

## A brief history of orthodontics

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### American orthodontics, 1900 to 1910

TOP

The most dominant, dynamic, and influential figure in the specialty of orthodontics was Edward H. Angle (1855-1930). He is regarded as the “Father of Modern Orthodontics.” Through his leadership, orthodontics was separated from the other branches of dentistry (e.g., crown and bridge, prosthetics), and the result was the specialty of orthodontics. Angle was the first to limit his practice to orthodontics.<sup>32</sup>

In 1878 Angle received his DDS degree from the Pennsylvania College of Dental Surgery, and in 1887 he was appointed to the chair of orthodontia in the Dental Department of the University of Minnesota. He read his “revolutionary ideas” at the ninth International Medical Congress (District of Columbia), which received wide attention. The paper was entitled “Notes on Orthodontia With a New System of Regulation and Retention.”<sup>4</sup> It was later published in the *Ohio Journal of Dental Science* (1887).

In 1888, during a lecture to the Iowa State Dental Society on his “system of orthodontia,” Angle demonstrated for the first time the expansion arch and its auxiliaries. In 1894 he was appointed the first professor of orthodontia at Marian Sims College, receiving the MD degree from that college the following year. He declared:

Not until orthodontia is studied and practiced as a distinct branch of dentistry will it ever obtain success. There should be specialists in orthodontia and the general practitioner should send to the specialist freely.

His classification of malocclusion was published in the *Dental Cosmos* in 1899. The next year, having commenced informal instruction in his office, he organized the first school of orthodontia—The Angle School of Orthodontia. He placed the following advertisement: For the fitting of teachers and specialists in orthodontia. Two short sessions are held each year, beginning November 1 and May 1. Postgraduates in dentistry and only those thoroughly ethical, received. Class limited to fifteen members. For information, address Edward H. Angle, MD, DDS, 1107 North Grand Ave., St. Louis, Mo.<sup>33</sup>

Angle stated that “the idea of a postgraduate school was forced upon me because I wished to see those who had a desire to study orthodontia better receive the opportunity to do so.” The course of instruction included art (taught by artist Edmund Wuerpel), rhinology, embryology, histology, comparative anatomy, and dental anatomy, in addition to his appliances. In 1907 Angle started a school in New York city, and then, from 1908 to 1911, his school was in New London, Conn., where 6-week sessions were offered at a tuition of \$200. In 1916 Angle moved again, this time to Pasadena, Calif., for reasons of health. >From 1924 to 1927, his course was extended for 1 year.

In 1911 he declared:

Indeed, experience has proved that the degree of our success in the treatment of cases of malocclusion depends largely on the degree to which nature can be induced to complete the development of the underdeveloped bone, and the measure of this bone development depends greatly upon the age and vigor of the patient. In other words, the work of the orthodontist should be the intelligent assisting of nature in her process of developing bone, thus making it possible for her to normally build the denture in its entirety.<sup>34</sup>

Angle had an uncompromising position against extraction. It was his credo that “the best balance, the best harmony, the best proportions of the mouth in its relation to the other features require that there shall be a full complement of teeth, and that each tooth shall be made to occupy its normal position—i.e., normal occlusion.”<sup>1,30</sup> Angle developed a classification of malocclusion based on this principle, which is still used today. He was an expert technician, a dynamic teacher, and a prime mover in making it known to dentists that orthodontics was a specialty of dentistry.<sup>1</sup>

Another distinguished orthodontist was Calvin S. Case (1847-1923). He was a graduate of Ohio College of Dental Surgery and the University of Michigan Medical School. By 1890 he began the practice of general dentistry in Chicago with special attention given to crown and bridge. Case was recognized for his skill and artistry in the esthetic aspects of the practice. In the same year he was appointed professor of Prosthetic Dentistry and Orthodontia at the Chicago College of Dental Surgery.

Case continued his interest in orthodontics, devising original appliances and the use of intermaxillary elastics (a technique for which both he and Baker were to claim originality). His special attention to the cleft palate patient was a pioneering work, and he developed a classification of malocclusion that included 26 divisions. It was his reintroduction of the concept that the removal of certain teeth will enable the correction of malocclusion and improve general health and comfort that proved to be a “bombshell.” It met with great opposition from many practitioners, especially those influenced by Angle.<sup>4</sup> In 1921 Case published his major work, *A Practical Treatise on the Technics and Principle of Dental Orthopedia and Prosthetic Correction of the Cleft Palate*.

