Definition: **dentistry** from *Philip's Encyclopedia*

Profession concerned with the care and treatment of the mouth, particularly the teeth and their supporting tissues, the gums and oral bones. As well as general practice, dentistry specialties includes oral surgery, periodontics (structures around the teeth) and orthodontics (irregular teeth and jaws).

Summary Article: **Dentistry** from *Encyclopedia of 20th Century Technology*

In the early twentieth century a visit to the dentist was usually for a toothache, cured by extraction or replacement of missing teeth that had already been extracted. Preventive and restorative technologies existed but were not widespread, and materials were limited. Fluoride was known to have prophylactic qualities against caries, a vaccine was being developed for periodontal disease, and a zinc phosphate cement was used to seal fissures in the occlusal surface of molars. Diagnostic procedures included x-rays but x-rays were not generally applied in dentistry until about 1916. Anesthesia, in the form of nitrous oxide gas or ether had been in use in dentistry since 1863 (earlier than in surgery). In 1904, Alfred Einhorn introduced procaine (trade name Novocain), an injectable local anesthetic, to the practice of dentistry. It was superior to cocaine, which had been used previously, in that it did not cause tissue sloughing and was not addictive. The combination of anesthesia and electrical drills prepared the way for increased extraction and restorative work.

Public health leaders had an interest in dentistry, and throughout the world clinics were opened by philanthropists following the example of American industrialist George Eastman. By 1925 the inverse relationship between caries, or tooth decay, and tooth mottling as a result of natural fluoride in drinking water impelled further epidemiological studies, and by 1962 many U.S. cities and up to 30 other countries were adding sodium fluoride to their water supply. Fluoride treatments in the form of topical applications were provided for children, and dental hygienists visited schools showing students how to brush and floss their teeth. As a result of better dental education, the prevention of caries and dental restorations helped improve overall public health. Dental specialties such as orthodontics, endodontics, oral surgery, prosthodontics, pedodontics, and periodontics rapidly developed, each with their specialized technologies. Along with local anesthesia, topical numbing, use of a suction machine, and a reclining chair with leg rests, psychological amenities such as music or television available to distract and ease the patient's anxiety and ability to undergo lengthy procedures if necessary.

**Technologies and Materials**

Technologies used in diagnostic work include x-rays, study models, and an examination using explorers and probes to find cavities and measure periodontal pocket depth. The first x-ray equipment specially designed for dental radiography was introduced around 1923, but early machines were not shockproof. The modern dental unit in which x-ray tube and high-voltage transformer are both contained in a single comparatively small housing was introduced in 1933. Early x-ray films were made from celluloid but had to be cut and wrapped, and were dangerous because of their flammability. The x-ray machine evolved with film technology. As films became faster, exposure to radiation for both dental personnel and patient could decrease. A long tube replaced the short cone in order to increase the distance between target (patient) and film.

Periapical and bite-wing views require 16 films and show individual teeth. Oral surgeons, orthodontists,
and prosthodontists require additional information about oral pathology, impacted teeth, developmental
dentitions, jaw relationships, and the temporomandibular joint as part of their diagnostic work. In the
1950s, a panoramic machine was built that traveled around the patient’s head. It only required one
exposure to radiation. The image produced is on a large film and shows the complete dentition, each
root and below, along with occlusal relationships. By the end of the twentieth century, digital intraoral
photography that instantly magnifies the teeth and underlying structures on a computer screen had
been invented.

Early formulas for impression materials contained shellac, talc, glycerin, and fatty acids. A superior
product, hydrocolloid (reversible agar-agar material) was heated, poured into trays, then cooled in the
mouth and used to make the initial impression for inlays and crowns. After the impression was made, it
was filled with a type of dental stone more accurate than plaster of Paris for the model. Today, a study
model impression is taken with alginate, an irreversible colloid material, mixed with water. This is placed
in a tray in the patient’s mouth, removed when set. Plaster of Paris, a gypsum hemihydrate compound, is
poured into this shell to create the model.

Restoration of teeth, whether with an amalgam filling, inlay, or crown, requires preparation with the use
of an abrasive dental drill. The clockwork motor-driven drill was first replaced by electric plug-in drills in
1908. These early drills operated at 600 to 800 revolutions per minute (rpm). By mid-century a high-
speed hydraulic drill, which operated at 60,000 rpm, was developed by the National Institute of
Standards and Technology (NIST) and the American Dental Association. Modern water-cooled, turbine-
powered drills rotate at speeds between 300,000 and 400,000 rpm. An assortment of different shapes
of burrs that fit the head can be interchanged for ease of manipulating the shape of the preparation.

The first modern materials for restorations of small cavities were made in the early nineteenth century
from gold foil, and from the 1900s, gold alloys. The process required special pliers, an alcohol lamp, a
gold foil annealer, and a mallet. The process was lengthy and very uncomfortable for the patient. Silver-
mercury amalgams were first used from 1832, but the poor quality limited use until a standard
manufacture was developed in 1895. Modern amalgam is made from mercury mixed with silver, copper,
zinc, and tin. As it hardens, the shape of the occlusal surface is carved and then burnished and polished
after it assumes its final hardness. Baked porcelain inlays had been in use from 1862, once an effective
dental cement had been developed. By mid-twentieth century, tooth-colored silicates or synthetic
porcelain replaced gold and provided an alternative to amalgam. The powder and liquid was quickly
mixed on a glass slab to a thick consistency with a spatula, and then transferred to the tooth. The
material was smoothed and after setting, polished with a special attachment to the dental handpiece.
Bonding, a process using composite resin materials, has replaced older techniques and materials. The
revolution in laser technology has allowed for gentle application of a polymer/monomer that creates a
tooth shade indistinguishable from the natural tooth that neither discolors nor decomposes.

