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Prevention Strategies for Dental Caries in the Adolescent

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Dental caries is an infectious disease that may result in an oral infection. The impact of a high rate of dental caries and its consequences as a public health problem was recognized in the 1940s. In an effort to reduce dental caries, community water fluoridation programs were initiated over 60 years ago in the United States. This practice was followed by the development of fluoride-containing dentifrices and the use of in-office topical fluoride applications. Since then, the profession and the public have witnessed a dramatic reduction in the rate of dental caries in the overall United States population.

The location of carious lesions has also demonstrated altered patterns. One of the most common sites for the initiation of decay is in the pit and fissures of the occlusal surfaces of posterior teeth [1]. Because of these findings, alternative treatment modalities have been developed, such as pit-and-fissure sealants, preventive resin restorations, fluoride varnishes, glass ionomers, polymeric resin composites, and new oral home care products and preventive strategies. New diagnostic tools have improved the ability to detect caries at a much earlier stage of development. Increased levels of research have improved the understanding of the formation of dental caries, challenging dental professionals to shift philosophically from previous invasive surgical interventions to more preventive, nonoperative treatment modalities. Increased emphasis on prevention by dental professionals along with increased public awareness of oral health issues has created educated consumers who seek optimal dental care.

Despite these intensified efforts over the last 6 decades to reduce the caries rate, dental caries remains a significant public health problem in certain populations. Those most affected are minority children and economically underprivileged, elderly, chronically ill, and institutionalized individuals. Studies

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show that despite improvements made in reducing the overall rate of caries in the general population, nearly 80% of adolescents have experienced dental decay [2]. Dental caries remains one of the most common diseases among 5- to 17-year-olds, reported to be five times more common than a history of asthma and seven times more common than a history of hay fever [1].

Adolescents represent a distinct cohort of patients defined broadly as youths between 10 and 18 years old who are distinguished by unique social and psychologic needs. In addition, this age group experiences the continuation of physical and dental development. Poor nutritional habits and poor self-care dental habits practiced by adolescents contribute to a higher caries rate. Specialized dental needs such as orthodontic treatment confound adolescent dental care. These distinctive dental, behavioral, and developmental changes demand a unique response from dental health care providers. The purpose of this article is to define strategies that can be used to prevent dental caries in adolescent patients.

Definition of caries

Caries can be defined as "a chemical dissolution of the dental hard tissues by acidic bacterial products from degradation of low molecular weight sugars" [3]. Note that this definition describes a process and not just the final cavitated lesion [4]. Current evidence reveals a continuum of caries, ranging from readily detectable lesions in the dentin to subclinical initial lesions in the enamel [5,6]. Other important terminology differentiates between an active carious lesion and an arrested lesion. An active lesion is one that continues to progress, whereas an arrested lesion is one that has ceased to progress. This distinction is important for purposes of patient risk assessment and determining treatment strategies.

Epidemiology

The 2000 Report of the Surgeon General on oral health stated that dental caries is the single most common chronic childhood disease. Several specific factors were enumerated, including the following: (1) 78% of 17-year-olds have at least one cavity or restoration; (2) greater than one third of the United States population has no access to community water fluoridation; (3) great disparities in rates of decay exist based on socioeconomic status; and (4) almost one in four children is born into poverty. Low socioeconomic status produces barriers to dental care, with poor children tending to have twice as many caries as their more affluent age-matched peers. This trend continues into adolescence. Poor adolescents from 12 to 17 years old have a higher percentage of untreated decayed permanent teeth than nonpoor adolescents across all ethnic and racial groups. Another factor is that 40% of the population has 80% of the caries [1]. Identification of patients

at higher risk for dental caries will enable health care professionals to focus on preventive strategies for these populations during adolescence [1].

Etiology

Dental caries is a multifactorial infectious disease process. This process is an interaction between host, diet, and dental plaque over time. Each individual who develops caries does so as a result of various combinations of these etiologic factors. Host factors include the tooth surface, saliva composition, flow rate, and composition of the acquired pellicle. Dietary factors include the amount, composition, and frequency of cariogenic foods and drinks. The number and type of microorganisms found in the dental plaque also influence the carious process. In addition to these clinical factors, socioeconomic status and behavior influence the adolescent's caries rate.

