

ENDODONTIC HISTORICAL PERSPECTIVE

*This is the first of a three-part series.
Part 2 of this Historical Perspective
will appear in next month's Journal.*

A historic review of endodontics, 1689-1963, part 1

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This review is not intended to add to our technical repertoire but rather to aid in our current understanding of endodontics. How can we appraise a new development or evaluate volumes of contemporary literature without placing them in their proper perspective? By reviewing and understanding the accomplishments of our predecessors, perhaps we can expand our future development.

The objective of this paper is to review the written history of developments in endodontic practice in chronological order. We have chosen to begin our review with the year 1687, when Charles Allen described procedures for transplanting teeth in the first English-language book devoted entirely to dentistry. Although some authors have cited accomplishments made in endodontics from ancient times, understanding these in light of the field of endodontics we know and practice today is sometimes difficult.

This paper is not intended to review the recent history of endodontics. We have purposely ended the chronology with the year in which endodontics achieved recognition as a special area in dentistry. We do not imply that there have been no signif-

icant accomplishments since 1963, but we have delegated to others the assignment of recognizing the contemporary leaders in endodontia.

The Empirical era (1687-1805)

Charles Allen is credited with writing the first book in English devoted exclusively to dentistry. Although endodontics as we know it today was not practiced at that time, Allen discussed procedures for transplanting teeth in his third edition, published in 1687. However, he did not record the pulpal procedure performed when "taking out the rotten teeth or stumps and putting in their places some sound ones drawn immediately out of some poor body's head."¹

The "tooth worm" theory persisted through the ages since Babylonian times. The tooth worm was thought to reside in the hollow portion of a tooth, where it would cause a toothache by gnawing at the structure of the tooth. Even Pierre Fauchard would not publicly deny its existence (although he said that the tooth worms were not spontaneously generated and must have found their

way into the tooth structure from contaminated food, if, in fact, they did exist).

In 1700, in a letter to the Royal Society of London, Anton von Leeuwenhoek, the "father of modern microscopy," identified what he believed was the source of such contamination: worm-infested cheese.² His findings did much to quash the "tooth worm" theory.

In 1728, Pierre Fauchard, the "founder of modern dentistry," wrote *The Surgeon Dentist*. This book provided accurate descriptions of pulp cavities and root canals of various teeth. In it Fauchard described the practice of opening teeth to relieve abscesses and to evacuate pus. After leaving the tooth open for a period of two to three months he filled the pulp chamber with lead foil. Although he did not mention root canal therapy, he described a pulp extirpation procedure using a small pin. Fauchard also described his treatment for deep carious lesions: application of the oil of cloves or cinnamon to the affected area for several weeks. For a persistent toothache, he mixed opium with the oil³ (Neaverth, E.J., unpublished material).

In 1756, Phillip Pfaff, the German dentist to Frederick the Great, first mentioned a pulp-capping procedure. He simply cut out a piece of gold or lead to approximate the opening over the pulp and placed this over the exposure so that the surface nearest the pulp was concave. This prevented the metal from contacting the exposed nerve. The technique was probably an improvement over Fauchard's method of filling the cavity directly over the exposure.⁴

Bourdet, the dentist to Louis XV of France, in 1757 described a procedure for extracting carious teeth, filling the root canals with gold or lead, and replanting them. He also described an "intentional" endodontic treatment in which he dislocated a symptomatic tooth in order to sever the nerve, and then immediately placed it back in its socket.¹ This practice had been described hundreds of years earlier by the Arabian physician Avicenna.³

The first recorded description of an endodontic procedure in this country has been attributed to Robert Woofendale, who came to New York from England in 1766. He brought with him a method of alleviating pain by cauterizing the pulp with a hot instrument. He concluded the treatment by stuffing cotton in the open canals.^{5,6}

(Of course, the Greeks and Romans had used cautery earlier. In addition to hot instruments, they also used boiling oil, herbs, opium, and arsenic to desiccate the dental pulp).³

In his publication *Practical Observations on the Human Teeth*, Robert Woofendale described his method for treating a nerve exposure. "When the nerve is exposed, a small bit of lint, dipped in the oil of cinnamon, cloves, turpentine, or any chemical

oil, frequently gives relief, and if repeated for sometime, often destroys the nerve." He also used repeated applications of crude opium and camphor to cauterize the nerve.⁷

