

Orthodontics in 3 millennia. Chapter 2: Entering the modern era

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In the early 1900s, groundbreaking scientists, working without benefit of graduate training and having little precedent, built the orthodontic edifice brick by brick. Kingsley pioneered cleft-palate treatment. Case showed us the importance of facial esthetics. Dewey and Ketcham made the ABO the first certifying board in dentistry. But it was Angle who gave us our first school, journal, society, and practical classification of malocclusion. (*Am J Orthod Dentofacial Orthop* 2005;127:510-5)

Toward the end of the 19th century, technology was beginning to make lives a little easier. The typewriter was invented in 1867, the telephone in 1876, the phonograph a year later, and air conditioning in 1902. In 1906, Kellogg gave us cornflakes.

Medicine likewise was making lifesaving advances. Laws were passed to discourage overcrowding in houses, provide clean water, and dispose of sewage and rubbish. Florence Nightingale began a training school for nurses. Pasteur proved that infections were caused by microorganisms, and Koch isolated a germ that was thought to cause tuberculosis.¹ Back in 1846, dentistry had been honored in its infancy when one of its members, William T. Morton, gave the first demonstration of the use of ether in surgery.²

The introduction of electricity into dentistry led to the operating light that freed the dentist from daylight and permitted dental offices to be redesigned to include ergonomic equipment and improve the patient's positioning. Electrically driven rotary cutting instruments revolutionized operative dentistry, and local anesthesia made possible improved surgical techniques.³ In 1896, Kells demonstrated the use of Roentgen rays in dentistry, and "cast gold fillings" made their debut the next year.²

In the latter part of the 19th century, a few dedicated dentists started to approach tooth regulation from a scientific standpoint. Their approach required not only mechanical skill but also knowledge of anatomy, physiology, and pathology.

At that time, many questioned whether teeth could be moved safely to new positions. Would the pulps remain vital? Would the uncompleted roots of growing teeth be

benet? Would tooth longevity be curtailed? The pioneers of that era faced a critical profession and a doubting public, which could be convinced of the practicability of orthodontic procedures only by successful treatment results.

ORTHODONTIC PIONEERS OF THE LATE 19TH CENTURY

Norman W. Kingsley (1825-1896, [Fig 1](#)) was the first of those dental pioneers who made the last half of the 19th century a period of great advancement. A splendid thinker and skilled artisan, he introduced several innovations, including occipital traction (1879). Initially, he extracted teeth and moved the anterior teeth back into the space thus created. Later, he gave up extraction and added an inclined plane of vulcanite to his mechanism to "jump the bite." He also experimented with cleft palate treatment, perfecting a gold obturator and an artificial vellum of soft rubber (1859), for which he was honored.

After 1850, the first texts that systematically described orthodontics appeared; the most notable was Kingsley's book, *A Treatise on Oral Deformities* (1880), the first to recommend that etiology, diagnosis, and treatment planning should be the foundations of practice.⁴ It was also the first to discuss cleft palate treatment in terms of orthodontics. Yet his fame as a dentist was nearly overshadowed by his talents as an artist and a sculptor.⁵

Despite the contributions of Kingsley and his contemporaries, their emphasis in orthodontics remained the alignment of the teeth and the correction of facial proportions.⁴ About that time, several dentists showed an interest in widening the maxillary arch. Almost 150 years later, their methods have not been much improved upon.

Amos Westcott made the first reported effort to use a telescopic bar in the maxilla to correct a crossbite (1859). In the 1840s, he placed chincups on his Class III patients ([Fig 2](#)). Emerson C. Angell was the first to open the median palatal suture with a split plate (1860), and

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Fig 1. Norman W. Kingsley.

William E. Magill was the first to cement (platinum) bands (1871).

That same year, C. R. Coffin, Kingsley's student, reported on a new design for an expansion appliance, which still bears his name (Fig 3). He embedded spring-action piano wire, bent into the shape of "W," into a vulcanite plate, separated the plate in the middle, and activated the spring so that its halves pressed the alveolar process to the outside.⁶ After World War II, acrylic replaced vulcanite.

