

Workshop on Guidelines for Sealant Use: Preface

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Although dental caries prevalence has decreased dramatically 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, "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, especially 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 Direc-

tors, the New York State Department of Health, the Ohio Department of Health, and the School of Public Health, University of 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.

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

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 Söderholm's (University of Florida, College of Dentistry) reaction paper prepared from a clinical perspective. Prior to a general discussion of the

papers, several participants made brief presentations on sealant-related data that 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 drafted from discussion held at the workshop and through subsequent commentary by workshop participants on multiple drafts of the document. Dental public health practitioners who did not participate in the workshop reviewed and 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 two settings to be somehow different, but rather that differing risk factors and clinical circumstances might justify altering treatment planning decisions. In fact, the decision-making process—once the patient is in the chair—is very similar in both settings.

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 underlay 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 made at the workshop will 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 considered in the workshop. For ex-

ample, 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.

Workshop on Guidelines for Sealant Use: Recommendations

The United States Public Health Service established a national health objective for the year 2000 that 50 percent of 8- and 14-year-old children should have pit and fissure sealants on one or more permanent molar teeth (1). To meet this objective, considerably more than the 11 percent of 8-year-old and 8 percent of 14-year-old children found to have sealants in 1986 must be reached (2). Although there is evidence of some increase in the percent 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 techniques 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 the Appendix) 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 pre-

senting 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 can take place in community primary dental care programs such 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.

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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:

- 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.

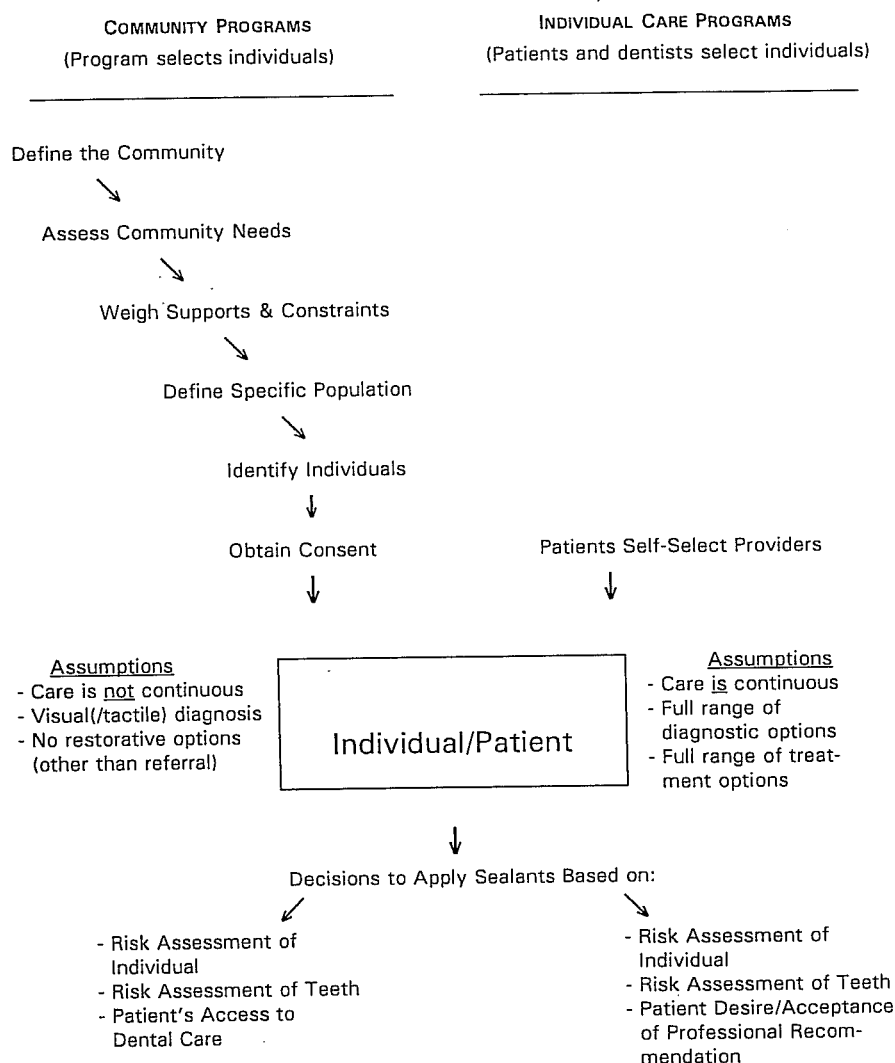
Some critical scientific facts related to sealant use follow:

- 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

FIGURE 1
Determinants of Sealant Delivery in Individual Care and Community Programs



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). Söderholm addressed some clinical aspects of sealant use in his paper presented at the workshop (10). 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 over recent years 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.

