

WORKSHOP ON GUIDELINES FOR SEALANT USE

Preface and Workshop Recommendations

**Albany, New York
April 29-30, 1994**

Sponsored by:

**School of Public Health, University at Albany, SUNY
Association of State and Territorial Dental Directors
New York State Health Department
Ohio Department of Health**

Funded by:

**W.K. Kellogg Foundation
Maternal and Child Health Bureau, USPHS
U.S. Centers for Disease Control and Prevention**

PRE-PUBUCATION REPORT

PREFACE

Although dental caries prevalence has dramatically decreased in the United States, the disease still affects more than 50 percent of school-aged children and almost all adults. Children from low socioeconomic status families, as well as minorities, American Indians and Alaska Natives are at higher risk for caries and are less likely than others to receive dental care. Because most childhood caries occurs on tooth surfaces with pits and fissures, the use of dental sealants seems to be a logical approach for further improving children's oral health. Sealant use by dentists, however, continues to fall short of expectations.

While several attempts have been made to increase sealant use both in private practices and public programs, the nation's ability to achieve the Healthy People 2000 objective for sealants is in doubt. The past decade saw several sealant promotion efforts, including the Massachusetts Department of Public Health's 1986 monograph, entitled *Preventing Pit and Fissure Caries: A Guide to Sealant Use*. The monograph described sealant application technique and provided guidelines for using sealants in individual office programs and in community programs, specifically those that were school-based.

Since publication of the sealant guide, additional information about dental caries epidemiology, clinical characteristics and conservative treatment options has emerged. Some of this new information, along with concerns about health care costs, have resulted in uncertainties about clinical decisions regarding sealant use in public and private settings. In situations such as this, expert analysis of available information often is a useful approach for addressing uncertainties and establishing guidelines that will improve the quality of care.

With this in mind, the Association of State and Territorial Dental Directors; the New York State Department of Health; the Ohio Department of Health; and the School of Public Health, University at Albany, State University of New York convened the *Workshop on Guidelines for Sealant Use* in April 1994 to evaluate and update guidelines for sealant use, specifically those contained in the 1986 sealant guide. The workshop did not address all of the aspects of sealant use that were covered in the Massachusetts sealant guide (e.g., sealant application technique), but narrowly focused on the process for selecting patients and teeth to receive sealants.

Twenty-two invited participants attended the workshop. Participants included clinicians, policy makers, program administrators, and researchers in both clinical dentistry and oral epidemiology.

A background paper on recent changes in caries epidemiology and their potential impact on sealant use was written for the workshop by Drs. L. Jackson Brown and Robert H. Selwitz of the National Institute of Dental Research. The paper was distributed to participants in advance of the workshop. A reaction paper from an epidemiologist's viewpoint was presented by Dr. R. Gary Rozier of the University of North Carolina, School of Public Health followed by Dr. Karl-Johan Soderholm's (University of Florida, College of Dentistry) reaction paper from a clinical perspective. Prior to a general discussion of the papers, several participants made brief-presentations on sealant-related data they had gathered in their own programs. Workshop participants then formed two work groups (one for individual patient care and one for community programs) to evaluate and revise the guidelines, as necessary. At various points during the process, the workshop reconvened to hear and discuss work group reports, in progress. The final recommendations were crafted from discussion held at the workshop and through subsequent commentary by workshop participants on multiple drafts of the document. Field reviewers, who did not participate in the workshop, commented on a late draft, as well.

Recommendations for sealant use were approached, as they were in the Massachusetts sealant guide, separately for individual care programs (mostly private practices), and for community programs. This approach should not suggest that the workshop participants considered the teeth of individuals who receive their dental care in these settings to be somehow different, but rather that differing risk factors and clinical circumstances may justify altering treatment planning decisions. In fact, the decision making process --once the patient is in the chair-- is very similar in both settings.

Themes of risk-based caries prevention and conservative methods for diagnosing and treating pit and fissure caries underlied all discussions.

The guidelines developed at the workshop do not differ greatly from those in the Massachusetts sealant guide; they should be viewed as *refinements* of the earlier guidelines. The most notable difference is that the community programs section has been expanded to include the program planning process that precedes the need for clinical decision making. Themes of risk-based caries

prevention and conservative methods for diagnosing and treating pit and fissure caries underlied all discussions. It was acknowledged that realizing the full potential for practicing conservative dentistry and improving cost-effectiveness in the prevention and control of dental caries will require improvements in the state-of-the-science both for caries diagnosis and risk prediction and that all recommendations evolve as new information emerges.

While the recommendations represent the consensus of the 22 individuals who participated in the workshop, they do not represent official policy of any agency, institution, or organization.

Several workshop participants commented on the need for other means to address sealant issues not taken up in the workshop. For example, more than one participant felt that a concise, straightforward description of the sealant application technique would be of value to dental care providers, regardless of practice setting. Furthermore, a variety of vehicles for communicating the workshop recommendations and other sealant information are needed at this time.

WORKSHOP RECOMMENDATIONS

INTRODUCTION

The United States Public Health Service established a national health objective for the year 2000 that 50 percent of eight and 14 year old children should have pit and fissure sealants on one or more permanent molar teeth (1). In order to meet the objective, considerably more than the 11 percent of eight-year-old and 8 percent of 14-year-old children found to have sealants in 1986 (2) must be reached. Although there is evidence of some increase in the percentage of children with sealants since 1986 (3-5), a significant gap remains between sealant prevalence and the year 2000 objective. Furthermore, public awareness and knowledge of sealants remain low (6). In an effort to improve provider knowledge about the appropriate use of sealants, the Massachusetts Department of Public Health published a monograph, *Preventing Pit and Fissure Caries: A Guide to Sealant Use* (7), in 1986. The monograph described sealant application technique and provided guidelines for using sealants in individual office programs and in community programs, specifically those that were school-based.

Since publication of the sealant guide, additional information about dental caries epidemiology, clinical characteristics and conservative treatment options has come to light. The Association of State and Territorial Dental Directors; the New York State Health Department; the Ohio Department of Health; and the School of Public Health, University at Albany, State University of New York convened the two-day *Workshop on Guidelines for Sealant Use* in April 1994 to reconsider and update the guidelines from the 1986 monograph. A background paper (8) and two reaction papers (9,10) were presented and discussed by the 22 workshop participants (listed in Table 1) prior to work sessions to revise the guidelines.

