

**THE UPDATE OF EVIDENCE-BASED RECOMMENDATION
FOR THE USE OF PIT AND FISSURE SEALANTS IN THE
NORTH YORK PUBLIC DENTAL PROGRAM**

An Evidence-based Report

A. Jokovic, J.L. Leake and P.A. Main

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**The Update of Evidence-based Recommendations
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1.0 The context for evidence-based recommendations

The North York area of the new City of Toronto is a multi-cultural area of over 540,000 people. Thirty-eight per cent (38%) of children in the North York area report they were born outside Canada. In Ontario, the children born outside Canada are 2.5 times more likely to have experienced dental decay and 2.2 times more likely to have urgent need for care. High levels of dental decay and unmet urgent needs also are common to families living in poverty who often seek care from the public health department. Dental diseases are concentrated in a minority of the population. For example, at age 13, 78% of caries is found in 25% of the North York child population.

The Toronto Public Health, North York Office (formerly North York Public Health Department) has provided dental treatment to children since 1939. Since then, clinical and community-based preventive services, such as fluorides and education, have been added.

Each year the program is allocated a fixed budget from which all program costs must be met. The program operates with core values of:

- Population health - doing the greatest good for the greatest number so as to make a measurable difference to the target population's health
- Prevention - health promotion and primary prevention strategies are favoured over treatment and rehabilitation
- Evidence-based care - scientific evidence of need and the effects of intervention will guide the provision of care; where evidence is lacking, studies may be mounted to develop that evidence
- Equity - care will be allocated directly in proportion to need with urgent and basic needs having priority

- Ethics - the program will adhere to ethical principles of autonomy, non-maleficence, beneficence, justice and collegiality and will be open to its resolution where these principles conflict

Program guidelines have been developed to assist clinicians in making decisions on the management of patient care. The guidelines and the underlying evidence-based report, also assist managers to allocate resources to achieve maximum impact and to assure the quality of patient care. These guidelines assist staff in decision-making for quality care. They also assist the managers in their decisions on allocation of resources to best fit the needs and to maximize the impact of the services provided.

2.0 The need to examine the use of dental sealants

In 1993, the Community Dental Health Services Research Unit developed evidence-based recommendations for using pit and fissure sealants in the City of North York Public Health Department's Dental Program (1). In establishing the recommendations, three aspects of sealant use were addressed:

- (1) Which teeth and tooth surfaces should be sealed?
- (2) How soon after tooth eruption should sealant be placed?
- (3) Which children should receive sealants?

The recommendations were based on: (a) the scientific findings on effectiveness of sealants in preventing and arresting occlusal decay, (b) the epidemiology of dental caries in school-aged children, and (c) the individual caries risk assessment science, all current to the year 1991.

Since 1991, observations indicating changes in the epidemiology of dental caries have emerged and various caries risk prediction models have been tested. Also, during the last five years, new findings on the effectiveness of visible-light-curing sealants have been reported, resin-based sealants containing fluoride have been introduced to the market, and attempts have been made to use glass ionomer cements as pit and fissure sealants.

All this implied a need to evaluate the recommendations for the use of sealants established in 1993, according to the relevant scientific evidence of the years 1991 through 1996, and refine them if indicated. This report provides an update to that 1993 document.

3.0 Structure of this report

The findings of the current review are presented in this evidence-based report. The structure of this report is based on the template proposed at the RCDSO/CDHSRU Workshop (Leake et al. 1996). The template covers the following areas:

1. Target population
2. Clinical problem
3. Clinical flexibility
4. Search strategy
5. Inclusion criteria
6. Summary of evidence
7. Comparison of costs
8. Relative importance of the potential outcomes
9. Evidence-based recommendations and any minority views
10. Comments or suggestions for further research

The project followed three steps:

- (1) critical review of relevant literature of the years 1991 through 1996;
- (2) evaluation of the recommendations in light of new scientific evidence, to examine the need for changes;
- (3) revision of the recommendations according to the evidence, if and where the need was determined.