Host factors

Host factors that affect the caries process begin with the tooth itself. The location, morphology, composition, and ultrastructure are the essential components. In the adolescent patient, the teeth are most vulnerable to the formation of approximal caries during the first 2 years following eruption. There is a continuous increase in the incidence of approximal caries in the adolescent patient concurrent with a comparative decrease in incidence of occlusal caries. Saliva is another host factor critical to the process. Saliva acts to mechanically clean teeth and to clear carbohydrates and acids from the plaque [7]. In addition, saliva serves as a buffer for plaque acids. This buffering mechanism neutralizes plaque acids, thereby raising pH and reversing the diffusion gradient for calcium and phosphate. As these two minerals return to the tooth, remineralization occurs in combination with any available fluoride. The acquired pellicle is an acellular film that covers the tooth surface and allows the oral bacteria to adhere to the tooth.

Dietary factors

Diet is another important component in the carious process. A diet composed of highly cariogenic carbohydrates is metabolized readily by the plaque bacteria to produce acids. These acids diffuse into the enamel as minerals diffuse out from the tooth, eventually leading to cavitation. It is not only the composition of the diet that is of concern but also the frequency of the "sugar" challenge. If sufficient time between acid challenges occurs, demineralization can be reversed, with resultant neutralization.

Bacterial process

The acquired pellicle is an acellular film that covers the tooth surface and allows the oral bacteria to adhere to the tooth. The bacteria in dental plaque

are diverse, but some species are implicated more specifically in the caries process. Two main groups of acidogenic bacteria have been identified: *Streptococcus mutans* and *Lactobacillus* species [7]. Also of particular importance to adolescents is the microflora of the partially erupted molars. *Actinomyces israelli* has been isolated from partially erupted teeth with white spot lesions [8].

Socioeconomic status

Although low socioeconomic status is not a physiologic cause of dental caries, it has an impact on the carious process. The caries rate among individuals living below the poverty level is higher than the rate among those who are economically comfortable. Lack of access to care among low-income individuals exacerbates the condition because dental caries is more likely to remain untreated [1]. Barriers to dental care may include limited income, lack of value placed on dental health, lack of knowledge of oral care, and transportation limitations.

Caries process

The dynamic nature of the caries process is important to its understanding. It is a balance between protective and pathologic factors, resulting in the constant flux between demineralization and remineralization.

The acidogenic bacteria pathologically drive the caries process by metabolizing the cariogenic carbohydrates to produce organic acids. These acids (lactic, formic, acidic, and propionic) diffuse into the enamel and partially dissolve the carbonated hydroxyapatite [5]. Calcium and phosphate then diffuse from the tooth. The demineralization process, however, can be reversed. If calcium and phosphate along with fluoride diffuse back into the tooth, a new veneer that is much less soluble forms on the tooth surface [7].

Risk assessment

By understanding the process of caries formation, it is possible to identify the factors that place the adolescent at risk. The use of risk assessment presents an ideal opportunity to design an intervention tailored to the individual adolescent.

Various methods of risk assessment by a number of investigators are available [9–11]. The American Dental Association (ADA) published a guideline in 1995 that adequately addresses risk assessment until further studies are completed and a new guideline can be published [12].

Low-risk adolescents

Adolescents are considered at low risk if they have not had caries in the last year, can demonstrate proper oral hygiene, have sufficient fluoride available, have regular dental visits, and possess ideal tooth morphology. For

low-risk adolescents, the recommendation is a 1-year recall, educational reinforcement, continued good oral hygiene, and the regular use of a fluoridated dentifrice.

Moderate-risk adolescents

Adolescents are considered at moderate risk if they have experienced one carious lesion in the last year; have deep pits and fissures, especially in the molar region; oral hygiene is only adequate; have inadequate fluoride available; white spot lesions are present; approximal radiolucencies are present on radiographs; appoint at irregular intervals for dental visits; or are in active orthodontic treatment. For moderate-risk adolescents, the recommendation is that they be placed on a 6-month recall, receive educational reinforcement, receive dietary counseling, use fluoride mouth rinse/gel daily along with professionally applied topical fluoride, have pit-and-fissure sealants applied, and brush daily with a fluoride dentifrice.

