

Considerations for treating adolescent patients

Jane A. Soxman, DDS

Adolescence is a time of accelerated growth with increasing caloric needs. A strong attraction for the taste of sugar and its availability have had detrimental consequences for the adolescent's dentition and general health. Numerous factors combine to contribute to the demineralization and erosion that predispose the enamel to smooth surface caries. Obesity and its associated maladies, eating disorders, and pregnancy are additional issues for consideration. Determining the need for and appropriate timing of extraction of third molars should be included in the treatment plan.

Received: October 2, 2002

Accepted: October 24, 2002

The accelerated growth during adolescence requires an increase in caloric intake but the foods that provide the additional calories often are associated with obesity and caries. The diet of U.S. children has changed dramatically in recent years due to irregular meals, fast foods, snacking, and consumption of high amounts of sugar. Although many age-specific factors make the adolescent more susceptible to caries, the ingestion of carbonated beverages seems to be one of the most significant causes of increased caries incidence and obesity. Milk has been displaced by soft drinks and noncitric juices that provide empty calories and lack the calcium essential for bone growth and density. Snacking provides the highest proportion of calories from carbohydrates. There has been a steady decline in fat and protein intake. The expectation is that these trends may lead to nutrition-related chronic diseases in the future.¹

Obesity

Since obesity in adolescence often continues into adulthood, every effort should be made to address this condition. Obesity can be influenced by excess caloric intake, decreased physical activity, and metabolic and endocrine abnormalities. For most otherwise healthy adolescents, snacking on high-starch foods and sitting in front of a computer or television have contributed to the deposition of excess body fat. An improper balance between energy intake and expenditure precedes most obesity. Weighing 20% or more above the recommended weight poses a significant health risk. Hypertension and elevated levels of serum cholesterol lead to cardiovascular disease. The incidence of Type II

diabetes is significantly higher in obese adolescents, who also are susceptible to long-lasting psychological effects such as teasing and social isolation. Obesity and Type II diabetes have been linked to soft drink consumption.²

Osteoporosis

Because it may be a critical time for bone mass formation, adolescence is an excellent time to focus on the prevention of osteoporosis. The phosphorous (phosphoric acid) in most cola drinks limits calcium absorption and has a direct influence on density of bone mineral. There is a direct association between soft drink consumption and bone fractures in teenage girls.³ Osteoporosis is characterized by a significant decrease in bone mass, which results in increased risk of bone fracture. Once bone is lost, restoration of bone mass may not be possible. This reduction in mass may occur prematurely due to improper calcium balance during growth.

Calcium is an important determinant of bone acquisition in adolescent girls. Inadequate calcium intake results in inadequate calcium for retention of bone and a reduction in peak bone mass. By age 16, girls have accumulated 90–97% of the bone mass of their premenopausal mothers.⁴ The recommended dietary allowance of calcium for adolescents is 1,300 mg per day, although some sources suggest that up to 1,800 mg per day may be required for skeletal calcium retention.⁴

Milk products are excellent sources of dietary calcium. One cup of 1% low-fat milk contains 287 mg, and one cup of 1% low-fat yogurt contains 313 mg. Cheese is “dentally friendly” and a good source of calcium (306 mg of calcium in 1.5 ounces

of cheddar cheese) but its fat content limits the quantity that should be eaten. Cottage cheese loses calcium in the whey that is drained off in the curdling process, so its calcium content is lower than might be expected.⁵ One cup of broccoli contains 94 mg of calcium. A product such as Viactiv Soft Calcium Chews (McNeil Nutritional, Ft. Washington, PA; 877/842-2848) is an alternative to calcium supplements in a tablet form.

Caffeine and sugar

The addition of larger amounts of caffeine has made some soft drinks even more appealing. Consumption of as little as two cans of caffeinated soda per day has produced withdrawal symptoms.⁶ Schools have made soft drinks available to students throughout the day along with snacks that compete with school meal programs. The exclusive vendor contracts influence the choices of children in terms of drink preference. Children are becoming addicted to caffeine and sugar. Sugar-free soft drinks show similar caries incidence in caries experience.⁷ Parents must be cautioned that sugar-free carbonated drinks still may contain high concentrations of natural fruit sugars. Mineral dissolution of enamel starts to occur at a pH of 5.5. The pH of soft drinks may be as low as 2.2.