Like the previous guide, decisions about when to apply sealants in individual care programs were addressed separately from community programs. Figure 1 illustrates differences between the two settings with regard to determinants for an individual presenting for sealants and the primary influences on clinical decisions. The two situations are distinguished by assumptions about the availability of diagnostic and treatment options and utilization of dental care by patients. Individual care providers, whether in private practice or public settings, are more likely to provide continuous care, with a comprehensive range of caries diagnostic and treatment options available. Generally, the people treated in community sealant programs are more likely to be episodic users of primary dental care services. Individual patient care usually is provided in private dental offices, but also may take place in community primary dental care programs such

Individual care programs, whether in private practice or public settings, are more likely to provide continuous care, with a full range of caries diagnostic and treatment options available.

Community sealant programs treat people who are more likely to be episodic users of primary dental care services. Diagnostic and treatment options are limited.

as community health centers or neighborhood clinics. Community primary care programs that meet the assumptions used for individual care programs should employ those guidelines within the context of available resources and knowledge of risk factors in the population served. Programs that generally do not provide continuous care nor have access to a full array of caries diagnostic and treatment options must take such factors into consideration when determining individual patient caries risk and the most appropriate clinical decisions.

Sealants are an important dental caries prevention technology, ideally used in combination with patient education, effective personal oral hygiene, fluorides and regular dental visits. The following principles and scientific facts should underlie the use of pit and fissure sealants in public and private programs:

Principles

- Prevention of dental caries is better than treatment. Therefore, sound, nondiseased teeth are more highly valued than adequately restored teeth.
- For equivalent outcomes, the least invasive approach, using the simplest intervention for managing dental caries, is preferred.
- Minimizing the cost of preventing or controlling pit and fissure caries is desirable.
- Strategies for sealant use (e.g., patient selection, clinical decision making) may differ between individual care and community programs.

Critical Scientific Facts Related to Sealant Use

- Sealants have been demonstrated to be a safe and effective long-term method to prevent pit and fissure caries (11-13).
- Pit and fissure caries attack begins in childhood and continues through adolescence and into adulthood (14-16).

- In addition to preventing carious lesions, sealants can arrest caries progression (17-20).
- Effective sealant use requires meticulous application technique, particularly moisture control (7,10). Sealant retention should be checked within one year of application (7).

The following guide is an updated and expanded approach to selecting communities, individuals, teeth and tooth surfaces to receive sealants. It does not, however, address all aspects of sealant use. The discussions of caries diagnosis, risk assessment and the expanded use of sealants as therapy for caries confined to the enamel should be of particular interest to dental care providers who treat patients in individual care programs. For those working in community sealant programs, the expanded discussion of the role of community needs assessment in program design and the concept of interim sealants in specific situations should be helpful.

The reader should consult other sources for the most current information about aspects of sealant use not addressed in this document (7,8,21-27). Sealant application technique was well-described in *Preventing Pit and Fissure Caries: A Guide to Sealant Use* (7). Since that time, however, research has indicated the effectiveness of reduced etch time (15-20 seconds) from the one minute standard in 1986 (24), and other research on tooth preparation has opened the door for alternatives to the pumice prophylaxis using a rotary instrument (25-26). Soderholm (10) addressed some clinical aspects of sealant use in his paper presented to the Workshop. The American Dental Association provides information on sealant materials accepted by its Council on Dental Materials, Instruments and Equipment (27). A detailed guide for planning and implementing community sealant programs has been developed by the American Association of Community Dental Programs (21).

While this document represents the consensus of the 22 individuals who participated in the Workshop, it does not represent official policy of any agency, institution, or organization.

SEALANT USE IN INDIVIDUAL CARE PROGRAMS

The goal of individual patient care programs is to achieve and maintain optimal oral health, which includes the prevention of oral diseases and, when treatment is necessary, conservation of tooth structure consistent with patient desires. Unlike community sealant programs, as defined for this workshop, individual care programs provide for continuity of care and incorporate comprehensive approaches to diagnosis, treatment planning, treatment, and follow-up. The changes observed in caries rates, patterns and lesion progression allow for more effective and judicious use of sealants in individual care programs (8-10). Also, differences in caries risk among individuals, teeth and/or tooth surfaces have presented opportunities for the development of risk assessment models (28,29). Although a practical risk assessment model that can be applied at the individual level is not yet available, substantial progress has been made in assessing one's risk for dental caries (30-33). The following guidelines are provided to assist practitioners in determining the appropriate use of sealants.

Preventive sealants are applied to at-risk, caries-free pits and fissures to prevent caries.

Therapeutic sealants are applied to pits and fissures in which caries is confined to enamel (incipient lesions) to arrest caries progression.

All patients having teeth with morphological characteristics that place them at risk of developing dental caries should be considered for *preventive sealant* applications. Under certain circumstances, patients having caries in pits and fissures also are candidates for sealants (17-20). Such sealants will be referred to as *therapeutic sealants*. Although the majority of sealants have been placed in children, recent studies suggest that the risk for pit and fissure caries extends into and well beyond adolescence (14-16). Adults who are at risk for developing lesions in pits and fissures that were

previously caries-free, as well as those who may require sealant replacements, also should be evaluated for sealants. The goal of preventing caries through the more widespread use of sealants will be best accomplished by providing preventive sealants to individuals at high risk and placing therapeutic sealants on carious lesions limited to enamel.

Individual care providers have considerable influence on patients' decisions about sealants. The recommendation of a dentist or office staff member is more likely to influence parents to have sealants placed on their children's teeth than learning about sealants through the media (34). The dental office, therefore, is a critical place for sealant promotion, another avenue for increasing sealant

prevalence. Promotional materials for patients are available from governmental agencies and through the American Dental Association catalog (35).

Risk Assessment of Individuals

Determination of the need for sealants begins with an assessment of the individual's risk for dental caries (Figure 2). Factors contributing to an individual's caries risk include caries history in primary and permanent teeth, previous dental care, use of preventive practices, family and medical history, among others (30,33). Risk for pit and fissure caries varies from one patient to another, and within the same patient from one point in time to another. Changes in habits, life circumstances, health status, and medication use (e.g., anti-sialogogues or sweetened syrups) are known to influence risk for caries (36,37). The different and changing risk profiles among patients in individual patient care programs require continuous monitoring.