By the end of the 18th century, Frederick Hirsch, a noted German practitioner, wrote of diagnosing occult dental diseases by tapping the suspected teeth. He found that the diseased tooth elicited pain on percussion. The treatment he recommended was perforation of the tooth at its neck followed by repeated insertion of a red-hot probe. He considered the tooth cured after the cavity was filled with lead.³

The Vitalistic era (1806-1878)

In 1805, J. B. Gariot became one of the first to recognize the problem of vitality in connection with pulp treatment. In *Traité des Maladies de la Bouche*, he declared that destruction of the pulp does not destroy the vitality of the tooth.⁸

Although Bourdet has been credited by some as the first to have used an impervious root canal filling, the specimen he used was probably a displaced tooth that he reimplemented or transplanted. Therefore, the roots were probably not "in situ" while being filled.¹⁻⁹

In 1802, B. T. Longbothom, Charleston, SC, recommended filling the roots of teeth when it was deemed inadvisable to extract them.⁵ However, Edward Hudson, an Irishman practicing in Philadelphia, is generally given credit for having been the first to place fillings in root canals in 1809. He packed the canals with gold foil, using instruments of his own design.^{5,10} Hudson was an exceedingly thorough and successful clinician in his use of gold as a restorative material.⁷ He was an

innovator for his time as he stressed the importance of preserving natural teeth.¹¹

John Callow, London, in his *Opinions on the Causes and Effects of Diseases in the Teeth and Gums*, published in 1819, credited Charles Bew with describing the flow of blood into the pulp through the apical foramen and out through the dentinal wall and periodontal membrane. This placed Bew along others of his time who subscribed to the "vitalistic theory" of teeth.⁸

A young German immigrant, born in 1785, came to this country and failed in his efforts to become a salesman. In 1807, with little or no formal background in dentistry, he opened a Philadelphia dental office. Eleazar Parmly, the founder and co-editor of the first dental journal, described the young man's first extraction this way: "He grasped the tooth with an instrument, shut his eyes, and turning his head from the patient, made a strong effort which dislodged the tooth." This was an inauspicious beginning for Leonard Koecker, who became a successful dentist and wrote *Principles of Dental Surgery* in 1826, an excellent text that became a standard work for 50 years.¹¹

Koecker believed that, when a pulp was destroyed by disease or by artificial means, the whole dentinal core of the tooth immediately died. The tooth then became a foreign body, which necessitated extraction to prevent inflammation and subsequent suppuration and death of the vital tissues around it.

In an effort to avoid loss of the tooth, Koecker popularized the pulp capping procedure. Although he is sometimes given credit for introducing and even for inventing the capping operation, it was essentially the

same treatment that Pfaff described in 1756.⁷⁻⁹ Koecker believed that living tissue could not remain healthy and viable beside dead tissue. Although not all of his successors subscribed to this principle, it dominated pulp treatment procedures for over 50 years.⁸

Although the "vitalistic" or "double membrane" theory dates to the beginning of the 19th century, it was not until 1829 that S. S. Fitch formulated and presented its doctrines in his book, *System of Dental Surgery*. He believed that teeth were like hollow bones and had an outer periosteum (periodontal membrane) and an inner periosteum or lining membrane that lay between the pulp and dentin. The crown was therefore nourished exclusively by the dental pulp or by its membrane, whereas the roots were supplied by the pulp membrane on the interior and by the alveolar membrane on the exterior.

According to this theory, when the pulp was removed, only the crown lost all its vitality, whereas the roots continued to be nourished by the periodontal membrane. This led to the practice of removing the crown of teeth after extirpation of the pulp and placing a pivot crown on the remaining root(s)^{7,8} (Neaverth, E.J., unpublished material).