4.0 Target Population

These guidelines apply to the child population served by the Community Dental Services Division, North York Public Health Department. They do not necessarily apply to other child populations where the prevalence of pit and fissure caries is markedly different or where it may be beyond the capacity of the program to provide such care.

5.0 Clinical Problem

These guidelines address the management of dental caries on pits and fissures (chewing surfaces) of children's primary and permanent posterior teeth. The guidelines focus on preventing and arresting the caries process in these susceptible teeth and surfaces through the use of dental sealants.

These guidelines do not address the prevention and management of early enamel caries through other technologies, e.g., diet counselling, nor the management of the later stages of the disease when a restoration would, ordinarily, be required.

5.1 Prevalence of the problem

Tooth-specific and surface-specific caries attack rates

Between the years 1991 and 1996, two studies reported tooth-specific and surface-specific dental caries rates in school-aged populations. Li et al. (3) analysed data from the 1986-1987 National Survey of the Oral Health in the United States. They found that, among 5 to 17 year-old children, occlusal caries accounted for more than a half (58%) of dental decay prevalence, and that pits and fissures of first and second molars, along with buccal and lingual pits of first molars were most susceptible to dental decay in the permanent dentition. The hierarchy of caries attack rates, from highest to lowest, was: occlusal surfaces of first molars (maxillary - 32.4%, mandibular - 31.3%), occlusal surfaces of second molars (mandibular -

21.0%, maxillary - 17.4%), buccal pits of mandibular first molars (19.1%), lingual grooves of maxillary first molars (15.6%), and occlusal surfaces of premolars (maxillary - 0.2%) and (mandibular - 0.5%). In the primary dentition, occlusal and proximal surfaces of molars were at highest risk to decay, with the rates not being as dissimilar between these surfaces as in the permanent dentition: 15.7%-27.1% and 10.5%-18.9%, respectively.

Chestnutt et al. (4) analysed data from a sample of 15-year-old children from Lanarkshire, Scotland. They found that 79.4% of occlusal surfaces of first molars were decayed or filled, accounting for 19.9% of caries prevalence. The second highest caries rate was for the occlusal surfaces of second molars: 38.5%.

However, as Rozier noted in his reaction paper to the recommendations for guidelines for sealant use from the workshop held in Albany, 1995 (5), in only a few studies published to date, tooth-specific and surface-specific caries attack rates were adjusted for the length of time that teeth had been at risk for caries. Since caries experience is cumulative, tooth-specific and surface-specific rates depend on the age composition of survey participants, and, therefore, are accurate only when derived taking the post-eruptive age of teeth into account. For example, in a survey of 15 year-old Scottish children, first molars have been at risk for about twice as long as second molars, which might have inflated caries attack rates for occlusal surfaces of first molars compared to second molars. Rozier concluded that, in light of this approach to analysis of tooth-specific caries rates, occlusal surfaces of first and second permanent molars are at similar, if not equal risk for caries in the first post-eruptive year, and that, therefore, second molars should also be considered for receiving sealants.

Conclusions:

- Pits and fissures of first and second permanent molars are at greatest risk for dental decay (3,4);
- First and second permanent molars are the priority candidates for teeth to be sealed (3-5).

Susceptibility of pit and fissure surfaces over time

It has been held that the susceptibility of occlusal surfaces to caries is highest within two to four years following tooth eruption and decreases progressively thereafter. However, since the mid-1980s, evidence has started to emerge that pits and fissures of first permanent molars remain susceptible to primary dental decay longer than that two to four years, into and well beyond adolescence. Studies published in the last five years (4,6,7,8) have replicated the findings of those published before 1991 (9-12). Hence, eight studies now indicate changes in the longitudinal pattern of pit and fissure caries occurrence.

In a 3-year study of caries susceptibility of tooth surfaces in 12 year-old children, from a fluoride-deficient area in Scotland, Chestnutt et al. (4) found high caries incidence in the pits and fissures of first molars. Even though these teeth had been erupted for at least six years at the beginning of the study, 40.6% of the occlusal surfaces, recorded as sound at baseline examination, became carious over the three years of follow-up.

