

# The Four Premolar Controversy

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How did the idea of premolar extraction get started? In the late 1800s, Edward Hartley Angle was driven by the idea that proper occlusion would allow the maintenance of 32 straight teeth and eventual basal bone development to complete the human destiny. Although he extracted teeth at first, he later was emphatically against premolar annihilation.<sup>1</sup> His rival, Calvin Case, joined by a former student, Martin Dewey, frequently debated the subject at dental meetings.<sup>2</sup> All three men were influential in the field and published textbooks, but Angle remained uppermost in the minds of professionals because of his classification of malocclusion, which remains in popular usage today. Angle's nonextraction philosophy remained strong until another of Angle's students, Charles Tweed,<sup>2</sup> made a major impact by reversing several hundred nonextraction cases and presenting them at a major dental meeting around the 1940s. He became the deciding influence on the profession to move back toward the extraction of four first premolars, a philosophy which still prevails today. One of Tweed's characteristic techniques was to spend a year or more torquing the molars for anchorage so that they performed like tent stakes angled in the ground against the pull of the tent. His textbook and teaching earned his philosophy the title, "Tweed school of thought."

Next came John Pritchard, who gave a presentation<sup>3</sup> that created a stir against Tweed's extraction trend. He maintained that a high percentage of extraction cases were dismal failures because it left spaces, pushed faces back, and created poor occlusion. Then John Witzig and Terrance Spahl complemented his work when they published a three-volume set on orthodontics<sup>4</sup> and nicely

described what they call the "Great Second Molar Debate." This work points out a long list of weaknesses regarding the four premolar method and claims a relief of problems by removing second molars instead. Most of what Witzig and Spahl did was not only healthy for the profession but started a much needed reversal of this trend of premolar extraction. Unfortunately, they ignored the cornerstone of gnathology, mounted casts in centric relation. They also categorically denied the correctness of centric relation and, in fact, went so far as to say that "pushing the jaw too far back" is the cause of temporomandibular joint disorders. Graber<sup>5</sup> also described posterior superior displacement of the mandible caused by prematurities of occlusion. This idea started long ago and ignores the fact that the mandible cannot be pushed too far back, but the anterior teeth can be overcoupled.

## Reasons for Extraction

Why are premolars extracted for orthodontics? The obvious reason most frequently given is: "There isn't enough room." Even before orthodontics became a specialty, this answer was foisted on the innocent public. Angle said:

It is a very common and typical case of the first class, demanding, according to the plan of treatment hitherto universally followed by the *old school*, the sacrifice of teeth, for it was reasoned that in such cases the jaws were too small to accommodate the teeth, usually supposed to be on account of the inheritance of the small jaws of one parent and the large teeth of the other; therefore the supposed logical treatment was to

help Nature in overcoming her blunder of fashioning a small jaw for the reception of the full complement of well developed teeth, by reducing the number of teeth—two or four of the premolars being sacrificed. ...<sup>1</sup>

The second reason is to correct a bimaxillary protrusion. When all other criteria are met, especially organic occlusion,<sup>6</sup> it is then a valid reason. The problem is that bimaxillary protrusion is rare. What is more common are cases that do not have proper lateral development. In other words, they are short of Pont's index.<sup>7</sup> The author has seen two legitimate cases of bimaxillary protrusion in 45 years of practice.

The third reason for extracting premolars is the need to correct interarch discrepancy. This seems to make some sense if two maxillary premolars are extracted only in a retrognathic mandible or two mandibular premolars in case of a prognathic mandible.

## Results of Premolar Extractions

*Dished-in face*<sup>8</sup> (Fig 1). There are many degrees of this problem, and this example, of course, is one of the worst. It comes from the way the case was treated. If the molars can be brought forward without tipping the anteriors back or collapsing the arch in some fashion, then the esthetics would be much better. The normal premolar closure technique does a little of both, which is expected given the anchorage problem.