All patients having teeth with morphologic 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, referred to as therapeutic sealants.

All patients having teeth with morphologic 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 used to date 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 wide-

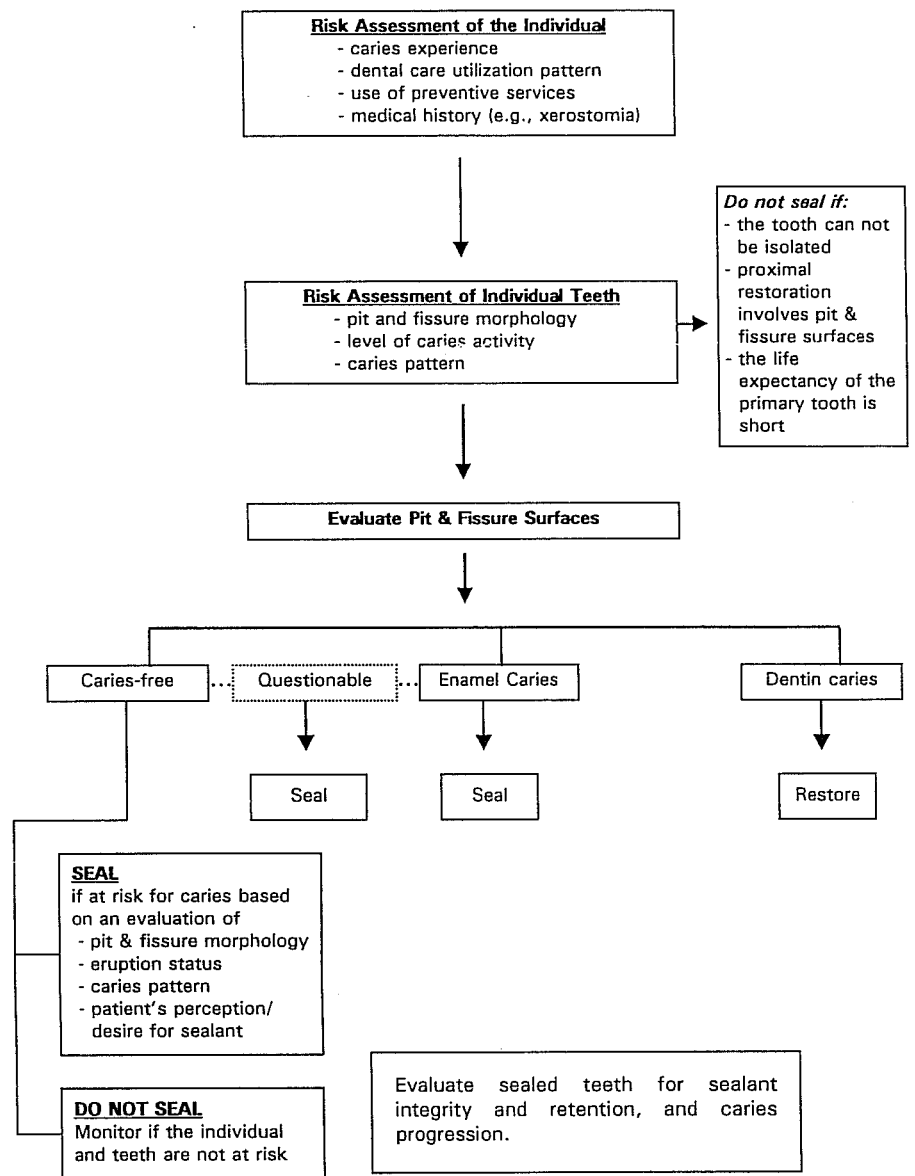
spread use of sealants will be accomplished best by providing preventive sealants to individuals at high risk and placing therapeutic sealants on carious lesions that are limited to the enamel.

