<sup>10</sup> performed an observational study using ART and sealants on 118 children (aged 5 to 18 years) in an underserved community in Mexico.

Outcomes reported:

- 85% of the children reported no pain, and 93% were comfortable with the restorations.
- At 2 years, 66% of the 370 restorations and 35% of the 193 sealants were retained.

The authors concluded that ART is acceptable and effective for controlling and preventing decay in a socioeconomically deprived community.

Wang *et al.* (2004)<sup>11</sup> evaluated the ART restoration of 150 Class I cavities in 118 Brazilian children (aged 7 to 12 years), with no comparator.

Outcomes reported:

- After six months, 83 patients were evaluated; 71.8% of their restorations were designated as acceptable.
- After three years, 49 patients with a total of 57 ART restorations were evaluated; 21.0% of their restorations were designated as acceptable.

The authors concluded that, for those children who returned for recalls, 94.7% of the restored teeth were retained.

Gao *et al.* (2003)<sup>12</sup> compared restorations using glass ionomer cement and ART with non-gamma 2 amalgam alloy and conventional methods. They evaluated 149 restorations in 68 patients in a hospital clinic (no ages given).

Outcomes reported:

- ART methods took approximately twice as long as conventional methods.
- After 30 months, one ART restoration failed.
- ART restorations showed high early losses of sealant material, but no caries developed.

The authors concluded that, although the restorations performed satisfactorily, the cements showed a continuing deterioration, requiring longer term studies for evaluation.

One guideline, by the Scottish Intercollegiate Guidelines Network (2005), was identified.<sup>13</sup> Links to the full guideline and NGC summary are available in the list of references. The objective of the guideline is “to present effective strategies for preventing and managing dental decay in the pre-school child.”<sup>13</sup> The guideline mentions ART under cavity preparation techniques in practice based management. It stated that ART should be considered as an alternative treatment to conventional techniques, in carious primary teeth. The guideline stated that glass ionomer cement with ART is not appropriate for use in Class II cavities in primary teeth.

In summary, the Scottish guideline and most studies concluded that ART methods with glass ionomer restorations are clinically effective and acceptable for prevention and treatment of dental caries. All studies but three pertained to school aged children. The other three studies enrolled elderly patients, radiotherapy patients, and one did not specify age group.

**REFERENCES SUMMARIZED:****Health technology assessments**

No literature identified.

**Systematic reviews and meta-analyses**

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**Randomized controlled trials**

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### Guidelines and recommendations

13. Prevention and management of dental decay in the pre-school child: a national clinical guideline. In: *National Guideline Clearinghouse (NGC)* [database online]. Rockville (MD): NGC; 2006. Available: <http://www.sign.ac.uk/pdf/sign83.pdf> (accessed 2008 Aug 28)  
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*Note: see Cavity Preparation Techniques, p. 12*

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**APPENDIX – FURTHER INFORMATION:****Review articles**

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