*Relapse* (Figs 2 and 3). There are two types: Type one: The teeth tend to crowd back like the original malocclusion. Type two: Spaces open up, the opposite of type one. Flattening the arc of the arch to close the extraction site encroaches on the tongue's space (cyclic space). Then, instead of a U-shaped arch, a V-shaped arch is created. This crowds the tongue, which is a powerful muscle and is still the same size.

*Compromise of the temporomandibular joint (TMJ)*. Because of the extractions, the treatment plan involves closing the space and moving the canines back, closer to the TMJs. It is almost impossible to move the canines in this fashion without tipping

them in as well. This automatically overcouples them. Any time the space is shortened between the work and the fulcrum, the power of the system is increased and the joints are strained.

*Loss of vertical dimension*. As teeth are leaned in toward the tongue, their height decreases. This closes the vertical dimension (Fig 4).

*Weak or lost contact points*. Pritchard<sup>9</sup> says 33% of the 100 patients he surveyed had open contacts. (See type two relapse above.)

*Reduced smile width*. When the teeth change from a U-shaped arch to a V-shaped arch, the smile will be much narrower (Fig 5).

*Nose and/or chin appear longer and bigger*. This is related to the same problem of tipping the anteriors inwardly to close the spaces. (See "dished-in face" above.)

*Tongue biting and lack of space*. The tongue soon learns to stay out of the way, but the accident rate is still higher. (See relapse above.)

*Four missing teeth*. This does not sound bad when the orthodontist explains that these teeth are almost "extra," and if the premolars are already pushed out of the arch, parents easily give in to their removal, believing that the professional knows best. But when Crozat arch development is explained to them, the idea of extraction becomes ludicrous.

*Teeth leaning inwardly*. This was discussed in "loss of vertical dimension" above. This problem is grossly overlooked by orthodontists. Not only is it unstable for retention and less functional from an engineering standpoint (overcoupling), it is also very unattractive. Casts of finished extraction cases look good because the buccal cusps are tight against each other, but what are the lingual cusps doing? (Fig 6).

## Case Study

A young lady, Bridget, presented on January 10, 1992. She was treated 9 months with Crozats and 10 months with fixed appliances. Her treatment was completed 19 months later, without extraction, after she had been advised by at least three orthodontists to have four premolars removed and 30 months of treatment.



Fig 1 Nose and chin size are overemphasized.



Fig 2 Relapse type I.



Fig 3 Relapse type II.

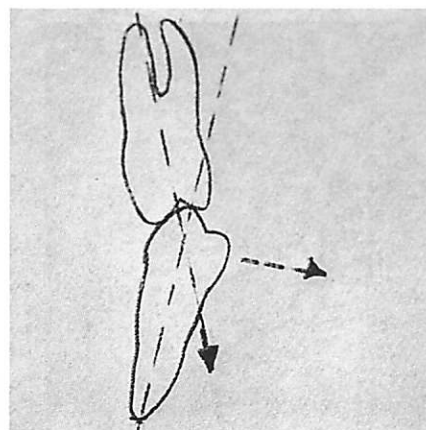


Fig 4 Teeth leaning inward tend to relapse inward and close the bite.



Fig 5 Narrow smile.



Fig 6 Teeth leaning inward.



Fig 7 Mandibular cast of Bridget's preorthodontic case.

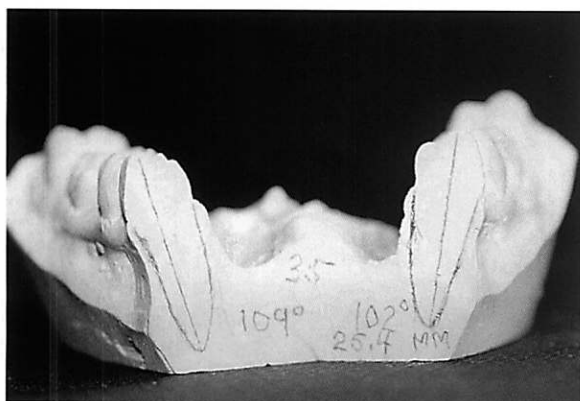


Fig 8 Mandibular cast of Bridget's postorthodontic case.

