

# Orthodontics in 3 millennia. Chapter 5: The American Board of Orthodontics, Albert Ketcham, and early 20th-century appliances

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Early in the last century, 3 events put Colorado in the orthodontic spotlight: the discovery—by an orthodontist—of the caries-preventive powers of fluoridated water, the formation of dentistry's first specialty board, and the founding of a supply company by and for orthodontists. Meanwhile, inventive practitioners were giving the profession more choices of treatment modalities, and stainless steel was making its feeble debut. (*Am J Orthod Dentofacial Orthop* 2005;128:535-40)

**T**he opening years of the 20th century witnessed many medical and dental breakthroughs. The new fields of endocrinology, nutrition, hematology, immunology, and other areas of medicine brought an understanding of the etiology of many noninfectious diseases, and antibiotics were hailed as “miracle drugs” in the battle against infectious diseases. Dentists realized that single-handed dentistry could be vastly improved by auxiliaries, so dental assistants began doing more than simply passing instruments. In 1913, Alfred C. Fones<sup>1</sup> founded the first school for dental hygienists.

More far-reaching was the discovery in 1908 by Frederick S. McKay,<sup>2</sup> a Colorado dentist, that brown stains (mottling) of his patients' teeth were related to the local water supply. In 1925, McKay's research verified that drinking water with high levels of naturally occurring fluoride was associated with reduced dental caries. We are proud that McKay—dentist, periodontist, teacher, musician, and orthodontist (Angle School, 1903)—was one of us.

## THE AMERICAN BOARD OF ORTHODONTICS AND ALBERT H. KETCHAM

By 1929, the 3 cornerstones of the professional pyramid were in place, but some leaders of the American Society of Orthodontists felt that, for orthodontics to be a true specialty, a means of certifying the competence of its members should be established. In medicine, there already were 2 specialty boards—ophthalmology and otolaryngology.

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Thanks to the vision and optimism of President Albert Ketcham (Fig 1) and Organizing Committee chairman Martin Dewey, it became a reality at the Estes Park, Colo, meeting of the American Society of Orthodontists that summer. The American Board of Orthodontics thus became the first specialty board in dentistry. Appropriately, Ketcham was elected its first president.<sup>3</sup>

Albert H. Ketcham (1870-1935; Angle School, 1902) was a Vermonter who came to Colorado hoping that the clean, rarified air would cure his tuberculosis. Fortunately for orthodontics, it did, and Ketcham rose from his stretcher to become the foremost orthodontic leader in the West.<sup>4</sup> He pioneered dental radiography and was the first US orthodontist to install an x-ray laboratory. He delivered the first paper on x-rays in orthodontics to the American Society of Orthodontists in 1910. In 1926, he presented the first comprehensive data on root resorption.<sup>5</sup> Although the earliest mention of root resorption in permanent teeth goes back to 1856, it was a report by Ketcham in 1927 (followed by a second in 1929) that finally aroused the concern of orthodontists.<sup>6</sup>

He became one of Angle's “enemies” when he modified Angle's appliances and questioned some of his arbitrary pronouncements. In contrast to Angle, Ketcham never sought credit or acclaim; he worked in a quiet, modest manner and never discouraged former associates from remaining in the area to practice. According to Pollock, “In the early days of orthodontia, when Angle . . . was leading orthodontic thought, it was Ketcham who offered a harbor to which the storm-tossed orthodontic neophyte could come for encouragement and calm advice.”<sup>7</sup> Scientist, teacher, organizer, philosopher, and humanitarian, Ketcham ranks as one of the “Big Four” of orthodontics.<sup>6</sup>



**Fig 1.** Albert Ketcham was leading force behind ABO.

In 1936, a year after his death, the Albert H. Ketcham Memorial Award was established to be awarded to an orthodontist or other scientist who makes an outstanding contribution to the specialty. The first presentation was made the next year to John V. Mershon. To date (2004), 87 people have received the award.

## APPLIANCES

### The crib grows up

Victor H. Jackson (1850-1929; Fig 2) deserves credit for advocating orthodontics for the largest possible number of people. To accomplish this, he designed a wire crib in 1887 (patterned much after the design of Schange) to which were soldered a number of finger springs for tooth movement. Most appliances, in addition to steel piano wire, were made of "nickel silver," an alloy of copper, nickel, and zinc.<sup>8</sup> His technique became known as the "Jackson System," opening the door to what some have called the "Age of Systems."<sup>9</sup> He was also the first to mention fixed retention and fiberotomy.<sup>10</sup>

The Jackson appliance was taken up by William E. Walker (1863-1914), who used precious metals. Although Walker died before he crossed paths with George B. Crozat, the latter became familiar with the Jackson appliance as a student at the Dewey School. After Crozat graduated, he acquired 2 patients who were being treated by Walker in New Orleans.