High-risk adolescents

High-risk adolescents are described as those who have experienced two or more new carious lesions in the last year, have experienced smooth surface caries in the past, have an elevated *Streptococcus mutans* level, demonstrate poor oral hygiene, consume a diet high in cariogenic foods/drinks, have irregular dental visits, and have reduced salivary flow. For high-risk adolescents, the recommendation is to have pit-and-fissure sealants placed, brush with fluoride dentifrice, floss daily, use daily home fluoride rinses, receive professionally applied topical fluoride applications and dietary counseling, and use antimicrobial agents.

Prevention strategies

Primary

Primary preventive strategies concentrate on promoting oral health and include recommendations for increased fluoride exposures, enhanced diet education programs, and improved oral home care routines.

Increased fluoride exposure

Research supports that the use of fluorides has dramatically decreased the incidence of dental caries [13]. As a result of community water fluoridation, fluoride dentifrices, fluoride mouthwashes, professionally applied topical fluoride, and systemic fluoride supplementation, dental caries continue to decline throughout the industrialized world [14]. Fluoridated dentifrices have had a positive effect on caries prevention because the delivery of small daily amounts of fluoride is very effective (low dose, high frequency). For individuals at low risk, the use of fluoride dentifrices in conjunction with water

fluoridation may be the only two fluoride products necessary to prevent dental caries in the adolescent [1]. Patient compliance is an essential component of any fluoride regimen. Thus, before fluoride treatment, each topical application system should be evaluated based on its efficacy, taste, ease of use, and the specific needs of the individual adolescent as follows [15]:

- 1.23% acidulated phosphate fluoride—professionally applied topical application inhibits caries formation by reducing enamel solubility and improving remineralization; no bitter aftertaste; 1-minute uptake
- 2.0%–2.2% sodium fluoride—professionally applied; reduces caries; most effective when a four-visit procedure is used; no tartness or aftertaste; 4-minute uptake required
- 0.4% stannous fluoride—daily application; brushed on at bedtime; reduces caries; pleasant slight metallic taste; may produce extrinsic stain
- 1.1% neutral sodium fluoride—daily application; brushed on at bedtime or applied using a custom tray; recommended for bulimic and xerostomic patients

When applying acidulated phosphate fluoride, it is not necessary to perform a dental prophylaxis. Having the patient brush the teeth clean as part of the oral care instructions is sufficient plaque removal before applying the topical fluoride treatment [16]. The administration of topical fluoride by way of tray application or with a cotton tip applicator has been the accepted method of delivery in the United States. More recently, fluoride-containing varnishes have become available in the United States. Varnishes appear to provide longer exposure to fluoride following application [14]. In addition to professionally applied and prescription home-use fluoride agents, numerous over-the-counter products are available.

Another chemotherapeutic agent available in the caries prevention armamentarium is the prescription antimicrobial agent chlorhexdine gluconate. This mouth rinse can be used to decrease cariogenic bacteria and is justified in high-risk patients when other measures such as diet control, mechanical plaque removal, and fluoride have failed to control caries progression [12,17]. Manufacturer's recommendations for chlorhexidine gluconate are to avoid use by adolescents under age 18 years and to limit use to no longer than 1 month so extrinsic staining does not occur.

Enhanced diet awareness

As adolescents begin to develop socially, parental supervision declines and choices expand. Adolescents gravitate toward new diets that are rich in negative calories. In addition to peer pressure, soft drink companies' marketing strategies often target young adults. An increase in poor food choices, frequent snacks, abundant consumption of sweetened, acidulated carbonated and noncarbonated beverages places the adolescents at greater risk for caries development and negatively influences overall nutrition and health [18]. Carbonated beverages exacerbate the demineralization process [19]. Caffeinated

carbonated beverages consumed by adolescents have the added risk of contributing to the habitual ingestion of these beverages [20]. Collaboration among dental and medical organizations, governmental agencies, education officials, parents, and consumer groups is needed to bring awareness to and to promote the development of health-enhancing behaviors [20]. Beverage and snack-food vending machines in schools have emerged as a major source of promoting poor dietary habits. Healthy choices consisting of high nutritional value need to be made available to adolescents. Bottled water should always be a choice where soft drinks are offered [18]. Adair [21] suggested that dental offices engage in comprehensive nutritional and dietary counseling beyond the prevention of dental caries. Parents need to be a part of the education equation because they are the ones who purchase the food, prepare meals, and serve as role models. The message that needs to be conveyed is that teeth contribute to good nutrition and that good nutrition contributes to healthy teeth; both contribute to good oral and systemic health.