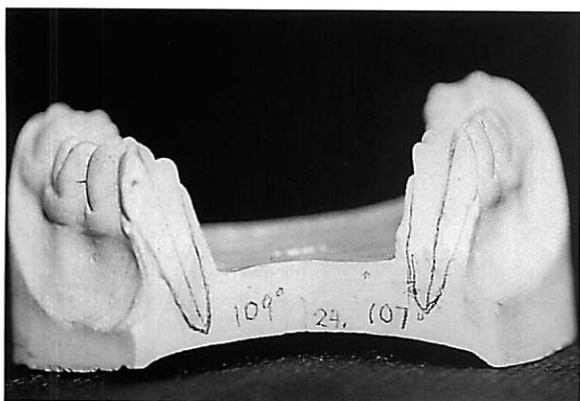


Fig 9 Cast of Charles Stuart's ideal demonstration case no. 1581.

After completion of her treatment, the procedures were investigated in light of the controversy about nonextraction treatment. In the pretreatment mandibular cast a parallel cut was made along the long axis of the first premolar to determine at what angle to the occlusal plane this tooth stood. With a simple protractor placed across the occlusal surface of the two first premolars and an approximate outline of the root penciled on the cast, angles were measured at 90 degrees for the left first premolar and 93 degrees for the right first premolar (Fig 7). Then the same cut was measured in the posttreatment cast. The angles were 102 degrees and 109 degrees, respectively (Fig 8).

To compare those angles with something that was considered "normal," the cast (1581), (Charles Stuart considered it to be the most ideal organic occlusion), was cut in the same way Bridget's cast had been cut. The numbers were almost the same, 107 degrees for the left first premolar and 109 degrees for the right first premolar (Fig 9). This means that Bridget's posttreatment casts showing premolars standing at an angle greater than 90 degrees (seemingly leaning outward) were actually correct. That meant that the original cast showing angles of 90 and 93 degrees was incorrect. The distance between the root tips of all three casts was the same. This meant that the center of rotation was at the end of the root.

This discovery was the final and most conclusive evidence supporting the contention that premolar annihilation is wrong. It became more apparent that cephalometric radiographs<sup>9</sup> can be and are misleading. Lateral head films do not record this premolar angle, nor do frontal films or tracings.<sup>10</sup> An easy way to measure this angle must be developed to have valid preorthodontic records and a shift away from extraction orthodontics.

Are there legitimate reasons for four premolar extractions? Maybe, but rarely are they found. The criteria listed by Witzig and Spahl<sup>11</sup> are:

1. On or close to Pont's index.
2. Severe crowding in both arches.
3. Severe bimaxillary protrusion.
4. Skeletal development equal to or greater than normal.

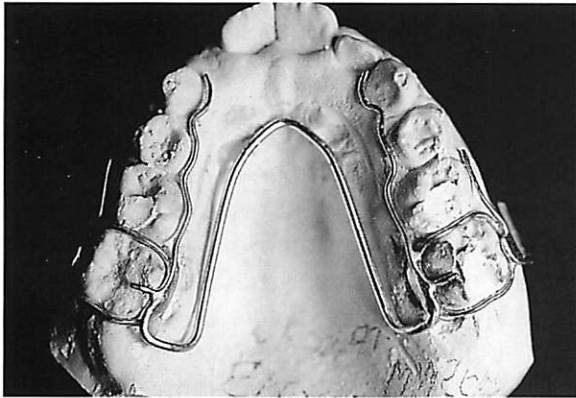


Fig 10 Functional appliances work from the inside of the teeth to expand the arch.

