

# Orthodontics in 3 millennia. Chapter 12: Two controversies: Early treatment and occlusion

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From the beginning, orthodontists have been faced with the decision of when to start treatment. Until the late 20th century, this decision was based on clinical observation, the influence of strong leaders, and (after midcentury) the results obtained by what Europeans called “functional jaw orthopedics.” Recent findings questioning the efficacy of early treatment have forced orthodontists to ask themselves whether their decision to “start now” is being influenced too heavily by practice-management considerations. Our concept of occlusion has evolved from a static to a dynamic one. Emulating their prosthodontist brethren, orthodontists have attempted to reproduce jaw movements with the use of articulators, but the popularity of these devices has been declining in recent years. (*Am J Orthod Dentofacial Orthop* 2006;130:799-804)

## EARLY (MIXED DENTITION) TREATMENT

### Definition

The concept—and the necessity—of early treatment is controversial. Some define it as removable or fixed appliance intervention in the deciduous, early mixed, or midmixed dentition. Others place it in the late mixed dentition stage of development (before emergence of the second premolars and the permanent maxillary canines).<sup>1</sup> The American Association of Orthodontists’ Council of Orthodontic Education defines *interceptive orthodontics* as “that phase of the science and art of orthodontics employed to recognize and eliminate potential irregularities and malpositions in the developing dentofacial complex.”<sup>2</sup>

### Clinical period

Not only is there disagreement as to what early treatment is, but also, for over 200 years, orthodontists have not been able to agree on its effectiveness. Like the extraction pendulum, the trends in mixed-dentition treatment have swung back and forth.

Joseph Fox (1776-1816, English), in his *Natural History of the Human Teeth* (London, 1803), recommended that treatment be started “before 13 or 14 years of age, and as much earlier as possible.”

Angle<sup>3</sup> advocated the institution of orthodontic treatment “as near the beginning of the variation from the normal in the process of the development of the dental apparatus as possible.” Pretty much in line with the beliefs of their mentor, James and John McCoy

advocated treating a malocclusion when it first appeared, no matter how early.

Mershon and Hellman were among the first to advise that treatment might be undertaken too early if serial observations of the dentition are not made to determine abnormal development.

Before cephalometrics, it was believed that orthodontic appliances influenced growth and facial patterns. According to Kloehn,<sup>4</sup> children were often treated “for 6 or 8 years under the impression that we were stimulating growth of the mandible and facial bones.”

Use of cranial base superimposition led to the erroneous belief that the maxillary molars cannot be moved distally. Brodie concluded that the pattern of growth is unchanging and immutable. For many years, this belief stifled the concept of early growth modification.<sup>5</sup> Although Nance<sup>6</sup> advocated that “active treatment in the mixed dentition period is desirable only in Class III cases, crossbites, and Class II cases wherein facial appearance is markedly affected,” he freed orthodontists from their hesitancy to treat patients before the development of the adult dentition.<sup>7</sup>

Eby<sup>8</sup> was among the first to point out that, since there is a range of difference between chronologic and physiologic age, and since a person’s growth rate varies, the patient’s age is an indefinite basis for establishing diagnosis and treatment.

Bercu Fischer<sup>9</sup> stated (1941) that “early treatment is always desirable because. . . tissue tolerance and the power of adjustment of the tissues are at or near their maximum. The optimum time to start treatment is when the roots of the temporary molars are about two-thirds resorbed.”

Tweed<sup>10</sup> warned against taking early treatment too

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lightly: "The treatment of malocclusions occurring in the mixed dentition stages of growth and development is a complicated and serious undertaking unless the orthodontist is thoroughly qualified and unless he has prepared a complete set of records." He recommended eliminating abnormal swallowing and tongue habits as causative factors and using a Kloehn or similar headgear as needed throughout patients' growth periods.

Taking a swipe at straight-wire advocates, Ricketts<sup>11</sup> argued for starting treatment at an early age to obviate or simplify full treatment at a later stage, as opposed to adherents of straight wires who must restrict their options by waiting until full eruption. "Bioprogressive practitioners rarely begin orthodontic treatment with a leveling arch," he said. "They usually aim first at. . . orthopedic correction, controlled arch length increase, and deep bite correction by anterior tooth intrusion."

Assuming a more cautious stance, Moyers<sup>12</sup> warned that "there is no assurance that the results of early treatment will be sustained and that 2-phased treatment will always lengthen overall treatment time. Early treatment not only may do some damage or prolong therapy, it may exhaust the child's spirit of cooperation and compliance."