Foreman (7) reported that 25% of US Navy personnel between ages 17 and 25 (mean 20.9 years), presented with new pit and fissure caries while on active duty. He concluded that about one third of those in their late teens and early 20s have occlusal surfaces that become carious, unless they are sealed.

Stahl and Katz (6) conducted a retrospective analysis of dental records of the 1989 class at the US Coast Guard Academy. They found that 43% of the students, whose median age was 17 on initial examination, developed decay on the occlusal surfaces over a period of 40 months, with first and second molars showing the highest incidence, 15%. The authors conclude that their results confirm that occlusal caries is increasingly becoming a disease of young adulthood. They also calculated that, assuming first molars erupted in the sixth year of life, the study participants exhibited 10% of their occlusal caries incidence rate 11-14 years after the teeth eruption. Likewise, assuming second molars erupted at the age of 12, the incidence 5-8 years after the eruption accounted for 14% of the incidence rate for these teeth. These figures are very conservative since they were only calculated for the occlusal caries in the presence of sound proximal surfaces.

In a similar study, Richardson and McIntyre (8) followed a cohort of Royal Air Force recruits between 1988 and 1992, and found that one in ten of the sound occlusal surfaces of first and second molars became carious over the four years. The tooth-specific incidence rates determined during the observation period were as follows: upper first molars - 5%, lower first molars - 8%, upper/lower second molars - 11%. The authors suggested that occlusal surfaces remain susceptible to dental decay in the late teens and early twenties.

These findings are biologically plausible. The first hints of occlusal caries attack on first permanent molars sustained beyond the first four post-eruptive years coincided with the decrease in the rate of progression of dental lesions that became evident during the 1980s. The lengthening of the interval between caries initiation and its cavitation extends the period of primary dental caries activity on occlusal surfaces of first molars, which, in turn, might result in the extended period of caries susceptibility (13).

Conclusions:

Permanent molars appear to remain at high risk for dental decay beyond the four years of post-eruptive age (4,6-12). However, this is not yet conclusive due to the following:

- relatively few number of studies conducted;
- differences in the age cohorts studied;
- variability in diagnostic techniques applied; and
- differences in the treatment thresholds of participating dentists.

Which children are susceptible to pit and fissure caries?

With an increasing proportion of caries-free children and a decreasing proportion of children with a high caries experience, coupled with diminishing resources for public dental programs, the correct prediction of the occurrence of dental decay on an individual basis is necessary for the cost-effective placement of pit and fissure sealants. Recently, much interest has been devoted to developing methods for the identification of individuals at risk for high levels of dental caries.

Research in the area of caries risk assessment has indicated numerous predictors of future high caries increments. The following indicators appear in the majority of the multivariable models developed to date:

- pit and fissure morphology;
- caries history in primary and permanent dentition; and
- current level of caries activity (14-20).

Investigators at the University of North Carolina conducted a study of caries risk assessment on 5,233 first and fifth grade children residing in communities with low water fluoride levels between 1986 and 1989 (14,15). Four categories of information were collected at baseline examination: clinical indicators, microbiologic assays of stimulated saliva, sociodemographic data and health-related behaviours. High caries risk was defined as a DMFS increment of ≥ 4 for a grade 1 cohort, and ≥ 5 for a grade 5 cohort. Clinical indicators were the major contributors to the models, resulting in the average sensitivity of 0.61 and the average specificity of 0.83. For grade 1 these were: the initial dmfs and DMFS, and pit and fissure morphology score; for grade 5: the initial DMFS, pit and fissure morphology, and mean plaque score.

Demeres et al. (16) identified past caries experience as the best predictor for caries increments of one or more carious lesions in primary dentition over one year in five-year old Montreal children. This predictor alone reached 0.78 for the sensitivity and 0.77 for the specificity.