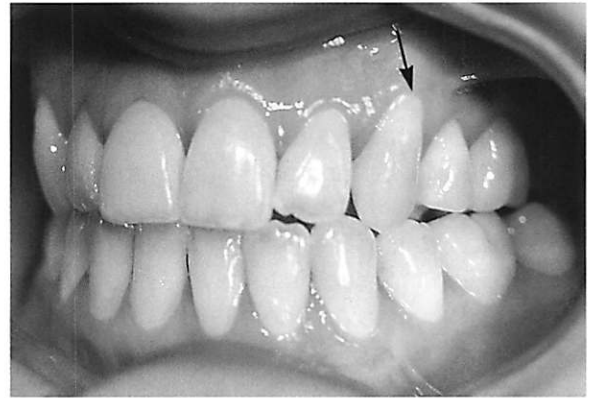


Fig 11 Recession can occur if one tooth is moved too far.

5. A tooth size discrepancy beyond normal or correctable limits.

## Myths about Nonextraction Orthodontics

*Arches cannot be expanded.* Answer: They can be if the proper tools are used. Crozats are the author's choice, but rapid palatal expanders and all the functional appliances work. They work from the inside of the teeth and not from the outside (Fig 10).

*Teeth will be moved out of bone.* Answer: Teeth are moved in groups, not individually. One tooth moved too far can cause recession, but usually when that happens, forces are too great and not equally distributed (Fig 11). The alveolar process moves with the teeth as they are tipped. When teeth are pushed and tipped toward where Nature intended them to be, the bone follows.

*An expanded arch cannot be retained.* Answer: The face at 12 or 14 years of age is not finished growing. The retention issue is mostly involved with whether organic occlusion is sought. The most common mistake is a centric relation to centric occlusion slide. This alone reduces the stability of the finished treatment.

*Expansion orthodontics takes longer.* Answer: Extraction requires at least 2.5 years to close the spaces. The average treatment with Crozat expansion is about 1 year. The first phase of Crozat expansion takes about 4 to 6 months; then fixed appliances (brackets) to rotate, level, and finish take another 6 months. A longer case took about 3 years for a 40-year-old man with unilateral cross-bite, class II malocclusion with major crowding, open bite, and a maxillary right central incisor that was found to be ankylosed after 7 months had been spent trying to move it.

*Cephalometric tracings are reliable for extraction diagnosis.*<sup>5</sup> Answer: Never should their use be the only criteria, because the width is excluded, particularly in the premolar area, where the arc of the arch should be rounded out to a U shape. There is a need in premolar extraction cases to flatten the arch, which often ends up with almost a straight line from the distal of the central incisors to the second molars. Flattening this segment of the arch helps to close the excess loss of tooth structure without tipping the incisors back too far.

Review of the literature<sup>9</sup> reveals many different cephalometric analyses: The Steiner analysis, one of the most common, gives an in-depth criteria for the

relationship of maxillary and mandibular incisors. The Sassouni analysis emphasizes vertical and horizontal relationships. The Harvold and Wits analyses describe and emphasize the degree of jaw disharmony. The Ricketts analysis attempts to locate the chin in space and relate the dentition to the profile. The McNamara analysis is another attempt to improve on what has gone before. Downs, Ackerman, and Proffit have also contributed to this mass of confusion that seems to have a real grip on the profession. It seems no one has the real answer or understands what is missing.

The mainstream orthodontist feels compelled to use cephalometrics defensively because it is thought to be the "state of the art." It helps only if the practitioner realizes that the width and the arc of the arch are missing from the equation. Ricketts et al<sup>10</sup> try to correct the lack of width by adding a frontal cephalometric tracing. The tracings show some important measurements but leave out the critical width in the premolar area.