The nonvitalists of this period included such eminent scientists as John Hunter, the great British surgeon and anatomist. Hunter believed that dentin had no circulation, sensibility, capability of repair, and did not possess any of the properties of a living tissue. Other leading proponents of the nonvitalistic theory included Cuvier and Robertson from England.⁸

Until 1836, extirpation of vital pulp was an extremely painful procedure. Before that time, a symptomat-

ic pulp was cauterized with a hot instrument, or corrosive acids such as sulfuric or nitric were used to destroy the pulpal tissue. Then, Shearjashub Spooner, New York, used a protoplasmic poison (arsenic trioxide) to devitalize the pulp before removing it⁵ (Neaverth, E.J., unpublished material). Spooner was not the first to use arsenic, however, as the practice dates back to the ancient Chinese empires where it was described as a treatment for conditions similar to alveolar abscesses.³

This form of pulp treatment became an immediate success as it was painless. The practice led to imprudent use of arsenic devitalization of the pulp and for treatment of hypersensitive dentin. In addition, leakage of the arsenic through the root canal destroyed the adjacent vital supporting tissues of the periodontium. As gutta-percha and other impervious cements were not used at the time, the problem of leakage probably occurred with relative frequency¹⁰ (Del Rio, C., unpublished material). As recently as the 1920s, arsenic still was being used by many dentists to destroy the pulp before removing it.¹²

In 1837, Jacob Linderer and his son Joseph, a dental student, published a manual recommending the use of an essential or narcotic oil to render the pulp insensible before attempting to place a permanent filling in a tooth with an exposed pulp.⁴

Edwin Maynard, Washington, DC, is credited with developing the first root canal broach in 1838, which he fabricated by filing a watch spring. This enabled dentists to enter and to treat teeth with small canals, such as premolars and molars. In addition, Maynard developed hoe-like instruments that could be used for enlarging and for shaping root

canals.^{5,13} However, he became most famous for the Maynard Rifle, which he designed and which was used by armies all over the world (Milas, V.B., personal communication, Oct, 1974).

In 1839, Baker wrote in the *American Journal of Dental Science* that his treatment for an exposed nerve was to remove the nerve, clean the canal, and fill the canal with gold foil. He is credited with writing the first published account of pulpal extirpation, canal cleaning, and root canal filling.³

During the same year, S. P. Hullahen, Wheeling, W Va, classified the causes for toothaches as: exposure of the nerve; fungus of the nerve; confinement of pus inside the tooth; diseased periosteum covering the fang; and sympathy (psychosomatic).

According to his classical description of "fungus of the nerve," he probably was referring to what is now called a pulp polyp.³

Although "mazer wood" had been brought to England as a curiosity for 200 years, it was not until 1847 that Edwin Truman introduced gutta-percha as a filling and denture base material.^{11,14}

Throughout the 1850s, plugs of wood soaked in creosote were used to fill root canals. A solution of Hill's stopping and chloroform or eucalyptus oil was used as a liquid cement to seal the wooden plug. This was an early attempt to obturate the canals with a solid root-filling point and cementing medium or sealer.³

Hill's stopping (restoration) was composed of gutta-percha, quicklime, powdered glass, feldspar, and metal filings. After 1848, it was routinely used as a temporary restoration.¹²

In an article published in the *Bos-*

ton *Medical and Surgical Journal* in 1850, W. W. Codman claimed that the ultimate design of all pulp capping was to obtain the production of secondary dentin at the point of exposure of the pulp. Although the pulp capping procedure had been in vogue since Koecker popularized it in 1821, Codman was the first to claim the ultimate objective of deposition of secondary dentin.⁷

In 1851, S. P. Hullihen described an operation he claimed to have performed since 1845. Although he labeled it "risodontryphy," it was known for many years as "Hullihen's operation." The procedure was a venting technique used to treat a congested pulp. After a flap was raised over the root of the symptomatic tooth, a spearlike drill was used to bore through the alveolus and root to gain access to the canal and to induce hemorrhage of the pulp^{3,5} (Neaverth, E.J., unpublished material).

Hunter and Fox also had used this technique of drilling into pulp cavities earlier, but they did so in order to allow the escape of pus; whereas, Hullihen did so to deplete a congested pulp and to allow its preservation.⁷

Thomas Rogers reviewed the subject of pulp capping at a meeting of the Odontological Society of London in 1857. He reported on 220 cases of pulp capping, of which 202 were deemed successful. He provided an outline for the conditions of success in nerve capping as follows: general good health of the patient; freedom from inflammatory tendencies; absence of previous considerable pain in the tooth; absence of disease in other parts of the tooth; no caustics to deaden the pain.