Case was a strong advocate of the relationship of malocclusion to facial improvement. Facial improvement was a guide to treatment.

## Case/angle controversy

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Originally, Case was a genuine admirer of Angle. He advocated the Angle system at every turn and hoped to place this system before the dental profession. In fact, he gave up the general practice of dentistry because of Angle's influence. The discord started over the claim that Angle attributed the origin of the use of intermaxillary elastics to Baker, while Case thought that he should have received that credit. In fact, when Angle described this procedure, he never mentioned Case. This led to charges and countercharges between them in 1903. Case's claim was that in 1890 he started this procedure and reported it at the Chicago Dental Society and also at the Columbian Dental Congress in 1893.

The second point of contention was—and is the one usually remembered—the question of the extraction of certain teeth as a means of treatment. Angle's thesis was that “there shall be a full complement of teeth, and that each tooth shall be made to occupy its normal position.” Case defended the discreet use of extraction as a practical procedure, while Angle believed in nonextraction. However, the unexpected result of this controversy was that it convinced general practitioners that they should not attempt orthodontic treatment but should refer patients to the specialist.<sup>35</sup>

The extraction story was continued into 1911 with Martin Dewey (1881-1933) an ardent champion of nonextraction. Dewey served as professor of Orthodontics at Kansas City Dental School, the University of Iowa Dental Department, the Chicago Dental College, and the New York College of Dentistry. He gained a wide reputation as an outstanding teacher. He had started his own graduate school in orthodontics in 1911 as the Kansas City School of Orthodontia and continued it as he traveled from one city to another, ending in New York City with his death in 1933. His influence was much felt since he was the editor of the *INTERNATIONAL JOURNAL OF ORTHODONTIA* for 17 years and also the president of the American Dental Association in 1931.<sup>36</sup>

The climax of this conflict was a debate in 1911 at the annual meeting of the National Dental Association (former name of the ADA). Bitterness and animosity were rampant. It took many years after this episode for the problem to become a matter of calm and objective evaluation and respectful appreciation of various points of view, each of which has made its contribution to orthodontics.

The first decade of the twentieth century was an era of the manufacture of standardized appliances. These appliances were made as sets of various kinds mounted on cards and sold by dental supply companies. By the use of a few simple soldering techniques, the dentist could make a required “fitting,” as it was called.

William J. Brady (Iowa City) advertised as a consulting specialist in orthodontia:

Advice by mail upon regulating cases of all kinds. Appliances fitted to models with full instructions for handling from beginning to end. Instructions: send good models of both upper and lower, with thin wax bite. Give age and sex. Pack carefully. After examination, an estimate of the cost of instructions of appliance will be submitted free of charge. If satisfactory, remit the amount by bank draft or money order.

George C. Ainsworth patented a regulating appliance that used vertical tubes and the principle of the loop wire in 1904.<sup>37</sup> Varney Barnes patented the so-called Barnes posterior tube consisting of a soldered band that held several teeth together, with vertical tubing applying root pressure to individual teeth.<sup>21</sup>

Many innovative ideas and procedures were introduced. Victor H. Jackson (1850-1929) was experienced in mechanics and devised a specially designed appliance known as the Jackson crib, which incorporated the use of an auxiliary spring (finger) as an aid in tooth movement.<sup>38</sup> His appliance was one of the first “systems” of treatment to influence the development of modern orthodontics. Jackson published *Orthodontia and Orthopaedia of the Face* in 1904. In it he claimed that with his method a large number of patients could be cared for as contrasted to the highly sophisticated techniques in vogue at the time that limited the number of patients.