Erosion

The process of erosion is one in which surface enamel is lost without bacterial involvement. Enamel dissolution due to erosion has been studied and identified in adolescents.⁸ Factors influencing this type of erosion include type of acid, chelating properties, temperature, and exposure time.⁹ Most soft drinks contain phosphoric, citric, tartaric, and/or carbonic acid or a combination thereof. The combination of these acids with those produced by the oral flora from the sugar in the soft drink potentiates the erosive capability of the beverage. Certain brands of candy, including Sour Patch Kids and Warheads, combine sugar with tartaric, citric, and malic acid; consumption of these may lead to marginal breakdown around sealants and restorations. Concomitant issues such as plaque formation, virulence of

bacterial strains and sugar fermentation, salivary secretion and buffering capacity, hormones, and oral hygiene affect the extent of erosion in the adolescent.

Eating disorders

Eating disorders such as anorexia nervosa and bulimia nervosa also can have devastating effects on the enamel. Both of these eating disorders are most prevalent in adolescent girls. Obsession with weight gain causes voluntary starvation and/or regurgitation of food. Chronic exposure to the acid in the vomitus (pH 1.0–5.0) erodes the lingual surfaces of the teeth. This erosion is compounded by vigorous brushing to remove any trace of food. Patients may complain of thermal sensitivity and margins of restorations may be higher than the occlusal surface due to enamel erosion. Gingival recession with abrasion of cervical cementum also may be apparent. The palate may be inflamed or callused from the acid vomitus and trauma from induced vomiting. To overcome the effects of this habit, rinsing with water and sodium bicarbonate after emesis should be recommended to neutralize the gastric acids. Custom trays can be fabricated for daily topical fluoride application.¹⁰

Gastric esophageal reflux disease

Gastric esophageal reflux disease (GERD) is a disease in which gastric acid is returned from the stomach through the esophagus into the oral cavity. Although GERD generally is associated with a high-fat diet, obesity, and older age, children also may suffer from it. Silent GERD may have no corresponding symptoms other than erosion of the enamel. Posterior teeth have the highest level of involvement. Bulimia, attrition, and abrasion may have similar effects on the enamel.¹¹ There is a synergistic relationship between attrition, acid erosion, and a reduction in the buffering capacity of saliva. Symptoms of GERD in the adolescent may include difficulty sleeping, irritability, recurrent pneumonia, anemia, asthma, bronchitis, laryngitis, and changes in appetite.¹²

Parafunctional habits

Parafunctional habits such as bruxing can lead to severe attrition with complete loss of enamel on the occlusal and lingual surfaces of teeth. A nightguard may be required to avoid significant loss of vertical dimension and replacement with full-

coverage crowns. Parafunctional habits in adolescents also have been shown to result in temporomandibular disorders.¹³ Gum chewing, jaw play, biting foreign objects, persistent arm leaning, and ice crushing have been associated with joint tension, noises, and a damaging effect on muscles of the TMJ.

Pregnancy

Pregnancy always must be considered prior to obtaining radiographs or performing treatment. Some states consider a pregnant teenager under the age of 18 to be an emancipated minor and therefore able to provide consent for her own dental treatment. The FDA classification of drugs for safety during pregnancy should be obtained before the use or prescribing of any drug. Erythromycin estolate increases the risk of cholestatic hepatitis and should be avoided throughout pregnancy. It should be safe to perform dental treatment, including the use of nitrous oxide, after the first trimester but an obstetrician should be consulted first.¹⁰ Pregnancy gingivitis or enamel erosion from morning sickness may be the first sign of a pregnancy.

Orthodontics

The importance of excellent oral hygiene and limitation of dietary sources of acid and sugar must be stressed throughout orthodontic treatment. The primary care provider should record hygiene status and inform parents of areas of early demineralization. Far too often, when orthodontic appliances are removed, the perfect orthodontic result is completely overshadowed by severe decalcification.

Treatment of adolescents

Goals in treating adolescent patients include increasing the resistance of teeth to acid dissolution and/or reversing the process of erosion, demineralization, and decalcification. Dietary modifications are mandatory. Ingestion of acidic soft drinks, sports drinks, and candy must be curtailed. If soft drinks are consumed, a straw should be used to protect the maxillary incisors from prolonged exposure to acids and sugar. Also, the importance of not swishing the beverages through the teeth like mouthwash must be stressed. If GERD is diagnosed, patients should not eat or drink within four hours of bedtime. Antacids may be suggested to alleviate

minor reflux symptoms. A referral to a gastroenterologist may be advisable.