*Expanding the teeth does not develop the bone (alveolar process) under the teeth. It only tips the teeth.* Answer: Even if teeth are tipped outwardly, the occlusal forces stimulate arch development. This was first shown by Angle in his now-famous "Huning" case.<sup>1</sup> He showed a maxillary cast of a finished case; then 2 years later a maxillary cast of the same patient showed an apparent improvement to the angle of the teeth. Angle thought the improvement came from the continuous growth and development of the bone. The author agrees with this contention bolstered by his experience attempting to keep all the permanent teeth in the arch and develop basal bone.

For example, Ian presented on June 5, 1991. Treatment was started with Class II elastics. By August 26, 1991, the Class II relationship was half corrected. By October 24, 1991, the expansion was complete, and the Class II relationship was reduced to a normal Class I. Inactive treatment over a period of 2 years included Crozats worn with no expansion (passive) and a gradually decrease in the frequency of Class II elastics until none were used. Treatment was discontinued until October 1, 1993, when all the permanent teeth had erupted; then all teeth except the second molars were bracketed. Treatment

continued until April 19, 1994, when brackets were removed and retainers placed. His active treatment time totaled slightly less than 12 months (Figs 12 to 19).

Another remarkable discovery occurred when the root angulation of his molars before and after the arch development was analyzed. These pictures tell the story of tipping teeth versus moving them bodily. Maxillary molars can be moved bodily, but mandibular molars can only be tipped. This is probably because the midline suture opens up with the maxilla, and there is none below. Mounted casts rather than cephalometric radiographs give reliable diagnostic information (Fig 20).

## How to Fix this Problem of Premolar Extraction

1. Dentistry needs to agree on occlusion. No one except gnathologists have properly described it. Organic occlusion<sup>6, 12-15</sup> is the most physiological, natural occlusion. The more it is studied, the more self-evident it becomes. But dentists want to squabble about something and tend to think they are experts by virtue of a degree. The lack of any definitive agreement among orthodontic authors is emphasized in this literature (Fig 21).

Think of the division in dentistry about one aspect of occlusion: centric relation. This controversy could occupy a complete book, but suffice it to say none of the orthodontic books pictured here speak of the importance of centric relation. Andrews<sup>16</sup> is the only author who has attempted to specifically designate what occlusion requires. Unfortunately, his six keys to optimal occlusion leave out centric relation, immediate anterior disclusion, and cusp-fossa relation. The rest of these authors do not even bring up the subject, much less take a stand, with the exception of Witzig and Spahl, who categorically deny its benefits. The lack of mounted casts among orthodontist testifies to this statement.

2. Mount all orthodontic casts. Dr Larry Andrews is designing a plastic articulator to be used for

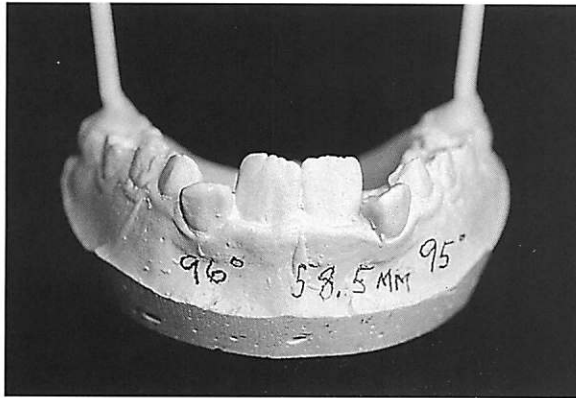


Fig 12 Ian's pretreatment maxillary cast.

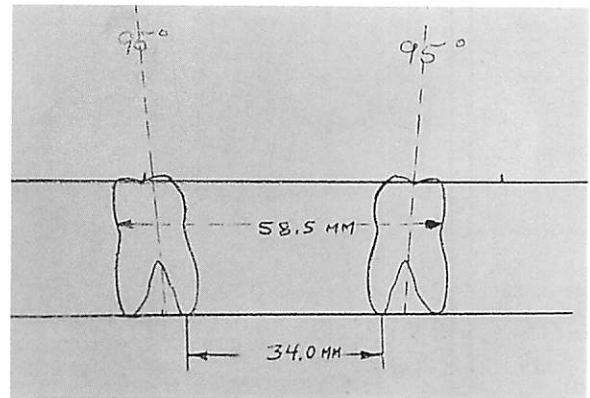


Fig 13 Diagram of Ian's maxillary first molars shown in Fig 12.