Another contribution was reintroduction of the maxillary suture opening by Herbert A. Pullen (1874-1938) in 1902.<sup>39,40</sup> Charles A. Hawley (1861-1929) used a celluloid sheet containing a geometric figure that, when adapted to a model, determined the extent of proposed tooth movement (1905)<sup>41</sup> and introduced the retainer appliance that bears his name (1908).<sup>40</sup>

Scientific studies included research in dental histology, particularly by Frederick B. Noyes (1904);<sup>42</sup> the influence of heredity and environment on dental structures (1905);<sup>43</sup> emphasis on rhinology, which brought the medical fraternity into cooperation (1907);<sup>40,44</sup> the study of the

deciduous dentition vis-a-vis nasodental growth, especially by Edward A. Bogue (1838-1921),<sup>45</sup> and the diagnosis of “mouth breathing,” which took on special meaning (1907).<sup>30</sup>

In 1907 Benno Lischer (1876-1959), dean and professor of dental orthopedics at Washington University Dental School in St. Louis, founded the International School of Orthodontia, and in 1912 he published *Principles and Methods of Orthodontia*. He was an advocate of early treatment. Lischer wrote: “It is my firm belief that irreparable damage is done by oft repeated advice to wait until the permanent teeth are all erupted before beginning operations for correction of malocclusion.”<sup>46</sup>

Other publications included the first separate journal entitled *American Orthodontist*, which started in 1907 and ceased publication in 1912. In 1909 C. N. Johnson (Chicago) edited a work entitled *A Textbook of Operative Dentistry*, which contained a chapter, “Orthodontia,” written by Herbert A. Pullen covering over 275 pages of text. It contained not only etiology, diagnosis, and treatment modalities but also instruction in laboratory procedures.

## American orthodontics, 1910 to 1920

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The second decade of this century is noted for several important advancements, namely, the serious study of tissue changes during orthodontic tooth movement by Albin Oppenheim (1911)<sup>38</sup> and the beginning of a major interest in diet, nutrition, and genetics as reflected in orthodontic diagnosis.<sup>47</sup> Moreover, Alfred Rogers (1873-1959) introduced the concept of myofunctional therapy (1918).<sup>48</sup> John V. Mershon (1867-1953) introduced the removable lingual arch based on the principle that teeth must be free and unrestricted for adaptation to normal growth.<sup>49</sup> Albert H. Ketcham (1870-1935), a devoted researcher, was one of the first to introduce the roentgenogram and photography into orthodontic practice.<sup>48</sup> He was a great humanitarian and, as early as 1910, established an orthodontic clinic at the Children's Hospital in Denver. He was regarded as a leader in orthodontics in the West and in his memory the American Association of Orthodontists has established the Ketcham Award to be given annually to a member in recognition of outstanding contributions to the specialty. A. LeRoy Johnson (1881-?) reemphasized the biologic concept in orthodontics: “The form of structure is the result of an interaction of function and structure, and that in the ultimate function is the determining factor in form development.”<sup>50</sup> It was the individuality of the norm that was paramount.

One of the outstanding scientific figures of this period was Milo Hellman (1873-1947). since 1912 he had turned his attention to research in the science of anthropology and its relation to the growth and development of the human dentofacial complex. Hellman sought an explanation of the development of human dental occlusion, linking the phenomenon of occlusion with the evolution of the dentition as a whole. He introduced craniometric measurements and a classification of dental development (1935).<sup>51,52</sup> His philosophy of orthodontics was based on the biologic concept and held that it was through the scientific method that the problems of orthodontics would be solved. Hellman's motto was “perfection is the goal, adequacy is the standard” (Personal interview with W. H. Krogman). He seemed to embody the plea of Eugene Talbot, who wrote in 1890: “There is now a demand for more breadth of scientific culture, and more comprehensive knowledge without which good judgment is impossible.”

The INTERNATIONAL JOURNAL OF ORTHODONTIA AND ORAL SURGERY was started in 1915. This year is its diamond jubilee year.

## American orthodontics, 1920 to 1930

TOP

The decade of the 20s was noted for the introduction of several new appliances, such as the George Crozat removable with springs (1928),<sup>53</sup> the open tube of James D. McCoy (1922),<sup>54</sup> and the universal by Spencer P. Atkinson—the appliance that was a combination of the ribbon arch appliance and the edgewise appliance. There was the introduction of stainless steel to

appliance fabrication by the Belgian, Lucien de Coster (he was the editor of *Archives of Orthodontics*). Research studies included orthodontic metallurgy, particularly by the metallurgist R. W. Williams; Paul Simon's (1883-1957) studies of facial bones that introduced the orbital-canine rule, gnathostatics (1924)<sup>55</sup>; the research of the apical base by Alex Lundström (Sweden) that made an impact in this country<sup>56</sup>; and the studies of root resorption by Albert H. Ketcham.

