Introduction: A Short History of the Care of Teeth and Dentistry

Since the earliest people got their first teeth, humans have suffered mightily from gum disease and tooth decay. The treatment of these dental problems often caused more pain than the disease itself, so it is no wonder that people feared—and still fear—the tooth-puller!

In many ancient cultures, the tooth represented vitality and immortality. When someone had a toothache, spiritual leaders would treat the problem with amulets, prayers, and incantations. Magical mystery and superstition surrounded the tooth and its power to produce pain. Demons were blamed. And tooth worms. Many people believed that worms bored holes into the teeth and caused pain by thrashing about. Healers tried to smoke the worms out of the cavities or kill them with concoctions of urine and spider juice. This belief persisted into the Middle Ages.

Hippocrates (known as the Father of Medicine) pooh-poohed the tooth worm theory and suggested that people were predisposed to toothaches if their bodily fluids, or *humors*, were out of balance. He recommended treating infected teeth with cauterization and astringents, and even bloodletting. This idea of opening a vein to let blood out was popular even in the 1900s.

At one time medicine and dentistry were not separate professions. As the practice of bloodletting caught on, physicians decided it was "beneath them" to perform the procedure,

thinking that it was the work of butchers. Priests were forbidden to shed blood, so barber-surgeons took to cutting hair and pulling teeth.

For thousands of years, gum disease caused by excessive wear from chewing coarse foods accounted for most tooth loss. But as civilizations developed and refined sugar found its way into the diet, tooth decay claimed more teeth. Sugar was expensive, so the richer a person was, the more likely he or she was to suffer from *caries*, or tooth decay.

During the Renaissance, when the arts and sciences flourished, lead and gold fillings were used for the first time to stop tooth decay. In 1683, the Dutch naturalist Anton van Leeuwenhoek looked into his microscope and discovered *animalcules* (bacteria) in his tooth scrapings *(plaque)*.

In 1728, Pierre Fauchard, who is regarded as the father of modern scientific dentistry, published his book *The Surgeon-Dentist, or Treatise of the Teeth*. In it he put forth several ideas that are still current: the importance of keeping the teeth clean because oral health affects the whole body; the need for specialized dental education; the necessity of scaling teeth and cleaning the root surfaces to prevent *periodontal* (gum) disease; the need to align teeth in the jaw; and instructions for using ivory in dentures, connecting them with springs, and coloring the artificial teeth.

Dentistry, as a distinct field of medicine, developed in the 1800s. Baltimore College of Dental Surgery, the first dental college in the world, was founded in 1840. At the same time, Horace Wells discovered that he could perform painless tooth extractions by giving nitrous oxide gas (laughing gas) to his patients. Then William Morton successfully used ether as a general anesthetic. In 1858, local anesthetics were given by injection of a drug made from cocaine.

In 1890, Willoughby D. Miller, an American dentist, discovered how plaque forms and can lead to the destruction of teeth. Other dentists began to teach preventive measures for getting rid of plaque and avoiding tooth decay and gum disease.

The German physicist Wilhelm Roentgen developed the practical use for x-rays to make photos, or *radiographs*. X-ray photos of the teeth were taken for the first time in 1896.

Dental treatment has evolved rapidly in the past century. Adding fluoride to the public water supply has dramatically reduced the incidence of tooth decay. Ultrasonic cleaning tools and drills help make a visit to the dentist's office quick and painless. We can be glad that the days of the tooth worm are behind us.

The Tooth

The Functions of Teeth . . . Not Just for Chewing!

Eating

The main function of teeth is to break food into small pieces that you can swallow safely and digest. The different shapes and structures of teeth allow for the different functions of biting, tearing, and grinding.

Speech

Although every normal child is born with a voice, he or she must learn to speak. No specific body part is used exclusively for speech. Different parts of the body designated for breathing, chewing, or swallowing all work together to create speech. The teeth (with the tongue, lips, and palate) help to form words.

Appearance

Teeth help to form the shape of the face. The canines, or cuspids, at the corners of the mouth give the smile a pleasant symmetry. But missing teeth may turn a smile into an embarrassed tight-lipped expression or make the cheeks look hollow.

Different Teeth for Different Tasks

Humans are *omnivores*. We eat everything—animal and plant materials—so we need teeth that will grind a steak, crush a pinto bean, and slice off a piece of celery.

The shape of the tooth determines its function. The six front teeth in the upper and lower jaws have single, sharp edges—like knives. The 10 back teeth in each jaw have large blunt surfaces for grinding food. Humans mainly chew by moving their jaws up and down, with only a slight side-to-side

motion. The front teeth slide across each other like the blades of scissors, and the back teeth meet with force to crush and compress the food like a compactor.

Incisor

Incisors

The four flat front teeth in each jaw (the central and lateral incisors) have spade-shaped edges for cutting and slicing. Incisors typically have a single root.

Canine, or cuspid

Canines or Cuspids

These four "doglike" teeth next to the lateral incisors each have a single *cusp*, or point on the surface, for holding and tearing food. Meat-eating animals such as tigers have oversized cuspids for killing and eating their prey.

The root of the canine is extra long and large to secure the tooth in the bone so it won't come loose from the tearing movements. The surface of the tooth is smooth and the cusp is rounded, so the canine tends to be self-cleaning. Because the tooth is resistant to decay and is firmly anchored in the jawbone, the canine is often the last tooth lost to age.

The canines, or cuspids, are also known as "eyeteeth." Folk wisdom held that the eyeteeth were connected to the eyes, and that pulling an eyetooth could make the patient blind.

Centuries ago, if a person committed a felony, his or her punishment might be the painful extraction of one or more teeth. The eyeteeth were usually the first to go because they were easily accessible and their absence created a wretched smile and a warning to others. So would-be criminals had to decide whether their illicit goals were worth losing a tooth. Thus the saying, "I'd gladly give my eyeteeth."

Bicuspids

Often called premolars, these first and second bicuspids share characteristics with molars and canines. They each have a large chewing surface, like the molar, and cusps (in this case, two), like the canine. These teeth crush *and* tear food. The bicuspids may have one or two roots, and sometimes three.

Bicuspid

Molars

The two or three teeth farthest back in the mouth are the molars (first, second, and third). These are the largest teeth, with broad surfaces and three to five cusps for grinding. The curving roots of the molars anchor the teeth deeply in the jawbone to withstand the tremendous chewing pressures exerted. The lower molars have two roots, and the upper ones almost always have three.

Molar

The Structure of the Tooth

The two basic parts of a tooth are the *crown* and the *root*. The tooth is a living structure and also is made up of four dental tissues: *enamel, dentin, cementum,* and *pulp*.

The Crown

The crown is the part of the tooth you can see above the gum. It is completely covered with an outer layer of enamel, which protects it from wear and decay. The top of the crown is the hard surface for biting and chewing.

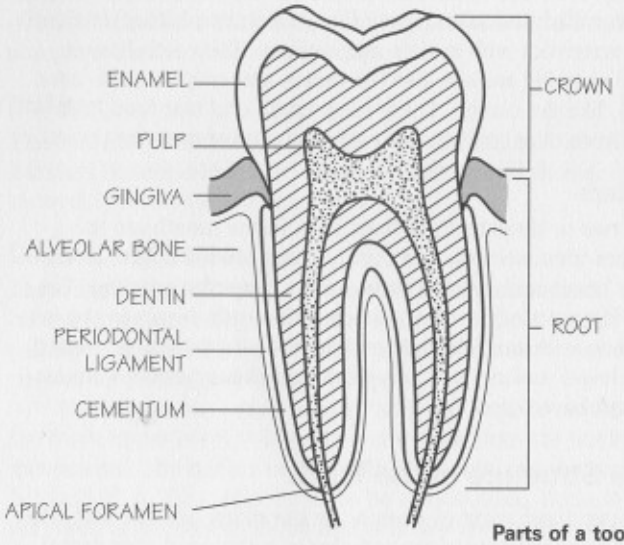
The Root

The root is the part of the tooth that is below the gum. It makes up almost two-thirds of the total length of the tooth. In a healthy mouth, the root should not be visible. It is firmly embedded in a socket in the jawbone and protected on its outer surface by a thin layer of hard tissue called cementum. According to its function, a tooth may have one, two, or three roots, which hold the tooth in the jawbone.

Enamel

Enamel, composed of calcium and phosphate crystals, is the hardest substance in the human body. It reacts with various minerals in the mouth and gets harder over time. That may be why children often have tooth decay (or caries), but people older than 20 rarely do.

The third molars, also called the *wisdom teeth*, most often appear during the late teens or early 20s. The expression "to cut one's wisdom teeth" means to attain maturity.



Parts of a tooth

Enamel protects the dentin and pulp from the impact of grinding and chewing, as well as from the corrosive substances in the mouth such as acids and enzymes. Because of its unique structure, it can withstand the full swing of temperature changes. Enamel won't crack if you eat a bowl of ice cream and then drink a mug of hot apple cider.

Even though enamel is hard, it is still vulnerable. When a tooth *erupts* (comes through the gum), the cells that make enamel die. Without living cells, enamel has no way to repair itself. So any defects that occurred when the enamel formed, or any damage sustained from decay or wear, will always remain.

A tooth is not really white. Enamel has a gray or bluish tint. It is semitransparent and reveals the color of the dentin underneath.

Dentin

Dentin is a bonelike tissue that makes up the main portion of the tooth. It is the same material as an elephant's ivory tusk. At the crown, dentin is covered with enamel; at the root, with cementum. It is a highly porous, slightly yellow substance that, when stained by foods, drinks, tobacco, or antibiotics, can turn orange, brown, or black. Dentin surrounds the pulp, except at the end of the root (the *apical foramen*) where the blood vessels and nerves enter the pulp cavity.

Cementum

Cementum is a thin hard tissue that covers and protects the outer surface of the root. It is softer than enamel and similar to bone but without the blood vessels and nerves. You shouldn't be able to see cementum, but it may be visible if the gum has receded. It is attached to the fibers of the periodontal ligament and helps connect the root to the jawbone.

Pulp

Pulp is the soft tissue that occupies a space inside the tooth called the pulp cavity or chamber. The pulp extends down the roots of the tooth in the pulp canals, or root canals, to the apical foramen where the pulp tissue leaves the tooth and enters the jawbone. It contains sensory nerves, blood vessels, odontoblasts (a kind of cell), and fibrous connective tissue. The network of nerves signal pain when the pulp is inflamed from tooth decay or trauma.

The blood cells and lymph vessels connect the tooth with the rest of the body; they supply nutrients for the dentin but can also spread disease and infection throughout the body. Odontoblasts are cells that make up the outer lining of the pulp and extend through narrow channels, or tubules, into the dentin. These cells continually form new dentin. The dentin tends to grow inward, making the pulp chamber and root canals smaller. Over time, the tooth becomes insensitive. However, if the pulp is damaged or dies, then the dentin will no longer be maintained, and the tooth will die.