Risk Assessment of Teeth

Assessment at the tooth level is performed to determine the need for a sealant. Factors that should be considered are the individual's risk for developing dental caries, level of caries activity, pit and fissure morphology, caries pattern, and life expectancy of primary teeth. Use of sealants also depends on the status of proximal surfaces of the tooth selected for sealing, the eruption status, and the ability to adequately isolate the tooth. Furthermore, the distribution of caries by tooth type provides a clear indication of susceptibility of different teeth to caries. Studies suggest that first and second permanent molars are at greatest risk for pit and fissure caries (7-10,38). Primary molars, premolars, and permanent maxillary incisors that are at high risk also may need to be sealed.

Evaluation of teeth results in pit and fissure surfaces being classified into one of three categories: *caries-free*, *enamel caries*, and *dentin caries*. Figure 3 provides clinical presentations of each of the three categories. Although caries diagnosis historically has been performed by a visual-tactile examination, using a mirror and explorer, studies suggest that visual examination of air-dried teeth alone, with or without magnification, may provide comparable or superior diagnoses (39-48). Moreover, probing for dental caries using a sharp explorer with firm pressure may damage noncavitated carious enamel (41,48). Diagnostic techniques now under development may improve our ability to identify dental caries with greater accuracy in the future and reduce patient risk (10). There is a need to establish standards for the diagnosis of dental caries, perhaps through a consensus development conference or other forum. At this time, a prudent approach would be to use light to moderate pressure if using an explorer.

Caries-free teeth

The decision to seal a sound or caries-free surface is based principally upon considerations of caries risk as influenced by pit and fissure morphology, eruption status, and caries activity in the mouth (Figure 2).

Pit and Fissure Morphology: Pit and fissure morphology has been shown to be a significant factor in predicting caries risk (30). Previous guidelines have clearly stated that teeth with well-coalesced pits and fissures and wide, easily cleaned grooves usually do not require sealing (7, 49-51). Teeth with deep pits and fissures that catch an explorer are ideal candidates for sealants.

Permanent molars have the most susceptible pits and fissures. Premolars are much less susceptible to occlusal caries than permanent molars (8-10, 38). Therefore, fewer premolars will be indicated for sealant application than permanent molars. The need for sealant use in first and second primary molars also is determined by the pit and fissure morphology and the life expectancy of the tooth. Primary molars, particularly second molars, may demonstrate deep pits and fissures. Sealants may be indicated on primary molars with clear evidence of pit and fissure caries activity or deep and/or stained fissures, particularly if proximal tooth contact does not exist. In such cases, sealant application is indicated consistent with the overall assessment of the individual's risk and the life expectancy of the tooth.

Questionable Caries: Sometimes it is difficult to distinguish sound pits and fissures from those with caries limited to enamel. In this situation, commonly referred to as *questionable caries* (7), a tooth would be considered at risk for dental caries and should receive a sealant. A sealant placed over a carious lesion limited to enamel will prevent the progression of undiagnosed caries, should it be present. This approach is justified since it has been shown that if a diagnostic error occurs and caries is sealed, the lesion will not progress, but will arrest, provided the sealant remains intact (17-20).

Eruption Status: Previous guidelines have stressed the need to seal the tooth immediately after eruption (7, 49, 50). However, studies have suggested that adequate isolation is essential for sealant retention and that sealant success is positively associated with the eruption status of the teeth and the operator's ability to maintain a dry field (13). Whenever possible, therefore, it is recommended that the sealant placement be delayed until the tooth is sufficiently erupted.

In the past, most pit and fissure caries on permanent molar teeth was thought to occur within four to six years after eruption (49,50). Therefore, most existing sealant guidelines recommend that pit and fissure surfaces that have remained caries-free for four years or more do not require sealants (49,50). Based on clinical and epidemiologic data, post-eruptive age alone should no longer be used as a major criterion for deciding whether a tooth should be sealed. The primary consideration should be the risk of the pit and fissure surface to caries consistent with an individual's overall caries risk at the time of evaluation.

Caries Pattern: If the pattern of caries indicates susceptibility to pit and fissure caries, as evidenced by the occurrence of one or more lesions per year, it is advised that the remaining caries-free pit and fissure surfaces of teeth at greatest risk be sealed. If an individual demonstrates proximal caries activity, sealants still may be indicated for noncarious occlusal surfaces. The conservation of occlusal surfaces always should be considered when restoration of proximal surfaces of teeth is undertaken. Several conservative approaches to managing posterior proximal caries can allow independent management of the proximal and occlusal aspects of the same tooth. Conservative procedures for management of proximal caries on posterior teeth may range from remineralization protocols to direct access restorations, including posterior Class III glass ionomer restorations and slot preparations combined with conventional restorative materials (10,52-60).

Enamel Caries

Enamel lesions are those in which demineralization is confined to the enamel. Upon visual examination, the tooth demonstrates a white halo of opacity or chalkiness surrounding the air-dried pit or fissure. Current radiographic methods cannot detect enamel caries in pits and fissures until the lesion has reached the dentin. Sealants can be safely placed on enamel lesions without jeopardizing the health of the tooth (17-20).

Dentin Caries

Usually the progression of the lesion into the dentin results in the collapse of at least part of the overlying enamel, producing a readily identifiable clinical cavity. Recent studies report lesion progression into the dentin under apparently intact surface enamel, thus making it more difficult to detect lesions in dentin by clinical means (61,62). The visual clues to the presence of a dentin lesion include changes in color, opacity or translucency of the tooth (44). Radiographs show radiolucency beyond the dentino-enamel junction. A pit or fissure surface with definite caries involving dentin should have the caries removed and restored

conservatively. This treatment may include the use of sealants, in conjunction with composite restorative materials, in preventive resin restorations (53-60).

Evaluation of Sealants

Reported complete sealant retention after 10 years ranges from 41 to 57 percent (63). Failure of a sealant to be retained on a tooth surface primarily is related to operator technique -- specifically moisture contamination at a critical point during the sealant application process. Because most sealant failure occurs relatively soon after application, sealants should be evaluated clinically within one year of placement (7).