Under the guidance of Albert H. Ketcham, the American Board of Orthodontics was created in 1929 and incorporated in 1930.

## American orthodontics, 1930 to 1940

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In 1931 B. Holly Broadbent published an article in the first issue of the new *Angle Orthodontist* entitled "A New X-ray Technique and Its Application to Orthodontia." It was the introduction to the specialty and to dentistry of cephalometric roentgenography and, of course, cephalometric tracing and evaluation.

Broadbent devised the roentgenographic cephalometer, which is the instrument that accurately positions the head relative to the film and x-ray source. His study, supported by the Bolton family, consisted of a longitudinal study of 3500 schoolchildren from birth to adulthood. In honor of his sponsor, Broadbent established a new point of reference on the skull, known as the Bolton point.

It was during 1940 that Oren A. Oliver (1887-1965) introduced the labial arch in conjunction with the lingual and thus establishing the labiolingual appliance. Robert R. W. Strang (1881-1982) founded a postgraduate school in Connecticut and was a strong influence on the specialty for many years. His book, *A Textbook of Orthodontia* (1933), was widely used and became a guide to the "Strang technique."<sup>57</sup> The French orthodontist, Pierre Robin, had developed a new concept in 1902<sup>58</sup>—the activator or monobloc. It was reintroduced in 1932 by the Swedish orthodontist, V. Andreson, and was based on the concept that the musculature has a determining effect on growth of the dental apparatus.<sup>59,60</sup>

In 1938 Joseph Johnson (1888-1969) introduced the twin-arch appliance in which the resiliency of the double wires would be the key factor; that is, the use of these thin-gauge wires provided the gentle force for tooth movement.<sup>61</sup>

Starting in 1936, the *Yearbook of Dentistry* was published annually. It contained articles from several branches of dentistry, especially on orthodontics, and was edited by such prominent orthodontists as George R. Moore and George M. Anderson (1897-1983). It is of interest to note that such topics as adult orthodontics, orthognathic surgery, and early extraction of the permanent first molars were fully discussed in these pages by the mid-1940s.

By the end of the decade, the public was beginning to be aware of the benefits of orthodontic treatment. It was a time when socialization of medicine and dentistry threatened. Dentistry fought for continuation of the private practitioner system. Clinics for profit were organized with the concept of prepayment plans. Compulsory health insurance was continuously being thrust on the public consciousness. However, the introduction of orthodontic health care programs did not enter the picture until the 1950s.

## American orthodontics, 1940 to 1950

TOP

The next decade saw the greatest impetus to research activity. Numbered among the outstanding contributors were Wilton M. Krogman (1903-1987) who, applying the principles of physical anthropology to the dentofacial complex with craniometry and roentgenographic cephalometry, brought to orthodontics a set of criteria for growth and development of the child

and adolescent that set the standard for all future research. Although not an orthodontist, Krogman's contributions to the study of the human being from birth to maturity have had a continuing positive effect on the establishment of a scientific base for the specialty. His publications have become classics in the field, earning him a worldwide reputation. In his honor the facility in Philadelphia where he worked for many years has been named the Krogman Center for Research in Child Growth and Development.<sup>62</sup> Allan G. Brodie also contributed to the study of the growth patterns of the human head from the third month of life to the eighth year. His research was published in the *American Journal of Anatomy* in 1941.<sup>63</sup>

In the same year, Charles H. Tweed (1895-1970) introduced into the literature an "edgewise" appliance, based on the basal bone concept. His method of treatment discarded the first molars as the key units in corrective procedures. Tweed's primary efforts were concerned with the movement of the mandibular incisors to the extent necessary to relocate them on the basal ridge of bone arising from the symphysis of the mandible, giving support to the alveolar process. Once positioned, these teeth become the governing factors for the determination of the location of both maxillary and mandibular arches.<sup>30</sup> His original work may be found in Volume 2 of the *Angle Orthodontist*. Tweed was also a strong advocate of "good facial esthetics."