Support for the Tooth

The supportive tissues of the tooth are called the *periodontium*, which includes the *periodontal ligament*, the *alveolar bone*, and the *gingiva*, or gums. The cementum, periodontal ligament, and alveolar bone connect the teeth to the jaws. When one of these is damaged or missing, the tooth will loosen and eventually fall out. The supportive tissues actually get stronger from vigorous use. However, if a part of the mouth is not used because of missing teeth, *malocclusion* (a "bad bite"), or pain from advanced caries, then the supporting structures will weaken and much damage will occur.

Periodontal Ligament

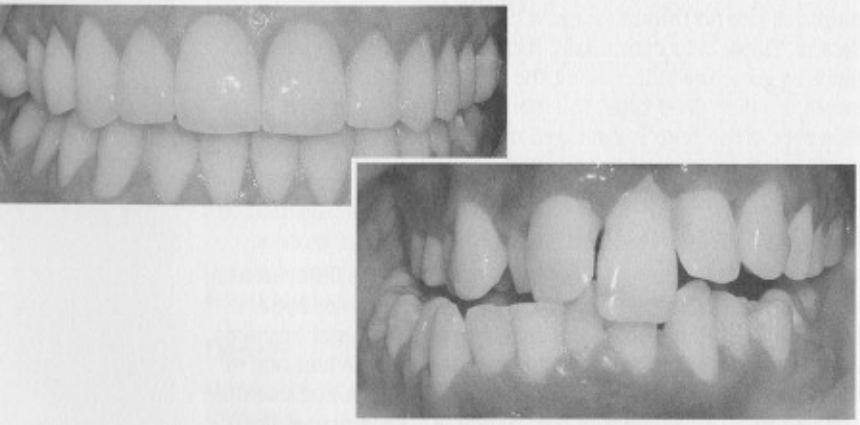
The periodontal ligament is a strong fiberlike tissue that anchors the root of the tooth (by the cementum) to the jawbone. It cushions the surrounding bone against the shock of chewing and biting. When extracting a tooth, the dentist cuts the periodontal ligament that connects the tooth to the bone.

Alveolar Bone

The bony part of the upper and lower jaws that surrounds and supports the roots of the teeth and the gums is called the alveolar bone, or jawbone. *Alveolar* means "hollow." The jawbone has hollow places, or *sockets,* that house the roots of the teeth.

Gingiva

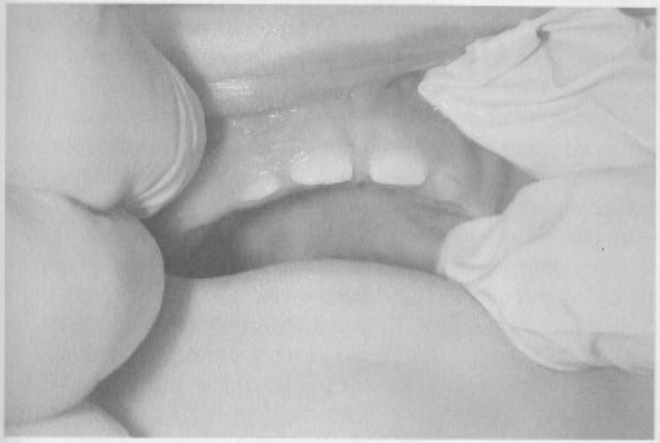
Gingiva is the formal name for gums. It is the thick pink tissue that covers the necks of the teeth and all of the alveolar parts of the jaws. When a tooth erupts, the gum covers the whole root and part of the enamel. It fits tightly, except for gaps between the tooth and gum, called *gingival crevices.* These are places where food particles and bacteria can collect. If you don't clean your teeth carefully and frequently, then *calculus,* a material made when plaque hardens, will form and periodontal (gum) disease will set in.



Healthy gums *(left)* fit tightly around the whole root and part of the enamel. Unhealthy gums *(right)* leave gaps, increasing the potential for disease and tooth decay.

Development and Eruption of Teeth

Under normal circumstances, you will develop two sets of teeth in your lifetime. If you take care of these teeth, you can avoid having to buy a third set—dentures!



Primary Teeth

The first set of teeth—called primary, baby, milk, or deciduous—is temporary but affects the future of your mouth in important ways. These teeth help to form facial contours and help you develop speech and the ability to chew. They also maintain space so that the permanent teeth can erupt in the correct formation.

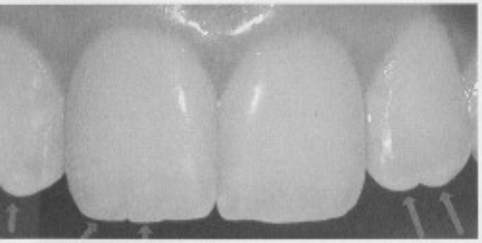
Proper care of the primary teeth is critical. Decay and infections can spread to the permanent teeth even before they have emerged. Premature loss of baby teeth (to decay or accidents) may cause permanent teeth to erupt in the wrong positions, requiring orthodontic treatment (such as braces). If a tooth comes out before it is supposed to, the dentist will decide whether to replace it. Sometimes the jaw is growing quickly, spaces are naturally occurring, and the permanent tooth has room to erupt. However, the dentist may decide to fit a metal or plastic device into the gap and "maintain" that space until the permanent tooth is ready to come in.

The baby teeth begin to form as tiny buds while the child is still in the mother's womb. At birth, all primary teeth and the

permanent first molars are present but still below the gums. When the baby begins to teethe at around 6 months of age, some of the primary teeth are ready to erupt. Although it sounds violent, this process is the slow sliding of the teeth through the gums, which have thinned and parted. At the time a tooth erupts, the root is only two-thirds formed. It may take four years after the appearance of the tooth for the apical foramen, periodontal ligament, cementum, and alveolar bone to fully develop.

The color of the primary teeth should be milky white, which indicates that the teeth are healthy and that the mother wasn't sick during her pregnancy. Tooth color other than white indicates a malformation of the enamel and a great risk for tooth decay.

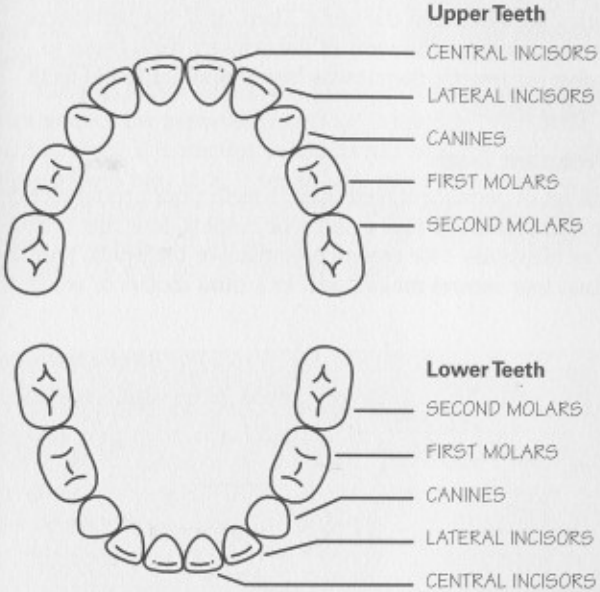
The three small bumps on the biting surface of the tooth are called *mamelons*. These are the places where the tooth buds started to develop. They will wear down in a few years as the teeth contact the teeth in the opposing jaw. If they don't, then the dentist must check for malocclusion, a problem with the way the teeth meet when the jaws close.



Mamelons

The set of primary teeth includes 20 teeth, 10 each in the upper and lower jaws. Each jaw, or *dental arch*, contains two central incisors, two lateral incisors, two canines or cuspids, two first molars, and two second molars. These erupt in sequence, starting with the lower central incisors and then the upper central incisors. The alternating eruption pattern of matching teeth in opposing jaws ensures that the child can bite and chew, and therefore digest, food properly.

The sequence of eruption is more important than when the teeth erupt. Boys' teeth tend to erupt later than girls' teeth. This may be an advantage because teeth that remain under the gum longer have a higher resistance to dental caries because of the extra time the tooth has to absorb the chemical compound fluoride. Most 3-year-olds have a complete set of primary teeth with fully developed roots.



Primary Teeth in the Upper Jaw

Eruption	Exfoliation
Central incisors, 7 months	Age 7
Lateral incisors, 9 months	Age 8
Canines, 18 months	Age 11
First molars, 14 months	Age 10
Second molars, 24 months	Age 10

Primary Teeth in the Lower Jaw

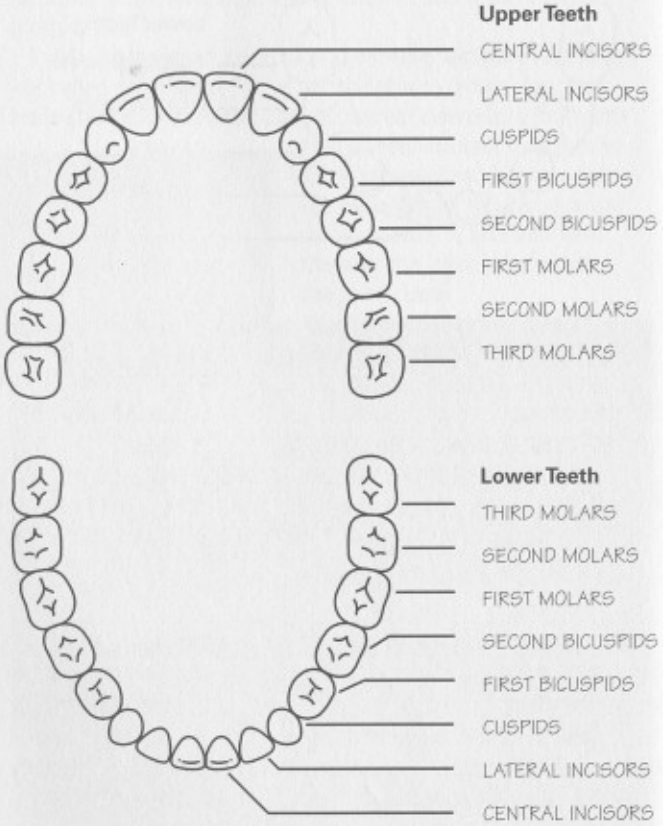
Eruption	Exfoliation
Central incisors, 6 months	Age 6
Lateral incisors, 7 months	Age 7
Cuspids, 16 months	Age 9
First molars, 12 months	Age 10
Second molars, 20 months	Age 11

Around the age of 4, the child's jaws grow dramatically, creating gaps between the teeth. Then, at 6, the permanent first molars erupt. The roots of the primary teeth begin to dissolve (or *resorb*), the crowns lose support, and the teeth fall out *(exfoliate)*.

Permanent Teeth

A full set of permanent teeth has 32 teeth (four central incisors, four lateral incisors, four canines or cuspids, four first premolars or bicuspids, four second premolars or bicuspids, four first molars, four second molars, and four third molars or wisdom teeth). By the age of 13, most people have 28 permanent teeth. The third molars erupt (if at all) by the early 20s. The permanent teeth are yellowish in color, much larger than primary teeth, and closely spaced.