The investigations of John Nutting Farrar (1839-1913, Fig 4) began the era of biologic tooth movement. In an 1876 article, he advocated specific limits for the movement of teeth and, in so doing, laid the foundation for "scientific" orthodontics. He was among the first (1850) to use occipital anchorage to retract anterior teeth (Fig 5). He recommended the bodily movement of teeth (1888). Based on animal studies, Farrar originated the theory of intermittent force and developed a screw to deliver this force in controlled increments ("about one two-hundred-fortieth of an inch every morning, and the same in the evening"). His *Treatise on Irregularities of the Teeth and Their Correction* (1888) is considered the first great work devoted exclusively to orthodontics. For these reasons, he has been called the "Father of American Orthodontics."⁷

Before the century closed, several other men made important contributions to the new science. Eugene S. Talbot (1847-1925), a prolific inventor, was one of the first to use the Roentgen ray in orthodontic diagnosis. He stressed the study of the causes of malocclusion, especially constitutional and hereditary factors, as the key to treatment.⁸ He was one of first to suggest endocrine glands as a possible cause of deformities and proposed that all malocclusion patients were either



Fig 2. Amos Westcott used chincup in 1840s to treat Class III patients.

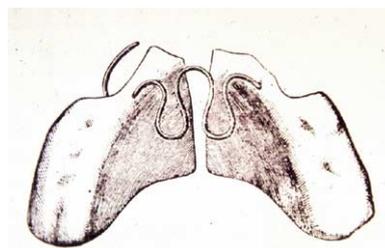


Fig 3. C. R. Coffin embedded spring-action piano wire, bent into shape of "W," into vulcanite plate, separated plate in middle, and activated spring so that halves pressed alveolar process to outside. This expansion appliance still bears his name.

"neurotics, idiots, degenerates, or lunatics." His unshaken pursuit of this theory led to much antagonism.

Talbot was the first dentist to specialize in both orthodontics and periodontics. He wrote *Irregularities of the Teeth and Their Treatment* (1888), which went through 6 editions; *Degeneracy: Its Causes, Signs, and Insults* (1898); and more than 90 articles on gingival pathologies and irregularities of the teeth.⁹

In 1893, Henry A. Baker introduced intermaxillary rubber bands to correct protrusions. His method came to be known as "Baker anchorage."¹⁰

Wilhelm Conrad Roentgen (1845-1923), a German physicist, discovered the x-ray (1895), for which he received the first Nobel Prize (1901). Although this discovery instantly revolutionized medical and dental diagnosis, it would be at least 10 years before it found use in orthodontics and 35 before it would enable orthodontists to visualize changes in the skull (cephalometrics).¹¹

Simeon H. Guilford (1841-1919, dean of the Philadelphia Dental College, was one of the few authors to

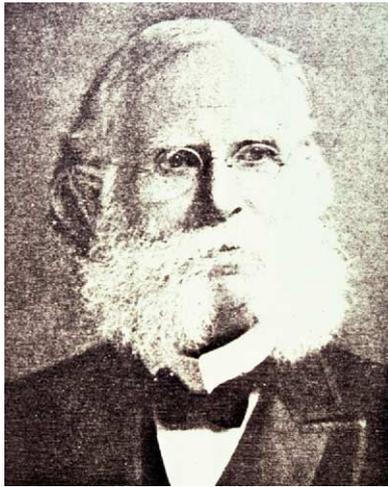


Fig 4. John Nutting Farrar began era of biologic tooth movement.

treat orthodontics comprehensively, reaching beyond mechanics to seek the causes of and the factors related to malocclusion. In 1889, he undertook the first course for undergraduates, for which he wrote the first text.¹² On the topic of extraction, he commented in his book, *Orthodontia: Malposition of Human Teeth*, “no operation in the practice of orthodontia is more important, or has associated with it greater possibilities for good or evil to the patient than that of extraction.”¹³ His determination to broaden the horizons of orthodontics affords him a distinguished place in its history.

Calvin S. Case (1847-1923, Fig 6) wrote *A Practical Treatise on the Technics and Principles of Dental Orthopedia* (1908), contributed 2 chapters to the *American Textbook of Operative Dentistry* (1897), and wrote 123 articles. He was the first to use (about 1893), along with Henry Baker, Class II elastics and was the first to attempt bodily movement. He was also the first to use light wires (.016 and .018 in).

Case advocated extraction to correct facial deformities, even though fewer than 10% of his patients had that problem. In so doing, he incurred the wrath of Angle and his disciples. Case’s 1911 paper provoked an acrimonious debate that came to be known as the “Great Extraction Debate.” Dentists today are likely to be amazed at the bitter, uncompromising tone of so-called scientific “discussions.” Yet that was the character of the era; intemperate remarks and personal vilification were the order of the day.¹⁴

Also contrary to Angle, Case used a different type of appliance for each patient and stressed facial esthetics in contrast to Angle’s reliance on occlusion. He advocated changing the name of the specialty to “facial orthopedia.”



Fig 5. Farrar was among first to use occipital anchorage to retract anterior teeth.