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 and 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, and 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., antisialogogues 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 isolate the tooth adequately. 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 perma-

FIGURE 2
Guidelines for Sealant Use in Individual Care Programs



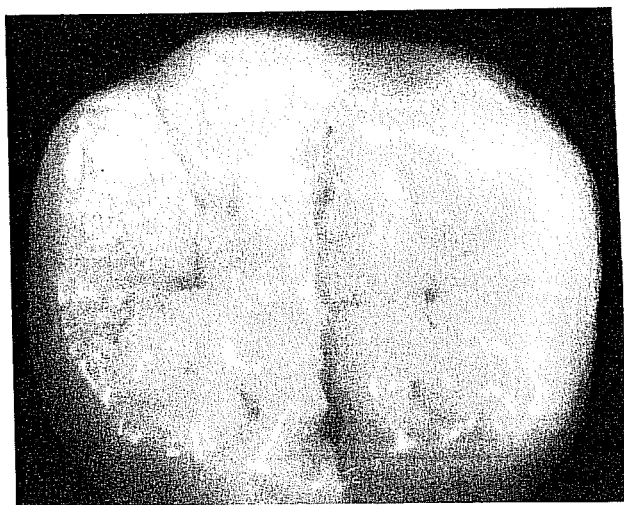
nent maxillary incisors that are at high risk also might need to be sealed.

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 cari-

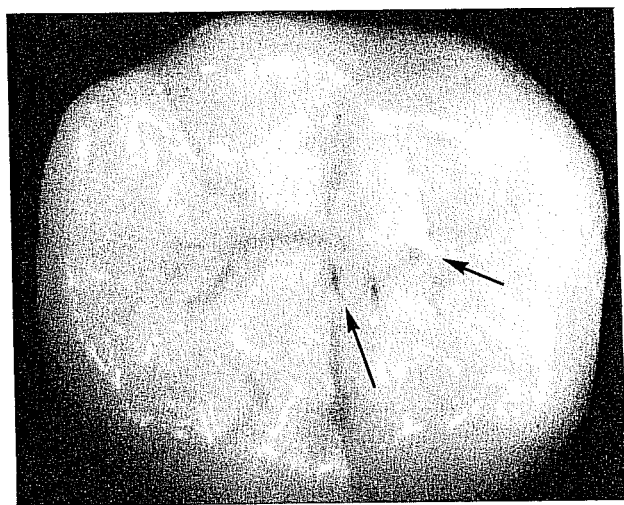
ous enamel (41,48). Diagnostic techniques now under development may improve our ability to identify dental caries with greater accuracy in the future and reduce patient risk (10). There is a need to establish standards for the diagnosis of dental caries, perhaps through a consensus development conference or other forum. At this time, a prudent approach for caries diagnosis 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 car-

FIGURE 3
Clinical Presentation of Pit and Fissure Tooth Surfaces According to Category of Dental Caries: Caries free, Enamel Caries, Dentin Caries
 (photos courtesy of Professor Ivar Espelid, University of Bergen, Norway)



Caries free



Enamel caries



Dentin caries

ies 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 stated clearly 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, can 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