Chewing gum is well-accepted as an adjunct to oral hygiene. Stimulated saliva contains a higher proportion of free calcium and phosphorous and raises the pH of the oral cavity. Sugar-free gum contains sorbitol, xylitol, or a combination. Sorbitol is 60% as sweet as sucrose; however, oral bacteria still can use it to make lactic acid.¹⁴ Xylitol, on the other hand, is nonacidogenic and has been shown to enhance remineralization.¹⁵

Patients should be instructed to delay brushing for at least an hour after consuming erosive foods or drinks. Surprisingly, fruits and salads are considered to be erosive. Rinsing with water or chewing a stick of sugarless gum would be the preferable method of oral hygiene. Stress that toothbrush bristles should be extra soft.¹⁶

The posteruptive benefits of topical fluoride in water, rinses, gels, pastes, and varnish are far greater than any ingested fluoride. Fluoride at 0.04 ppm can enhance remineralization.¹⁷ Bottled water containing 1.0 ppm of fluoride is available now for purchase in grocery stores. For patients who are caries-active or undergoing comprehensive orthodontic treatment, rinses such as Phos-Flur (Colgate Oral Pharmaceuticals, Canton, MA; 800/821-2880), Fluoriguard (Colgate Oral Pharmaceuticals), and Act (Johnson & Johnson, New Brunswick, NJ; 800/526-3967) can be used daily. Prescription toothpastes and gels containing 5,000 ppm of fluoride in a concentration of 1.1% sodium fluoride (PreviDent 5000 (Colgate Oral Pharmaceuticals) and NeutraCare Home Topical (Oral-B, South Boston, MA; 800/566-7252)), as opposed to the 1,000 ppm of fluoride contained in traditional toothpaste, can be burnished into enamel once or twice daily. (Fluorosis is not a concern for patients over the age of 7.) For more serious decalcification or caries activity, a series of four or five in-office topical fluoride treatments placing the 5,000 ppm pastes or gels in a tray or orthodontic vacuum-formed retainers for home use may be recommended.

Fluoride varnish prolongs the contact of fluoride, enhancing fluoride uptake and retention of enamel. It has not been approved yet by the FDA for use as a caries-preventive agent and has no insurance code except in the state of Washington. Varnishes available in the United States

are Duraphat (5.0% sodium fluoride (NaF)/2.26% fluoride) (Colgate Oral Pharmaceuticals), Durafleur (5.0% NaF/2.26% fluoride) (Pharmascience Inc., Montreal, Quebec; 888/550-6060), Fluor Protector (1.0% difluorosilane/0.1% fluoride) (Ivoclar-Vivadent, Amherst, NY; 800/533-6825), and CavityShield (5.0% NaF) (Omni Oral Pharmaceuticals, West Palm Beach, FL; 800/445-3386).¹⁸ They are safe, easily applied, and set in contact with saliva. Repeated applications are recommended, with schedules varying from one application every six months to three applications over a one-week period.¹⁹

Fluoride varnish has been shown to be effective in reducing demineralization around orthodontic brackets and on any area of enamel that displays decalcification.²⁰ In the high-risk patient whose oral hygiene is problematic, use of fluoride varnish as a preventive agent prior to demineralization is recommended. Fluoride varnish is most effective when used for early decalcification; it has little value once cavitation has occurred.

Third molars are the teeth most often congenitally missing. One or more third molars are missing in 9–20% of all children. Initiation stages of development begin around age 4 or 5; the earliest age for crypt formation is 6. During the initial stages of calcification, ages 7–9, the mandibular third molars calcify faster than those in the maxilla. By age 10, calcification of the third molars is more pronounced in the maxilla. If there is no evidence of development by age 10, the probability of agenesis is 50%.²¹

Crown formation generally is complete by age 14; by age 16, the roots are about half their final length with an open apex. By performing extractions prior to age 18, there is a significant decrease in postoperative complications. With incompletely formed roots, less bone removal is necessary. The incompletely formed roots are farther away from the inferior alveolar nerve, reducing the risk of postoperative anesthesia or paresthesia. By performing extractions earlier, osseous healing is improved without bony defect; the bone is less calcified, resulting in a less traumatic procedure; the recuperative period is shortened significantly; and there are fewer complications due to less tooth structure.²² A panoramic radiograph can be obtained to evaluate the

presence and position of the third molars after the completion of orthodontic treatment or by age 15 or 16.

Conclusion

The dentition of the adolescent patient requires not only careful observation during each periodic examination but also the need for diagnosis and intervention with timely treatment. Counseling regarding the detrimental effects of diet may be offered, although numerous studies have concluded that education and advice regarding dietary changes rarely are heeded. Instead, suggestions for supplemental preventive care, instruction in good oral hygiene habits, use of topical fluoride, and appealing dietary modifications may be the better approach. Parents should be informed that their own dietary habits are a model for their children. An understanding of the causes of demineralization and caries, along with traditional and more recent additions to the dental armamentarium for controlling or reversing this trend, will help dentists guide the adolescent patient toward optimal oral health.