Anticipating our current concepts of preserving or restoring harmony and proportion in facial contours, he said, “The occlusion or malocclusion of the buccal teeth gives no indication of the real position of the dentures in relation to facial outlines.”¹⁵ Case used headgears for cleft patients and others. Some consider his greatest contribution to be the prosthetic correction of cleft palate.

Because of his modesty and Angle’s forcefulness and charisma, Case’s accomplishments were slow to be recognized, but he is now considered one of the “Big Four” in orthodontics.¹⁶

The most dominant, dynamic, and influential figure in orthodontics was Edward H. Angle (1855-1930). He is regarded as the “Father of Modern Orthodontics.”¹⁷ Probably no other man in dentistry did more to foster this branch of dental science as a specialty, causing its separation from general practice and advocating it as a recognized and distinct science.¹⁸

Soon after obtaining his dental degree in 1878, Angle became interested in “regulating” teeth. By 1886, he had achieved enough of a reputation to be appointed chair of the orthodontic department at the University of Minnesota (1886-92). His address at the Ninth International Medical Congress in Washington, DC (1887), calling for the separation of orthodontics from dentistry, caused a reaction that marked the beginning of a life of controversy.

After heading orthodontic departments at several dental schools, Angle decided he could be more effective by teaching small, select groups in his Saint Louis office. Thus was founded (1900) the first postgraduate school of orthodontics (Angle School of Orthodontia, Fig 7). He also founded the first orthodontic journal,



Fig 6. Calvin S. Case.

The American Orthodontist, in 1907, but could not prolong its publication beyond 1912.

Angle's classification, published in *Dental Cosmos* (1899), remains the most widely accepted classification of malocclusions. Based on the relationship of the maxillary to the mandibular first molars, it provided the first orderly means of characterizing malocclusions, and its universal acceptance by the dental profession is a testament to its practical simplicity.

The seventh and final edition of his book, *Treatment of Malocclusion of the Teeth* (1907), became the standard of the profession. Angle held 37 patents; his most noteworthy appliances are the E-arch (1900), the pin-and-tube appliance (1910), the ribbon arch (1916), and the edge-wise appliance (1925). The latter, with modifications, is the one most commonly used today in orthodontics.

Angle organized the first orthodontic society (1900), the American Society of Orthodontists (now the American Association of Orthodontists),¹⁹ and became its first president. He was a forceful teacher, and his idealism inspired 2 generations of disciples to become the specialty's leading clinicians, teachers, and administrators. At his death, his followers organized the Edward H. Angle Society of Orthodontia (now "Orthodontists"), which continues to uphold his high standards.

About 1908, Angle married his longtime secretary, Anna Hopkins (1872-1957, Fig 8), who had obtained her DDS degree from the University of Iowa and her orthodontic training in his school. "Mother Angle" became secretary of the American Society of Orthodontists, a founding coeditor of the *Angle Orthodontist*, and honorary chair of the Angle Society executive committee, but she would be best remembered as Angle's amanuensis, editor, foil, and buffer for many of his downtrodden students.

Before 1887, it was necessary to design and fabricate an appliance for each patient. Angle standardized his appliances and developed a collection of prefabricated parts (the "Angle System") that could be purchased and, in various combinations, used in most conditions. Casto stated, "Through his influence, orthodontics emerged from a speculative or empirical state to the position of an exacting science."^{18,20}

THE PROFESSIONALIZATION OF ORTHODONTICS IN THE EARLY 20TH CENTURY

A philologist, Sir James Murray (English, 1909), realized that the suffix "ia" properly referred to a medical condition (eg, amnesia) and suggested the term *orthodontics*. But it was not until the 1930s that *orthodontics* started to be used by the profession. *Dentofacial orthopedics*, suggested in 1976 by B. F. Dewel, has been added to better describe the whole compass of an orthodontist's bailiwick.²¹

Before the first American dental school opened at the University of Maryland in 1840 (Baltimore College of Dental Surgery), the only way to become a dentist was to be an apprentice or a preceptor with an established dentist. Thus, it was possible to be a practitioner of "tooth straightening" without having a degree. Lectures at the college extended only from November through February over a 2-year period.²

Most orthodontic pioneers of the late 19th century had medical degrees in addition to their DDS degrees. This practice went out of fashion during the first decade of the 1900s. Although Christophe Delabarre (1784-1862) had advocated as early as 1819 for "a special class of physicians" to treat malocclusions, the training of specialists was long in coming.