In a series of studies, Steiner, Helfenstein and Marthaler (17,18,19) found that the number of decayed and treated primary molars, and the number of decayed and treated permanent first molars were the best and the most consistent predictors for high caries increments among 5, 7 and 10 years old children. For the increment of at least two, four or six new carious lesions over four years in 7-year-old children, this two-predictor model had the sensitivity of 0.65, 0.78 and 0.81, and the specificity of 0.65, 0.78 and 0.77, for the cut-off points from the lowest to the highest. The authors achieved almost the same result in predicting

5-year increments in 7-year-old children using only one predictor: the number of decayed and treated primary molars.

By plotting the receiver operator characteristic (ROC) curve, ter Pelkwijk et al. (20) determined that at the age of 7 the best screening criterion for a DMFS>0 at age 9 is a dmft of = 5 and for a caries increment (Δ DMFS>0) between ages 7 and 9 is a dmft of=4, while for a DMFS>0 at age 11 and for a Δ DMFS>0 between ages 7 and 11, the critical screening criteria at age 7 appear to be a dmft =4 and a dmft =3, respectively.

Knowing the characteristics of risk assessment, a model that can be applied with 100% accuracy at the level of the individual will never be available. Considering variations in caries levels and disease-promoting factors between age cohorts, socioeconomic and cultural groups, as well as differences in dental public programs' resources, a single highly accurate model applicable across all age and all population groups is probably unrealistic (14,15,21). Instead, different criteria have to be applied in different communities to categorize a given child as a high caries risk individual. When deciding on the cut-off point, clinical and economic trade-offs (proportion of misclassified children) have to be considered (14,15).

Conclusion

Factors associated with the incidence of dental caries independent of the above mentioned variations are:

- Past caries activity: susceptibility to further dental decay onset is positively associated with a child's previous dmfs/DMFS scores (14-20)
- Pit and fissure morphology: children with deep pits and fissures are at higher risk for dental decay on pits and fissures (14,15)

6.0 Clinical flexibility

The guideline does not apply if the dental caries is rampant; although it may be part of an overall management approach.

The guideline need not be followed where a parent with full information as to the harms and benefits declines to accept these recommendations, or where a child is unable to co-operate sufficiently to allow the procedure.

7.0 Summary of the evidence for efficacy

7.1 Search Strategy

The literature was searched to compile:

- (1) articles pertaining to:
 - (a) tooth-specific and surface-specific caries attack rates;
 - (b) susceptibility of occlusal surfaces to dental caries in relation to post-eruptive tooth age
 - (c) individual-based clinical indicators for the use of sealants;
 - (d) cariostatic effectiveness of all currently used and tested sealants, and
- (2) documents reporting recommendations and expert opinions for the use of sealants.

The dental literature was searched from January 1991 to November 1996. The search strategies were: (i) a search of the Medline database, (ii) a specific search of the Index Medicus and the Index to the Dental Literature, (iii) a hand search of journals known to publish information of interest for the year 1996 (Community Dentistry and Oral Epidemiology, Journal of Public Health Dentistry, Journal of the American Dental Association, Journal of the Canadian Dental Association, Journal of Dentistry for Children, British Dental Journal, Acta Odontologica Scandinavica, Scandinavian Journal for Dental Research, Quintessence International, Journal of Preventive Dentistry, Community Dental Health), and (iv) a review of the references of documents identified through 1, 2, and 3. The search was limited to the English-language literature involving human subjects. No attempt was made to identify unpublished studies.

The Medical Subject Headings (MeSH) used were: pit and fissure sealants, effectiveness, dental caries, and dental fissures. The Medline was also searched under the following key-words: pit and fissure sealant, prevention, dental caries, retention rate, caries susceptibility, tooth surface, pit and fissure, caries incidence, caries prediction, past caries, caries risk assessment.

The bibliographies from the retrieved documents were reviewed to:

- screen for further references; and
- retrieve references that were the basis for sealant use recommendations identified through literature search. The latter were used to evaluate the validity of these recommendations.

7.2 Criteria used to include/exclude evidence

The library of the retrieved documents was subjected to a preliminary evaluation. According to the objective of the project, the following were excluded: (i) studies on short-term (<2 years) effectiveness of sealants, (ii) studies where sealants were associated with other preventive measure(s) and the effects of the individual interventions could not be differentiated, (iii) studies assessing only caries predictors other than clinical, and (iv) documents with recommendations for sealant use not supported with scientific evidence.