Disclaimer

The author has no commercial interest in any manufacturers mentioned in this article. No profit or gain will be made in connection with the publication of this article.

Author information

Dr. Soxman is a diplomate of the American Board of Pediatric Dentistry and a member of the General Dentistry Advisory Board. She maintains a private practice in Allison Park, Pennsylvania.

References

- Jahns L, Siega-Riz AM, Popkin BM. The increasing prevalence of snacking among U.S. children from 1977 to 1996. *J Pediatr* 2001;138:493-498.
- Fagot-Campagna A. Emergence of type 2 diabetes mellitus in children: Epidemiological evidence. *J Pediatr Endocrinol Metab* 2000;13:1395-1402.
- Wyshak G. Teenaged girls, carbonated beverage consumption and bone fractures. *Arch Pediatr Adolesc Med* 2000;154:610-613.
- Matkovic V, Fontana DF, Tominac C, Goel P. Factors that influence peak bone mass formation: A study of calcium balance and the inheritance of bone mass in adolescent females. *Am J Clin Nutr* 1990;52:878-888.
- National Dairy Council. Thinking about calcium? Find it in food first. Rosemont, IL: National Dairy Council;2001.

- Majewski RF. Dental caries in adolescents associated with caffeinated carbonated beverages. *Pediatr Dent* 2001;23:198-203.
- Jones C, Woods K, Whittle G, Worthington H, Taylor G. Sugar, drinks, deprivation and dental caries in 14-year-old children in the north west of England in 1995. *Community Dent Health* 1999;16:68-71.
- Deery C, Wagner ML, Longbottom C, Simon R, Nugent ZJ. The prevalence of dental erosion in a United States and a United Kingdom sample of adolescents. *Pediatr Dent* 2000;22:505-510.
- Hughes JA, West NX, Parker DM, van den Braak M, Addy M. Effects of pH and concentration of citric, malic and lactic acids on enamel, *in vitro*. *J Dent* 2000;28:147-152.
- Nowak A, ed. The handbook, ed 2. Chicago: American Academy of Pediatric Dentistry;1999.
- Ali DA, Brown RS, Rodriguez LO, Moody EL, Nasr MF. Dental erosion caused by silent gastroesophageal reflux disease. *J Am Dent Assoc* 2002;133:734-737.
- Perkins S, Wetmore M-L. Acid-induced erosion of teeth. *Dent Today* 2001;April: 82-87.
- Gavish A, Halachmi M, Winocur E, Gazit E. Oral habits and their association with signs and symptoms of temporomandibular disorders in adolescent girls. *J Oral Rehabil* 2000;27:22-32.
- Douglas C, ed. Chewing gums can deliver an oral health benefit. *The Colgate Oral Care Report* 2001;11:6-8.
- Mandel ID. Caries prevention: Current strategies, new directions. *J Am Dent Assoc* 1996;127:1477-1488.
- Jaeggi T, Lussi A. Toothbrush abrasion of erosively altered enamel after intraoral exposure to saliva: An *in situ* study. *Caries Res* 1999;33:455-461.
- Featherstone JDB. The science and practice of caries prevention. *J Am Dent Assoc* 2000;131:887-899.
- Beltran-Aguilar ED, Goldstein JW, Lockwood SA. Fluoride varnishes. A review of their clinical use, cariostatic mechanism, efficacy and safety. *J Am Dent Assoc* 2000;131:589-596.
- Vaikuntam J. Fluoride varnishes: Should we be using them? *Pediatr Dent* 2000;22:513-516.
- Ogaard B, Larsson E, Henriksson T, Birkhed D, Bishara SE. Effects of combined application of antimicrobial and fluoride varnishes in orthodontic patients. *Am J Orthod Dentofacial Orthop* 2001;120:28-35.
- Uzamis M, Kansu O, Taner TU, Alpar R. Radiographic evaluation of third-molar development in a group of Turkish children. *ASDC J Dent Child* 2000;67:136-141,83.
- Peterson LJ. Principles of management of impacted teeth. *In: Peterson LJ, ed. Principles of oral and maxillofacial surgery*. Philadelphia: Lippincott Williams & Wilkins;1992:104-109.

Published with permission by the Academy of General Dentistry. © Copyright 2003 by the Academy of General Dentistry. All rights reserved.