Improved oral home care routines

Dental plaque is a major contributing factor in the caries process. Thus, caries control must include an individualized oral self-care program that includes thorough plaque removal, the use of fluorides, and dietary counseling. Educating the adolescent that a plaque-free tooth surface is less likely to decay is an important concept in any oral health promotion strategy. Brushing with ADA-approved dentifrices and the use of mouth rinses, dental floss, and other dental-health products are marketed to meet a broad range of personal preferences to appeal to adolescents.

Because adolescent compliance to a self-care program may be an issue, recommending a power toothbrush may facilitate and motivate the patient to brush more frequently. Some power toothbrushes are equipped with a timer that helps the patient regulate the time spent on brushing. Adolescents undergoing orthodontic treatment greatly benefit from the power toothbrush efficiency in plaque and food debris removal around orthodontic appliances because removal of the plaque biofilm presents a special challenge. Use of the power toothbrush may aid the adolescent who has fixed appliances in complying with the guidelines to brush three times a day.

Secondary

Secondary preventive strategies focus on the oral health care provider's ability to assess adolescents most at risk, educate them on the carious process, inform them of their individual risk factors, and provide them with appropriate preventive therapies.

Examination

Because of the unique characteristics that place the adolescent at high risk for dental caries, the American Academy of Pediatric Dentistry

(AAPD) emphasizes the importance of a clinical oral examination with the appropriate diagnostic tests. The process of risk assessment should begin during the dental examination. The periodicity of these examinations should be every 6 months or as indicated by the individual's risk assessment [22]. A controversy exists between the European model of examination and the traditional method. With changing patterns of caries formation, there appear to be some drawbacks to the visual-tactile method traditionally used. The present method only allows for presence/absence of the disease state and does not measure the process of caries formation. Further, the traditional method does not quantify the lesion, making determination of activity difficult. Currently, other assessment techniques and methodologies are being developed by the International Caries Detection and Assessment System that use visual characteristics along with an additional set of criteria for recording of caries activity [23]. These new developments may enhance clinical evaluation.

The examination should begin with a thorough medical history. Systemic diseases and medications can play a part in the caries process. A side effect of some medications can be xerostomia. Other medications may use sugar as a base. Both of these factors increase dental caries risk. Sometimes, alternative medications can be prescribed, but often these specific drugs are necessary. The clinician has an opportunity to offer home care options that will improve oral health despite continued use of the medications. Systemic diseases can also place the adolescent patient at risk because of the symptoms of the disease or the side effects of treatment. Adolescence also is the age at which eating disorders are often initiated [24]. Disturbed eating patterns and decreased salivary flow can place these individuals at a slightly higher risk of developing caries.

Dental history

The dental history can provide important information on the adolescent's attitude toward dental care, the frequency of past dental visits, and the patient's oral home care regimen. One of the most important pieces of information to be gained as part of the dental history is the revelation of previous caries history. In children and adolescents, a previous history of decay is one of the best predictors of future caries development [1].

Dietary analysis is recommended by the AAPD. The management of the adolescent diet should include consideration for the dental disease patterns, the dietary carbohydrate intake, and the psychosocial aspects of the patient's nutrition [25].

Radiographs

Radiographs can be obtained during the examination of the adolescent patient. New guidelines published by the ADA and the Food and Drug Administration recognize caries risk assessment as an indicator for determining the frequency or interval of radiographs [26]. Bitewing radiographs are still

recommended for detection of caries. Digital and conventional radiographs can produce equally diagnostic radiographs. Although bitewing radiographs may not be definitive for the detection of early carious lesions confined to the enamel, they are important in comparing the lesion and its progression over time [27].

Despite a decrease in the rate of caries formation that has been reported, long-term studies indicate a continued prevalence of approximal caries formation [28,29]. One study found that the probability of new approximal carious lesions was 80%. This study also showed that these carious lesions are characterized by a slow rate of caries progression. Of greatest significance for the adolescent is that the period at highest risk for approximal caries formation is the first 4 to 5 years after eruption, with the highest peak formation at 2 years after eruption [28].