GUIDELINES FOR SEALANT USE IN COMMUNITY PROGRAMS

For the past two decades in the United States, community programs, most often either school-based or school-linked, have provided direct service by applying sealants to children's teeth. Community, or public health, options for reducing pit and fissure caries through sealant use, however, go beyond the direct service approach (64). Additional options include sealant promotion to increase their use in private dental practices and the development of public policies that foster sealant use (e.g., through Medicaid rules or dental practice acts). The guidelines that follow are in two parts: developing a community strategy for sealant use, and program design options for communities that select the direct service approach. It should be noted that even among direct service programs, settings other than schools may be feasible and appropriate for sealant application, as demonstrated with young adults in military service (15).

Designing a community sealant program involves a series of decisions for which there are few "hard and fast" rules. Some of these decisions must be made by assessing population needs and balancing them with supports and constraints in resources and other factors. Figure 4 illustrates seven major decisions that should be made when designing a community sealant program -- there may be others as well. The figure is presented in the form of a worksheet that may be helpful in identifying issues and making planning decisions. The narrative provides additional information to help identify the factors to weigh when making program design decisions.

The community programs guidelines recognize that all communities are not the same. They often vary with respect to caries levels, dental treatment resources,

public health systems, and the value placed on oral health and dental caries prevention. Therefore, the early steps have been designed to help assess community need for sealant programs and do not assume that a program will be implemented in every instance.

Because several direct service sealant program models have operated successfully over the years, the guidelines offer flexibility for designing such programs. Community goals and other considerations will influence the path chosen. Program objectives should be established in advance of program design decisions. For example, one community may choose to offer sealants to the greatest number of people, while another may target specific population groups (e.g., low income). Dental disease patterns continue to evolve, as do the programs designed to meet community needs. Therefore, ongoing monitoring and evaluation of program operations and design are important.

Developing a Community Strategy for Sealant Use

1. Defining the Community

The community to be served first must be defined. For these guidelines the term "community" is broadly defined as any group with shared characteristics. For example, the community can be one or more municipalities, neighborhoods, school systems, managed care organization memberships, or other populations. In some instances, a state's population may meet the definition of a community.

2. Assessing Community Need for Dental Sealants

Once the community has been defined, the next step is to assess the need for a sealant program. Verification of need (e.g., prevalence of untreated pit and fissure caries and filled occlusal surfaces, level of control of proximal caries, sealant prevalence) may come from a variety of sources. It may be the result of an epidemiologic surveyor may be determined informally from observations reported by teachers, school nurses, or dental clinic staff. If direct assessment of the caries level is not possible, proxy measures for selecting populations with high caries risk may be used (e.g., low income).

The Association of State and Territorial Dental Directors' *Assessing Oral Health Needs: ASTDD's Seven-Step Model* (65) is a useful tool for assessing community oral health, including sealant needs. The ASTDD model offers a choice of data collection methods suitable for different levels of available resources. Options include secondary data, clinical program data, questionnaires, screenings and epidemiologic surveys. The model provides

detailed descriptions of needs assessments methods. However assessed, the community need for sealants should help to determine the approach(es) for addressing the problem.

3. Weigh Support and Constraints for Sealant Program Development

Once need has been established, a decision on how to increase sealant prevalence requires consideration of support for program development and constraints that could interfere. Support and constraints may be as general as the value that the community places on oral health or as specific as the availability of people to work on the project and funding for implementation. By identifying support and constraints early, a rational approach can be selected. For example, if a state's dental practice act does not permit dental hygienists or assistants to apply sealants without an on-site dentist, it will be much more costly to operate a direct service sealant program unless dentists are willing to donate their time.

4. Select Approaches for Increasing Sealant Prevalence

Given a community's needs, support and constraints, decisions must be made on the necessity and practicality of a sealant program. If there is sufficient need and the balance of support and constraints tips toward the ability to initiate a program, selecting one or more of several approaches for increasing sealant use is the next step.

Direct service programs, in which sealants are applied to individuals' teeth, traditionally have operated in school settings. Transporting a mobile dental clinic and setting up portable dental equipment at schools are common program models. Sometimes, children are enrolled and screened at school but receive sealants at an off-site dental clinic. Other potential sites are institutions (e.g., correctional, residential programs for people with mental retardation or other developmental disabilities), military installations, and --where needs assessment has shown primary molars of young children to be appropriate targets for sealants-- Head Start programs.

A variety of *sealant promotion* efforts offers the potential for increasing sealant use in dental offices (66,67). The recommendation of a dentist or office staff member is more likely to influence parents to have sealants placed on their children's teeth than learning about sealants through the media (34). The sealant promotion approach may target the dental profession, the public, individuals responsible for administering health benefit plans, or a combination thereof. A *policy development* approach relates to policies likely to increase sealant use.

For example, raising Medicaid fees and broadening or eliminating age restrictions for sealant application could increase appropriate sealant use. In addition, a coalition of agencies and organizations could review the problem of dental practice act requirements that restrict sealant placement by dental auxiliaries and work toward modifying those requirements.

These guidelines do not provide detail on either the sealant promotion or policy development approaches. Those who select the direct service approach can use the following section on design options for direct service sealant programs to make decisions about their programs.

Design Options for Direct Service Sealant Programs

5. Define Specific Population(s)

Specific populations to receive sealants may be targeted further, or "modified," by a variety of factors to reach those in greatest need. Some degree of targeting probably will be unavoidable unless resources are unlimited. Traditionally, sealant programs have been for schoolchildren -- but other special populations may be candidates as well.

School-based or -linked programs usually operate in second and sixth grades, as suggested in *Preventing Pit and Fissure Caries: A Guide to Sealant Use* (17). Often, the programs re-examine the children the next school year to place sealants on newly erupted teeth and tooth surfaces, and to replace missing sealants. Although re-examination may reduce the time available to see new children, it is very important for quality assurance and program evaluation. Other grades may be selected to coincide with program objectives or school considerations (e.g., whether sixth grades are in elementary or middle schools). Selection of higher grade levels usually represents a trade-off between identifying a greater number of sufficiently erupted teeth and diminishing participation by older students. Alternately, a program may be offered to all schools or only those with high numbers or percentages of children from low income families. Such programs, however, may offer sealants to *all* children in the grades selected at a particular school. Low income families generally have more dental caries and less access to dental care, making them a frequently targeted population group for sealant programs. For children, eligibility for free or reduced cost school lunch programs is often used as a proxy for low income (68,69).

Research has shown that the clinical progression of caries today is slower than in the 1960s and 1970s and that teeth are at risk for pit and fissure caries for a longer time (10). Although school-based or school-linked programs still may be highly appropriate, other possibilities now exist. Some examples of special populations that could be targeted are listed in Figure 4.