The first molar (6-year-old molar) is the key to the proper placement of the permanent teeth. It is the first permanent tooth to erupt. If it emerges in the correct position, with healthy primary teeth next to it, it serves as a guide for the rest of the permanent teeth. But if the primary tooth next to the first molar is missing, the molar will tip or drift out of position and misdirect the eruption of the other teeth.



Permanent Teeth in the Upper Jaw

Tooth	Eruption
Central incisors	Ages 7 to 8
Lateral incisors	Ages 8 to 9
Cuspids	Ages 11 to 12
First bicuspids	Ages 10 to 11
Second bicuspids	Ages 10 to 12
First molars	Ages 6 to 7
Second molars	Ages 12 to 13
Third molars	Ages 17 to 21

Permanent Teeth in the Lower Jaw

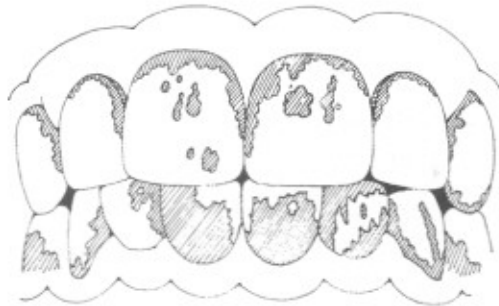
Tooth	Eruption
Central incisors	Ages 6 to 7
Lateral incisors	Ages 7 to 8
Cuspids	Ages 9 to 10
First bicuspids	Ages 10 to 12
Second bicuspids	Ages 11 to 12
First molars	Ages 6 to 7
Second molars	Ages 11 to 13
Third molars	Ages 17 to 21

How to Keep Your Teeth for a Lifetime

Enemies of Your Teeth and Gums

Tooth decay, or dental caries, is a destructive infectious disease caused by specific bacteria that feed on sugars in food and produce acids that attack the enamel. If left untreated, it will work its way through the enamel, dentin, and pulp and eventually to the alveolar bone. In the worst case, the infection could spread through the bloodstream to other parts of the body, causing specific reactions that could result in death.

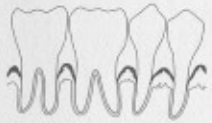
The bacteria responsible for caries are spread from one person to another by saliva. It is possible to transmit enough bacteria to cause infection simply by sharing a fork, blowing on someone's food, or even kissing that person!



Plaque typically accumulates in those hard-to-reach places—the pits and fissures of teeth, between teeth, and in crevices below the gum line.

Plaque

Tooth decay generally begins with the formation of plaque, which contains a sticky substance called *dextran*. Bacteria digest sugars, producing dextran and acids. Plaque sticks to teeth and dental restorations (crowns, bridges, fillings, dentures, and implants) and holds those acids in close contact with the tooth surface.



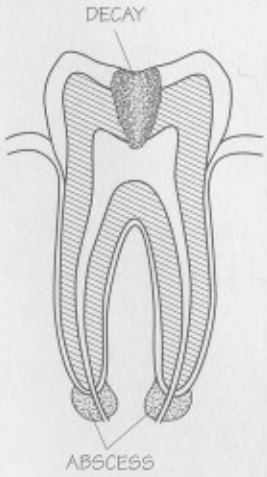
Plaque accumulates in the pits and fissures of the molars and bicuspids, between teeth, and in crevices below the gum line. If it is not removed quickly and the acids are left undisturbed, the acids will react chemically with the minerals in enamel and dissolve them. The cycle of plaque formation and the process of tooth decay continue as long as colonies of bacteria are permitted to cling to the plaque on the teeth and feed on the constant supply of sugar that is introduced throughout the day, every day.

Calculus

You can remove plaque easily by brushing and flossing diligently. But if you ignore plaque, it will eventually absorb calcium salts from saliva and harden into calculus, or *tartar*. Because calculus is rough and impossible to scrape off without special dental tools, it attracts more bacteria, which irritate and inflame the gums. Calculus is the primary cause of periodontal disease.

Acids

Strong acids in the mouth attack the calcium salts in enamel. As the surface of the crown is dissolved, the enamel becomes porous. When a cavity or hole develops, the acids can reach the dentin, which is softer and more susceptible to caries than the enamel. Soon, bacteria can swarm through the dentin to the pulp and attack the nerves and blood vessels. The pulp gets infected but cannot swell inside the tooth. Pressure builds. Pain is severe. The infection spreads through the root canals into the tooth socket, causing an *abscess*.



Besides eating sugary foods, which bacteria use to produce acids, you may do other things that cause strong acids to attack the teeth and irritate the gums. Sucking on a lemon, putting an aspirin directly on a mouth sore, drinking carbonated beverages that contain acids as well as sugar, and bingeing and purging (an eating disorder called *bulimia*) all expose your mouth to corrosive acids.

Saliva is slightly alkaline and can neutralize the acid in the mouth. If plaque is allowed to remain on the teeth, it locks in the acids and prevents the saliva from washing them away. It takes 20 to 40 minutes for the saliva to completely neutralize the acids. If you eat candy or drink sodas throughout the day, however, your mouth will stay acidic and decay will continue without a break.

Sugars

Sugar is the main staple in the diet of plaque-forming bacteria. If you reduce the amount of sugar you eat, you'll reduce the amount that the bacteria eat. Then the bacteria can't produce as much acid to destroy the teeth. Of course, the opposite works, too. The more sugar you eat, the more the bacteria eat, and the more acids are produced to attack the teeth.

Certain sweets are particularly harmful because they stay in or stick to the mouth for a long time: hard candy, cough drops, breath mints, non-sugarless chewing gum, caramels, pastries, and dried fruit. Other sugary foods that you eat often or between meals also promote tooth decay. If starch sticks to the teeth, an enzyme in saliva called *amylase* can convert the starch to sugar, and then the acid-producing cycle starts again.

Tobacco

Smoking and chewing (smokeless) tobacco do not cause tooth decay but will, at the very least, stain your teeth and foul your breath. Tobacco irritates the soft tissues of the mouth—gums, tongue, *palate* (the roof of the mouth), and lining of the cheeks. It can cause sores, a white plaque on the roof of the mouth, or even oral cancer. In fact, the use of either smoking or chewing tobacco is considered to be the leading cause of oral cancer. Smokers are four to 15 times more likely to get oral cancer than nonsmokers.

Tobacco does more than just stain teeth. Users are more likely than nonusers to suffer from excessive tartar buildup and periodontal disease, and to get oral cancer.

Tobacco users are more likely than nonusers to suffer from periodontal disease. Smoking depletes vitamin C, which healthy gums need. Nicotine constricts the blood vessels, limiting the supply of blood and oxygen to the tissues. These factors, along with excessive tartar buildup (particularly for pipe smokers), increase the risk of getting gum disease. In fact, tobacco may interfere with the treatment of gum disease and make it ineffective.

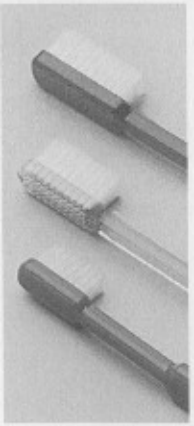
Genetics

Many factors affect the development of teeth and of oral and facial structures. During pregnancy, the mother may be exposed to chemical or environmental hazards. She may run a high fever for a long time, take certain medications or substances (such as alcohol or drugs), or have severe nutritional deficiencies. All of these influences can cause defects in the enamel and dentin of the baby's teeth, especially if they happen while the teeth, jaw, and face are forming.

Heredity plays a major part in the health of the teeth and supporting structures. "Good" or "bad" teeth can run in the family. Genetics determines how white teeth are, how quickly and how much the teeth will discolor, whether gums are predisposed to chronic swelling, and whether a person might develop an autoimmune disease that dries out the saliva and keeps it from neutralizing acids.

The range of possible genetic defects includes missing a complete set of permanent teeth; developing too many teeth, or teeth that are unusually small or large; teeth that are fused together or share one root canal; a cleft lip and/or palate; and upper and lower jaws that don't match in size or meet properly.

Prevention of Tooth Decay and Gum Disease



Although you can't control what kind of teeth you inherit, you can control how well you try to prevent tooth decay and gum disease. You accomplish this by developing good habits of oral hygiene and making good choices about eating.

How to Brush

The key to preventing caries and periodontal disease is controlling plaque. Whether you use a manual or electric toothbrush, toothpaste or tooth gel, is not as important as whether you brush your teeth regularly, thoroughly, and correctly.

Choose a toothbrush that is comfortable for you to use. Although the American Dental Association (ADA) does not recommend a specific manufacturer or style of toothbrush, it suggests one that is small enough to reach every face of the teeth, with soft, round-ended bristles, a flat brushing surface, and a straight handle. A dry brush cleans better than a wet one, so alternate two brushes. Replace your toothbrushes after three months of use (or before if they are worn out) and after an illness. And never share a toothbrush because you can "catch" tooth decay—that is, you can spread plaque-producing bacteria through saliva.

Choose a fluoride toothpaste that is not too abrasive. Those brands that claim to remove tough stains (caused by tobacco and coffee) and whiten teeth can also make the teeth sensitive by removing cementum and exposing the dentin. (Excessive pressure can wear away enamel, too.)

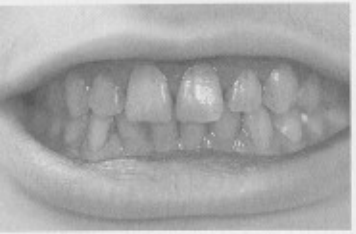
Ideally, you should brush your teeth after every meal and snack. Proper brushing shouldn't take longer than three minutes. Dentists recommend that you brush your teeth a minimum of twice a day, after the first and last meals. If you are going to prevent the buildup of plaque, you must interrupt its formation once every 24 hours.

Develop a plan of attack that you can follow routinely. You may prefer to brush all the outside surfaces first, or you may decide to divide your mouth into quadrants and brush each area inside and out before moving on to the next section. To brush the outside surfaces, set the bristles against the teeth near the gums at a 45-degree angle. Move the brush gently back and forth in short strokes about a half a tooth wide. Clean one or two teeth at a time. Brush along the gum line, too.

Use the same technique to clean the inside surfaces. For the incisors, however, you may find it easier to clean them by holding the brush vertically and using up-and-down strokes. Then, with the brush held flat, scrub the chewing surfaces. Be sure to brush every surface, particularly the hard-to-reach ones like the most-often neglected tongue side of all molars and the cheek side of the upper molars. Finish up by lightly brushing your palate and tongue (from back to front).

Because you can't see plaque with the naked eye, you can't know for sure that you've gotten all of it off your teeth unless you use a harmless dye called a *disclosing agent*. Using a disclosing agent

Using the proper technique for brushing your teeth will help ensure effective cleaning.



occasionally will help you learn how to effectively brush your teeth. You can either chew a disclosing tablet or swish a solution around your mouth. The dye will stain any remaining plaque. Clean the missed areas with your toothbrush and remember to spend more time on those places the next time you brush. After cleaning your teeth, rinse thoroughly with water or a mouthwash containing fluoride.