### Academic period

While American orthodontists were arguing the merits of early treatment, Europeans were exploring various growth-modification alternatives based on the theory of functional jaw orthopedics. After this approach was introduced into North America by the likes of Harvold and McNamara, further justification for early intervention was found. However, subsequent investigations showed that there is little support for the notion that early functional appliance treatment reduces both the need for extraction and the length and complexity of a later fixed-appliance phase.

In a study comparing 1-stage and 2-stage Class II nonextraction treatments, Livieratos and Johnston<sup>5</sup> minced no words when they concluded that the 2 groups underwent skeletal changes that left them essentially indistinguishable at the end of treatment. Therefore, for most such patients, the choice of treatment might very well constitute a practice-management, rather than a biologic, decision. Gianelly<sup>13</sup> agreed: "There are few, if any, benefits that are unique to and dependent on earlier treatment. For more than 90% of patients, all treatment goals can be accomplished in 1 phase of treatment started in the very late mixed dentition."

### Recent concepts

The 1997 Workshop Discussion on Early Treatment cautioned that "iatrogenic problems may occur with early treatment such as dilaceration of roots, decalcification under bands left for too long, impaction of maxillary second molars from distalizing first molars, and patient 'burnout.'"<sup>14</sup>

A recent study at the University of North Carolina concluded that "for children with moderate to severe Class II problems, early treatment followed by later comprehensive treatment does not produce major differences in jaw relationship or dental occlusion compared with later 1-stage treatment."<sup>15</sup> Ferguson<sup>16</sup> must have raised some eyebrows when he wrote that 2-phase treatment "is merely a means to capture patients for orthodontic treatment and prevent them from going elsewhere." Bowman<sup>17</sup> believed that today's trends are to treat earlier and often. He ridicules braces for baby teeth and asks, "Can in utero treatment be far off?" Let's hope so.

Turpin<sup>18</sup> summarized the results of the 2002 International Symposium on Early Orthodontic Treatment. Class II correction—a delay in treating Class II problems—might not compromise treatment results, and it can increase efficiency. Patients with severe skeletal disharmony, excessive vertical development, and lack of cooperation obviously make it more difficult to achieve all objectives when treatment is limited to a single phase.

A delay in starting treatment allows for self-correction of open bites in some patients, but this is unpredictable. Incisal contact is unlikely in most of these patients in the long term.

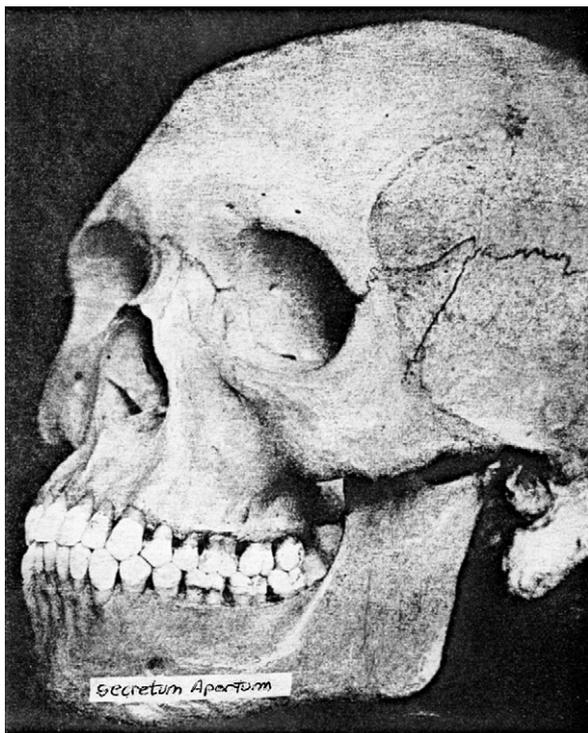
Examine early to manage arch-length problems, including the need for disking deciduous teeth and selected extractions in some patients. Start treatment before the loss of the deciduous second molars, if possible.

To correct Class III disharmony, diagnose and consider early treatment because of the unpredictability of growth. Don't expect total success in most patients in the long term. If disharmony is severe, delay treatment until you have proof that growth has ceased and include orthognathic surgery as a treatment option.

Diagnose impaction and transposition and consider the need for early treatment because of the severity of complications that can be caused by unerupted and impacted teeth.

### OCCLUSION

In 1972, Graber<sup>19</sup> proposed dividing the history of occlusion into 3 periods: (1) fictional (before 1900), (2) hypothetical (1900-1930), and (3) factual (after 1930).