6. Identify Individuals to be Evaluated for Sealants

Once a specific population has been selected, including any modifiers to further target the program, a decision must be made whether to offer the program to all or selected individuals. Even in schools in low income areas, all individuals at a given grade level may be offered sealants, or only those who qualify for the lunch program or do not have a dentist. Information on utilization of dental care can be obtained on consent forms or health histories. Many times schools will be unwilling to select *individual children* on these bases for fear of stigmatizing them or as an equity issue relative to other children. It usually is acceptable, however, to select *schools* according to some indicator of economic need. These are all decisions that should be made according to program goals and community considerations. Participation in a community sealant program is contingent upon consent of a parent or guardian in accordance with local standards.

7. Identify Teeth/Tooth Surfaces

Not all individuals within a population are equally appropriate candidates for dental sealants. There are dental conditions that either place them at very low caries risk (e.g., no past caries history combined with well-coalesced pits and grooves) or preclude sealant use (e.g., large proximal caries or restorations on all teeth with fissured surfaces). The individual care guidelines for sealant use (Figure 2) are the basis for tooth selection in targeted community programs. However, since community programs generally lack both the continuity of care and comprehensive array of caries diagnostic and treatment options, those guidelines have been adapted for community programs.

While current models for identifying individuals who are at high risk for dental caries require further development, knowledge about surface-specific caries attack rates and the relationship of tooth eruption to age can help in the design of a program that conserves limited resources and maximizes effectiveness (8,67). Studies suggest that first and second permanent molars are at greatest risk for pit and fissure caries and that primary molars, premolars and permanent maxillary incisors are at much lower risk (7-10,38). Table 2 lists the likelihood of

the occlusal surfaces of first and second permanent molars being erupted suitably for sealant application at different grade levels (70). While occlusal surfaces are the first to be suitably erupted for sealant application, buccal pits of lower molars and lingual grooves of upper molars also are at substantial risk for caries and should be sealed when they meet sealant criteria, including the requirement to maintain a dry operating field. It is possible to delay sealant application for these surfaces until a child is seen during the next school year, on follow-up.

Unlike the model for tooth and tooth surface selection in individual care programs, risk assessment of individuals in community sealant programs should give considerable weight to the likelihood of the individual receiving future dental care. This factor can be assessed by observing the presence of caries and restorations or by a questionnaire. It is possible, therefore, that sealants will be applied to a greater proportion of sound teeth and teeth with questionable caries in community programs than in individual care programs because of the inability to monitor teeth over time in the former and a consequent need to "err on the safe side."

Another adaptation of the individual care model is the proposed use of *interim* sealants in community programs for some teeth judged to have dentin caries. An interim sealant is one placed over suspected dentin caries when definitive

An *interim sealant* is one placed over suspected dentin caries, as a caries control measure, when definitive diagnostic and restorative care are not expected to occur in the near future.

diagnostic and restorative care are not expected to occur in the near future. Use of interim sealants for caries control is similar to the decades-old use of Intermediate Restorative Material (IRM). The use of interim sealants includes notification of the patient and parent/guardian of the

need for restorative care. Interim sealants are recommended only in instances where the examining dentist in a community sealant program believes that the patient is unlikely to complete a restorative care referral in the near future and the size of the carious lesion(s) is not too large to preclude the procedure. Interim sealants are intended to arrest dentin caries until the tooth or teeth can be evaluated and more appropriately treated. The procedure is justified in community sealant programs in light of reports of children with significant dental caries being found, upon follow-up examination, who have not received care

despite previous referral, and by studies in which frankly carious teeth were sealed successfully for many years (71-74).

The success of a community sealant program strategy that employs interim sealants would be enhanced greatly by the availability of a different color sealant (e.g., red or pink) along with education of, and communication with, local dentists on the meaning of the color-marked sealant. These steps would alert dentists to the need for careful diagnosis and treatment planning of teeth with color-marked sealants. Manufacturers of dental sealants should develop a different color (other than white or clear) sealant specifically for use in community sealant programs. In the absence of the availability of the color-marked sealant, programs using interim sealants must be committed to communicate with patients, parents/guardians and the dental community.

Evaluation

Community needs, caries patterns and dental technology are all dynamic factors that could affect the appropriateness of a sealant strategy over time. Just as communities should assess needs before embarking on a sealant strategy, they also should re-evaluate those needs periodically along with the effectiveness of the programs they have developed. Likewise, sealant programs should undergo periodic evaluation to determine whether they are meeting their goals efficiently.

Evaluation should focus on the need for sealants, program quality and costs, and the extent to which established programs are meeting the sealant needs of the community. An established program can document sealant need with programmatic data. For example, participation rates in a direct service sealant program may reflect a community's expressed interest in sealants. The number of children found by the program to be lacking sealants and at sufficient risk for pit and fissure caries to require sealant application indicates unmet need. Another evaluation component should be the assessment of program quality (75,76). For example, data on retention rates of sealants placed, comparison of program practices with established standards for infection control, and sealant application technique may be used to evaluate programs. A re-examination component will provide the opportunity for determining sealant retention rates. Program efficiency can be measured in terms of cost per individual, per tooth sealed, or per number of carious lesions prevented.

Other approaches to increasing sealant use also can be evaluated. The effects of

sealant promotion programs could be evaluated through surveys of dentists and parents, as well as through the kinds of needs assessment activities mentioned previously. Impacts resulting from policy changes in Medicaid can be assessed through program data on the number of sealant claims submitted. The following list may be useful in deciding which factors to include in an evaluation of a program:

- change in dental caries experience
- number of sealants placed
- number of children receiving sealants
- community support demonstrated
- number of children with prior dental caries experience
- retention rate of sealants
- sealant program costs
- number of Medicaid recipients served

CONCLUSIONS

The guidelines developed at the Workshop on Guidelines for Sealant Use, though similar to those presented in the 1986 Massachusetts sealant guide, should be viewed as *refinements* of the earlier guidelines. The guidelines for deciding which patients and teeth should receive sealants in individual care programs were adopted and modified for community programs because of differences in clinical circumstances and patient risk factors rather than characteristics of teeth. It was acknowledged that realizing the full potential for practicing conservative dentistry and improving cost-effectiveness in the prevention and control of dental caries will require improvements in the state-of-the-science both for caries diagnosis and risk prediction.