Crozat (1894-1966) was a descendant of a French marquis of early Louisiana. A Southern gentleman of fine tastes, he authentically restored the Houmas House, an 1840 plantation house near Baton Rouge. It has been



**Fig 2.** Victor H. Jackson pioneered removable appliances and was first to recommend fiberotomy.

used as a movie setting, and it remains a tourist attraction. Early in his practice, seeking a means of treating patients with an esthetic appliance but without extractions, Crozat modified Walker's device and introduced it in 1919. Originally called the "invisible brace," it later became known as the Crozat appliance (Fig 3). For many years, the "Crozat technique" was one of the most popular in use.<sup>11</sup>

### Angle's appliances

When the Crozat appliance was being developed, a typical fixed appliance consisted of bands only on the first molars, with wire ligatures tied to a heavy (.060-in) labial or lingual archwire<sup>12</sup>—the E (expansion)-arch. This was essentially the design of Angle's first (1900) contribution to the orthodontists' armamentarium of appliances, drawing on the most suitable features of previous appliances,<sup>13</sup> and was an improvement on the basic design of the late 1800s. Each end of the wire was threaded, and a small nut was placed on the threaded portion to advance it.<sup>14</sup>

Because the E-arch could only tip teeth, Angle began placing bands on other teeth and used a vertical tube (1910) on each tooth into which a pin, soldered to the archwire, was placed. To move the teeth, he repositioned the pins at each appointment by the laborious process of resoldering them. At the beginning of treatment, the archwire had to be conformed to the malocclusion and then "ironed out." This tedious procedure proved too difficult for the average clinician, so the pin-and-tube, or "bone-growing," appliance (Fig 4) never achieved widespread use.

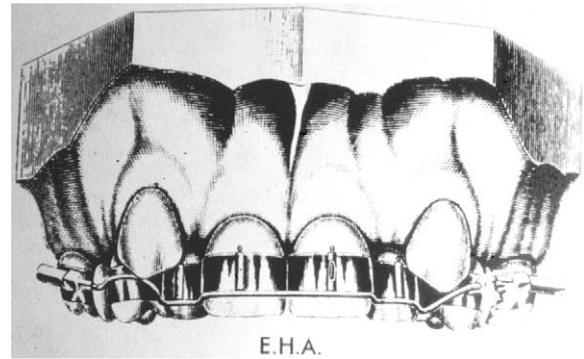


**Fig 3.** Crozat appliance.

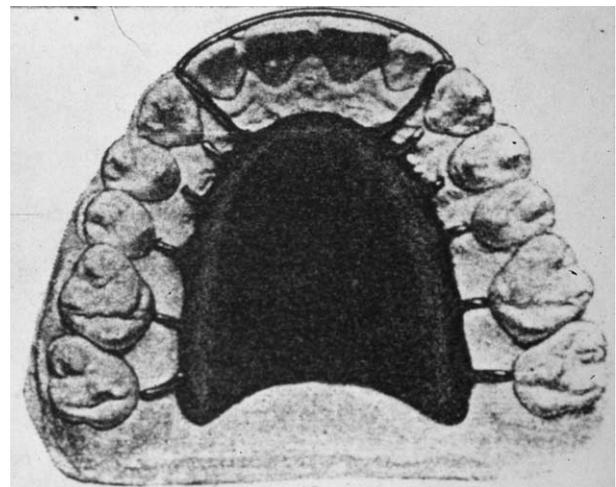
In addition, the pin-and-tube appliance could not control the tooth roots because of the round archwires, so Angle modified the bracket to receive a rectangular arch fitted closely into a machined bracket. The ribbon arch (1916), of  $.022 \times .036$ -in gold, was held firmly with pins. Compared with its predecessors, it was small enough to have good spring qualities. But like its predecessors, the ribbon arch had threaded ends and still had to be ironed out. Expansion was still the therapeutic goal in most patients.<sup>12</sup> Furthermore, the ribbon arch lacked premolar control and ease in seating between the horizontal molar tubes and the vertical bracket slots. Despite these drawbacks, the ribbon arch was an immediate success and continued in use for a decade after introduction of its successor, the edgewise appliance.<sup>12</sup>

