

Orthodontics in 3 millennia. Chapter 6: More early 20th-century appliances and the extraction controversy

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The trying conditions of the Great Depression and World War II did not deter innovative orthodontists from adding 3 new appliances to our armamentarium. Clinicians become fragmented into various technique “camps.” Silas Kloehn’s neck gear became a more patient-friendly version of extraoral anchorage, but it still had drawbacks. Angle’s stranglehold on the specialty was finally broken when 3 of his disciples made extractions respectable. (*Am J Orthod Dentofacial Orthop* 2005;128:795-800)

In New South Wales, Australia, P. Raymond (Paul R.) Begg (1889-1983; Angle College, 1925) (Fig 1) was a jackaroo before studying under Angle. At the college, Begg assisted Angle in teaching the new edgewise mechanism. Practicing in Adelaide, Australia, Begg had difficulties with the edgewise in attempting to close extraction spaces and reducing deep overbites. He therefore developed his own bracket (1933), which was essentially a ribbon-arch bracket turned upside down. It was the first bracket system that used single, round, stainless-steel wire of .016-in diameter or less.¹

He later added auxiliary springs to the appliance to control root positions. During the 1940s, Begg developed the highly resilient, stainless-steel “Australian” wire, replacing precious metal. This was introduced in the United States in late 1956. His innovations came together in the multiloop light-wire, or Begg, technique (1965). He was using titanium wire long before American orthodontists had discovered its unique properties. Begg practiced orthodontics for more than 55 years and registered his last patent at age 84. He wrote *Begg Orthodontic Theory and Technique* (1965).² Although still in contemporary use, the Begg technique has declined in popularity.³

Universal appliance

Inspired by Calvin Case’s light-wire technique, Spencer R. Atkinson (1886-1970) invented the universal bracket (Fig 2) in 1929 (although it was not introduced until 1937),¹ as a means of incorporating

light forces into his technique. He was also influenced by Albin Oppenheim’s theories about the goal of light pressures, constantly applied, yet offering a physiological rest period as the light, fine wire actions become passive. Angle had been grooming Atkinson to take over the college, but, because the universal appliance was based on a combination of Angle’s ribbon arch and edgewise appliances, Angle broke off their relationship.

The gingival wire was designed for mesiodistal movements and extrusion-intrusion, whereas the occlusal wire could be used for rotations and buccolingual movement. This appliance enabled orthodontists, for the first time, to use a ribbon arch or a round wire, singularly or in concert with each other, or a round wire in each channel, and even these in various combinations.⁴

The universal became the most popular appliance in southern California during the 1930s and 1940s, yet Atkinson donated all profits from its sale to the California Institute of Technology and refused to allow his name to be attached to it. The machine shop that milled the first brackets for the universal appliance gave rise to the West Coast’s first orthodontic supply house, Unitek Corporation (UNIversal TEChnique).

Twin wire

About the same time that Atkinson was developing the universal appliance, the idea of light forces also appealed to Joseph E. Johnson (1888-1969) (Fig 3), who reasoned that 2 light (.010-in) wires would be more physiological than 1 heavy one. A 1913 graduate of the Dewey School, Johnson practiced in Louisville, Ky, and lectured in Havana, Cuba, and at universities such as Columbia and University of Pennsylvania. In contrast to the universal appliance, both wires were inserted into the same channel, which was fastened with either a ligature

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Fig 1. P. Raymond Begg originated popular multiloop technique and was longtime leader in Australian orthodontics.



Fig 3. Joseph E. Johnson, also proponent of light forces, developed twin-wire technique in 1929.

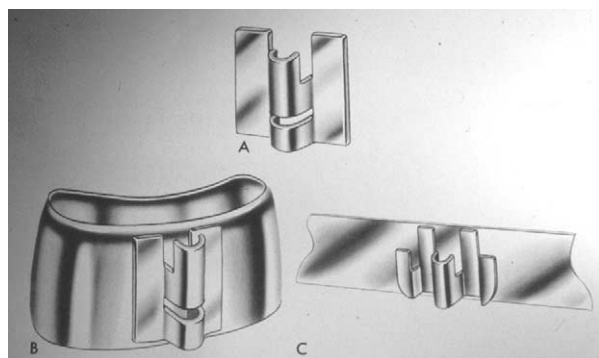


Fig 2. Universal bracket was designed by Spencer R. Atkinson to incorporate light forces into his orthodontic practice.