Caries Diagnosis: Agreement was reached that pit and fissure caries confined to enamel generally can be distinguished from caries that has progressed into dentin and that the preferred treatment differs for the two. It was acknowledged that visual examination of air-dried teeth alone may provide comparable or superior diagnosis to the traditional visual-tactile examination using mirror and explorer. Furthermore, diagnostic techniques under development may improve our ability to diagnose dental caries with greater accuracy in the future. At this time, a prudent approach would be to apply only light to moderate pressure if using an explorer. There is a need to establish standards for the diagnosis of dental caries, perhaps through a consensus development conference or other forum.

Caries Risk Assessment: "Modern" dentistry calls for an assessment of

individual patient risk for dental caries in order to determine the most appropriate and conservative plan for preventive and restorative care. While the current science of risk assessment --at the levels of the community, the individual and the tooth-- requires improvement, there are several basic risk assessment principles that providers should apply at this time.

Sealant Use in Individual Care Programs (care is comprehensive and continuous): Caries risk assessment should have a strong influence in determining who receives sealants. Sealants should be used to prevent caries in at-risk teeth (preventive sealants) and to treat teeth with questionable or definite caries confined to the enamel of pits and fissures (therapeutic sealants).

Sealant Use in Community Programs (care is neither comprehensive nor continuous): The design of a community sealant program should be based on an assessment of the oral health needs and resources of a community. Because comprehensiveness and continuity of care cannot be assumed for community sealant programs, as defined in the Workshop, it would be prudent to use sealants more liberally on sound and questionable teeth observed in those programs. The use of interim sealants was proposed, under specific circumstances, in community programs. Interim sealants, ideally of a color different from other sealants, would be placed to arrest dentin caries in children who are unlikely to receive dental care in an individual care program in the foreseeable future. Additional protocols and materials development, such as color marking, would facilitate the use of interim sealants in community programs.

Participants in the Workshop on Guidelines for Sealant Use were unanimous in their support for increasing the appropriate use of pit and fissure sealants in both individual patient care and community programs. Only through continued efforts by all segments of the dental community can the benefits of sealants significantly enhance the oral health of all.

ACKNOWLEDGEMENTS

The recommendations from the Workshop on Guidelines for Sealant Use were the result of the work of the 22 workshop participants. Drs. Jayanth Kumar and Mark Siegal organized the workshop, and compiled and edited the recommendations. Special thanks go to Drs. Stephen Corbin, Raymond Kuthy and R. Gary Rozier for their assistance in developing the early drafts of the manuscript. Dr. John Rossetti, of the federal Maternal and Child Health Bureau, was an ad hoc reviewer of the recommendations, as they developed, and a supporter of the workshop. Additional thanks go to the support staffs of the Bureaus of Dental Health of the New York State Health Department and the Ohio Department of Health. The workshop was supported by grants and contracts from the W.K. Kellogg Foundation, the National Center for Education in Maternal and Child Health, and the Centers for Disease Control and Prevention (Division of Oral Health). Professor Ivar Espelid, of the University of Bergen (Norway) provided the photos of the criteria for diagnosis of pit and fissure caries.

REFERENCES

1. U.S. Department of Health and Human Services, Public Health Service. Healthy People 2000: National Health Promotion and Disease Prevention Objectives. DHHS Publication No. (PHS) 91-50213. U.S. Government Printing Office, 1990.
2. ADA News. Sealant use low: study. April 3, 1989, p.24.
3. Phipps KR, Mason JD, Fleming DW. Dental health of school children -- Oregon, 1991-92. MMWR 1993;42(46):887-91.
4. Ohio Department of Health, Bureau of Dental Health. The Oral Health of Ohioans, 1993. Columbus: 1994, 41 p.
5. Gift HC, Newman JF. Oral health activities of U.S. children: results of a national health interview survey. J Am Dent Assoc 1992;123(10):96-106.
6. Gift HC, Corbin SB, Nowjack-Raymer RE. Public knowledge of prevention of dental disease. Public Health Rep 1994; 1 09:397-404.
7. Preventing pit and fissure caries: a guide to sealant use. Massachusetts Department of Public Health, Boston, MA, 1986.
8. Brown LJ, Selwitz RH. The impact of recent changes in the epidemiology of dental caries on guidelines for the use of dental sealants. National Institute of Dental Research. Presented at the Workshop on Guidelines for Sealant Use, Albany, NY, April 1994.
9. Rozier RG. Reactor paper to "The impact of recent changes in the epidemiology of dental caries on guidelines for the use of dental sealants" -epidemiologic perspective. Presented at the Workshop on Guidelines for Sealant Use, Albany, NY, April 1994.
10. Soderholm, KJM. Reactor paper to "The impact of recent changes in the epidemiology of dental caries on guidelines for the use of dental sealants" -- clinical perspectives. Presented at the Workshop on Guidelines for Sealant Use, Albany, NY, April 1994.
11. American Dental Association, Council on Dental Health and Health Planning and Council on Dental Materials, Instruments and Equipment. Pit and fissure sealants. J Am

Dent Assoc 1987;114:671-2.

12. Weintraub JA. The effectiveness of pit and fissure sealants. J Public Health Dent 1989;49(Spec Iss):317-30.

13. National Institutes of Health: Dental Sealants in the Prevention of Tooth Decay. Consensus Development Conference Statement. J Dent Educ 1984;(Supplement): 126-31.

14. Ripa LW, Leske GS, Varma AO. Longitudinal study of the caries susceptibility of occlusal and proximal surfaces of first permanent molars. J Public Health Dent 1988;48:8-13.

15. Foreman FJ. Sealant prevalence and indication in a young military population. J Am Dent Assoc 1994;125:182,184,186.

16. Stahl JW, Katz RV. Occlusal dental caries incidence and implications for sealant programs in a US college student population. J Public Health Dent 1993;53:212-8.

17. Mertz-Fairhurst EJ, Schuster GS, Fairhurst CWO Arresting caries by sealants: results of a clinical study. J Am Dent Assoc 1986; 112: 194-197.

18. 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.

19. Handelman SL, Leverett DH, Iker IP. Longitudinal radiographic evaluation of the progress of caries under sealants. J Pedod 1985;9: 119-26.