**Fig 1.** Angle's model of ideal occlusion was "Old Glory."

### Fictional period

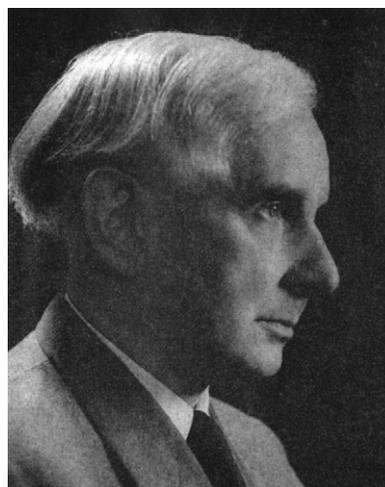
Early practitioners' concepts of occlusion were vague, at best. Terms such as "antagonism," "meeting," and "gliding" of teeth were used.<sup>19</sup> Orthodontists were primarily concerned with tooth alignment, or "regulation," as if each arch were a thing in itself. It remained for Angle to devise the classification that, despite Lischer's<sup>20</sup> efforts to establish the concepts of *mesio-occlusion*, *distocclusion*, and *neurocclusion* in lieu of Angle's Class I, Class II, and Class III as descriptors of jaw relationship, persists to this day.<sup>3</sup> His other criterion was the "line of occlusion," which was intended to govern the length, breadth, and curve of the arches; the pattern of teeth; and their positions relative to skeletal parts. Whether Angle was referring to a line through the contact points, the centers of the crowns, or the buccal surfaces has not been made clear.<sup>21</sup>

### Hypothetical period

Cryer<sup>22</sup> also criticized Angle for using an ancient skull that he called "Old Glory" (Fig 1) to demonstrate ideal occlusion when there was no way this prognathic set of jaws could ever fit into the straight profile of Apollo Belvedere (Angle's paragon of a profile). The skull had been presented to Angle by Richard Summa



**Fig 2.** Summa introduced Angle to archaeological treasures of mid Mississippi Valley.



**Fig 3.** Simon's concept of gnathostatics, though controversial, helped make orthodontists more conscious of basal relationships.

(Fig 2), one of Angle's first students and an amateur archeologist. Summa was influential in organizing the American Society of Orthodontists and founding the first orthodontic journal, *The American Orthodontist*. During World War II he was forced to resign his professorship at the University of Iowa because of his German birth.

Case<sup>23</sup> accepted Angle's hypothesis of the constancy of the first molar but rejected the idea that "normal occlusions and normal facial lines are inseparable." Simon<sup>24</sup> (Fig 3) tried to broaden the concept of occlusion by relating the teeth to the rest of the face and the cranium, using the orbital, Frankfort, and median



**Fig 4.** Stallard's work in gnathology bridged prosthodontist's and orthodontist's conceptions of occlusion.

sagittal planes for orientation (gnathostatics). He prophesied in 1922 that some day orthodontists would look at occlusion from the functional standpoint. At least some orthodontists were starting to tell their patients to "close" instead of "open."

Other critics soon found that Angle's description of normal inclined plane relationships alone did not satisfy the dynamics of function and the role of dental articulation, especially the role of the canine. Angle's protégé, Allan G. Brodie,<sup>25</sup> further broadened the concept of occlusion by recognizing the contributions of the teeth to the entire kinetic chain of head posture.

#### Factual period

In the 1930s, the static concept of occlusion gave way to one that was more dynamic. In 1924, Beverly B. McCollum, considered the "Father of Gnathology," discovered the first positive method of locating the hinge axis, a milestone in dental research, and, in 1926, founded the Gnathological Society. His concept of occlusion—along with that of Stallard, Stuart, and others—considered cusp contact during functional movements. In 1931, Stuart and McCollum developed the first semiadjustable articulator. However, it remained for Ronald Roth to popularize their use in orthodontics in the 1970s.

Harvey Stallard (1888-1974) (Fig 4) graduated from the Angle School in 1922—a full 20 years after his wife, Guilhermena Mendell, had done so! Soon after opening their office in San Diego, Calif, he began working with McCollum and Charles E. Stuart in gnathology (a term that he proposed). In 1927, he