Initially, 60 papers were identified. Following the above criteria, 35 were retained. Of these papers: (i) 6 report on the epidemiology of dental decay - 2 on tooth-specific and surface-specific caries attack rates and 4 on time pattern of the incidence of occlusal caries; (ii) 9 present the predictive ability of caries risk assessment models; (iii) 18 concern cariostatic effectiveness of sealants - 13 in preventing and 5 in arresting dental decay; and (iv) 4 contain recommendations for sealant use drawn from scientific evidence.

7.3 Description of possible options

Caries in the pits and fissures of teeth are reduced by fluorides, Olivier et al. (22), and by dental sealants. Tooth-brushing by itself is thought to have almost no effectiveness since the diameter of an individual bristle is larger than the diameter of the fissure, meaning that even an individual bristle can not enter to the bottom of the fissure. Therefore the fissure can not be debrided of plaque or of the nutrients for the bacteria. Fluorides, while efficacious, are evidently insufficient to completely prevent the decay of pits and fissures since pit and fissure decay persists and constitutes the major component of the burden of illness.

Accordingly, the current best option to manage pit and fissure caries, at a stage prior to restoration, in susceptible individuals is dental sealants. Thus the options occur in the answers to the questions posed in the earlier review:

1. which teeth and tooth surfaces should be sealed?
2. how soon after tooth eruption should sealant be placed?
3. which children should receive sealants?
4. which material to use?

Section 5.1 described the prevalence, susceptibility over time and prediction of pit and fissure caries. The conclusions from that section address the first three of these questions.

7.3.1 Devices and clinical procedure

In the clinical procedure the surface of the tooth to be treated is cleaned with pumice in water using a rotating bristle brush; the surface of the tooth is etched with a mild (orthophosphoric) acid; the acid is rinsed off; the tooth is isolated from the saliva, air-dried and the liquid sealant is applied and cured (23).

7.3.2 Ease of use in clinical settings

The procedure is straightforward and in most dental offices is carried out by dental hygienists. Attention must be paid to keeping the freshly etched surface dry and, in particular, away from any contamination by saliva. As with other agents, the etch and the sealant should be kept away from the eyes and skin of patients.

7.3.3 Estimates of cost of providing sealants

Sealants are an established technology, provided by most dentists, and there is little concern over the costs of training or new equipment.

7.3.4 Likely cost per patient treated

In the fixed budget and staffing levels of the North York Public Health Department the major cost of providing sealants is the staff time. An earlier study of the times required to provide different services in the Health Department showed that an auto-polymerizing sealant required 11.5 minutes (95% CL = 9.5-13.5 min) (24).

We have no evidence or experience with providing, light-cured sealants, or glass ionomer cements (GIC's) and have not learned that these take less time or have lower material costs.

Sealants can be applied by dental hygienists, whereas amalgams have to be provided by dentists. Thus sealants have the advantage of lower dollar costs of application, in comparison to amalgams, because of the costs of the labour inputs.

7.3.5 Evidence for the effectiveness of sealants

Sealants in wide use today are resin-based, classified by the polymerization method as auto-curing or visible-light-curing. Others contain fluoride. There have been studies on the use of glass ionomer cements as pit and fissure sealants.

Effectiveness of sealants in preventing dental decay

The effectiveness of sealants in preventing pit and fissure caries had originally been evaluated in clinical trials with a half-mouth design. They were conducted to determine the relative caries reduction rate. A meta-analysis (25) of 44 such studies found that the proportion of occlusal decay prevented in the experimental group (PF) by one-time application of autopolymerizing sealants was 69.3%, 68.9% and 58.6% at 25-36, 37-48 and >48 month follow-ups, respectively, where PF was calculated as $(I_0 - I_1)/I_0$, where I_1 is the incidence of occlusal caries in the group of teeth treated with sealants, and I_0 the incidence in the control group. Since the rate of clinical wear of sealants is highest during the first two years following the application (38), these studies have indeed established cariostatic effectiveness of clinically worn sealants.