To overcome the drawbacks of the ribbon arch, in 1925, Angle reoriented the slot from vertical to horizontal and inserted a rectangular wire “edgewise”—with its greater dimension perpendicular to the long axis of the teeth. Rather than being held with lock pins, which often broke and defied removal, the archwire was tied in place with steel ligatures. To correct rotations, three-quarter rings were soldered off-center on the bracket. Those of you old enough to remember soldering these tiny “doughnuts” might be wondering whether today’s appliances, with so many built-in controls, are taking away our right to be called “wire-benders.”

The archwire, as well as the bands and brackets, was of  $.022 \times .028$ -in gold. At first, the initial archwire was adapted to the malocclusion and ironed out. Later, it was found that an “ideal,” smaller-dimension round wire ( $.022$ ) was resilient enough to initiate treatment. The edgewise appliance was the first bracket able to move teeth in all 3 planes simultaneously.<sup>15</sup> It soon



**Fig 4.** Pin-and-tube appliance proved too difficult to master.



**Fig 5.** Baker's vulcanite retainer.

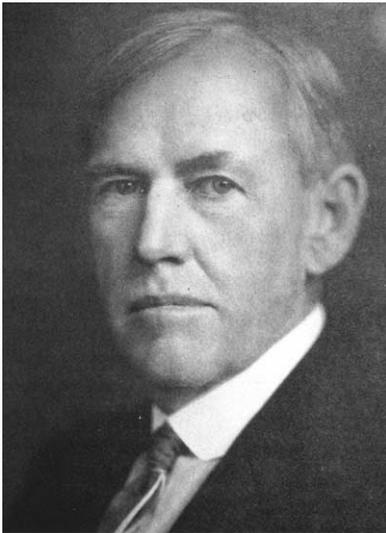
became the most popular appliance in the United States.

Three quarters of a century after its introduction, the edgewise concept is unchanged, although many modifications and variations exist, beginning with Steiner's substitution of a harder gold and later, when chrome steel came in, reduction in archwire diameter to  $.018 \times .022$  in.<sup>12</sup> Unfortunately, these innovations did not ensure the stability of expansion treatment.<sup>14</sup>

#### Hawley retainer

Henry Baker used maxillary and mandibular vulcanite removable retainers with labial wires, but the vulcanite was not adapted to the teeth. Instead, the teeth were prevented from moving lingually by metallic spurs embedded in the vulcanite (Fig 5).

The retainers (1919) of Charles A. Hawley (1861-1929; Angle School, 1905) (Fig 6) were an improvement over Baker's in that the base material was flowed



**Fig 6.** Charles A. Hawley's name has become synonymous with retainer.

against the lingual surfaces, thus helping to prevent rotations. In the late 1930s, vulcanite was replaced by acrylic. Every dentist knows what a Hawley is, but few know that Charles Hawley was one of the first to use nitrous oxide for extractions. His other contributions include a system of geometrical charts for predetermining arch form, a gold annealer, and various instruments. His daughter, Carlotta, did much to elevate the status of female orthodontists.<sup>16</sup>

#### **Mershon lingual arch**

John V. Mershon is remembered most for his development in 1909 of the removable lingual arch, designed to apply gentle pressure on the teeth to keep them (if otherwise rigidly connected) from interfering with the forward growth of the jaws. It might be considered the first "invisible" appliance. Furthermore, it reduced the frequency of visits, to 6 or 8 weeks.

It consisted of a heavy lingual arch, usually .036 or .040 in in diameter, inserted into vertical posts soldered to the lingual surface of the first molar bands. For individual tooth movements, various finger springs were soldered to the base arch. In the Mershon method, the appliance was used at intervals throughout the child's growth period, with frequent "rest periods" during which the appliance was removed to allow natural adaptation of the teeth to their new positions.<sup>17</sup>

Subsequent experience has shown that the lingual arch serves best as a space maintainer or as a base for part-time elastic traction. Although considered a revolutionary advance in its time, as a tooth-moving appliance, it offers little more than esthetics.<sup>12</sup> For this



**Fig 7.** Labiolingual appliance was but 1 of Oren A. Oliver's many contributions to orthodontics.

important contribution to the orthodontic armamentarium, Mershon refused to patent his invention or to accept any remuneration.