How to Floss

Most people use dental floss (a thread usually made of nylon) from time to time like toothpicks—to dislodge bits of food caught between the teeth. But using floss every day between every tooth, below the gum line, and under fixed bridges actually loosens the plaque that a toothbrush can't reach. Flossing reduces your risk of developing gum and bone disease and is so important to oral health that Dr. Michael F. Roizen, author of *Real Age: Are You as Young as You Can Be?*, suggests that flossing every day can add two years to your life expectancy!

Ideally, you should floss whenever you brush. If you floss only once a day, however, do it at bedtime. Wrap about 18 inches of waxed or unwaxed floss around your middle fingers until you have an inch or two of floss between them. Hold the floss taut and guide it between two teeth. Curve the floss against a tooth and slide it gently under the gum line. Scrape it up and down on the surface of that tooth, and then curve the floss on the other tooth and repeat the process.

Start at the rear molar on one side of the upper jaw and work to the center. Then move to the other rear molar and work back to the center. Do the same for the lower jaw. Let out more floss as you move along, or replace it if gets heavy with plaque or starts to fray.

If teeth are so tightly spaced that you can't get the floss between them, use a floss threader and insert it into the space below the contact points. This also works to get under a fixed bridge.

Rinse your mouth thoroughly when you finish. Your gums may bleed a little if you have *gingivitis* (inflammation of the gums) or if you were too rough. But keep at it, with a gentler touch. After a few days of flossing, the bleeding will probably stop.

How Fluoride Helps to Prevent Tooth Decay

Fluoride is a chemical compound that forms when fluorine combines with other elements. If enough fluoride is in the body when teeth are developing, it will react with other minerals to make the tooth enamel extra strong and extra resistant to the acids that cause tooth decay. After teeth are formed, fluoride reinforces enamel and also acts with minerals in saliva to restore enamel in the earliest stages of decay.

Fluoride is present everywhere, in varying amounts. The concentration of fluorides in the soil, water, and plants in certain areas may be lower or higher than in other areas. We can't count on what we eat and drink to give us a consistent, balanced supply of fluoride to ensure that our teeth are strengthened and protected. So we must take steps to expose our teeth to fluoride. You can take fluoride internally or apply it directly to the surfaces of the teeth.

Fluoridation, or adding fluoride to our water supply, is considered to be one of the greatest efforts to protect public health. Studies have shown that supplementing local water supplies with fluoride is an effective and economical way to strengthen people's teeth against dental caries. Many people choose to drink bottled water rather than tap water. Most bottled water, however, does not contain enough fluoride to ward off decay. In-home water filters not only eliminate impurities in tap water, but some filters also eliminate vital fluorides from the water supply. Find out whether the water in your home is fluoridated. If it is, try to drink eight glasses of tap water each day and know that while you are replenishing fluids in your body, you are also protecting your teeth from decay.

If the home, or "primary," water supply has been determined to be fluoride deficient, other fluorides can be taken internally (as food or medicine), including supplements in liquid solutions and in tablets (often combined with vitamins). Since ingested fluoride is most effective on unerupted teeth, it should be introduced at 6 months of age and continue until the second permanent molars erupt. Guidelines for fluoride supplementation are available from the American Dental Association.

Erupted teeth also benefit from having fluoride applied directly to the surfaces and hard-to-clean spots. Topical fluoride applications should *not* be swallowed. For people especially susceptible to caries, the dentist or hygienist paints a fluoride solution on the teeth or places gel in a tray inserted temporarily over the upper or lower arch of the teeth. Everyone (unless advised *not* to by a dentist or physician) should use fluoride toothpaste. In fact, the American Dental Association won't approve any toothpaste that does *not* contain fluoride.

ADA ACCEPTED American Dental Association

If you don't see this sign from the American Dental Association on your toothpaste, the ADA has not accepted it. One of the reasons may be because it doesn't contain fluoride.

Mouthwashes, or mouth rinses, do little more than mask breath odors for 15 or 20 minutes, unless they contain fluoride or an antimicrobial agent that fights tartar and/or plaque. Fluoridated mouthwashes, now available over-the-counter, are anticavity rinses. While many mouthwashes do not contain fluoride, they may still have benefits. Read the label to see whether the mouthwash contains these plaque fighters: cetylpyridinium chloride and domiphen bromide. Look also for antimicrobial ingredients, such as sodium benzoate, benzoic acid, or chlorhexidine.

It is possible to get too much fluoride, which can cause mottling and pits in the enamel and lead to discoloration of the enamel. This condition, called *fluorosis*, happens in areas where the drinking water has too many fluorides. It doesn't occur where the water supply is artificially fluoridated. The upside of this condition is that although the teeth are stained, they are quite resistant to decay. Bleaching and bonding can help restore the surface of enamel.

How Good Nutrition Helps

When and how often you eat may affect your dental health more than what and how much you eat. You don't have to give up sugar to protect your teeth. If you eat sweet foods and drinks only at mealtimes and faithfully brush and floss your teeth afterward, you can avoid tooth decay.

The extra saliva produced to digest a meal will wash away or neutralize acids. Some people suggest ending a meal with aged cheddar cheese for dessert because when it dissolves in saliva, the cheese releases calcium and phosphates that are stored in the plaque and slow the acidic breakdown of the enamel.

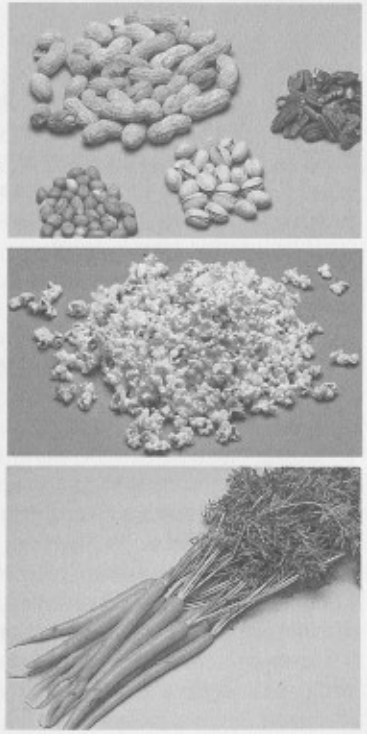
Eating sugary foods between meals will keep the acid level of the mouth high. If you must snack, choose foods that are low in sugar content: peanuts, popcorn, pretzels, olives, eggs, meats, milk, and plain yogurt. Even better are raw vegetables and fruits (but not fruit juices!) because they are high in fiber and require vigorous chewing, which stimulates salivation and cleans the teeth and gums. Snacking before bedtime is harmful because of the reduced production of saliva during sleep. The plaque remains undisturbed on the teeth for hours.

Baby bottle tooth decay (BBTD) is a type of caries in children younger than 3 years old caused by using a bottle filled with formula, milk, or fruit juice as a pacifier. When a baby is put to bed with a bottle filled with anything other than water (preferably fluoridated), then the sugars collect around the teeth. The bacteria have all night to produce acids, which destroy the enamel.

Protecting Teeth From Injury

Environmental Hazards

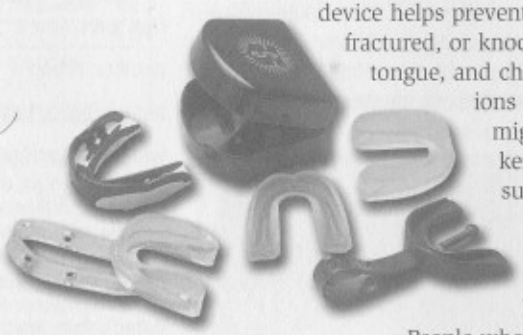
Apart from decay, accidents are the main cause of tooth injury and loss in children. Many teeth have been knocked out because of a jump off a swing, a shove into a drinking fountain, a fall at the swimming pool, and poor footing on a wet tree trunk. Automobile crashes or sudden stops account for more tooth injuries. Everyone should take safety precautions to avoid these kinds of accidents. Don't run or climb on wet surfaces. Watch where you're going. Wear a seat belt.



Tooth loss often has an indirect cause. Radiation of the head or neck, such as in treatment for cancer, can destroy the salivary glands. The acids created by certain bacteria remain on the teeth, so decay sets in with a vengeance. Blood disorders affect the body's ability to fight infection, making a person susceptible to periodontal disease. Often, people cope with stress by grinding their teeth (a habit called *bruxism*). The constant heavy pressure can injure periodontal ligaments, causing bone erosion and, ultimately, loss of teeth.

Mouth Guards

Everyone who plays active sports that are potentially dangerous to the face and head should wear a mouth guard. This device helps prevent teeth from getting chipped, fractured, or knocked out and protects the lips, tongue, and cheeks. The mouth guard cushions the impact of a blow or fall that might cause a concussion or broken jaw and distributes the pressure throughout the jaw.



Wearing a mouth guard is required in many sports, such as football, basketball, boxing, lacrosse, and ice hockey. People who surf, skateboard, ride scooters, rodeo, or participate in gymnastics should also protect their teeth by wearing mouth guards.

You can buy mouth guards in a store, or a dentist can make them specifically to fit your mouth. Stock mouth guards are available at sporting goods stores. To keep these in place, you have to clench your teeth, which may interfere with your breathing. "Boil-and-bite" mouth guards are made with moldable plastic that can be softened in warm water. The plastic then takes the shape of the teeth. Be careful not to burn your mouth when inserting the guard after heating it! To get the best fit and comfort, ask your dentist to make one from an impression of your teeth.

Usually, a mouth guard is worn on the upper teeth, but sometimes people may want one to cover the lower teeth, too, if they have braces. Whatever mouth guard you choose, be sure it fits well and that you are able to speak and breathe easily while wearing it.

Face Protectors

Face protectors are absolutely necessary if you play a position in a sport that puts you directly in the line of something that can hurt your teeth or face. Baseball catchers and hockey goalies fall in that category.

Your Tooth Is Injured . . . Now What?

Injuries range from a tiny fracture in the enamel to broken and *avulsed* (knocked out) teeth. You might not see the fracture but will feel discomfort when chewing or if a sharp edge of the enamel irritates your lips or tongue. Seek treatment before the tooth is permanently damaged. If you experience sensitivity to changes in temperature, or find loose tooth fragments, call your dentist immediately. Treatment may include capping, bonding, root canal therapy, or extraction.

If you break your tooth, try to gather the broken pieces. Rinse your mouth with warm water. Take the pieces to the dentist, who will determine whether they can be bonded back onto the tooth. If swelling occurs, apply a cold compress to the face at the swollen area.

An avulsed tooth can be successfully replanted in the socket if you act fast. The first 30 minutes after the tooth is knocked out are critical. Hold it by the crown—not by the roots as you may destroy any surrounding tissue. Rinse it in milk, if available, or hold the tooth under cold running water. Set it back in its socket and see your dentist immediately.