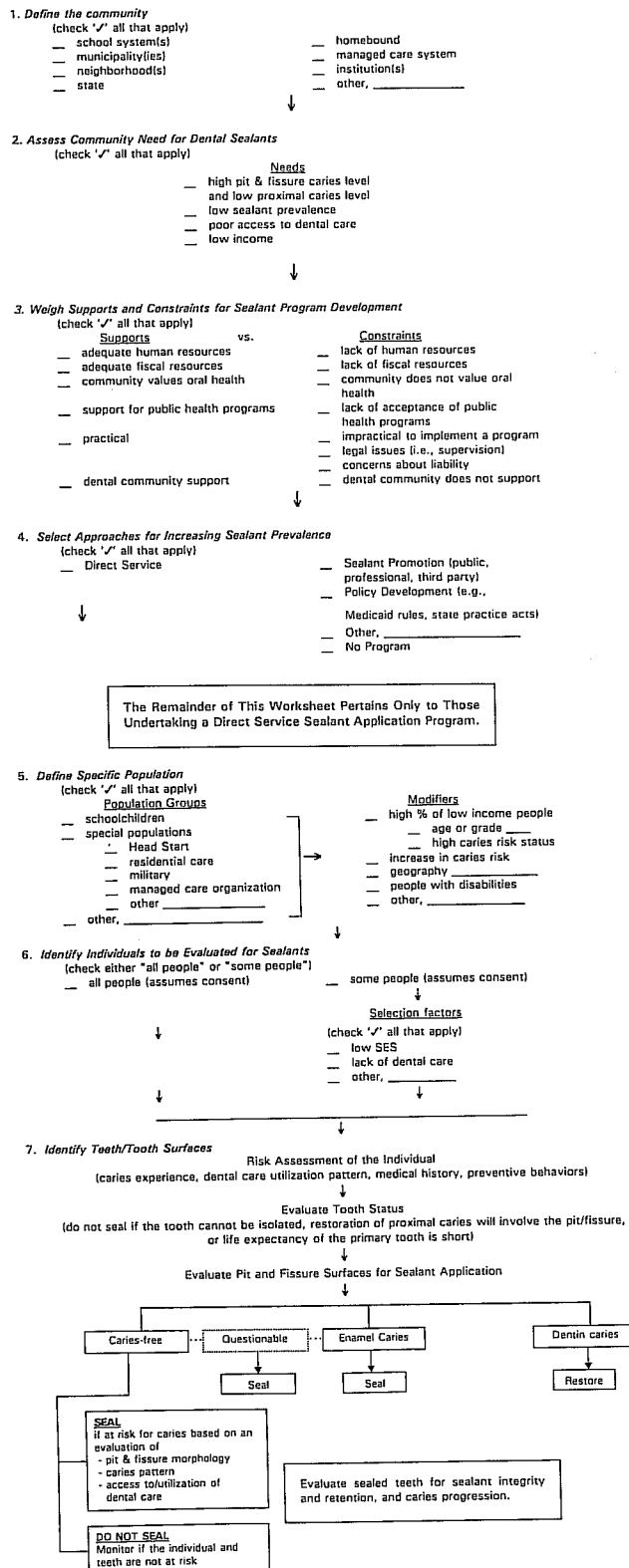
that have remained caries free for four years or more do not require sealants (49,50). Based on clinical and epidemiologic data, posteruptive age alone should no longer be used as a major criterion for deciding whether a tooth should be sealed. The primary consideration should be the risk of the pit 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 can 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 placed safely 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

FIGURE 4
Worksheet for Determining the Need for Community Sealant Programs and Designing a Direct Service Community Sealant Program



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 failures occur 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 plan-

ning decisions. The narrative provides additional information to help identify the factors to weigh when making program design decisions.

The community program 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 been 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.

Develop a Community Strategy for Sealant Use

1. Define 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. Assess 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) can come from a variety of sources. This verification can result from an epidemiologic survey or can 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 can 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 rationale 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, decision makers must assess 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.

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; however, other special populations may be candidates, as well.

School-based or school-linked programs usually operate in second and sixth grades, as suggested in "Preventing Pit and Fissure Caries: A Guide to Sealant Use" (7). Often, the programs reexamine the children the next school year to place sealants on newly erupted teeth and tooth surfaces, and to replace missing sealants. Although reexamination can 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 pro-

TABLE 1
Availability for Sealant Application of Occlusal Surfaces of First and Second Permanent Molar Teeth, According to Grade Level, Ohio 1987-88 (70)

Grade Level	Percent of Students with All 4 Occlusal Surfaces Sufficiently Erupted* for Sealant Application and with No Occlusal Surfaces Sufficiently Erupted*			
	First Permanent Molars		Second Permanent Molars	
	All 4	None	All 4	None
First	57.2	18.8	—	—
Second	88.5	1.8	—	—
Third	96.8	0.0	—	—
Sixth	—	—	23.6	37.6
Seventh	—	—	55.5	11.8
Eighth	—	—	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.

gram objectives or school considerations (e.g., whether sixth grades are in elementary or middle school). 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 percents 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 is slower today 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 who 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 this basis 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. All these decisions 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 di-

agnostic and treatment options, these individual care 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 1 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 need 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 on follow-up during the next school year.

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 our 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 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 or 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 (17,19,71,72).

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 communication among patients, parents or 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 reevaluate 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 might 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 (73,74). 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 reexamination 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, and
- number of Medicaid recipients served.

Conclusions

The guidelines developed at the Workshop on Guidelines for Sealant Use, although 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. Pit and fissure caries confined to enamel generally can be distinguished from caries that has progressed into dentin; the preferred treatment differs for the two. Visual examination of air-dried teeth alone may provide a comparable or superior diagnosis to the traditional visual-tactile examination using mirror and explorer. 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 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 as-

sumed 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 com-

munity 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 mate-

APPENDIX

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rials 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.

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