The first lectures on "irregularities" of the teeth were given to undergraduates at the Baltimore College by Chapin Harris. Norman Kingsley lectured students on the causes and correction of malocclusion (1872), but it was another 17 years before an actual course in orthodontics was given (Simeon Guilford, Philadelphia Dental College, 1889). Even so, before 1910, orthodontics was taught as a branch of prosthetics, emphasizing technique over basic sciences.

Angle's attempts at teaching undergraduate dental students at 4 schools had been frustrated by his inability to separate orthodontics from the dental curriculum, although he finally established the first department of orthodontics in a university (Marion Sims Dental College, Saint Louis, 1897).

After the meeting of the National Dental Association in 1899, several members persuaded Angle to train them in his office. This was the first postgraduate course in orthodontics, as well as the first school devoted exclu-

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Fig 7. Angle School of Orthodontia, first postgraduate school for orthodontists.

sively to the specialty,²² and it was 3 weeks long. In 1908, he gave up his practice in Saint Louis and moved, first to New York, then to New London, and finally to Pasadena, Calif (1916). Wherever he went, the Angle School went with him. His students erected what was to become the first building exclusively devoted to the teaching of orthodontics (1922). In 1924, the school was chartered as the Angle College of Orthodontia, and the course was lengthened to a year; it closed in 1927. Yet no tuition was charged his students (except for materials), and no fee was asked from his patients.

Although Angle was a superb mechanic, he was also scholar enough to insist that his students become grounded in the basic sciences. Accordingly, he sought out experts in anatomy, histology, embryology, rhinology (the former specialty dealing with diseases of the nose), photography, and even art to help him.

In 1907, the Angle School got competition in Saint Louis. A second proprietary school, the International School of Orthodontia, opened less than 2 miles away. It must have been galling for Angle to learn that one of its founders, Benno Lischer (1876-1959, Fig 9), was once turned away from admission to Angle's school because he refused to sign a noncompetition agreement. Moreover, he was not formally trained.

Nevertheless, Lischer became a leading figure in the specialty: professor of orthodontics at Washington University (Saint Louis) from 1902 to 1924 and dean of the dental school from 1933 to 1945. He wrote *Elements of Orthodontia* (1909), *Principles and Methods of Orthodontics* (1912), and *Time to Tell* (1955). He was the first to use the term *cephalometrics* (1922); he championed the term *orthodontics* in place of *orthodontia*; and he coined *mesioclusion*, *distocclusion*, and *neutroclusion*, promoting their use in lieu of Angle's Classes I, II, and III.²³



Fig 8. Anna Hopkins and Edward H. Angle.

Only 1 class was trained at the International School, but it was revived 7 years later in Kansas City, Mo, by William Brady and Hugh Tansey. When it closed in 1941, the course was 12 weeks long.

In 1911, the Angle-trained (1902) Martin Dewey (1881-1933, Fig 10) opened another proprietary school, also in Kansas City. Like the Angle School, the Dewey School changed locations as its owner sought new opportunities. Dewey finally settled in New York City (1919); the school continued until about 1960.

One of Angle's star pupils, Dewey became an educator, an author, a debater, and an editor. He was the first editor of *The American Orthodontist* and then helped found the *International Journal of Orthodontia* (1914), which he edited until his death. He wrote 3 texts on anatomy and orthodontics. During the extraction debate of 1911, he was the chief spokesman on the side of nonextraction. As the editor of the *International Journal of Orthodontia*, he editorialized against Angle's efforts to establish a state specialty board (in Arizona). This, along with his competing school, was the cause of a permanent rift between them. News of his death carried on the electric sign over Times Square attested to his fame.²⁴

Becoming an orthodontist before 1920 was limited



Fig 9. Benno E. Lischer.



Fig 10. Martin Dewey.

to either training as a preceptor or attending a 6-week course at a proprietary school. Except for the Angle School, entrance requirements were simply the possession of a DDS degree and a letter of recommendation. The non-Angle schools operated on the belief that orthodontics was a part of dentistry, like crown and bridge or prosthetics. The applicant accepted this belief because he had been told as an undergraduate that his education for the practice of orthodontics was complete except for the mechanical training.

There was nothing in the short course to change this viewpoint. Lectures consisted of the most elementary consideration of the denture. Three mornings each week were spent in an orthodontic clinic observing appliance manipulation. There were no assignments, quizzes, or examinations, and the diploma was granted

without the candidate's even having placed a separating wire. In fairness, however, the Dewey School turned out some graduates who contributed significantly to orthodontic progress (Croizat, Eby, Joe Johnson, Oliver, Margolis, and Salzman, to name a few). The proprietary schools served a worthwhile function: they were responsible for the awakening of the universities to the possibilities of orthodontics.²⁵

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