Clinical Sealant Retention Following Two Different Tooth-cleaning Techniques

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Abstract

Objectives: *This study compared the effectiveness of two different tooth-cleaning techniques on clinical sealant retention.* ***Methods:*** *Seventy-four children in second and third grades at an elementary school in the rural town of Waverly, Tennessee, had sealants applied to four, noncarious, fully erupted, first permanent molar teeth. The teeth had been cleaned using a brush attached to a rotary instrument with fluoridated prophy paste, versus a toothbrush without paste (dry brushing). A split-mouth design was used, whereby one side (upper and lower) of the mouth was subject to one tooth-cleaning technique while the opposite side received the other technique.* ***Results:*** *Twelve months after a single application of pit and fissure sealant, 63 children were available for recall. Exactly 252 teeth were examined and overall retention was high, with approximately 98 percent of sealants retained. Although the greatest loss of sealant occurred with the rotary instrument technique, the difference in proportions of missing sealant between techniques was not statistically significant.* ***Conclusions:*** *In this study, the tooth-cleaning technique of dry brushing with a toothbrush as a preparatory step in the sealant procedure yielded high clinical sealant retention at 12 months. This retention was comparable to that observed with rotary instrumentation. This finding suggests that dry brushing by the operator may be an acceptable alternative to using a rotary instrument with brush and paste. [J Public Health Dent 1998;58(3):254-6]*

Key Words: tooth-cleaning techniques, sealant retention, rotary instrumentation, dry brushing.

Millions of children globally have had sealants applied to pit and fissure surfaces of their teeth to prevent dental caries. The effectiveness of a dental sealant depends upon its long-term clinical retention and regular maintenance (1-3). As long as it remains intact on a pit and fissure surface, that surface will be protected from initiation of dental caries or progression of existing incipient caries (3-6). The application of sealant is technique-sensitive and failure of a sealant to be retained on a tooth surface could be the result of any number of factors (7,8), including inadequate tooth selection (morphology), preparation (cleaning), isolation (moisture control), conditioning (etching), or polymerization (curing). Thorough training, experience, and operator proficiency can control these factors. In school-based programs, evaluation of clinical sealant retention within 12 months of application provides important information on operator proficiency and program quality (9).

In a survey of school-based or school-linked public health sealant programs nationwide, it was reported that 70 percent used an operator and dental assistant, 19 percent used a single operator only, and 11 percent used a combination (10). Additionally, 63 percent of programs removed debris and gross plaque from pit and fissure surfaces to be sealed by using a brush or rubber cup in a rotary instrument, 29 percent used a toothbrush, and the remaining 8 percent used other tooth-cleaning techniques. Most public health sealant programs in Tennessee use a single operator only. Tooth cleaning is performed by one of two techniques: rotary instrumentation with fluoridated paste or by dry toothbrushing.

Waggoner and Siegal (8) provided a brief review of in vitro and in vivo studies of tooth-cleaning techniques for their effect on clinical sealant retention, sealant bond strength, or depth of sealant penetration. Techniques reviewed included rotary instrumentation using rubber cups or brushes with pumice or paste (fluoridated and nonfluoridated), removal of debris with a sharp probe, supervised toothbrushing with fluoridated toothpaste, air abrasion, and others. In general, clinical studies suggest that independent of tooth-cleaning technique, sealant retention rates are similar (8,11-13). Notwithstanding the existing body of evidence, none of the sealant studies compared sealant retention rates following dry toothbrushing to those following other conventional methods of cleaning.

The purpose of this study was to determine if any difference in clinical sealant retention occurred as a result of applying sealant to pit and fissure tooth surfaces cleaned by dry brushing with a toothbrush versus rotary instrumentation with brush and fluoridated prophy paste.

Methods

In the fall of 1996, a pit and fissure sealant study was conducted at Waverly Elementary School in Waverly, Tennessee. Consent of parent or guardian was obtained for 103 children to participate in the study. These children met the study criteria in having four fully erupted perma-

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nent first molar teeth with well-defined occlusal anatomy, free of dental caries and restorations. Of these 103 children, only 74 were actually included as participants in the study. The others were eliminated because they were outside the desired age range (6 through 8 years old); because they moved out of the county; or because they were unable to cooperate due to anxiety, gag reflex, or other conditions that made it difficult to apply sealants.

A half-mouth study design was used wherein prior to etching and sealing, upper and lower molars on one side of the mouth were cleaned with fluoridated prophy paste (Nu-Pro®) on a brush attached to a rotary instrument and on the opposite side using a toothbrush without paste. In each successive patient, the cleaning technique was alternated in regard to right and left sides of the mouth to control for operator preference. One dentist who was experienced in conducting school-based sealant programs examined the teeth, cleaned each tooth for exactly 15 seconds using one of the two aforementioned techniques, and applied all the sealants.

A single operator, half-mouth technique was used for applying the sealant. Subsequent to the tooth-cleaning step, the permanent molars were washed, isolated with cotton rolls, and dried with compressed air for 15 seconds. Pit and fissure surfaces were etched for 20 seconds using Enamel Prep®,a 37 percent orthophosphoric gel etchant. The etched teeth were washed, isolated, and thoroughly dried for 15 seconds. A light-cured opaque sealant (Helioseal®) was applied with a canula to the pit and fissure surfaces of the teeth. A high intensity visible light (Max Light®) with a 13 mm diameter, 80 degree fiber optic probe was used to expose each tooth to a 20-second burst of high-intensity visible light necessary for polymerizing the sealant.