If you can't replant the tooth, carry it to the dentist under your tongue or between your cheek and gum. If you are worried about swallowing the tooth, cover it with milk in a container or roll it up in a wet towel. *Do not allow the tooth to dry.* Go directly to the dentist—and don't forget the tooth!

If a permanent tooth gets knocked out, the trauma may cause damage to the nerves and blood supply, and even the alveolar bone. Often, the pulp dies. A dentist can determine whether root canal therapy will be necessary. If a primary tooth gets knocked out, the dentist may replant the tooth or decide to insert a space maintainer to keep the teeth on either side of the space from moving together before the permanent tooth erupts.

The main reason a replanted tooth might be lost is due to root resorption. This happens when the body rejects the roots and absorbs them over time. It is important that the dentist take an x-ray film of the tooth at least six months after it has been replanted to make sure that the roots are still intact.

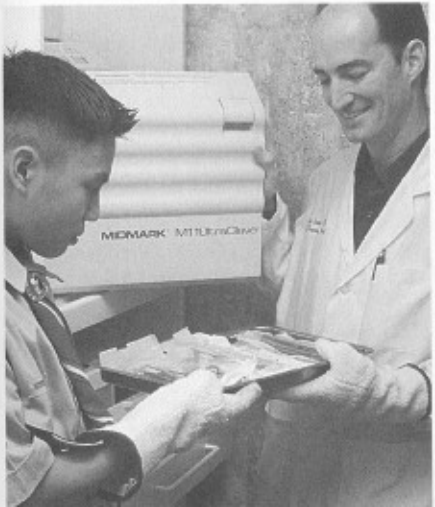
At the Dentist's Office

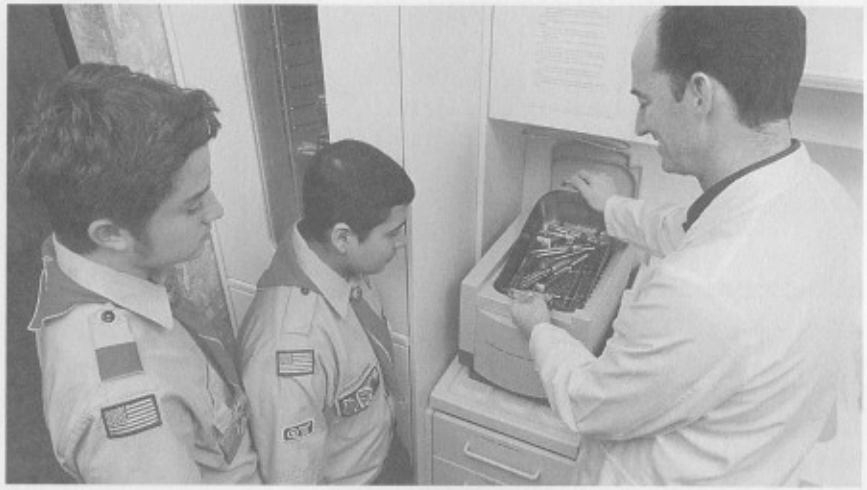
Equipment and Materials

Equipment

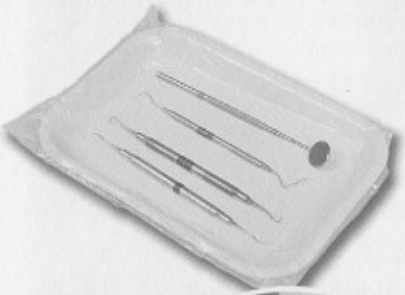
The dental unit, which may be freestanding or attached to the examining chair, holds various pieces of equipment: an adjustable overhead spotlight, which directs a high-intensity beam on the mouth; a saliva ejector, or small suction pump placed in the mouth to keep it dry during treatment; air hoses for low-speed and high-speed rotary hand pieces or drills; and an instrument tray.

Other equipment includes an autoclave for sterilizing instruments, an x-ray machine, and an ultrasonic cleaning machine, which emits high-speed sound waves that vibrate the tartar deposits off the teeth.

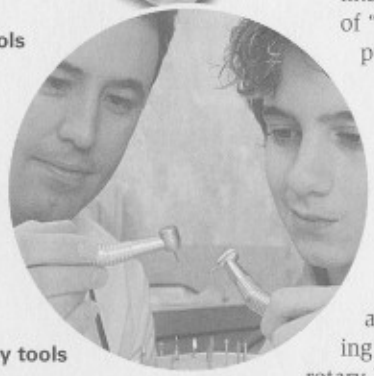




The ultrasonic cleaning machine shown here is just one of the many technical pieces of equipment now used by modern dentists.



Hand tools



Rotary tools

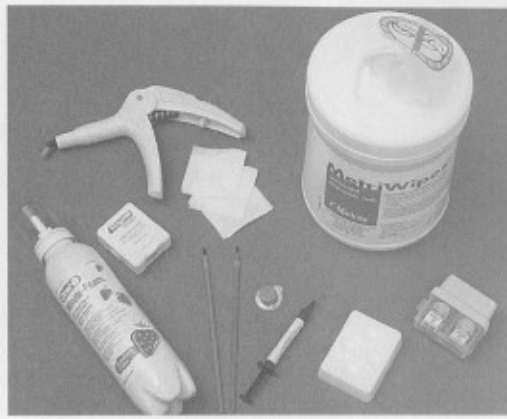
Instruments

The instrument tray holds an assortment of tools for various tasks. The *angled hand mirror* helps the dentist examine hard-to-see tooth surfaces. The *explorer* is a metal probe with a curved, pointed end that is used to poke around in crevices and cavities. The *periodontal probe* has a straight tip marked like a ruler and is used to measure the depth of "pockets," or spaces where the gum has pulled away from the teeth. A *scaler* is a narrow-bladed instrument for scraping plaque and tartar off the crown; a *root planer* scrapes the buildup off the roots. A *water-and-air syringe* is for flushing debris that has just been scraped off the teeth and for cooling down the teeth during drilling.

Some other tools include tweezers, a polisher, hypodermic syringes for injecting anesthetic, and high- and low-speed rotary hand pieces with their attachments: drilling and grinding burs, and cleaning heads.

Materials

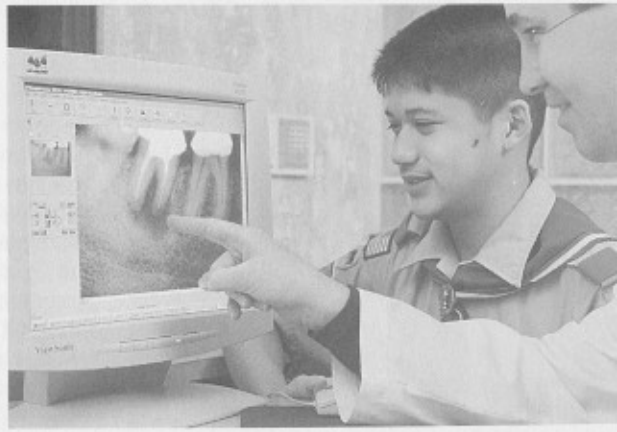
Dental materials include dental floss, polishing pastes, filling materials for cavities, gauze squares, fluoride varnishes, sealants, and substances for making dental impressions and artificial teeth. Certain dental supplies, such as disposable gloves and surgical masks, are used to prevent and control the spread of infection.

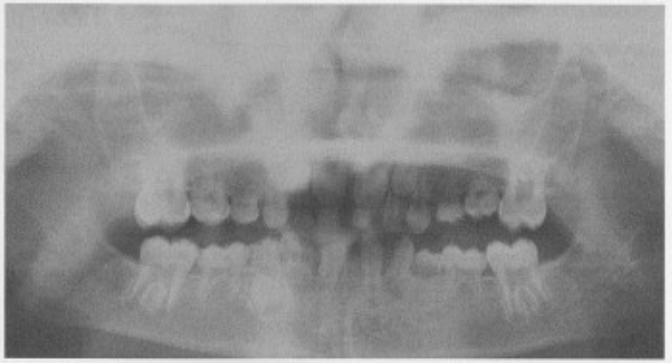


The Examination

The main purpose of dental care is the prevention of tooth decay, gum disease, and disorders affecting oral health. Because decay and disease get worse if left untreated, you should get your teeth cleaned and examined once every six months. To prevent dental and medical complications that can result from certain procedures, the dentist must know your medical history, especially whether you have conditions such as asthma, allergies, immune system problems, or infectious diseases.

During the examination, the dentist will inspect the teeth, gums, and tissues of the mouth. Your dentist is looking for evidence of not only decay and disease but also problems with the teeth and jaws aligning correctly. Because much of this information can't be determined just by looking in your mouth, the dentist depends on x-ray films, or dental radiographs, to detect damage and abnormalities early in their development.

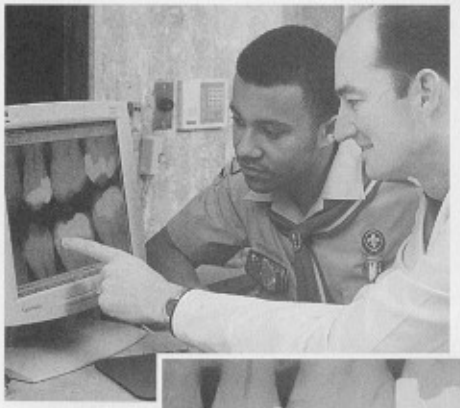




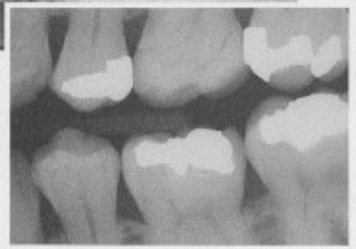
On an X ray, tooth decay and abscesses show up as darker patches.

The Radiograph

The X ray is a form of electromagnetic radiation that can penetrate bone and soft tissues. Dense tissues like teeth and bone absorb more radiation than soft tissues like cheeks and gingiva. These substances cast shadows on the film when the X ray penetrates them. Teeth and bone will cast more of a shadow than gums, but they will appear lighter because the film image is a negative. Caries, abscesses, and bone loss appear darker than normal. Metal crowns and fillings look like white patches on the film.



Radiographs are taken inside and outside the mouth, depending on what views are required. The *bitewing films,* taken inside the mouth, show only the crowns and parts of the roots of two or three pairs of opposing upper and lower teeth. These radiographs reveal decay between adjacent teeth and under restorations (materials that replace tooth structure and function), bone loss from periodontal disease, and ill-fitting fillings. Bitewing radiographs are typically taken at 12-month intervals.



Bitewing radiograph

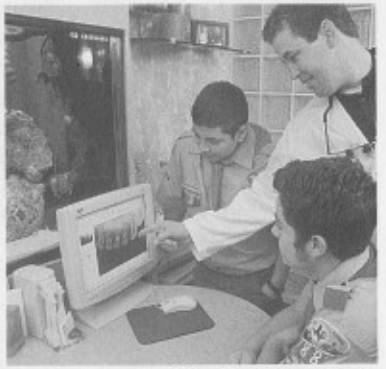
The *periapical films,* also taken inside the mouth, show four entire teeth, from the crowns to the roots and including some of the periapical bone, which surrounds the root tips. These radiographs indicate the condition of the root and bone; missing, *impacted* (teeth that haven't erupted and remain fully or partly in the bone), or fractured teeth; and cysts, tumors, and abscesses.