Lith and Gröndahl [29] used the presence of approximal carious lesions in the enamel to predict future approximal caries. Another study confirmed these findings and recommended that the use of radiographic findings of approximal carious lesions could be used as a means of risk assessment, creating an ideal opportunity to focus on the prevention of approximal caries for the adolescent by emphasizing a self-care regimen [28].

Adjunctive assessments

Other adjunctive diagnostic tools are in the process of becoming available. Some examples include quantitative fiber-optic transillumination; quantitative laser/light–induced fluorescence; and infrared laser fluorescence. Enamel, dentin, plaque, carious lesions, and microorganisms demonstrate fluorescence. Quantitative laser/light–induced fluorescence is a measurement of the fluorescence of the different structures as the laser/light passes through the tooth. Caries has a lower autofluoresence than sound enamel and dentin. A review of studies revealed the validity of this technology to detect dental caries and the ability of this technology to assess the success of caries prevention [30]. With quantitative fiber-optic transillumination, the teeth are transilluminated with a fiberoptic light, followed by a charge-coupled device receptor to collect the photon energy, which is then converted by a video processor and displayed on a computer monitor. Studies show the specificity and sensitivity to be high [31]. Infrared laser fluorescence functions by transmission of infrared light through the tooth. The reflective and fluorescent photons are measured, and the intensity is displayed as a number. Results of a study demonstrated that infrared laser fluorescence may be helpful in monitoring the activity of occlusal caries in permanent molars [32]. In this study, the sensitivity was measured at 92% and the specificity at 69% for visual examination [32]. In general, these tools show promise for the early detection of caries; when used as an adjunct to clinical examination, they have the potential to provide an opportunity to implement innovative preventive strategies and to evaluate the success or failure of these strategies.

Prophylaxis

The AAPD strongly recommends professional removal of plaque and calculus, with the frequency based on the individual's assessed risk. The prophylaxis should include instructions on age-appropriate oral hygiene techniques and removal of plaque, calculus, and stain with rubber cup, fluoride prophylaxis paste, and hand instruments [33].

Pit-and-fissure sealants

Multiple studies suggest that sealant placement benefits adolescents who are most at risk. Sealants have been demonstrated to be effective in preventing occlusal pit-and-fissure caries, with clinical retention being the strongest predictor of success [26]. Sealants can be placed in teeth without caries, and studies show that they can also be safely placed in teeth with incipient caries activity [34]. The goal is to place the sealant as early as possible after eruption of the permanent tooth [35]. It must be emphasized, however, that the caries pattern in adolescents shifts from pit-and-fissure caries to smooth-surface interproximal lesions, which necessitates the placement of sealants in conjunction with various fluoride therapies to provide a comprehensive caries prevention plan for the adolescent.

Behavior

One goal of the dental profession is that individuals achieve optimum oral health throughout their lives. Oral health promotion programs are the key to meeting this goal because lack of oral self-care leads to dental disease [14]. The success of any caries prevention program or any other dental/health promotion program depends on the interest, motivation, and cooperation of the patient. Dental/health promotion programs directed toward adolescents present challenges because of the rapid physical, cognitive, and social changes experienced by this population. The need for parental separation, independence, autonomy, peer interaction, and peer acceptance is paramount. During this period, individuals feel invincible. Health issues may not be perceived as personally relevant but are viewed to be problems affecting the aged. Adolescents may be influenced to change behaviors only when there are immediate consequences to their actions [36]. Risky behaviors are attempted to gain social acceptance. Adolescents begin to have behavioral choices that were not available in childhood. They have the choice of studying, what beverages to drink, whether to smoke or drink alcohol, what friends to have, what parties to attend, and what clubs to join. This is the period in which management of health behaviors emerges as an issue due to expanding opportunities as adolescents begin to transition to the independence and autonomy of adulthood [37]. Fostering an awareness of oral health–enhancing and systemic health–enhancing behaviors are important because lifestyles and habits formed during the adolescent developmental period are more likely to continue into adulthood [38]. Relative to

physical health, adolescence is the healthiest period because this stage of development is characterized by a relatively low incidence of disabling or chronic illnesses. At the same time, it is a period of physical danger because of unhealthful behaviors and risky activities. The physical risks incurred from substance abuse and sexually transmitted diseases are preventable if the adolescent avoids these risky behaviors [39]. The same holds true for the development of dental caries. If adolescents decrease sugar intake, brush their teeth daily with fluoridated toothpaste, and maintain semiannual dental recall examinations, then they significantly reduce the likelihood of developing dental caries.