Approximately 12 months after the sealants were applied, the children were recalled for evaluation. A portable dental chair (Adec®) and dental light (Aseptico®) were set up in the elementary schools. A dentist experienced in conducting clinical sealant studies, but who was completely blind in regard to cleaning method location, examined each child for sealant retention using an explorer and front surface mouth mirror. Only the occlusal surfaces of the teeth were evaluated and retention of the opaque sealant was determined by visual confirmation as being completely retained (presence of sealant on all three areas of the occlusal surface-mesial, central, and distal thirds), partially retained, or completely missing (14).

Results

Sixty-three (85%) of the original 74 children receiving a single application of sealant were available for recall 12 months later. Sealant loss and retention by technique is presented in Table 1. The overall clinical sealant retention was over 98 percent. None of the teeth had sealant completely missing; partial loss of sealant was observed in four different children. Three of the four partially missing sealants occurred on the upper right molar and one on the lower right molar. While the proportion of sealants retained by both techniques was very high over the study period, the greatest amount of retention occurred with the dry brushing technique. The mean within-child difference in proportions of lost sealants for the two methods was 0.016 (95% CI=–0.016, 0.048).

Discussion

From 1987–96, the experience of the Oral Health Services Section of the Tennessee Department of Health has been that cleaning techniques using rotary instrumentation yield high clinical sealant retention rates ranging from 90 percent to 98 percent at 12 months. Comparable experience with dry toothbrushing has not been studied. Although the evidence in the literature suggests that sealant retention rates are similar regardless of tooth-cleaning technique employed, the clinical studies are relatively few and none have evaluated the technique of dry toothbrushing. Consequently, the authors were curious to see how dry brushing compared to rotary instrumentation with paste in regard to clinical sealant retention. Results of this study show no difference in clinical sealant retention between these two cleaning techniques.

Since almost one-third of public health sealant programs across the country use a toothbrush to clean teeth prior to sealant application, the acceptability of this technique in relation to clinical retention is important. In some of these programs children are doing the actual brushing rather than the operator. One might surmise that proficiency and consistency of brushing could not be controlled with this approach, and that it might adversely affect clinical sealant retention if plaque and debris are not adequately removed from fissure areas, especially in children with poor oral hygiene. Nevertheless, in one study where children brushed with a fluoridated toothpaste and thoroughly rinsed, under the supervision of a dentist who subsequently checked their molars to ensure they were clean and free of debris, clinical retention rates at 4 and 6 years

TABLE 1
Sealant Retention 12 Months after Single Application by Cleaning Technique

Cleaning Technique	No. Teeth Sealed	No. Teeth with Sealant		Percent Teeth with Sealant	
		Partially Missing	Completely Missing	Partially Missing	Completely Retained
Rotary instrument with brush and fluoride paste	126	3	0	2.4	97.6
Toothbrush without paste	126	1	0	0.8	99.2
Both techniques	252	4	0	1.6	98.4

of age were 73 percent and 58 percent, respectively (12).

In this study, the examiner was unaware of the assignment of side of the two tooth-cleaning techniques within the mouth of each child. However, the operator who applied the sealants was not masked, as he had just previously cleaned the teeth. In principal, it is ideal to reduce or eliminate any potential for bias in the study design. For practical and logistical purposes, an effort was made, barring minor changes in technique, to simulate the actual clinical setup—including personnel, equipment, and supplies—available at a typical school-based public health sealant project in Tennessee.

Recommendations for wide-scale adoption of a particular tooth-cleaning technique are not possible based upon the results of this one study that includes a small sample of children followed over a short period of time. Nevertheless, this study does provide evidence to suggest that dry brushing, when properly performed by the operator, is an acceptable and practical alternative to rotary instrumentation for cleaning teeth prior to dental sealant application.

References

1. National Institutes of Health. Consensus Development Conference Statement. Dental sealant in the prevention of tooth decay. J Dent Educ 1984;48:126-31.
2. Simonson RJ. Retention and effectiveness of dental sealants after 15 years. J Am Dent Assoc 1991;122:34-42.
3. Feigal RJ. Sealants and preventive restorations: review of effectiveness and clinical changes for improvement. Pediatr Dent 1998;20:85-92.
4. Swift EJ. The effects of sealants on dental caries: a review. J Am Dent Assoc 1988;116:700-4.
5. Handelman SL. Therapeutic use of sealants for incipient or early carious lesions in children and young adults. Proc Finn Dent Soc 1991;87:463-75.
6. Proceedings of the workshop on guidelines for sealant use: recommendations. J Public Health Dent 1995;55:263-73.
7. Gwinnett JA. Pit-and-fissure sealants: an overview of research. J Public Health Dent 1982;42:298-304.
8. Waggoner WF, Siegal M. Pit and fissure sealant application: updating the technique. J Am Dent Assoc 1996;127:351-61.
9. Preventing pit and fissure caries: a guide to sealant use. Boston: Massachusetts Department of Public Health, 1986.
10. Siegal MD, Lalumandier J, Farquhar CL, Bouchard JM. School-based and school-linked public health dental sealant programs in the United States, 1992-93. Columbus, OH: Association of State and Territorial Dental Directors, 1997.
11. Donnan MF, Ball IA. A double-blind clinical trial to determine the importance of pumice prophylaxis on fissure sealant retention. Br Dent J 1988;165:283-6.
12. Houpt M, Shey Z. The effectiveness of fissure sealant after six years. Pediatr Dent 1983;5:104-6.
13. Scott L, Brockman S, Houston G, Tira D. Retention of dental sealants following the use of air polishing and traditional cleaning. Dent Hyg 1988;62:402-6.
14. Mertz-Fairhurst EJ, Della-Giustina VE, Brooks JE, Williams JE, Fairhurst CW. A comparative study of two pit and fissure sealants: results after 4 years in Augusta, Ga. J Am Dent Assoc 1981;103:235-8.