After sealants had been officially recognized as a caries preventive measure, studies with non-treated control teeth were no longer ethically acceptable. Since occlusal caries does not develop as long as the sealant remains adhered to the tooth, the longevity of sealants' clinical retention has been adopted as a measure of their success in preventing occlusal caries (26).

Between 1991 and 1996, several studies on sealant effectiveness in preventing pit and fissure decay were published. Clinical evaluation of *autopolymerizing sealants* was extended beyond 10 years: Simonsen (27) found in his study with a two-cohort design that the complete retention on permanent first molars 15 years after a single application was 27.6%, with caries reduction of 52%. Findings of shorter-term studies were similar to those published before 1991: 81% (28) and 61% (29) of sealed first permanent molars remained fully covered after 4 years.

Visible-light-curing sealants were evaluated in three clinical studies between 1991 and 1996. Raadal et al (30) found the complete retention of 97% and Gandini et al. 66% (31), after two years. In the Manitoba Fissure Sealant Pilot Project, 85% of permanent first and second molars were completely sealed at two-years follow-up (32).

A review of studies on glass ionomer cements used as pit and fissure sealants, published in 1996 (33), indicated comparatively very low short-term complete retention rates. In three most recent clinical trials, these rates were: 23% at one year (33), 26% at two years (34), and 4% at four years (29). In a field trial (36) only 2% to 6% of treated surfaces remained completely covered with glass ionomer after six months.

A review of the studies on the effectiveness of autopolymerizing sealants by Ripa (26) suggests that the highest rate of sealant loss occurs during the first year after their application, and declines significantly thereafter. In a recent study, Futatsuki (37) confirmed these findings, reporting high early loss of sealants: 14.4% at the 3-months recall, with a further loss of 7.0% at 6-months recall.

Effectiveness of sealants in arresting dental decay

In 1991, Handelman (38) published a review of the clinical trials on the progression of incipient occlusal caries sealed with autopolymerizing sealants. These studies were originally designed to allay the profession's concern about inadvertent sealing of dental decay. The results not only dispelled this concern, but suggested that resin-based sealants should be considered as a new approach to the treatment of caries confined to the enamel. The overall finding was that the carious process is inhibited and may even regress under clinically intact sealants. The effect of sealants was assessed using radiographs and/or bacterial count. Radiographic evaluation presented in this review showed that dental decay was arrested and might have regressed, if pits and fissures remained sealed. In the study from 1981, where carious first permanent molars of 6 to 9 years old children were sealed, there was no progression at the annual examinations and up to four years and a significant decrease in the penetration rating was registered. In a very similar study from 1985, the penetration ratings fluctuated by only 0.1-0.3 points at three annual recalls.

The study conducted in 1986 did not find any change in the depth of sealed occlusal lesions of first and second permanent molars over two years in a group of 12 to 15 year-old children. In these studies caries penetration was measured using a scale of 0-4, with '0' indicating no penetration and '4' being one-quarter to one-half penetration into dentin. Bacteriological evaluation demonstrated a major reduction (1,000-fold at one year; 2,000-fold at two year) in the count of cultivable microorganisms over time, in a medium taken from the infected dentin, when the retention of sealants was complete.

These findings were confirmed by Weerheijm et al. (39). They found the decrease of on average 100-fold in the number of microorganisms in samples taken before and after caries had been sealed with resin-based sealants.

Mertz-Fairhurst et al. (40,41) examined the effect of composite resin restorations on the carious process penetrating as far as halfway through dentin. Serial standardized radiographs taken over the six years did not show any obvious progression of the sealed lesions, confirming the previous finding. In this study, the tooth preparation involved enamel bevelling only, regardless of the depth of dental decay.

Based on this evidence on the cariostatic effectiveness of sealants, the newest edition of "The Art and Science of Operative Dentistry" (42), a standard textbook of operative dentistry used in Canadian dental schools, recommends that non-cavitated carious lesions are to '...receive either 'no treatment' or are to be treated with sealants, antimicrobials, or both...'.