The literature supports the premise that adolescents possess the cognitive ability to consider multiple elements simultaneously, methodically, and carefully. They can assimilate information to make decisions [38]. Thus, this developmental period can be viewed as a period of challenges and opportunities [38]. Education provides the opportunity for adolescents to engage in advanced reasoning and abstract and logical processes to grasp medically related concepts such as the dental caries process. The establishment of daily oral health routines culminates in habits that will be practiced and maintained throughout their lives.

In 1989, the National Cancer Institute developed a program for use by physicians to help their patients stop tobacco use. The program activities included four recommendations that addressed four *A*'s: ask, advise, assist, and arrange. In 1991, a fifth *A* was introduced: anticipatory guidance. Irwin [40] suggested that physicians use the five *A*'s as an outline for successful health promotion in adolescents:

- Anticipatory guidance—establish a trusting relationship over the course of several visits when the young person enters adolescence. Practitioners need to be aware of relevant behaviors during the stages of adolescence and be sensitive to concerns and issues presented.
- Ask—question the adolescent directly about present and future health-enhancing and health-compromising behaviors. Focus not only on the negative behaviors but also on what they are doing to stay healthy.
- Advise—offer the adolescent advice about health promotion even when it is not requested. Serve in the capacity of an advisor because the adolescent is unlikely to ask for advice.
- Assist—support the adolescent by encouraging participation in programs that promote health.
- Arrange—arrange follow-up visits to monitor progress made by the adolescent.

The Public Health Service modified the five *A*'s of health promotion and further enhanced a clinical intervention to be used with tobacco-using patients [41]. The Public Health Service *A*'s excluded anticipatory guidance and added assess between advise and assist. The Public Health Service tobacco model can be readily applied to an oral health promotion strategy

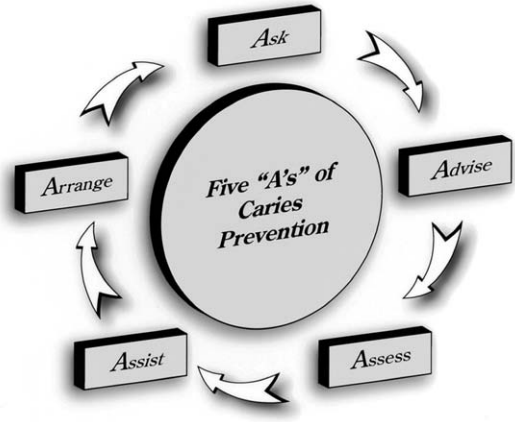

Fig. 1. The five A's of caries prevention for the adolescent. (Courtesy of Christine Bettinger.)

to decrease dental caries risk among the adolescent population (Fig. 1). In the dental setting, the periodic and ongoing basis of dental care incorporates the anticipatory guidance phase of the strategy throughout each step of the process. Therefore, it is classified as a separate step. Its role is practiced in each level of the preventive strategy (Fig. 2).

- Ask—identify caries risk through evaluation of the adolescent's medical history, past dental history, oral self-care routines, diet, and social behaviors. This query provides the dental health professional with information relative to the adolescent's dental knowledge and attitude.
- Advise—introduce age-appropriate oral self-care instructions. The practitioner routinely shows areas of plaque retention in the adolescent's mouth and discusses consequences relative to caries development as it pertains to the individual's current oral self-care routine.
- Assess—determine the adolescent's receptiveness to oral health education. Is the patient interested and willing to learn and change? It is important to respect the adolescent's wishes and to motivate but not preach. The practitioner encourages the patient to identify any barriers to self-care recommendations presented and offers suggestions for elimination of barriers (eg, "I can't brush my teeth after every time I eat"). The practitioner may suggest that the adolescent rinses the mouth with water when brushing is not feasible. If the adolescent demonstrates no interest or willingness to learn and change, the issue should not be forced. The interaction should be documented and the patient educated again at the next recall visit. The ongoing preventive nature of dental care provides the opportunity to reinforce oral health education.
- Assist—identify a self-care program and encourage involvement by providing the adolescent with sample oral health care products.