A *full-mouth survey* is a combination of 14 or more periapical and four bitewing films showing all the teeth (crowns and roots) as well as all the surrounding alveolar bone. This set of films is taken as needed for a specific diagnosis, or at intervals of about every three to five years.

The *occlusal radiograph* is another one taken inside the mouth. It shows the full arch of the bite, from an upper or lower view, and is useful for locating abscesses; other problems in the jawbone, such as extra, unerupted teeth; and stones in the salivary gland ducts. Most people don't need this kind of radiograph except for special instances.

The *panoramic radiograph* is a wide view that shows all structures in the lower half of the face: upper and lower jaws, sinuses, and cheek bones. Dentists use it to evaluate the general condition of the mouth and to detect jaw fractures, possible tumors, and "hidden" impacted teeth. This radiograph is taken outside the mouth. A special x-ray machine automatically moves in a semicircle around the face and makes a series of exposures. Many dentists recommend making this kind of radiograph every five years.

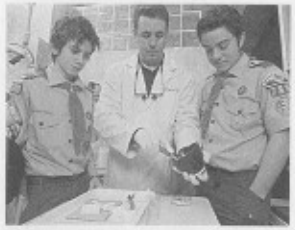
Periapical film

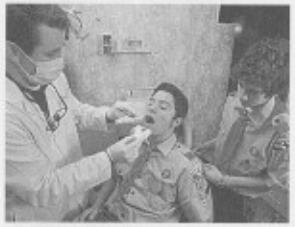


Occlusal radiograph

Panoramic radiograph

Some people worry about their exposure to radiation when x-ray films are made. When carefully used, x-rays are not dangerous; however, dentists take certain precautions to reduce the risk and the exposure. They use high-speed film, timers, and filters to reduce the exposure time and eliminate unnecessary radiation. They also cover the patient with a lead apron during the x-ray procedure, which pro-



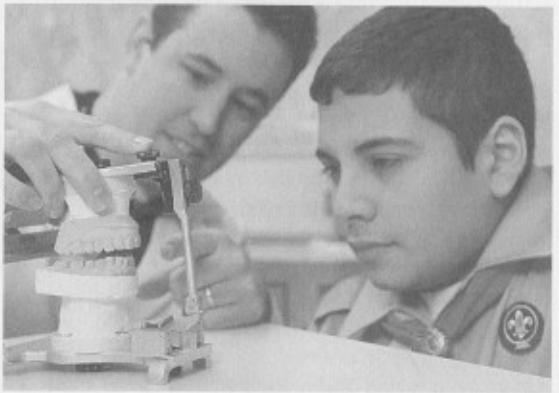


tects the body, particularly the reproductive organs, from exposure. This apron should have a thyroid collar to protect the thyroid gland, which easily absorbs radiation. Dentists also follow recommended guidelines about how often to make x-ray films. Finally, more and more dentists are using *digital radiography*, which greatly reduces the exposure to radiation.

The Dental Model

After the dentist examines the mouth and studies the radiographs, he or she may decide to make a three-dimensional model of the teeth and jaws. This record is important for determining the exact position of the teeth and the relationship between the jaws, particularly if orthodontics (such as braces) or extensive prosthodontic repairs (such as dentures) are necessary.

First, an impression tray that fits the contour of the dental arch is filled with a sticky impression material that is much like modeling clay. Then the tray is pressed over the teeth of one jaw and the material is allowed to set for a few minutes until it gets firm. The tray is removed, and the process is repeated for the other jaw. Later, a dental technician will cast models of the jaws by dental stone into the impressions, or molds, and letting it harden. Then the models are mounted on an *articulator*, a hinged device that allows the dentist to open and close the jaws and study the bite, or *occlusion*.



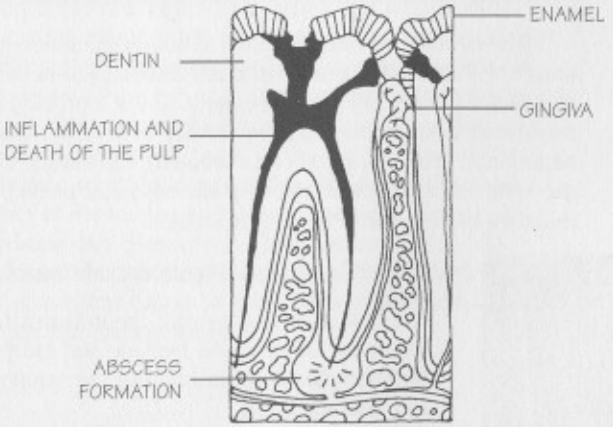
Checking for Decay

To check for decay, the dentist uses a small mirror and explorer to examine the crown of each tooth. When the probe is poked into the chewing surface, it will stick or be difficult to remove if caries is present. A white spot on the tooth indicates that *decalcification* (softening of the enamel due to loss of calcium salts) has begun. A cavity, or hole, is a sign that decay has destroyed the enamel and penetrated the dentin.

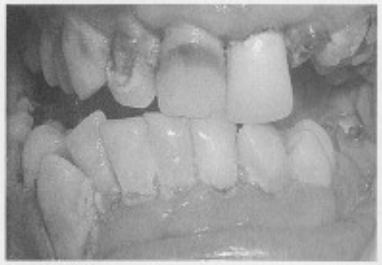
More and more dentists are using a laser procedure that gives a digital reading of the progression of decay and can detect it at a very early stage. Early detection of decay through new dental technologies can help save teeth!

Decay and cavities tend to occur in specific areas of the teeth where food and bacteria are easily trapped: in grooves and fissures on the molars and bicuspids; on the surfaces between adjacent teeth (called *proximal surfaces*), especially where one tooth touches another; and in the *sulcus*, the V-shaped depression inside the cuff of gum tissue that forms around the base of the crown.

Progress of Tooth Decay



A small cavity left untreated becomes larger.



Badly diseased gums

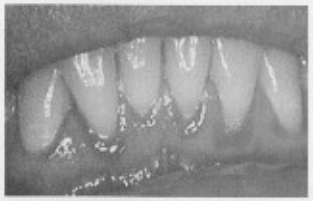
Checking for Gum Disease

In the past, tooth decay was the main reason people lost their teeth. But today, because fluoridation has helped prevent decay, the number one reason for tooth loss is periodontal disease. Plaque causes most periodontal diseases, but certain factors can increase the risk. Among these are smoking or chewing tobacco, poor nutrition, impacted teeth, ill-fitting restorations, and a family history of the disease.

If you have any of these symptoms of periodontal disease, see your dentist:

1. Gums that bleed when you brush your teeth
2. Gums that are tender, swollen, or red
3. Gums that no longer adhere to the teeth
4. Persistent bad breath
5. Pus in the gingival crevice
6. Loose teeth
7. A change in your bite
8. A change in the way your partial dentures fit

The dentist can often tell by a visual examination of the mouth whether you have periodontal disease, but he or she also depends on x-ray films of bone loss and a probing assessment to determine the degree of activity or severity. With a periodontal probe (manual or automated), the dentist will test the gums for attachment, depth of the sulcus or pocket, tooth mobility, bleeding, and bone destruction.

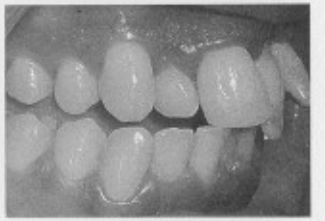


Gingivitis

There are four stages of periodontal disease.

- The first stage is *gingivitis,* the inflammation of the gums. Diligent oral hygiene and routine professional cleaning can improve the symptoms and heal the gums.
- The second stage is *early periodontitis.* The tissue lining the sulcus becomes inflamed and swollen; the sulcus deepens, providing a perfect place for bacteria to multiply; and damage to the tissue extends as far as the alveolar bone.
- In the third stage, *moderate periodontitis,* the pockets deepen even more, harmful bacteria thrive, the periodontal ligament and alveolar bone are inflamed, and bone dissolves.
- In the fourth stage, *advanced periodontitis,* bone loss is so severe that the tooth is loose in its socket and eventually will fall out.

Treatment varies depending on the stage of the disease, from simple tartar scraping and tooth polishing, to removal of damaged tissue with a spoon-shaped instrument, to scraping and planing (smoothing) the tooth root, to gum surgery. The dentist will probably refer a patient with periodontitis to a specialist called a *periodontist.*



Advanced periodontitis

Checking for Oral Cancer

Of all the places in the body where cancer occurs, the mouth is the seventh most frequent. Certain oral cancers, such as cancer of the tongue, are deadlier than colon cancer, breast cancer, or Hodgkin's disease. The main victims of oral cancer are smokers, former smokers, and heavy drinkers of alcohol. Survival rates improve dramatically if the oral cancer is detected and treated early.

The most common place for the cancer to develop is on the lips (particularly the lower lip). This is often the result of regular exposure to the sun and mostly affects light-complexioned people. Other areas of oral cancer, in order of frequency, are the sides and back two-thirds of the tongue, floor of the mouth, gingiva, roof of the mouth, and insides of the cheeks.

Cancers of the tongue and floor of the mouth are quite deadly because they often spread *(metastasize)* to the lymph nodes and then to other parts of the body. The opposite happens, too; sometimes cancer in other parts of the body spreads to the mouth and causes tumors.

You should pay attention to the following warning signs and let your dentist know if you have any of these symptoms:

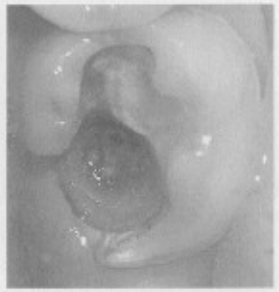
1. A sore in or around the mouth and neck areas that does not heal within two weeks
2. Unexplained bleeding in the mouth
3. Numbness or loss of feeling in any part of the mouth
4. Unexplained pain or soreness in the mouth
5. Swelling on the lips, tongue, roof of the mouth, or neck
6. Difficulty chewing or swallowing food
7. A lump or thickening in your cheek that you can feel with your tongue
8. A white or red patch on your tongue, gums, or soft tissues in the mouth

If the dentist suspects cancer, he or she or an oral surgeon will perform a screening procedure called a *biopsy*, which is the surgical removal of a tissue specimen to determine what kinds of cells are present. An oral pathologist will examine the tissue under a microscope and report the findings to the dentist or oral surgeon. If the cells are cancerous, then the treatment may require extensive surgery and/or chemotherapy or radiation therapy. If surgery is necessary, an oral surgeon may remove part of the jaw, tongue, or roof of the mouth.