Fig 14 Ian's posttreatment maxillary cast.

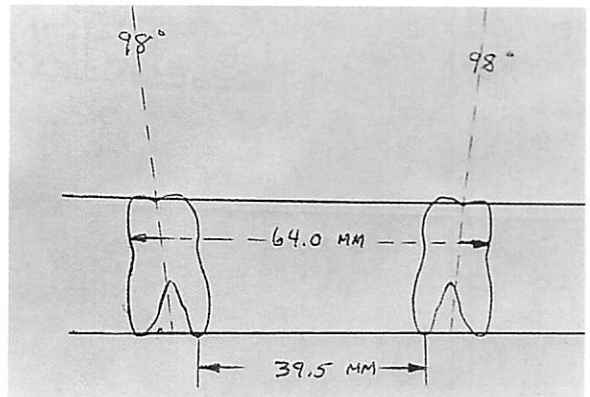


Fig 15 Diagram of Ian's maxillary first molars shown in Fig 14.

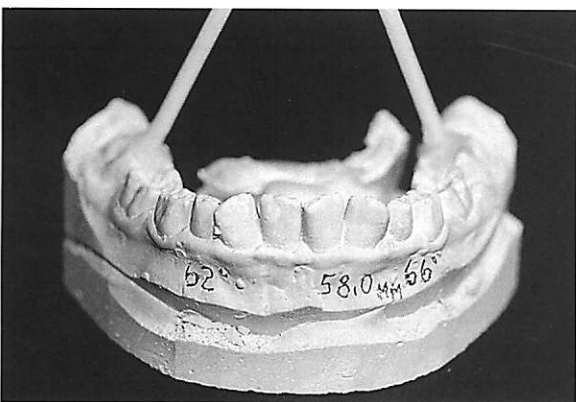


Fig 16 Ian's pretreatment mandibular cast.

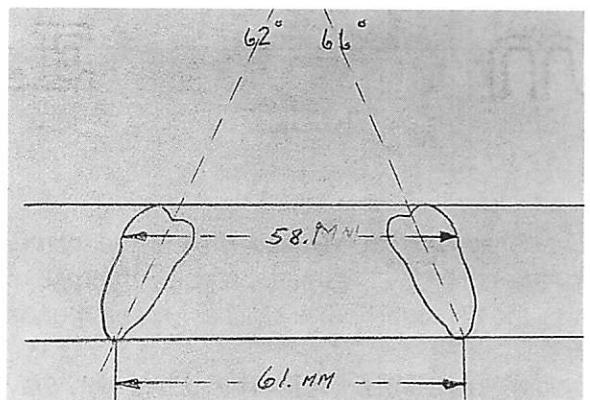


Fig 17 Diagram of Ian's mandibular first molars shown in Fig 16.

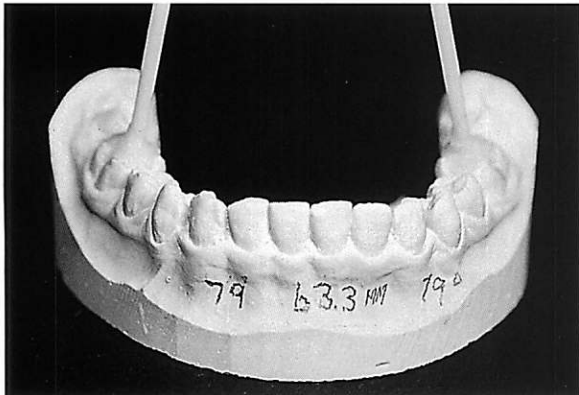


Fig 18 Ian's posttreatment mandibular cast.

