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Glass ionomer ART sealants in Chinese school children—6-year results☆

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ABSTRACT

Objective: To evaluate longitudinally ART sealants placed in Chinese school children under field conditions.

Method: 191 ART sealants were placed in 140 children, aged 11–14 years, by five assistant dentists in four secondary schools in Deyang, Sichuan Province, China. Teeth selected for sealing were those with pits and fissures that were deep or showing early enamel caries. Teeth were excluded if there was obvious cavitation extending into dentine. Standard instruments and procedures for ART sealants were used. The material used was a high-viscosity glass-ionomer (Ketac-Molar, 3MESPE) that was inserted into the pits and fissures with the ''press-finger'' technique. The status of the sealants was evaluated annually over 6 years after placement by the same examiner who was not involved in the placement of the sealants using explorers, mouth-mirrors and an intra-oral fibre-optic light. No missing sealants were replaced during the study.

Results: 107 sealants (56% of the original) were examined after 6 years. The cumulative survival rates of the sealants (partially or fully retained) after 2, 4 and 6 years were 79%, 68% and 59%, respectively. Caries prevention lagged the fall in sealant survival but remained high throughout the study period, being over 90% in the first 4 years and 85% after 6 years.

Conclusions: ART sealants placed under field conditions in Chinese schoolchildren have a high retention rate. Missing sealants should be replaced to maintain their preventive efficacy.

Clinical significance: The sealing of pits and fissures can be an effective caries preventive approach. Resin-based sealants have the disadvantage in that they require an optimal level of moisture control during placement. In children and in outreach situations glass ionomer ART sealants, which are more moisture tolerant, can offer a viable alternative.

1. Introduction

Evidence suggests that up to 90% of dental caries lesions in schoolchildren occur in pits and fissures.[1–3] The concept of sealing vulnerable pits and fissures for the prevention of caries dates from the early 1920s but sealants only became an efficacious intervention with the introduction of resin-based sealants some 40 years ago.[4,5]

One disadvantage of resin-based sealants is the need to maintain a very dry operating field since moisture contamination during placement is the most frequently cited reason

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for sealant failure.[6] In the traditional dental office setting and in adult patients optimal moisture control might not be so problematic, but in children moisture control might be compromised. Similarly, for care delivered in outreach situations devoid of compressed air and suction, resin-based sealants are usually not an option.

Originally developed in the 1970s, glass ionomer was first described for use as fissure sealants by McLean and Wilson.[7] Glass ionomer is a promising material for sealants since it is considered to be moisture tolerant during the placement procedure; it bonds physico-chemically to enamel and dentine without etching and slowly releases fluoride that can be cariostatic.[8] Glass ionomer specially developed for sealant use has a low powder to liquid ratio and small particle size to enable it to ''flow'' like resin-sealants into pits and fissures.[9] Unfortunately, such glass ionomer sealants have much poorer retention than resin-based sealants although the caries preventive ability between the materials remains equivocal.[10,11]

The concept of fissure sealing with a type II restorative glass-ionomer introduced into the pits and fissures using positive pressure exerted from an instrument or finger can be ascribed to Blagojevic and Mount.[12] Early studies using such an approach showed promising results when compared to resin sealants.[13,14] The ART approach uses a similar ''finger-press'' technique to condense the filling material into a cleaned carious cavity while simultaneously sealing residual pits and fissures, thus producing a ''sealant restoration''.[15] ART sealants, not to be confused with ART restorations which use the same ''press-finger'' technique, are recommended for early enamel caries and for caries susceptible pits and fissures where there is no frank cavitation.[15]

To date, rather few studies have been published examining the survival of ART sealants and most of these have been of relatively short duration. The objective of this analysis was to describe the survival of ART sealants placed under field conditions in Chinese school children over a 6-year period.

2. Materials and methods

This study was conducted in all four urban secondary schools in Deyang City, Sichuan Province, in western China from 1996 to 2002.

All children in their first year of secondary school, mostly aged 12–13 years, were invited to participate in an oral health survey. The childrens' parents were informed of the survey through the school and were free to opt for their children not to participate. Two dentists (CJH and ECML) then clinically examined the participant children to assess their caries status and treatment needs. The former was assessed according to criteria recommended by the World Health Organization (1987), which did not provide for the scoring of pre-cavitated caries lesions.[16] Tooth treatment needs criteria followed those recommended by WHO with the exception that sealants were indicated only for teeth with signs of early enamel caries lesions without cavitation or with deep pits and fissures.

ART sealants were offered to all screened children with an indicated need for sealants. Teeth that were judged sound with shallow pits and fissures or teeth with obvious cavitation extending into the dentine were excluded from sealant placement. No refusals were encountered.

All treatment was provided in the schools in late 1996 by five local assistant dentists after they had received a theoretical and hands-on training course in ART provided by an international expert in the approach (CJH) to ensure consistency in its application. No ancillary assistance was available during the provision of the treatment. The children were treated in the supine position by using tables available in the schools as a patient support. Lighting was provided by mains-powered portable lights. All treatment was accomplished using only hand-instruments following procedures as described by Frencken and Holmgren.[15] Isolation was achieved solely through the use of cotton wool rolls.

The pits and fissures were gently cleaned of plaque and food debris with the tip of an explorer ensuring that the tip was not forced into the pits and fissures. The occlusal surface was then washed by rubbing with a moistened cotton wool pellet. After drying the occlusal surface with dry pellets, it was conditioned for 10 s using the liquid component of the glass ionomer material used subsequently for sealing. The pits and fissures were then washed and dried as before. The material used as sealant was a hand-mix, high-viscosity glass ionomer (Ketac Molar, 3MESPE, Seefield, Germany) that is recommended for use with the ART approach. This was mixed strictly according to the manufacturer's instructions taking care to ensure the correct powder to liquid ratio. The mixed material was then placed into all the pits and fissures and then pressed into the depths using positive pressure from a gloved index finger lubricated with Vaseline, known as the ''press-finger'' technique. The occlusion was checked with articulating paper and any excess material was removed with a carver or excavator. No varnish or additional petroleum jelly was used to protect the glass ionomer.

The clinical status of the ART sealants was evaluated three months after placement and then annually for 6 years. One examiner (ECML), who was not involved in providing the sealants, performed all the evaluations. WHO periodontal probes, sharp sickle-shaped explorers, plane front-surface mirrors and an intra-oral fibre-optic light source were used in all the examinations. At each evaluation duplicate examinations were carried out on about 10% of the sealants selected randomly.

The retention of ART sealants was recorded according to the codes and criteria shown in Table 1. Only teeth with sealants that were completely missing or replaced by a restoration were classified as retention failures. The caries status of the surfaces that had received an ART sealant was also scored following the codes and criteria shown in Table 2. A caries lesion was scored at the level of cavitation into dentine. Teeth with caries in fissures previously sealed or adjacent to sealants were considered to be prevention failures. In addition, restorations placed in fissures that had previously been sealed were considered to be both sealant and prevention failures.

The collected data were entered onto a Microsoft Excel worksheet and analyzed using SPSS software for Windows on a personal computer. Actuarial life-table analysis was used in sealant survival estimations and the Wilcoxon (Gehan) test