Cancer treatments (especially radiation and chemotherapy) reduce the body's ability to fight infection. In some cases, the bone tissue in the jaw is destroyed. The dentist will take steps to reduce that risk by treating tooth and gum problems *before* radiation therapy. One serious side effect of radiation of the head or neck is damage to the salivary glands. If the glands are destroyed, the mouth dries out, swallowing becomes difficult, and tooth decay sets in.

Treating Teeth

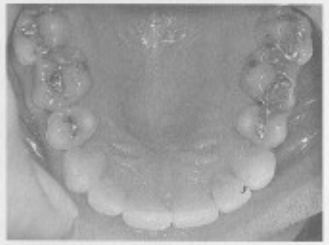
Decayed and Broken Teeth



If caries has not penetrated the enamel, the dentist may apply a plastic "pit-and-fissure" sealant to prevent bacteria from attacking the enamel on a bicuspid or molar. He or she may also paint fluoride on the smooth surface of the tooth, with repeated topical applications over time, in the hopes that the enamel will remineralize.

If caries has penetrated the dentin and created a cavity, the dentist will remove the decay and insert a filling. If the damage is extensive and the tooth is brittle, he or she will restore the tooth with an artificial crown. Once decay has reached the pulp, the dentist or a specialist (an *endodontist*) will perform root canal therapy to remove the pulp and save the tooth. As a last resort, the dentist will take out the tooth.

If the tooth structure is still sound, the dentist will fill the cavity with one of several materials: silver amalgam, gold, composite, or porcelain. The choice depends on various factors such as the location of the infected or broken tooth, the size of the decayed area, the strength of the filling material, aesthetic concerns, and cost.



Silver Amalgam. Silver amalgam is a mixture, or *amalgam*, of silver, mercury, and trace metals. Dentists have used it for more than a century to fill cavities in the grinding and chewing surfaces of molars and premolars. Because of the filling's dark color, dentists prefer to use it, if at all, in the inconspicuous back teeth and not on the front teeth. If properly formed, silver amalgam will completely seal the cavity. It is strong and durable, easy to insert in one office visit, cost-effective, and biocompatible—that is, it won't irritate the living tissues in the teeth and gums.

Silver amalgam has some disadvantages. It is brittle and requires adequate tooth support to hold it in place and keep it from getting chipped or shattered. Unlike the other kinds of fillings, silver amalgam is not attached or cemented to the

tooth. The cavity is undercut to lock in the filling when it hardens. Sometimes the filling becomes loose and falls out, or expands, causing the tooth to crack. The amalgam may leak at its margins (where the metal meets the tooth) and discolor the gums or enamel. Some people worry that the mercury is dangerous to their health, but there is no proof that the fillings cause any harm.

Gold (Foils, Inlays, and Onlays). If decay has destroyed large areas of the tooth, the dentist may recommend a gold filling, which is stronger than silver amalgam. Unlike the silver filling, gold is not brittle and can actually strengthen the tooth structure. It is lighter in color than silver amalgam and does not stain the enamel. However, gold does look artificial on visible tooth surfaces and is much more expensive than other filling materials.

Although rarely used anymore, 24-karat gold foil, or leaf, is compacted into small cavities with hand tools to form a very strong and long-lasting restoration. It is usually placed in front teeth, either between the teeth or along the gum. However, the vibrations caused by hammering the foil with a tiny mallet are strong enough to damage the blood vessels in the pulp, and may even kill the pulp.

Most solid gold fillings—called *inlays* or *onlays*—are cast from a mold of the cavity and cemented in place. These aren't really fillings because they are made in a dental laboratory. An inlay is set between the walls of tooth structure, but like a wedge, it can split the tooth if too much pressure is exerted to force it into position. With an onlay, gold "lays over" the natural cusps of the tooth, which have been cut down, and forms a protective bond.

Inlays, onlays, and crowns are also used to restore broken or fractured teeth. Unlike the inlay or onlay, which holds the tooth together from the inside, the crown completely or partially covers the tooth and holds it in place from the outside. If part of the tooth is broken off and the remaining structure can't support a filling, inlay, or onlay, then the dentist will "cap" the tooth with a crown.

The cast gold fillings, particularly the onlay, are very effective but quite expensive. And they require two or three office visits before the filling can finally be inserted. Between appointments, the patient must wear a temporary filling to protect the cavity from contamination and fracture. Although gold offers a better restoration than other filling materials, many patients decide against it because of the expense, the inconvenience, and its unnatural look on the teeth.

Composite. Composite is a mixture of plastic resin and fine reinforcing particles that is naturally white and can be shaded to match the color of a tooth. With recent developments, these tooth-colored fillings can last about as long as metal ones. The composite adheres to the surface of the tooth, so it can be painted on a discolored tooth or bonded to malformed or misshapen teeth. This allows the dentist to radically improve upon appearance of a damaged tooth and also make it stronger by bonding it together.

Before composite

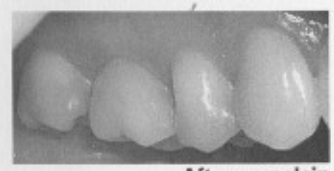
After composite

The composite techniques are more difficult for the dentist to perform if they are to be done well. For instance, it is very important to keep saliva or blood off the tooth once it has been readied for bonding. Dentists often say that placing composites is "technique-sensitive." That means that every step must be done with great care for a good final result. If composites are not done properly, leakage, tooth pain, damage to the nerve, and new decay may result.

Generally, the composites are more likely to be biocompatible than amalgam restorations. Anyone may have unusual sensitivity to any dental materials, so dentists may have to experiment and find out what works best for an individual patient.

Before porcelain

Porcelain. Porcelain is a ceramic material that, like the composite, can be colored to match the color of the natural teeth and is suitable as a filling and as a crown on visible surfaces. Because of its durability, longevity, and resistance to staining, porcelain is superior to composite; however, it is more brittle than gold or silver amalgam. Like gold fillings, it requires several office visits and is, therefore, more expensive than the amalgam or composite materials.



After porcelain

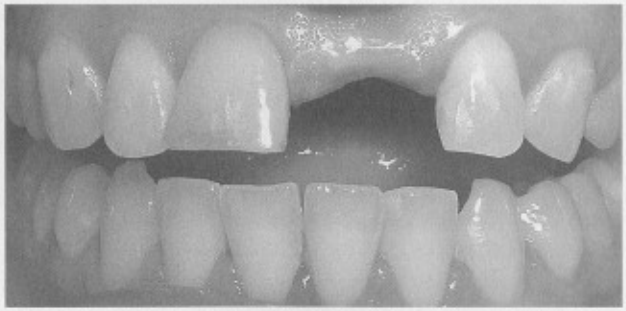
George Washington had lost all but one tooth by the time he became president. He wore several sets off false teeth, but they were never made of wood, as we commonly hear. His dentures were fashioned from gold, hippopotamus ivory, elephant ivory, walrus ivory, cattle teeth, and human teeth.

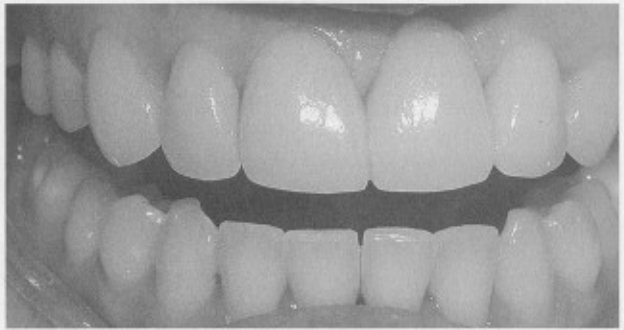
Missing Teeth

The main cause of tooth loss is periodontal disease, but dental caries, injury, congenital problems (problems that exist since birth), and tumors can all damage the tissues in the mouth and contribute to this serious condition. Missing teeth should be replaced immediately, except for the third molars, or wisdom teeth. It isn't necessary to replace primary teeth, but the spaces must be maintained so the permanent teeth can erupt in the proper alignment.

Most people are eager to replace missing teeth to improve their appearance, but there are more critical reasons for replacing them: to restore chewing function and fix a bad bite, to prevent damage to the remaining teeth, to prevent adjacent teeth from drifting into the spaces and getting out of alignment, to support the muscles that control facial expressions, and to prevent alveolar bone loss. These factors can lead to total tooth loss, which can actually cause the face to collapse.

The dentist, or a specialist called a *prosthodontist,* will decide what kind of treatment is required on the basis of how many teeth are missing and how healthy the adjacent teeth and gums are. A fixed partial denture, or *bridge,* is used to replace one or more missing teeth as long as there are healthy teeth on either side of the space. The good teeth are crowned to support and connect the artificial tooth.





If some of the adjacent teeth are not strong enough to support the bridge, then the dentist will make a removable partial denture, which depends in part on support from the gums and jawbones. If all the teeth are missing in a dental arch, a full removable denture is necessary.

Complete dentures are substitutes for natural teeth and have their drawbacks. People sometimes complain that chewing is more difficult, that the dentures don't fit properly and make clicking noises when they talk, and that wearing them makes them gag. So do your best to keep your own teeth!

Dental *implants* are another way to deal with missing teeth. Titanium anchors inserted into the jawbone act as artificial replacements for tooth roots. Then, a bridge, denture, or tooth is attached to the implant.

Implants can be a good idea no matter how many teeth are missing—from just one tooth, to all the teeth. They can replace missing teeth if the bone is healthy, thereby helping to keep the teeth on either side healthy, too. They are also used when all the teeth are missing to help give full dentures more stability.

Misaligned Teeth

Teeth that are crowded or crooked are difficult to clean, which makes them prone to tooth decay and gum disease. Missing teeth, misaligned teeth, and abnormal jaw structure affect the way the teeth in both jaws meet, or *occlude.* Malocclusion is a bad bite. It can cause the teeth to wear down unevenly. It may place stress on the tissues, bones, and joints in the face, causing pain or damage. Misaligned teeth may prevent a tooth from erupting *(impaction),* or they may cause one to grow out too far (for lack of resistance from an opposing tooth).

Sometimes the dentist can fix the problem by extracting a tooth. Usually, however, he or she will refer the patient to an *orthodontist.* Depending on the degree of tooth movement necessary, the specialist will recommend fixed or removable appliances such as braces and retainers.

Hazards in Dentistry

The dentist and his or her assistants work so close to their patients that the risk of catching and transmitting diseases is quite high. Although most people are especially fearful of getting HIV, the virus that causes AIDS, certain diseases are more common and dangerous, such as infectious mononucleosis, hepatitis B, gonorrhea, and syphilis. Hepatitis is particularly dangerous because people who have recovered from the disease may still be carriers.

The Occupational Safety and Health Administration (OSHA) has issued mandatory infection control procedures for dental offices. All dentists and staff members are required by law to follow the measures, which include treating all blood and saliva as if it were infectious for HIV and hepatitis B,

wearing disposable gloves as well as face masks and eye protection, discarding contaminated needles in special containers, and sterilizing reusable instruments. To avoid cross contamination, dentists and staff must take care to touch only those objects that have disposable covers (for example, light switches) or that will be sterilized.