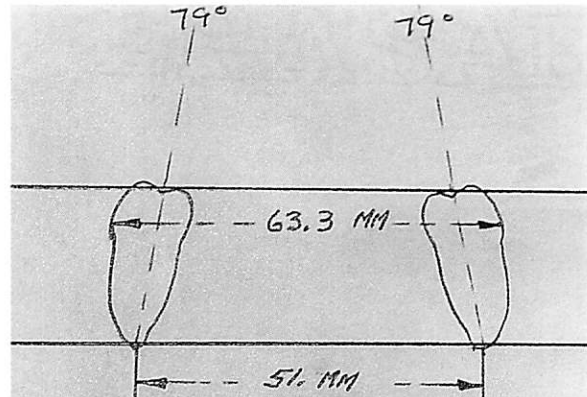


Fig 19 Diagram of Ian's mandibular first molars shown in Fig 18.



Fig 20 William McHorris' mandibular tooth analyzer by Whip Mix.

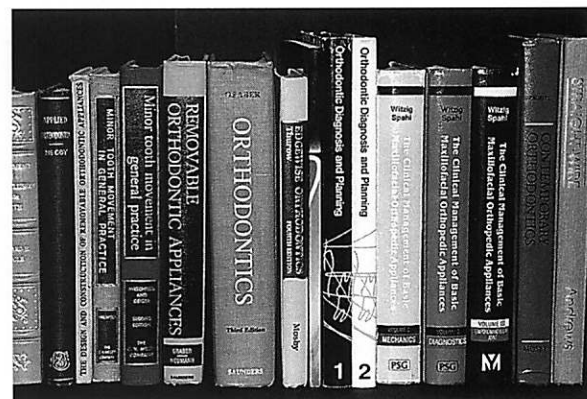


Fig 21 Major orthodontic textbooks.

orthodontists to mount casts. In the meantime, there are plenty of semiadjustable articulators that can be used. The author recommends Whipmix.

3. Measure Pont's index<sup>7</sup> first. This is the only way of assessing the shape of the arch in the premolar area. This, of course, is an approximate guide and not absolute, but this information must take precedence over cephalometric analysis, for example. When the width of the premolar

area is ignored, all is lost. This simple measurement is a powerful weapon in diagnosis of malocclusion. Some orthodontists gather strength of conviction to extract by listing all the complicated cephalometric readings. They do this to disguise and justify the fact that fixed appliances do not expand arches very well.

4. Measure the angles of all teeth, not just the anteriors, although there is no good way to do this presently.



5. Change the average program of orthodontics to a two-phase treatment program. Crozats, in phase one, expand and develop maxillary and mandibular arches. Move into the second phase using the conventional brackets to rotate, level, and finish the case. Let the orthodontic schools simplify treatment by teaching Crozat therapy.
6. Finish most cases with occlusal corrections.<sup>8, 19</sup> Adults especially need this treatment. It can be used routinely in all cases with the possible exception of a very unworn dentition at ages 10 to 12. These cases seem to settle in nicely to complete organic occlusion, but anyone with any wear and/or restorations needs the correction. This is a dangerous procedure left in the hands of a untrained person, and this recommendation is made with the strict admonishment to all orthodontists to become trained first. This procedure must follow strict principles of minimal reduction of tooth structure, always enhancing the anatomy rather than flattening it. If the case cannot be completed with minimal tooth reduction to perfect organic occlusion, then the orthodontic treatment has not been done properly and should be corrected.

## Conclusion

Anyone who reads this message is obligated to ask questions of his or her orthodontist. When enough dentists probe their weaknesses, change will occur. Call your orthodontist, your dental instructor, your colleagues, and most of all inform patients that they must avoid premolar extraction.

As a self-trained orthodontist, the author has learned that it is easy to move teeth but difficult to know where they go, and more difficult to keep them there. Very, very rarely is extraction necessary.

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