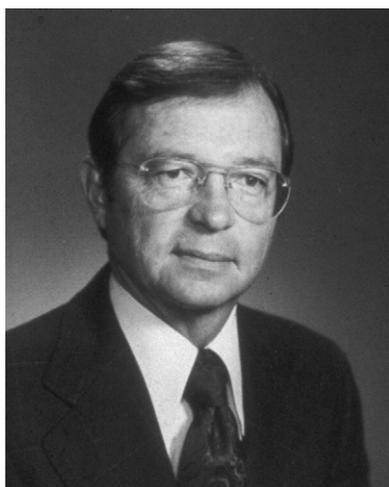


**Fig 5.** Thompson set standards for functional occlusion, mandibular movement, and rest position.

recognized that the teeth dictate the arc of closure and the occluded position of the mandible. Although he was an admirer of Angle, he did not accept Angle's premise that, if the teeth are placed in proper occlusion, the result would sustain itself. He was also opposed to "balanced" occlusion, defined as follows: during the entire lateral movement, posterior teeth on both the working side and the nonworking side are in contact. Early workers in the field of occlusion assumed that this type of occlusal construction was necessary to achieve the best results for both complete dentures and the natural dentition.<sup>26</sup>

Drawing on ideas advanced as early as 1919 by Nagao and in 1924 by Shaw, D'Amico further questioned the traditional concept of functional occlusion, believing that, when teeth are subjected to horizontal vectors of force, traumatic occlusion occurs, and periodontal tissues are destroyed. According to his theory of "cuspid rise," these teeth function during mastication to guide the mandible into centric relationship to prevent the contact of the remaining opposing teeth until they meet in centric occlusion.<sup>27</sup>

Thompson (Fig 5) and Craddock<sup>28</sup> advocated analysis of malocclusion from the rest position of the mandible instead of from the closed jaw relationship and favored the terms "functional analysis" and "static analysis" to distinguish these positions. He also concluded that not only is physiologic rest position highly constant (as did Brodie), but also it cannot be permanently altered by prosthetics, operative dentistry, or orthodontic procedures.<sup>29</sup> The post-World War II period witnessed many breakthroughs in dentistry. De-



**Fig 6.** Origins of “straight wire” are in Andrews’ 6 keys to occlusion.

tailed impression materials, high-speed cutting, and wider use of anesthesia brought an awareness of the proper treatment and preservation of occlusion, and oral rehabilitation had almost become another specialty. The importance of the temporomandibular joint, formerly a blind spot, was shown in the cephalometric laminagraphy of Ricketts and the electromyographic studies of Perry. This brought pressure on the orthodontist for finer detail in finishing than had usually been accepted.<sup>25</sup>

No one better spelled out those details than Lawrence F. Andrews<sup>30</sup> (Fig 6) when he presented to the specialty the 6 characteristics he considered to be present in normal occlusions. After studying 120 untreated patients having “ideal” occlusions, straight teeth, and pleasing smiles, Andrews found that they all had acceptable molar relationships, crown angulations (mesiodistal tip), crown (labiolingual or buccolingual) inclinations, and occlusal planes, but they lacked rotations and spaces. These 6 “keys” led directly to the straight-wire appliance and a supply company that grew out of Andrews’ garage.

In the 1970s, Ronald H. Roth<sup>31</sup> (1933-2005) suggested that orthodontists should embrace the principles of gnathology that had long been held by eminent prosthodontists and restorative dentists to establish a retruded, posterior-superior “seated” centric relation position when the interdigitating occlusion was in centric occlusion. He suggested that its attainment would mitigate the development of temporomandibular disorders.<sup>32</sup> He is credited with integrating widely accepted principles of occlusion into an efficient, predictable system of orthodontic diagnosis and treatment.

Roth<sup>33</sup> spent 40 years raising the awareness of the specialty in the importance of occlusion and proper condylar position, and was the driving force behind numerous gnathology organizations. His goals of ideal functional occlusion included condyles seated in centric relation, 4 mm of vertical overbite, 2 to 3 mm of overjet, and canine lift. (Obviously, “Old Glory” wouldn’t qualify.) Although not accepted by all orthodontists, by the 1990s, Roth’s philosophy of bridging orthodontic and restorative treatment objectives had made significant inroads into major graduate programs.

Eighty years after McCollum and Stuart devised the first articulator, orthodontists still can’t agree on the necessity of mounting cases. As recently as 10 years ago at the University of Southern California, Harry Aronowitz<sup>34</sup> admonished that “orthodontists of the ’90s are aiming high-tech tooth-moving mechanics toward occlusal objectives that, in many ways, have not changed appreciably since Angle’s time. . . . [They] are still evaluating occlusion with handheld study casts that can give only a static appreciation of occlusion.” Reminiscent of the edgewise-universal feud between northern and southern California in the 1930s and 1940s, Kasrovi et al<sup>35</sup> of the University of California, San Francisco, wrote: “There is no scientific evidence to show whether such a concept [dynamic occlusion] is valid. In such circumstances, one must be guided by clinical judgment.”

Although the history of occlusion is inextricably entwined with that of the temporomandibular joint, the latter will be discussed in a subsequent chapter.

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