Dentists and their patients are concerned about the effects of long-term cumulative exposure to low doses of radiation. In addition to those already-discussed measures dentists take to protect patients from x-rays, the federal government also requires that dental radiographic equipment complies with established performance standards. These include specifications for increased filtration of x-rays and kilovoltage settings. Furthermore, dentists and their assistants take the precaution of standing outside the examination room when making radiographs of the patient's mouth.

Mercury is a poison and, at high doses, can cause neurological problems. Some people claim that the mercury in silver amalgams is a safety hazard because it vaporizes and leaks into the bloodstream.

Careers in Dentistry

The General Dentist

The dentist you routinely see for checkups, cavity fillings, tooth extractions, and cleaning is the general dentist. He or she is trained to care for the teeth, mouth, and jaws and can recognize and treat conditions that affect not only the mouth and supporting structure but also the rest of the body. The primary focus of a general dentist is operative dentistry, which is concerned with fixing, repairing, or restoring teeth. The general dentist is licensed to prescribe certain drugs and to administer anesthetics. Often, the dentist is the first doctor to diagnose oral cancer or AIDS.

If someone requires special treatment such as braces, dental implants, or complicated root canal therapy, the dentist will refer that person to a specialist who has extra training for that treatment.

Specialties in Dentistry

The American Dental Association recognizes nine dental specialties. Each focuses on a specific type of dental treatment or kind of patient. Specialists who have met the educational requirements for that specialty can choose to limit their practices to their specialty, or they can also perform general dentistry. However, general dentists who practice a specialty may not limit their practices to that specialty.

Dental Public Health

Public health dentists focus on the prevention and control of dental diseases on national and international levels and promote oral health care through educational programs in communities and institutions. They generally work for government agencies such as the United States Public Health Service, hospitals, and universities. Dentists in this specialty study trends in dental disease and related disorders and report this information to other dentists and to the general public. A specialist in dental public health must earn a master's of public health (M.P.H.) degree and/or doctor of philosophy (Ph.D.) degree and complete a dental public health residency.

Endodontics

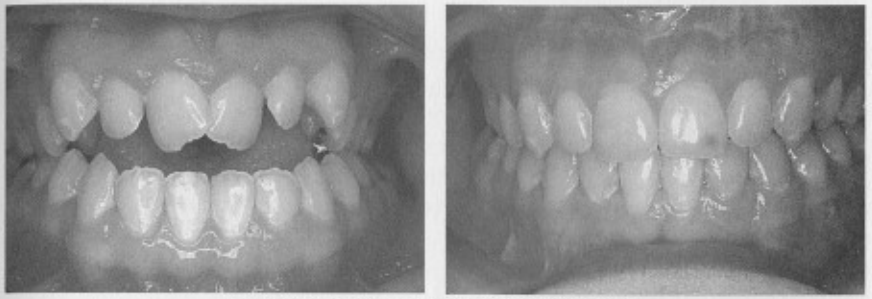
Endo means "inside." An endodontist cares for the inner parts of the teeth. This specialist is concerned with the prevention, diagnosis, and treatment of disorders of the dental pulp and tissues surrounding the root of the tooth. The endodontist is an expert in pulp capping, root canal therapy, surgical procedures such as root amputation, and bleaching (for teeth discolored as a result of pulp damage).

Oral Pathology

The oral pathologist studies tissues from the mouth and teeth and diagnoses oral diseases such as tumors and cancers. He or she is a resource person, or consultant, for general dentists and specialists. Although some oral pathologists treat patients referred by general dentists, most work in research environments in laboratories, hospitals, and dental schools.

Oral and Maxillofacial Surgery

This specialty involves the diagnosis and surgical treatment of diseases, injuries, and birth defects affecting the mouth, face, jaws, and neck. The oral surgeon performs complicated tooth extractions (for example, impacted third molars, or wisdom teeth) and biopsies; reconstructs cleft lips, cleft palates, and malformations of the facial bones; and replaces teeth with dental implants. He or she is trained to administer sedatives and anesthetics that most dentists are not permitted to prescribe.



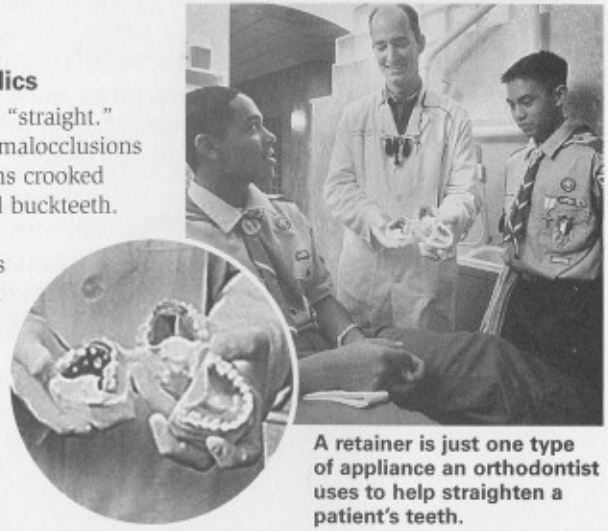
Before and after orthodontic treatment

Oral and Maxillofacial Radiology

This newly recognized specialty provides advanced imaging for patients who have complex problems. The general dentist (or other specialist) usually provides the patient with radiographic services. However, a patient may sometimes need advanced imaging techniques that require sophisticated and expensive equipment. Like oral pathologists, oral and maxillofacial radiologists may examine patients referred to them by other dentists or by physicians. Many of these specialists work in institutional settings such as dental schools, where they teach and also conduct research.

Orthodontics and Dentofacial Orthopedics

Ortho means "correct" or "straight." An orthodontist corrects malocclusions (bad bites) and straightens crooked teeth, crowded teeth, and buckteeth. This specialist uses fixed appliances such as braces to slowly reposition teeth and removable devices to change the structure of the jaws or keep teeth in place (with a retainer).



A retainer is just one type of appliance an orthodontist uses to help straighten a patient's teeth.

Slaves in ancient Rome had to clean and polish their masters' teeth. They picked tartar off with sharpened sticks and then rubbed on powders made from burned lizard livers and honey or urine to make them shine. Little did these slaves know that they were blazing a trail for dental hygienists.

Pedodontics

Pedo means "child." A pedodontist is a dentist who generally treats children until they reach age 12, the age when most children have all their permanent teeth. Some specialists also care for physically and mentally challenged adults. The pedodontist has extra training in the growth and development of children's facial structure and teeth and can spot a potential problem that a general dentist may overlook. This specialty is also called *pediatric dentistry.*

Periodontics

Peri means "around," so periodontics is the specialty concerned with tissues around the teeth—the gingiva and supporting bone. The periodontist prevents, diagnoses, and treats the gum disease caused by plaque. This specialist uses nonsurgical treatments such as scaling, root planing, and medication application to reduce the quantity of harmful bacteria and smooth the surface of the root (to slow the rate of bacterial regrowth), as well as surgical procedures to remove gum tissues and eliminate pockets, which trap food and the bacterial plaque.

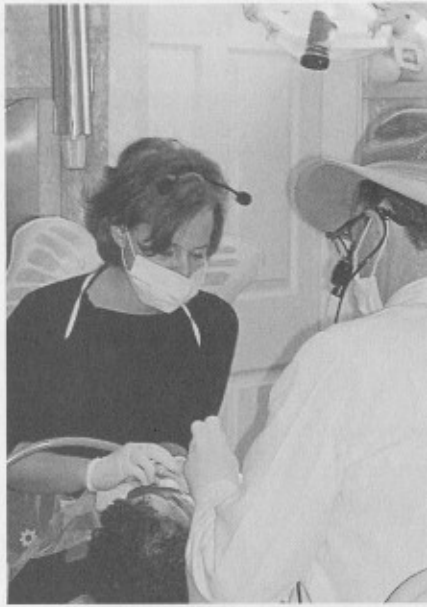
Prosthodontics

Prostho comes from a word meaning "replacement"—as in all or parts of damaged or missing teeth. The purpose of this specialty is to restore the normal chewing function of teeth and to improve the occlusion, or bite; to prevent further damage; and to improve appearance. Prosthodontists design, make, and fit inlays, crowns, bridges, partial and full dentures, and implants. *Maxillofacial prosthodontists* work with oral surgeons to replace lost parts of the face (such as noses).

Dental Auxiliaries

It takes a team to care for your mouth. After you, the general dentist has the overall responsibility for your oral health. But dentists also depend on several other people to help with diagnosis and treatment.

Dental Hygienist



The dental hygienist, a specially trained and licensed dental nurse, provides the most important preventive maintenance services: dental prophylaxis (teeth cleaning), application of topical fluorides and sealants, and oral examination for decay and periodontal disease. The hygienist takes radiographs, records case histories, charts dental conditions, and teaches patients how to properly brush and floss at home.

A minimum of two years of college in an accredited dental hygiene program is required to become a registered dental hygienist. Before getting licensed, however, the hygienist must pass a state board exam as well as a national ADA board.

Dental Assistant

The dental assistant helps the dentist work quickly and efficiently. He or she sterilizes instruments, mixes filling materials, rinses debris out of the patient's mouth, and hands tools to the dentist. The training requirements and responsibilities of this position vary by state. A certified dental assistant (CDA) has completed a one-year ADA-approved training program.

Dental Technician

The dental technician makes artificial teeth and sets of dentures under supervision—in a dentist's office or in a dental laboratory. Many dental technicians in the United States who wish to work without supervision are organizing to be recognized as "denturists," nondentists who make and fit dentures from start to finish. Their training, however, is often limited to on-the-job experience. There are no formal programs in the United States to train denturists.

Education and Cost of Training

The basic training for dentists is four years of dental school after graduation from college. Upon successful completion of dental school requirements, the graduate is awarded a doctor of dental surgery (D.D.S.) or a doctor of dental medicine (D.M.D.) degree. To practice, he or she must pass both a written national board and a state or regional examination. After passing the boards, the dental school graduate may apply to the state board of dentistry for a license to practice general dentistry. Some people go right into practice; others may enter a one- or two-year residency program in general dentistry; others may choose to train for one of the dental specialties; and still others may go into the armed services if they had an agreement with the government to pay for all or some of their dental school tuition.

A minimum of two years of postgraduate training in a program sponsored by a dental school or hospital is required to become a dental specialist. After successfully completing the requirements, the dentist is "board eligible." If he or she passes the board for that specialty, then he or she becomes "board certified." Certificates, not degrees, are awarded for advanced study.

The sponsoring institution may decide whether the dentist must pay for his or her advanced training, or whether he or she should receive a stipend (allowance). It is common practice to offer paid residency programs in hospitals in the areas of pedodontics, oral surgery, and general dentistry. Postgraduate training in dental schools for the other specialties usually require tuition. When you consider that a dental specialist has trained for six or more years after college, you'll realize what an extraordinary commitment that person has made in terms of time and money.