Individualized instructions might include the following: (1) practice techniques using sample products, (2) disclose plaque for the adolescent to identify easily, (3) demonstrate toothbrushing and flossing techniques in the adolescent's mouth, (4) discuss frequency of preventive therapies, (5) perform oral prophylaxis to mechanically remove soft and hard deposits.

- Arrange—schedule maintenance appointments with appropriate frequency and at time intervals based on the adolescent's assessed needs. The protocol for maintenance appointments should be provided. Monitoring of the adolescent's compliance is easily accomplished because the clinical manifestations of an effective oral self-care program are evident by examining the patient's mouth. Early intervention supports anticipatory guidance in addressing caries management for the adolescent patient [42]. The adolescent's progress relative to risk status is evaluated appointment by appointment and from year to year. This model allows the dental health professional to commend adolescents for successful compliance and to assist patients when they fail to achieve compliance. Alternative plans can then be determined and implemented.

The rationale for integrating the five *A*'s of caries prevention into a dental practice is to assist the adolescent patient in moving from unawareness toward knowledge and the initiation of healthful dental habits. The stages of learning visualized in Fig. 3 help the dental professional assist the adolescent in preventing dental caries [43].

- Unawareness—the adolescent may have incomplete or inaccurate knowledge on what causes dental caries and its consequences.

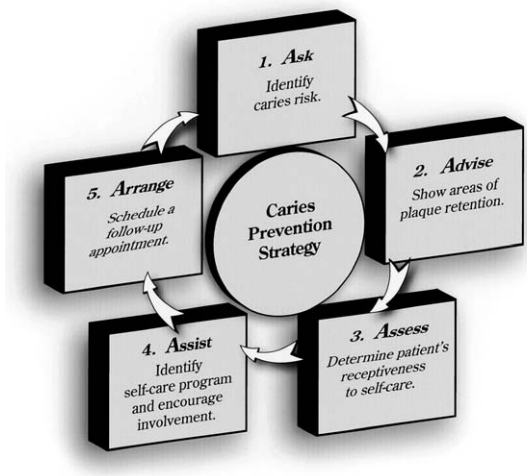

Fig. 2. Caries prevention strategy. (Courtesy of Christine Bettinger.)

Fig. 3. Stages of learning. (Courtesy of Christine Bettinger.)

- Awareness—appropriate information about the dental carious process is presented to the adolescent, providing the opportunity for the dental professional to begin establishing a trusting relationship.
- Self-interest—information relative to the adolescent's current dental status is presented so the individual can personalize the information.
- Involvement—the adolescent accepts the information and is motivated to change. Adolescents need to buy into the process and assume ownership for oral self-care–enhancing behaviors.
- Action—the adolescent acts based on the perceived need to improve oral health through the daily oral self-care strategies developed to address the identified specific needs of the individual.
- Habit—the adolescent consistently repeats the positive dental self-care behaviors until they become second nature to the individual and the outcomes are observable clinically.

Summary

The dental caries risk for adolescents represents a challenge for the adolescent and the dental professional. Efforts to decrease caries risk must be considered within the developmental and social context of the individual. Adolescence encompasses behaviors that include parental separation, a need for greater independence, expanded opportunities for lifestyle choices, and peer pressure and influence. Caries is a process that can be arrested at any point before cavitation; therefore, the goal of oral care should be a caries prevention strategy based on individual risk factors. Preventive

treatment modalities for the high-risk individual might include but should not be limited to individualized oral hygiene care instructions, dietary counseling, improving salivary flow rate through the use of alcohol sugars, and the application of sealants and topical fluoride.

Oral health education provides the opportunity for adolescents to engage in advanced reasoning in abstract and logical processes to grasp the concept of dental caries. To affect positive change, use of the five *A*'s can be applied as a method to decrease the dental caries rate in adolescents. Introduction of preventive strategies not only assists in meeting the special oral needs of the adolescent population but also helps to establish life-long healthful habits for the adolescent.

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