Conclusions

- One-time applied *autopolymerizing sealants* have high long-term retention rates (25,27). At least 60% of surfaces remain completely covered after five to seven years (25), if the recommended application technique (particularly moisture control) is followed;
- Since the *visible-light-curing sealants* are newer, only their short-term effectiveness has been evaluated, with the longest follow-up being 5 years in one study. Their

retention rates have been very similar to those of autopolymerizing sealants for the equivalent follow-up periods (30-32);

- The longevity of *glass ionomer cements* as sealants is significantly lower than of resin-based sealants, rendering them unsuccessful in pit and fissure applications (29,33,34);
- Research findings are conclusive that resin-based sealants arrest pit and fissure caries confined to the enamel, provided a sealant remains intact (38,39). There is also an indication that dental decay may even regress when sealed (38-41);
- Since the risk of sealant failure is highest soon after the application (26,37), sealants should be evaluated clinically within one year of their placement, especially when used as restorative materials(11).

8.0 Comparison of relative outcomes and costs

In comparison to the evidence of the effectiveness of autopolymerizing BIS-GMA sealants:

- glass ionomer cements are less effective and cost about the same
- light-cured sealants are similarly effective but have additional capital and maintenance costs of the light curing 'gun'

9.0 Relative importance of the potential outcomes

Pit and fissure decay, if not prevented, is treated with a relatively simple restoration. This requires a local anaesthetic and staff time of about 23 minutes for composites and 17 minutes for amalgam, but leaves the child with a restored tooth. Restorations have to be replaced. There is great variability in their survival but posterior composites last about four year and amalgams more than twice as long, according to Mjor et al. (43). Periodically there are concerns over potential hazards associated with dental amalgam, but the hazards of the other

restorative or sealant materials have not been subjected to the same degree of concern or examination. Generally the public accepts that there is little hazard associated with the provision of dental restorations.

Teeth, with well restored pits and fissures, function as well as the natural tooth. However, if restored with amalgam, they have a distinctive appearance. For most children this is not an aesthetic issue when the restoration is placed on the chewing surfaces of molar teeth. Thus, restorations on pits and fissures provide a treatment acceptable to the patient.

Pit and fissure caries is not easy to diagnose in the early stages. There is evidence that dentists in Canada are currently restoring non-cavitated lesions in children (44).

From the perspective of the patient, the additional benefit of preventing the decay through sealants (rather than early restoration of that same tooth after it is decayed) may be marginal. The prime benefit is in the retention of the natural tooth material and the avoidance of the treatment and retreatment cycle. The second benefit to patients is that sealants could prevent unnecessary dental restorations perhaps arising from dentists' false-positive findings on examination. However, that implies that the sealants would have been placed on teeth that were not going to decay – a false-positive prediction.

From the perspective of the Health Department, sealants should be preferred over waiting for the tooth to decay and providing an amalgam since the same or better outcomes can be provided with lower labour costs. This only holds true as long as the accuracy of the predictive methods are high and few efforts are wasted on false-positive predictions, and few teeth decay because of false-negative predictions.

10.0 Evidence-based recommendations and minority views

- (1) Sealants should be placed on pits and fissures of teeth to prevent and arrest caries (I-A);
- (2) Children with current or previous caries experience should be considered for sealants (II-B); others should not (II-D);

- (3) Occlusal surfaces of permanent molars should receive sealants if they exhibit:
 - deep and narrow pits and fissures (II-B);
 - questionable caries or caries confined to the enamel (I-A);
 - no concurrent interproximal lesion which would need restoration (III-B);
- (4) Sealants should be placed as early as possible after the occlusal surface is completely free of gingival tissue, and up to four years after tooth eruption (II-B);
- (5) Resin-based sealants should be used: autopolymerizing sealants (I-A); visible-light-cured sealants (II-B). Glass-ionomer cements should not be used to seal pits and fissures (I-A)
- (6) Sealants should be evaluated clinically within one year of their placement, especially when used over incipient lesions (I-A).

11.0 References

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