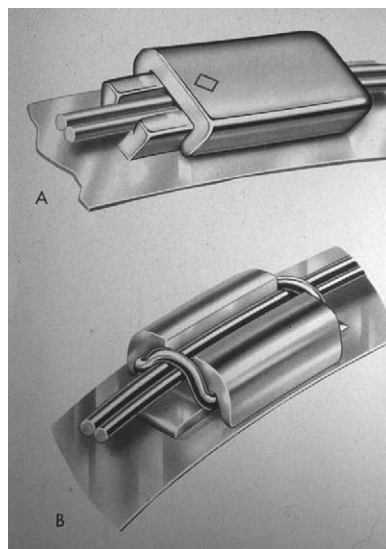


Fig 4. Two methods of engaging twin wires.

wire or a special cap (Fig 4). Although the twin-wire technique was effective at leveling and rotating teeth as well as more comfortable, it lacked control of the canines and the premolars (they were seldom banded) and was unsuitable for extraction cases.⁵

Depending on where one was trained, it was not unusual at that time for practitioners to develop strong loyalties toward a particular leader or technique (“Pied Piper syndrome”). Adherents of various appliances divided themselves into “camps,” and it was common to hear such terms as *edgewise man*, *universal man*, and *labiolingual man*. When William S. Parker opened his office in Sacramento, Calif, in 1948, he was a labiolingual man who found himself deep in edgewise-universal terri-

tory. “There was a very clear social pecking order in dentistry,” according to Parker. “If you believed in a certain methodology and practiced in an area where they didn’t believe in that methodology, you would be an outcast pretty damn soon” (telephone interview, December 31, 1995).

Preformed bands

The first orthodontic bands were just strips of metal wrapped around teeth, “pinched” to conform to the

tooth's shape, and then either soldered or spot-welded. By the late 1930s, Rocky Mountain Orthodontics had developed a line of preformed anterior and molar bands. Canine and premolar bands were made by specially adapting certain sizes of anterior bands.⁶ The cost of maintaining an inventory of different sizes was more than offset by the savings in chair time. This was dramatically illustrated by Robert M. Ricketts, when he demonstrated a complete 20-minute "strap-up" at the 1962 AAO meeting in Los Angeles. However, after bands with prewelded brackets and tubes became available, it was necessary to stock 10 to 15 boxes of bands, each housing up to 32 sizes of several bands each.

Acrylics

The vulcanization of natural rubber with sulfur had been discovered by Charles Goodyear about 1839. Although vulcanite (hard rubber) was a great technological advance, it was weak, unesthetic, and hardly friendly to the patient. It was also known to corrode the metal parts that it touched.

Invented by a German chemist, Otto Röhm, acrylic was introduced into the United States in 1936 and quickly found uses by the military in such applications as aircraft turrets and windshields (Plexiglas). By the 1940s, acrylic materials were being polymerized into pink dental plates by reacting, under heat and pressure, doughs made from acrylic powder, (which reduces shrinkage) and methyl methacrylate monomer. Later, self-curing acrylics were made by adding an accelerator.⁷ Today's orthodontic patients proudly display their removables in all colors of the rainbow.

Headgear

The term *headgear* has been applied to various devices that might properly be called *extraoral appliances*. Extraoral force can be applied to the teeth, to an *intraoral* appliance, or to the chin. Occipital headgears were true headgears, because they were attached to the occiput. The Kloehn-type device is more correctly called *neck gear*, or *cervical gear*. Thus, the term *cervical headgear* is an oxymoron.