When a large segment of tooth is destroyed, crowns and bridges are fabricated. Early crowns and
bridges employed gold alloys joined to gold. In mid-century, crowns made of porcelain fused to gold
were developed. This was esthetically superior to the gold crowns and stronger with respect to the
chewing surface.

The filling of a tooth root canal is necessary when decay has invaded the internal tooth structure. Root
canals were first filled with silver points, which were cut and measured to fit the walls of the excavated
tooth. An instrument called a reamer was used to clean out the canal, followed by filing and irrigation to

clean and shape the interior portion. Gutta percha, an inert material made from the latex of a tree from
Malaysia, gradually replaced silver as the material of choice for root canal filling.

**Permanent and Removable Restorations**

A denture is a prosthesis, an artificial device, made to take the place of missing teeth. It is either partial or full, and the appliance is either permanently cemented in the mouth or a clasp is made to hook the partial restoration onto existing teeth. In 1930, Vitallium, a chrome-cobalt alloy was introduced for making these clasps. Replacements for decayed or lost teeth have been produced for millennia. Charles Goodyear’s invention of vulcanized rubber, which could be molded against a model of a patient’s mouth, allowed cheap and self-retaining denture bases from 1864 (earlier false teeth on gold bases had been held in place by springs). In 1919, gingival-colored base material helped to make a more realistic prosthesis. Although implants were being fabricated from pyrolytic carbon in 1919, they did not gain widespread application until the 1990s. Despite high success rates, they are still considered experimental. Dentures today (teeth and base) are made from an acrylic material (methylmethacrylate) that is colored to simulate gum tissue and the tooth. A veneer or laminate is made from porcelain to fit the facial surface of a tooth that has been discolored or chipped or is otherwise esthetically unacceptable.

Dentures were improved through the invention of the articulator (a dental machine that works as closely as possible to the way the mouth works) by the Swiss Alfred Cysi in 1909. Esthetics developed to match the patient’s face with tooth shape.

Impressions for dentures were taken with rubber mercaptan-based materials that came in two tubes, one with a paste and the other with an accelerator made from lead peroxide and sulfur. These were mixed, placed in trays, applied to the arches, and removed after setting. Silicone, and later acrylic, compounds replaced rubber base impression material as well as hydrocolloid. Today, impressions for dentures are made in the same way as study models.

Fixed restorations require retention by cement, usually composed of zinc oxide-eugenol or zinc phosphate compounds. An improved cement in the 1970s added polyacrylic acid, which made it less irritating to the dentine and stronger. Glass ionomers (zinc oxide and polycarboxylate) had the advantage of better retention and were also used as a filling material for anterior teeth. A silicate cement (fluoroaluminosilicate glass and polycarboxylic acid) was introduced in the late 1970s in England. Cements made from calcium silicate and organic acid are also used to line the floor of a cavity before filling. Bone cements, used for attaching implants, or prostheses that require incorporation with osseous structures are now made from methacrylate and apatite compounds.

**Orthodontia**

Edward Hartly Angle established a school of orthodontia in 1900 and a year later established the American Society of Orthodontists. Orthodontics is the specialty that moves teeth to their optimum place in the oral cavity for both esthetics and function. The first bands used in orthodontia, made from stainless steel, were applied to each tooth and attached to wires that were tightened at timely intervals to move the teeth. Because these took up space in the mouth, it was routine to remove teeth. In the 1990s, braces made from very thin nickel titanium could preclude the need for extractions. To overcome resistance to treatment with metal braces, a new clear sapphire bracket was designed. A totally invisible lingual brace was designed for amenable cases. Cements used in orthodontia must adhere closely enough not to trap bacteria but also be removable at the appropriate time. Acrylic adhesives have made this possible.

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After the teeth have been moved to their desired positions and the braces removed, it is necessary for the bone to grow back into the areas that have been altered. Removable appliances made from methylnmethacrylate are then prescribed until the teeth are solidly held in the jaws. Headgear, an external apparatus that caused many teenagers embarrassment, has been replaced with the use of tiny magnets.

For more complex problems, orthognatic surgery is sometimes undertaken to correct severe jaw problems, after which banding is performed to complete the esthetic result.

**The AIDS Epidemic**

The most revolutionary change in technology resulted after the mysterious case of dentally transmitted acquired immune deficiency syndrome (AIDS) in 1987 in Florida. After exhaustive research by the Centers for Disease Control, the young woman’s case was traced to her HIV-infected dentist. The overhaul in protective gear for dental professionals now includes masks, eye protectors, gloves, and polyethylene disposable covers for the head, lamp, and everything that comes into contact with the patient. A rubber dam once used only for root canal procedures can provide a barrier between the tooth and saliva. Instruments are either sterilized or disposable. Although the mouth is not a sterile field and cannot be kept sterile, mandatory laws are enforced regarding the maintenance of dental offices and disposal of fluids, tissues, and supplies.

**Further Reading**


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