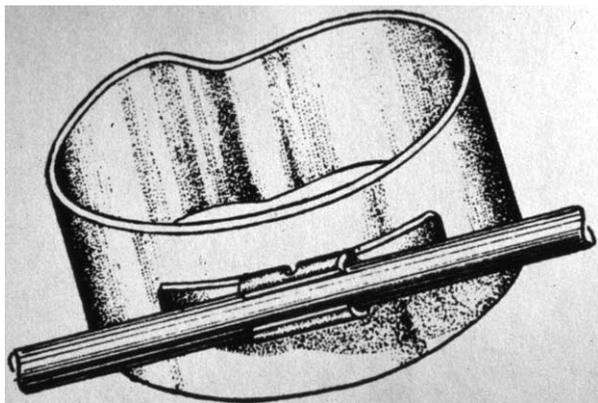
#### **Labiolingual appliance**

Credit for the addition of a labial arch to the technique must be given to 3 other men, who contributed to a device that came to be known as the labiolingual appliance: Lloyd S. Lourie Sr (1877-1959), a member of Angle's first class; Oren A. Oliver (1887-1965) (Fig 7), a pioneer Southern orthodontist who wrote *Labio-Lingual Technique* (1940); and Lowrie J. Porter (1895-1981), who contributed several refinements such as loops and a lingual lock.

The number of attachments was limited only by the operator's imagination. One such attachment was vertical spurs soldered to the labial arch to exert lingual pressure. Another refinement was the Oliver guide-plane, a "fence" attached to the anterior surface of the upper lingual arch that acted as a functional appliance in that it forced the mandibular incisors to occlude anteriorly. The labiolingual appliance featured bands on the incisors and the molars, and 2 wires (.010-in steel) to align the anterior teeth. No matter how elaborate the design, however, the appliance was not capable of more than tipping movements.<sup>12</sup>

#### **Open-tube appliance**

In 1922, James McCoy brought out a banded appliance based on a 1903 design of Calvin Case. The McCoy open-tube appliance (Fig 8) consisted of a .030- or .036-in gold archwire that was inserted into a



**Fig 8.** McCoy open tube was actually an early form of self-ligating appliance.

horizontal bracket, which was essentially a round tube having a 40% cutout.

Engagement of the archwire was achieved by simply snapping it into the open bracket. Although it permitted bodily movement in a mesiodistal direction, there was no torque control. Dr Harry Cimring, who wore the appliance as a teenager, described the “snapping in” as “brutal” (personal interview, November 1987).

### Stainless steel

The dawn of the “silver smile” occurred when gold gave way to stainless steel, although it took 20 years for American orthodontists to adopt it. Stainless steel was used as far back as 1913 to protect English cannon bores. In 1924, W. H. Hatfield patented “18-8” (18% chromium, 8% nickel) stainless steel.

The noncorrosive and rust-resistant properties of this alloy have revolutionized most modern industries, including food, transportation, and medicine. Its surface resists oxidation at high temperatures, making the sterilization of medical instruments possible.

The first orthodontists to use stainless steel were Europeans: Lucien De Coster (Belgium, 1927) in his appliances and Rudolf Schwarz in edgewise appliances.<sup>18</sup> Ernest S. Friel, impressed by De Coster’s 1931 demonstration, started using stainless steel bands in 1935.

Friel (1888-1970; Angle School, 1909) was the first in the British Isles to specialize. In 1926, he showed the correlation between growth of the mastication muscles and development of the dentition. He invented dynamometers to test the strength of muscles and instruments to increase it. He was the first orthodontist outside North America to receive the Ketcham Award (1960).<sup>19</sup>



**Fig 9.** Archie B. Brusse, founder of first orthodontic supply company.



**Fig 10.** Ad for early spot-welder.

In the United States, Oren Oliver started using stainless steel ligature wire in 1930. Rocky Mountain Orthodontics got its start when Archie B. Brusse (1884-1959) (Fig 9) and Lyndon Carman (1905-1977) founded a company to manufacture stainless steel brackets in Denver. Initially hampered by Krupp’s patents, Brusse and Carman finally got permission from American Steel and Wire Company, a subsidiary of US Steel. They introduced spot-welding to the profession

at the 1933 AAO meeting in Oklahoma City with the first spot-welder (Fig 10). Their total sales: 1 welder, ordered by Dr Emily T. Hicks of Pampa, Tex. Despite the high price of gold, orthodontists were still skeptical of stainless steel.<sup>20</sup>

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