Headgear was initially relied on to "anchor" maxillary molars while retracting anterior teeth after premolar extraction. The second use of headgear was to distally drive molars. After the introduction of cephalometry, it was found that headgear could also be used as an orthopedic appliance.⁸ Since its discovery in the early 19th century, extroral force has been in and out of favor. Angle used an occipital-pull headgear attached to the anterior teeth in 1889 (Fig 5), even for adults. Although it has been modified over the years, its basic structure is unchanged. Angle is said to have aban-

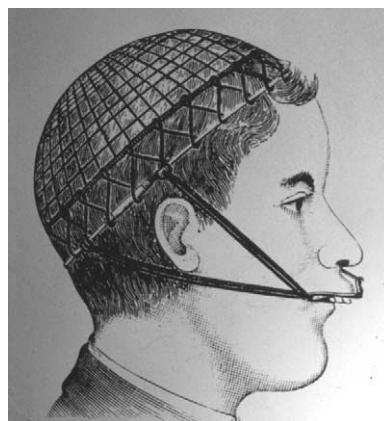


Fig 5. Angle's headgear.

doned it when he became convinced that Class II elastics would cause the mandible to grow. However, a former patient reported that she wore an occipital headgear at Angle's Pasadena clinic in the mid-1920s (personal interview, Marjorie Nelson, October 14, 1992). With the advent of cephalometric analysis, it became clear that both elastics and guide planes corrected Class II malocclusions more by displacing mandibular teeth.³

In 1947, Silas Kloehn (1902-1985) reported the use of an occipital headgear attached by hooks to a maxillary .045-in archwire stopped against the first molars, but when he noted that this combination could produce marked and uncontrolled molar tipping, he modified the appliance by soldering the bows to the inner arch in the incisor area, creating the now-familiar facebow.⁹

Today, as before, the chief deterrent to headgear use is its lack of patient acceptance. Even in our specialty, some (in touting their practices) inadvertently bad-mouth the appliance by proclaiming, "No headgear needed!" Another factor responsible for the decline in headgear use is the proliferation of noncompliance appliances.

Headgear milestones

- ca. 1802: Joseph Fox uses a chincup attached to a skullcap.
- 1822: Gunnell writes on the use of headgear for occipital anchorage.
- 1844: Westcott uses chin cups to treat Class III patients.
- 1850: Kingsley is among the first to use occipital anchorage to retract anterior teeth.
- 1863: Kneisel reports on occipital anchorage to correct mandibular protrusion.

- 1892: Kingsley describes the use of headgear to depress and drive the incisors distally after extracting the maxillary first premolars.
- early 1900s: Calvin Case uses extraoral anchorage extensively to treat blocked-out canines.
- 1936: Albin Oppenheim reintroduces extraoral anchorage after a long period of disuse.¹⁰
- 1947: Silas Kloehn introduces the facebow with a cervical strap, removing the stigma of “Victorian” headcaps.
- 1967: Donald R. Poulton (1932-) warns against the facebow’s adverse effects: extrusion and tipping of the maxillary molars, backward rotation of the mandible, impaction or buccalization of the maxillary second molars, and tipping of the palatal plane downward anteriorly.¹¹
- 1974: John H. Hickham (1934-2004) develops a line of headgears based on the concept of “directional force” in an effort to avoid these adverse effects.¹²
- 1988: Patrick K. Turley (1949-) researches correction of Class III malocclusions using palatal expansion and protraction headgear.¹³

EXTRACTION CONTROVERSY

Extraction of deciduous teeth was known in ancient civilizations. Ever since Celsus recommended it (as did Fauchard) to clear the way for permanent successors, there was little or no opposition to its practice. The controversy arose when dentists started removing permanent teeth. Hunter,¹⁴ the first author to go on record, opposed it on the grounds that it inhibited growth. In the early 1800s, extraction of maxillary first premolars was the routine method of treating Class II Division 1 malocclusions, but Delabarre warned (1818) against undesirable sequelae.¹⁵ He said, “It is much easier to extract teeth than to determine if it is absolutely necessary”—still good advice.

After initially extracting premolars, Kingsley later gave it up, especially after Angle renounced it. Then he tried to jump the bite by means of a steep, metal inclined plane. Isaac B. Davenport lectured in New York against it (1887), saying that extractions caused “a loss of important organs.”¹⁶ Calvin Case reintroduced it about 1893, arguing that, although the arches could always be expanded so that the teeth could be placed in alignment, neither esthetics nor stability would be satisfactory in the long term. Even though he did so only in severe cases (about 6%), he was roundly condemned for the practice.