Had he stopped at that point, his work might be considered a good

example of early scientific appraisal. However, Rogers concluded by prescribing three leeches and a laxative if the pulp capping failed.

In 1858, Jonathan Taft, professor of operative dentistry at the Ohio College of Dental Surgery, introduced a new approach to the dental pulp. He defended those who considered the pulp important, even after development and formation of the tooth were completed. Taft claimed that viable dentin possessed more resistance to decay than nonvital dentin.

In making a determination as to whether a pulp capping procedure was indicated, Taft considered the condition of the patient, the extent of the damage, the length of elapsed time since the damage occurred, and the capacity of the pulp to produce a bony deposit.

He recommended that the exposed pulp be covered with a few drops of collodion or gutta-percha dissolved in ether or chloroform. This dressing was to be applied before a gold restoration was inserted.⁴

In 1864, S. C. Barnum, New York, devised a thin sheet of rubber to isolate a tooth during gold foil operations. This became the indispensable rubber dam we know and use today. The material was quickly incorporated into root canal filling procedures and provided more aseptic treatment technique.^{3,5}

By 1865, E. L. Clarke, Dubuque, Iowa, and others of his time (and probably before) were filling the roots of teeth with a hot mass of base plate gutta-percha. The technique was to heat the material as hot and fluid as possible without burning it and then to churn it into the canals with a hot instrument.^{7,15}

G. A. Bowman, Missouri, has been given credit by many authors as the

first to have used gutta-percha as the sole material for filling a root canal.^{5,10,16} Bowman was also the co-inventor of the rubber dam clamp forceps in 1873.⁵

In 1867, Joseph Lister first recorded his experiences using carbolic acid as an antiseptic during surgical procedures. By coincidence, Leber and Rottenstein, Berlin, proved the existence of a parasite they called *Leptothrix buccalis* during the same year. They found this organism to exist on tooth surfaces, in carious lesions, and in the dentinal tubuli. Their findings led to the conclusion that tooth decay could cause gangrene of the pulp. It seems quite natural that attempts were made to transfer Lister's newfound antiseptic treatment of wounds into pulp treatment.⁴

Also in 1867, Magitot suggested the use of an electric current for pulp testing.⁹

In an 1870 review of 42 cases of pulp capping with a 10-year follow-up, G. V. Black reported only six cases in which the pulp survived longer than five years. Black advocated the use of zinc oxychloride as a capping material. This seemed to gain wide acceptance as a capping medicament and as a root canal filler throughout the American dental profession. It was often referred to as Ash's cement.³

Most European dentists accepted the practice of amputating devitalized pulps and mummifying pulp stumps. Adolph Witzel, Germany, has been credited with advocating this procedure and introducing it to the dental profession¹⁷ (Neaverth, E.J., unpublished material). In 1873, Witzel empirically adopted the methods of Lister by treating root canals with phenol in an attempt to sterilize them.¹⁸

About the same time, J. W. Keyes described the use of iodoform as a pulp and periapical dressing. Iodoform had been discovered more than 50 years before by Serullas.

Most historians credit Witzel for providing the first description of a vital pulpotomy in 1847, although Chase was performing this procedure as early as 1866. Witzel's technique was to apply arsenous acid to the inflamed pulp for 24 hours so as to devitalize only the coronal portion. At the next appointment, he amputated that portion of the pulp and treated the root stumps as healthy, freshly exposed pulps.^{3,7}

Necessity was the mother of invention in this instance, as pulp amputation was advocated in order to avoid the need for instrumentation and filling of the root canals. Few endodontic instruments were commercially available at the time, and, consequently, the success or failure of root canal therapy depended largely upon the ingenuity and manual dexterity of the operator.

Although in 1870 G. V. Black suggested the use of zinc oxychloride

as a pulp capping material, most American authors credit N. C. Keep, Boston, with introducing this preparation in 1876. The use of this material gained wide acceptance and was used for many years.^{5,7,10} (*Part 2 of this article will appear in next month's Journal.*)

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