20. Swift EJ. The effect of sealants on dental caries: a review. J Am Dent Assoc 1988;116:700-4.

21. American Association of Community Dental Programs. Seal America: the prevention invention. Cincinnati, Ohio. In press.

22. Waggoner WF. Managing occlusal surfaces of young permanent molars. J Am Dent Assoc 1991;122(11):72,74,76.

23. American Dental Association. Clinical Products in Dentistry: A Desktop Reference.

American Dental Association, 1993.

24. Tandon S, Kumari R, Udupa S. The effect of etch-time on the bond strength of a sealant and on the etch-pattern in primary and permanent enamel: an evaluation. *J Dent Child* 1989;56(3): 186-90.

25. Donnan MF, BalilA. A double-blind clinical trial to determine the importance of pumice prophylaxis on fissure sealant retention. *Br Dent J* 1988;165:283-6.

26. Boger TR, Garcia-Godoy F. Effect of prophylaxis agents on the shear bond strength of a fissure sealant. *Pediatr Dent* 1992;14(1):50-1.

27. American Dental Association, Council on Dental Materials, Instruments and Equipment. *Clinical products in dentistry*. Chicago, 1993.

28. Bader JD, ed. *Risk assessment in dentistry*. Chapel Hill: University of North Carolina Dental Ecology, 1990.

29. Johnson NW. ed. *Risk markers for oral diseases. Volume 1. Dental caries. Markers of high and low risk groups and individuals*. Cambridge, England. Cambridge University Press, 1991.

30. Graves RC, Abernathy JR, Disney JA, Stamm JW, Bohannon HM. University of North Carolina Caries Risk assessment study III. Multiple factors in caries prevalence. *J Public Health Dent* 1991;51:134-43.

31. Leverett DH, et al. Caries risk assessment by cross-sectional discrimination model. *J Dent Res* 1993;72:529-37.

32. Disney JA, Graves RC, Stamm JW, Bohannon HM, Abernathy JR, Zack DD. The University of North Carolina caries risk assessment study: further developments in caries risk prediction. *Community Dent Oral Epidemiol*. 1992;20:69-75.

33. Leverett DH, et al. Caries risk assessment in a longitudinal discrimination study. *J Dent Res* 1993;72:538-43.

34. Selwitz RH, Colley BJ, Rozier RG. Factors associated with parental acceptance of dental sealants. *J Public Health Dent* 1992;52:137-45.

35. American Dental Association Catalog. American Dental Association, Salable Materials Department. Chicago, 1993.
36. Feigal RJ, Jensen ME. The cariogenic potential of liquid medications: a concern for the handicapped patient. *Spec Care Dent* 1982;2:20-4.
37. Gift HC. Issues of aging and oral health promotion. *Gerodontology* 1988;4:194-206.
38. Li SH, Kingman A, Forthofer R, Swango P. Comparison of tooth surface specific dental caries attack patterns in US school children from two national surveys. *J Dent Res* 1993;72: 1398-405.
39. Angmar-Mansson B, ten Bosch JJ. Advances in methods for diagnosing coronal caries. A review. *Adv Dent Res* 1993;7:70-9
40. Wenzel A. New caries diagnostic methods. *J Dent Educ* 1993;57(6): 428-432.
41. Pitts NB. Current methods and criteria for caries diagnosis in Europe. *J Dent Educ* 1993;57:409-14.
42. Lussi A. Validity of diagnostic and treatment decisions of fissure caries. *Caries Res* 1991 ;25:296-303.
43. Lussi A. Comparison of different methods for the diagnosis of fissure caries without cavitation. *Caries Res* 1993;27:409-16.
44. Pitts NB. The diagnosis of dental caries: lingual and occlusal surfaces. *Dent Update* 1991;18:393-6.
45. Kidd EAM, Ricketts DNJ, and Pitts NB. Occlusal caries diagnosis: a changing challenge for clinicians and epidemiologists. *J Dent* 1993;21 :323-31.
46. Verdonschot EH, Bronkhorst EM, Burgersdijk RCW, Kong, Schaeken MJM, Truin GJ. Performance of some diagnostic systems in examinations for small occlusal caries lesions. *Caries Res* 1992;26:59-64.
47. Longbottom C, Pitts NB. An initial comparison between endoscopic and conventional methods of caries diagnosis. *Quintessence International* 1990;21: 531-40.

48. Bader JD, Brown JP. Dilemmas in caries diagnosis. *J Am Dent Assoc* 1993; 124:48-50.
49. Burt BA. Cost-effectiveness of sealants in private practice and standards for use in prepaid dental care. *J Am Dent Assoc* 1985;110:103-7.
50. American Dental Association. Pit and fissure sealant (Report). *J Am Dent Assoc* 1987;114:671-2.
51. Ripa LW: The current status of pit and fissure sealants. A review. *Can Dent Assoc J* 1985;5:367-380.
52. Newbrun E. Preventing dental caries: current and prospective strategies. *J Am Dent Assoc* 1992;123:68-73.
53. Maxwell H, Bales DJ, Omnell, K. Modern management of dental caries: the cutting edge is not the dental bur. *J Am Dent Assoc* 1993; 124:37-44.
54. Dawson AS, Makinson OF. Dental treatment and dental health. Part 1. A review of studies in support of a philosophy of minimum intervention dentistry. *Aust Dent J* 1992;371 :26-32.
55. Dawson AS, Makinson OF. Dental treatment and dental health. Part 2. An alternative philosophy and some new treatment modalities in operative dentistry. *Aust Dent J* 1992;37:205-10.
56. McConnachie I. The preventive resin restoration: a conservative alternative. *J Can Dent Assoc* 1992;58: 197-200.
57. Roth AG, Conry JP. A retrospective cohort evaluation of preventive resin restorations. *J Can Dent Assoc* 1992;58:223-6.
58. Ripa LW, Wolff MS. Preventive resin restorations: indications, techniques and success. *Quintessence Int* 1992;23:307-15.
59. Stadtler P. A 3-year clinical study of a hybrid composite resin as fissure sealant and as restorative material for class I restorations. *Quintessence Int* 1992;23(11):759-62.
60. Mertz-Fairhurst EJ, Smith CD, Williams JE, Sherrer JD, Mackert JR Jr, Richards EE,

Schuster GS, O'Dell NL, Pierce KL, Kovarik RE, Ergle JW. Cariostatic and ultraconservative sealed restorations: six-year results. *Quintessence Int* 1992;23:827-38.