The research by Albin J. Oppenheim (1875-1957) in "Tissue Changes Incident to Tooth Movement" was an important contribution to the scientific knowledge in orthodontics (1942).<sup>64,65</sup>

In 1947 the Danish orthodontist, Arne Björk, published a work entitled *The Face in Profile*, which was an anthropologic and radiographic study of the effects of variations in jaw growth using facial diagnosis. It made a great impact on our basic research efforts.<sup>66</sup>

H. D. Kesling<sup>67</sup> introduced his philosophy of tooth movement by using a rubber tooth-positioning device in which the teeth were moved into a more ideal cuspal relationship after major correction had been accomplished (1945). Other significant events were J. A. Salzmann's classification of malocclusion for handicapping problems<sup>68</sup>; and the establishment by Herbert K. Cooper (1897-1978) of the Cleft Palate Clinic at Lancaster, Pennsylvania, one of this country's leading facilities for the study and treatment of the dentofacially handicapped child. By 1947 there were more than a dozen books on orthodontics. Numbered among them are texts by George M. Anderson (revised by Martin Dewey); *Practical Orthodontics* by J. A. Salzmann; *Principles of Orthodontia* by Samuel Hemley (1898-1970); *Lippincott's Handbook of Dental Practice* (edited by Louis I. Grossman), which contained a valuable chapter written by Allan G. Brodie (1897-1976); *Applied Orthodontics* by James D. McCoy; and *Prevention of Malocclusion* by Paul G. Spencer. Robert E. Moyers and Sam Pruzansky were involved in extensive research efforts describing how electromyography may be of use in the study of the effect of the musculature on occlusion. This induced further investigation in uses of the removable appliance-activators.

The need for orthodontic care was recognized by the American Association of Orthodontists in the early 1940s. It appointed consultants to the government's Children's Bureau, and in 1948, at a conference arranged by the Bureau, principles were formulated for public orthodontic programs for children.

## American orthodontics, 1950 to 1960

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The decade of the 1950s was marked by a strong socioeconomic factor affecting the practice of orthodontics. Orthodontic treatment was introduced as a fringe benefit in health plans by private industry and labor organizations. It was the time of the post-World War II so-called "baby boom." This increase in the potential number of patients created a false shortage of orthodontists. George R. Moore (1899-1952) called for extensive surveys in widely separated areas of the country for the purpose of presenting an adequate appraisal of the nation's orthodontic needs.<sup>40</sup> In fact it was of the gravest concern not only to the American Association of Orthodontists but also to the American Dental Association and its Council on Dental Education with respect to the failure to develop graduate courses quickly enough to fill this demand. Thus the preceptorship

program was in full swing; in this program qualified orthodontists acted as preceptors to selected dentists, offering on-the-job training for a period of 3 years. Each of the constituent societies of the American Association of Orthodontists had its own qualifying or examining committees for those seeking membership.

There were few technical contributions during this period. Those of importance include cephalometric analysis introduced by William B. Downs (1899-1966) in 1948. Its significance was that it presented an objective method of portraying many factors underlying any malocclusion and that there could be a variety of causes of malocclusion exclusive of the teeth.<sup>69</sup> This was followed by the work of Wendell L. Wylie (1913-1966), whose research was directed to some underlying determinants of facial pattern applied to the anteroposterior relationships, called assessment of anteroposterior dysplasia.<sup>70</sup> Other analyses were presented by C. C. Steiner (1896-1989) (1953), C. H. Tweed (1953), S. E. Coben (1955), R. M. Ricketts (1966), V. Sassouni (1969), H.D. Enlow (1969), J.R. Jarrabak (1970), and A. Jacobson (1975).<sup>71</sup>

In 1952 “Oral Orthopedics” was demonstrated at the annual meeting of the American Dental Association. This was an early introduction of the relationship of orthodontics with periodontics and other related fields. This was followed by the publication of *Textbook of Functional Jaw Orthopedics* by Grossman, Häüpl, and Clarkson.

In 1954 the entire June issue of the *Journal of the American Dental Association* was devoted to the “Management of Occlusal Problems in the Practice of Dentistry” in which the concept of functional occlusion was noted to be basic to all of dentistry. In 1957 the first Roentgenographic/Cephalometric Workshop was held.