Between the publication of his sixth and seventh editions, Angle renounced extractions. Reasons advanced for this reversal include his acceptance of Wolff’s law, which Angle interpreted to mean that new

bone could be grown after the teeth were moved off their bony bases, and his belief that the proper function of the dentition could maintain teeth in their correct positions. A more personal reason might have been his disappointment in the outcome of his maxillary premolar–extraction treatment of his wife, Anna, for protrusion. Even so, it was said that he condoned it privately.¹⁷

Case opened a can of worms when he appeared in Chicago before the National Dental Association’s annual meeting in July 1911, with his paper, “The question of extraction in orthodontia.” The ensuing discussion erupted into a full-scale debate. Martin Dewey, taking up the gauntlet for the nonextractionists, challenged Case’s credibility and ridiculed him as only Dewey could. The interchange ranged over the entire field of orthodontic thought, including early regulation, heredity, bone-growing, and evolution.¹⁸ As though paving the way for the Scopes trial 14 years later, Case cited Darwin’s theory of evolution, while Dewey argued for special creation. Although Case was supported by impressive arguments from Matthew Cryer, a renowned anatomist, Angle’s followers won the day, and, for the next 30 years, extraction of teeth for orthodontic purposes essentially disappeared from the American scene.

Orthodontists such as John Mershon, Joseph Johnson, and George Crozat, whose appliances relied on a nonextraction philosophy, helped perpetuate this philosophy, but, by the 1930s, dentists were beginning to notice relapses. One of the first to analyze relapse from a scientific standpoint was Axel F. Lundström (1875-1941) of Stockholm, Sweden. He redefined the limits of orthodontic capabilities in his thesis (1923), showing that, when the *apical base* (roughly defined as the portion of the alveolar bone underlying the tooth roots) is deficient, crowded teeth moved by orthodontic means into an accepted normal arrangement will relapse when retainers are removed.¹⁹

Charles H. Tweed, Jr (1895-1970; Angle College, 1928) (Fig 6), was more concerned with dental protrusions and unsatisfactory facial esthetics. His dissatisfaction led him to begin extracting 4 premolars in certain patients after initially following Angle’s nonextraction dogma. At the 1940 annual meeting of the AAO, Tweed displayed 100 consecutive case records representing patients initially treated nonextraction and then retreated with removal of the 4 first premolars. Tweed’s criterion for facial balance was the position of the mandibular central incisors, from which developed the Tweed triangle (1936). His mechanics involved a rigid, time-consuming orthodoxy, and terms such as *anchorage preparation*, *tip-back bends*, and *en masse*



Fig 6. Charles H. Tweed's name has become synonymous with rigid, structured treatment philosophy.



Fig 7. Robert H. W. Strang spread Tweed gospel to East Coast orthodontists.

movements became part of the vernacular. His superb results soon attracted a following.

The many visitors to his office in Tucson, Ariz, prompted him, in 1941, to conduct seminars. These evolved (1947) into formal courses of instruction, initially called the Tweed Course, and from these developed the Charles H. Tweed Foundation for Orthodontic Research. Tucson became the mecca for an exacting edgewise discipline. The success of his courses attests to the fact that rank-and-file orthodontists had many doubts about the proper approach to treatment.²⁰

Even before Tweed became disenchanted with Angle's dogma, his fellow alumnus, Raymond Begg, was coming to the same conclusion. After returning to Australia, Begg followed Angle's nonextraction philosophy for 2 years. Then, as a result of his studies of attrition in Aborigines, he became convinced that crowding in modern man was the result of lack of interproximal wear. Consequently, in 1928, he began extracting premolars. These studies were the basis for his classic articles, "Stone Age man's dentition" (1954) and "Differential force in orthodontic treatment" (1961), in the *AJO*.²

Begg and Tweed were 2 of the 3 men having the greatest influence on extraction in midcentury. The third was Robert H. W. Strang (1881-1982; Angle School, 1906) (Fig 7), 1 of the last of the Angle group to obtain a medical degree (1904). As the first orthodontist in Connecticut, he taught in his office and home for 22 years and then inaugurated a 2-week continuing education course at Columbia University

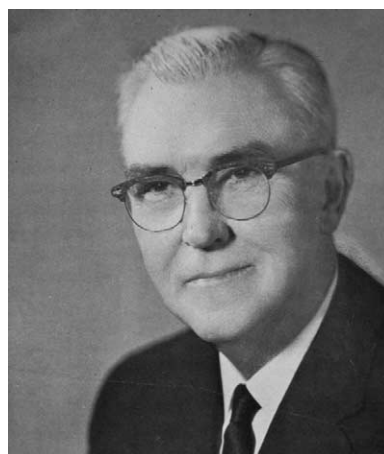


Fig 8. Hays N. Nance was meticulous clinician and investigator who focused specialty's attention on limitations of orthodontic treatment.