61. Weerheijm KL, van Amerongen WE, Eggink CO. The clinical diagnosis of occlusal caries: a problem. *J Dent Child* 1989;56: 196-200.

62. Wenzel A, Larsen MJ, Fejerskov O. Detection of occlusal caries without cavitation by visual inspection, film radiographs, xeroradiographs, and digitized radiographs. *Caries Res* 1991;25:365-71.

63. Ripa LW. Sealants revisited: an update on the effectiveness of pit-and-fissure sealants. *Caries Res* 1993;27(suppl 1):77-82.

64. Callanen VA, Weintraub JA, French DP, Connolly GN. Developing a sealant program: the Massachusetts approach. *J Public Health Dent* 1986;46:141-6.

65. Kuthy RA, Siegal MD. Assessing oral health needs: ASTDD seven-step model. Association of State and Territorial Dental Directors, Columbus, OH. In Press.

66. Bowman PA, Fitzgerald CM. Utah dentist sealant usage survey. *AS DC J Dent Child* 1990;57: 134-8.

67. Siegal MD, Garcia AI, Kandray DP, Giljahn LK. Trends in the use of dental sealants by Ohio dentists. In press.

68. Clark BJ, Graves RC, Webster DB, Triol C. Caries and treatment patterns in children related to school lunch program eligibility. *J Public Health Dent* 1987;47:134-8.

69. Ripa LW, Leske GS, Kaufman HW. Caries prevalence, treatment level, and sealant use related to school lunch program participation. *J Public Health Dent* 1991 ;51 :78-81.

70. Kuthy RA, Ashton JJ. Eruption pattern of permanent molars: implications for school-based dental sealant programs. *J Public Health Dent* 1989;49:7-14.

71. Mertz-Fairhurst EJ, Schuster GS, Fairhurst, C. Arresting caries by sealants: results of a clinical study. *J Am Dent Assoc* 1986;112:194-7.

72. Leverett DH, Handelman SL, Brenner CM, Iker HP. Use of sealants in the prevention and early treatment of carious lesions: cost analysis. J Am Dent Assoc 1983; 106:39-42.

73. Handelman SL, Leverett, DH, Iker HP. Longitudinal radiographic evaluation of the progress of caries under sealants, J Pedod 1985;9(2): 119-26.

74. Sterritt GR, Frew RA, Rozier RG. Evaluation of Guamanian dental caries preventive programs after 13 years. J Public Health Dent 1994;54:153-9.

75. Calderone JJ, Davis JM. The New Mexico sealant program: a progress report. J Public Health Dent 1987;47:145-9.

76. Ismail AI, King W, Clark DC. An evaluation of the Saskatchewan pit and fissure sealant program: a longitudinal follow-up. J Public Health Dent 1989;49:206-11.

Table 1: Participants in the Workshop on Guidelines for Sealant Use, Albany, New York, 1994. (I = Individual Care Program Group, C=Community Program Group)

Ronald Billings, DDS (I)
Eastman Dental Center
Rochester, New York

John P. Brown, BDS, PhD (C)
School of Dentistry
University of Texas Health Science Center
San Antonio, Texas

L. Jackson Brown, DDS, PhD (C)
National Institute of Dental Research
Bethesda, Maryland

Myles Brown, DMD (C)
New Mexico Department of Health
Santa Fe, New Mexico

Stephen B. Corbin, DDS, MPH (C, Chair)
Centers for Disease Control and Prevention
Rockville, Maryland

Burton Edelstein, DDS, MPH (I)
New London, Connecticut
(representing the
American Academy of Pediatric Dentistry)

Stephen A. Eklund, DDS, DrPH (I)
School of Public Health
University of Michigan
Ann Arbor, Michigan

A. Isabel Garcia, DDS, MPH (C)
Agency for Health Care Policy and Research
U.S. Public Health Service
Rockville, Maryland

Elmer L. Green, DDS, MPH (C)
New York State Health Department
Albany, New York

Lawrence F. Hill, DDS, MPH (C)
Cincinnati Health Department
Cincinnati, Ohio

Joseph G. Kalil, DDS (I)
Methuen, Massachusetts
(representing the American Dental Association)

Jayanth Kumar, DDS, MPH (I)
New York State Health Department
Albany, New York

Raymond A. Kuthy, DDS, MPH (C)
College of Dentistry
The Ohio State University
Columbus, Ohio

Barbara Park, RDH, MPH (I)
Centers for Disease Control and Prevention
Atlanta, Georgia

R. Gary Rozier, DDS, MPH (I, Chair)
School of Public Health
University of North Carolina
Chapel Hill, North Carolina

Mark D. Siegal, DDS, MPH (C)
Ohio Department of Health
Columbus, Ohio

Karl-Johan M. Soderholm, DDS, MPhil, PhD (I)
College of Dentistry
University of Florida
Gainesville, Florida

Robert H. Selwitz, DDS, MPH (I)
National Institute of Dental Research
Bethesda, Maryland

Gene Sterritt, DDS, MPH (C)
Centers for Disease Control and Prevention
Atlanta, Georgia

William Waggoner, DDS, MS (I)
College of Dentistry
The Ohio State University
Columbus, Ohio

Jane A. Weintraub, DDS, MPH (C)
School of Dentistry
University of North Carolina
Chapel Hill, North Carolina

Georgina P. Zalos, DDS, MPH (I)
Columbia University School of Dentistry and Oral
Surgery
New York, New York

Table 2: Availability for Sealant Application of Occlusal Surfaces of First and Second Permanent Molar Teeth, According to Grade Level, Ohio 1987-88. (70)

Percentage of Students with All Four Occlusal Surfaces Sufficiently Erupted* for Sealant Application and with No Occlusal Surfaces Sufficiently Erupted.*

Grade Level	<u>first permanent molars</u>		<u>second permanent molars</u>	
	All Four	None	All Four	None
1	57.2%	18.8%	--	--
2	88.5%	1.8%	--	--
3	96.8%	0.0%	--	--
6	--	--	23.6%	37.6%
7	--	--	55.5%	11.8%
8	--	--	75.8%	3.6%

* "Sufficiently erupted" means that the occlusal surface was completely exposed and clear of gingival tissue. This does not indicate eruption status of buccal and lingual surfaces with pits and fissures, which can contribute to overall caries levels.