During this period, Robert E. Moyers cautioned: “No one appliance can perform in a perfect manner all the various desired tooth movements . . . individuals champion their favorites while pointing out shortcomings of other devices . . .”

## American orthodontics, 1960 to 1970

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The 60s were the decade when the dental schools expanded the program in orthodontics not only on the graduate level but also on the undergraduate level (e.g., the University of Southern California). The preceptorship program of education was phased out. Approximately 350 orthodontists were completing their graduate training each year, thus providing a sufficient number of practitioners.

The importance of the various modes of orthodontic care delivery systems had developed to such a degree that the American Association of Orthodontists sponsored a conference on prepaid orthodontic care. The full impact of third-party payment schemes was making itself felt on orthodontic practice.

Research and technical procedures continued to expand. Raymond Begg of Australia introduced his multiple-loop light-force wire appliance, which continues to be in use today.<sup>72</sup>

## American orthodontics, 1970 to 1980

TOP

It is interesting that in a 15-year period, from 1964 to 1975, the membership in the American Association of Orthodontists—the number of qualified orthodontists in the country—increased from more than 3000 to 8600. It now became evident that there were sufficient numbers of orthodontists, and in some areas an overabundance of orthodontists resulted in many blank spaces in appointment books. In an effort to attract more patients, many orthodontists opened branch offices, or even resorted to offering other dental services. The American Association of Orthodontists launched a public relations program at a cost of millions of dollars. The climate of

practice was severely altered by the constraints put on the specialty by the Federal Trade Commission and the U.S. Supreme Court. They promulgated rules and regulations that permitted promiscuous advertising. An example: "Advertising serves to inform the public of the availability, nature, and prices of products and services, and thus performs an indispensable role in the allocation of resources in a free enterprise system."<sup>73</sup>

And what of the mechanics of the decade of the 1970s? Never before have so many different types of appliances been introduced. Surveying the list, one could, if he were to shop at an "orthodontic shopping center," find among others the following appliances: a funktionregeler, or functional regulator (Fränkel); Balter's bionator; Bimler's activator; Swartz's double plate; Klammert's activator; Stockfisch's kinetor; Andreson's removable appliance.

Dentistry, and indeed orthodontics, does not work in isolation but in scientific harmony with all health disciplines. There is an increased participation in the basic sciences—biology, medicine, and technology. The areas of abnormal orofacial growth and development and birth defects are receiving increased attention. These are but a few examples of pathways to progress for modern orthodontics.

Orthodontics finds itself directly involved in the new social outlook that has converted health from a privilege of the few to an entitlement for all. For years orthodontists have attempted to upgrade scientific and professional expertise. Now they are plagued with constraints from sources outside the specialty; continuing economic problems, threats from a variety of agencies to develop new plans for orthodontic care delivery systems, and governmental restraints have become part of our way of life.

The present state of orthodontics is in flux. There are many areas of concern that bear directly on the future of our specialty. In the area of education, such factors as a reduction in the number of graduate students because of the closing of dental schools and restrictive policies of the schools, the development of the dual-specialty practice, such as perioorthodontics and pedoorthodontics, and the encroachment of the general practitioner all play a part.

In our practices, whether solo, associateship, partnership, or group, there are the present concerns for the increasing costs of insurance programs, the promotion of advertising in all media by orthodontists and profit-oriented companies and organizations, and the invasion into the specialty of practitioners whose only qualification is a "short course" promoted by dentists for profit. There is also the organization of splinter groups into formal societies seeking recognition.

Changes in the areas of practice include a resurgence of treatment of the adult patient and its concomitant expertise as the public becomes aware of personal dental health and esthetics. Included also are the invasion of areas that had not received much attention in the past, namely, orthognathic surgery and the problems associated with the temporomandibular joint.

Orthodontics has achieved the status of a recognized specialty of dentistry because of a long period of craftsmanship and professional expertise. Our objective has always been to provide for the preservation of dental health through the conservation of oral structures and the maintenance of dental function. Orthodontics, and indeed all of dentistry if it is to survive as a profession, must continually reexamine its history and find relevant and significant ideals to meet the crises of today.

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