that continued until 1946. After taking the Tweed course, he became a principal advocate of the Tweed technique in his teaching and writing. His *Textbook of Orthodontia* (1933) became a standard text; he espoused the inviolability of intercanine and intermolar widths.²¹

Another defender of intercanine width was Hays N. Nance (1893-1964) (Fig 8), who, like Tweed, got his dental degree in 1919 and practiced general dentistry in Arizona. After a 3-year associateship with Albert Ketcham, he settled in southern California. In 1930, he began a series of investigations that led to his landmark

paper, "Limitations of orthodontic treatment." He found that treated dentitions return to their original intercanine and intermolar widths.²¹

He defined *leeway space* as the differential in tooth widths between deciduous and permanent buccal teeth. This space is normally closed by mesial drift of the permanent first molars as the deciduous teeth are replaced and can be "reserved" with a space maintainer in a borderline extraction patient.²² This led to the Nance analysis, a renewed interest in mixed dentition treatment, and an increase in second premolar extractions.²³ By the early 1960s, more than half of American patients undergoing orthodontic treatment had some teeth removed.³

REFERENCES

- McManaman JE, Woodside CM. Evolution of orthodontic bracket design. *Alpha Omegan* 2000;93:55-65.
- Simms MR. In memoriam: P. Raymond Begg (1898-1983). *Am J Orthod* 1983;83:445-6.
- Proffit WR, Fields HW, editors. *Contemporary orthodontics*. 3rd ed. St Louis: Mosby; 2000.
- Yudelson R. The universal appliance. *Am J Orthod* 1967;53:159-63.
- Gray W. In memoriam: Joseph E. Johnson (1888-1969). *Am J Orthod* 1970;57:413.
- Brusse M. The metamorphoses of orthodontic epidemiology and synergistic orthodontics. In: *Rocky Mountain Orthodontics 1997* [catalog]. Denver: RMO; 1997. p. v.
- Kusy RP. Orthodontic materials: from the past to the present. *Angle Orthod* 2002;72:501-12.
- Pavlick CT Jr. Cervical headgear usage and the bioprogressive orthodontic philosophy. *Semin Orthod* 1998;4:219-30.
- Poulton DR. The influence of extraoral traction. *Am J Orthod* 1967;53:8-18.
- Salzmann JA, editor. *Practice of orthodontics*. Philadelphia: Lippincott; 1966. p. 501, 751, 758.
- Silas J. Kloehn 1902-1985. *Angle Orthod* 1985;55:90-2.
- Hickham JH. Directional edgewise approach. *J Clin Orthod* 1974;8:617-33.
- Turley PK. Orthopedic correction of Class III malocclusion with palatal expansion and custom protraction headgear. *J Clin Orthod* 1988;22:314-25.
- Hunter J. *Natural history of the human teeth*. London:1771.
- Brodie AG. Orthodontic history and what it teaches. *Angle Orthod* 1934;4:85-97.
- Davenport IB. The significance of the natural form and arrangement of the dental arches of man. *Tr Odontological Society*. New York:1887. p. 62-103.
- Wahl N. The last graduate. *PCSO Bull* 1988;60:37-42.
- Shankland WM. *American Association of Orthodontists: the biography of a specialty organization*. St Louis: American Association of Orthodontists; 1971. p. 231.
- Lundström AF. Malocclusion of the teeth regarded as a problem in connection with the apical base. *Int J Orthod Oral Surg Rad* 1925;11:7-12.
- Dale JG. The Henry Ford of orthodontics. *J Charles H Tweed Found* 1988;16:59-76.
- Thompson W Jr. Dr. Robert H.W. Strang 1881-1982: In memoriam. *Am J Orthod* 1982;83:258-9.
- Nance HN. The limitations of orthodontic treatment: I. Mixed dentition diagnosis and treatment. *Am J Orthod* 1947;33:177-223.
- Adams WM. In memoriam: Hays N. Nance. *Angle Orthod* 1964;34:326-7.