Molar Control
Part 5

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The subject of molar control has been divided into four types of bends. The first category consisted of toe-in and toe-out bends (Part 2, JCO, February 2002), while the second included in-bends and out-bends (Part 3, JCO, March 2002). The step bend was then presented (Part 4, JCO, April 2002), and now the final bend will be discussed: the center bend—or, actually, its equivalent.

The Center Bend

Although we could choose to simply use a direct center bend between brackets to produce the moment required for rotation, two bends will be used to keep this two-step process the same for all treatments. Rotational bends are always placed first, and displacement bends are always placed last. Since all of these relationships can be treated as variations of the off-center bend, two off-center bends will be used to create what amounts to a center bend. The force system will be identical to the center bend. As explained earlier, the two short sections will point in the same direction, whereas in the step bend, it was seen that the two short sections pointed in opposite directions and were parallel to each other.

In both Figures 5-1 and 5-2, the center bend is shown as two off-center bends.

When the initial bends are placed for cor-

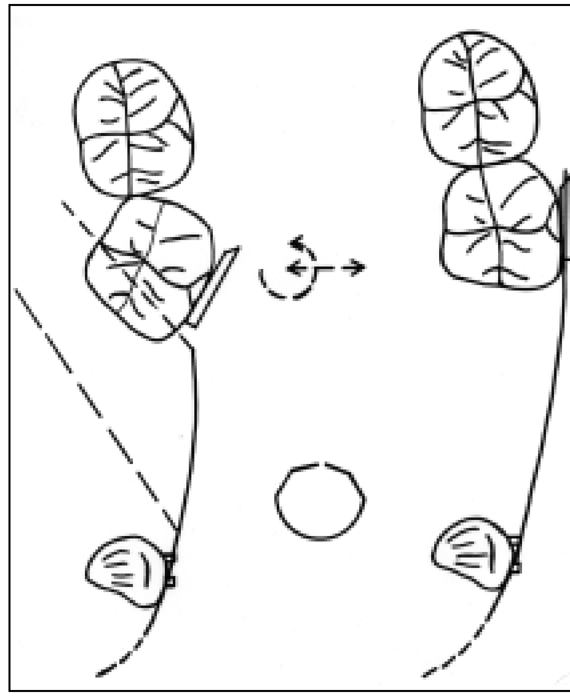


Fig. 5-1 Center bend.

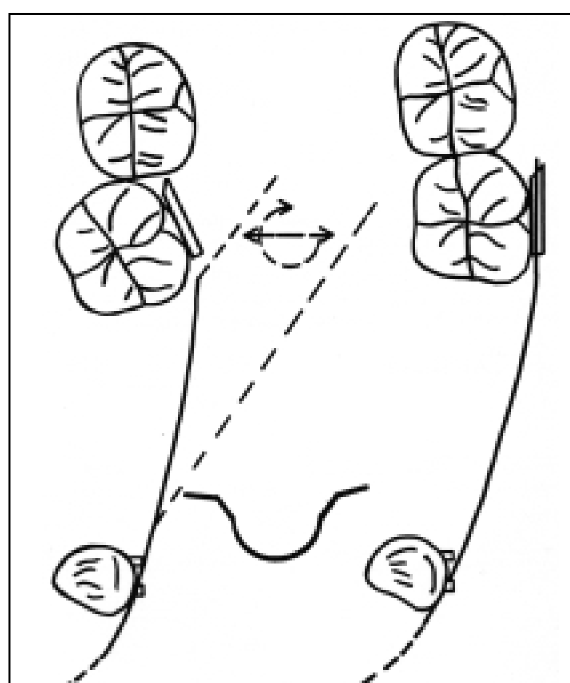
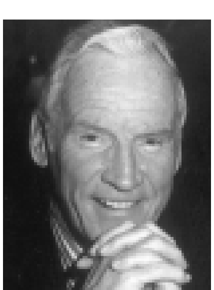


Fig. 5-2 Center bend with opposite forces and moments.



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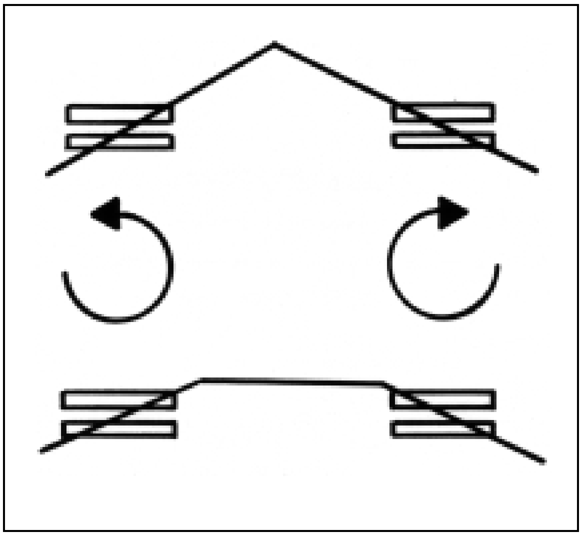


Fig. 5-3 Center bend is equivalent to two off-center bends.

rection of the first molar rotations, forces are produced in the horizontal plane of space. The displacement bends chosen produce forces opposite in direction to the forces associated with the moments acting on the molars.

Figure 5-3 demonstrates the use of two off-center bends instead of a center bend. The same force system, consisting of equal and opposite moments, exists in each case, but the use of two bends instead of one permits the two-step process in molar control to be used in each case on a routine basis. The operator need not know beforehand which wire-bracket relationship is necessary to provide the best available force system with the least amount of effort.

Actually, the following is what really takes place in terms of the force system produced. Although the bends in the archwire are 45° bends, the wire-bracket angles will not be 45° at the molars because of the rotations present. It is the wire-bracket angle that determines the force system. If the molars, for example, were rotated 10°, then the actual wire-bracket angle at each molar would be 55°. As a result, there would be a net horizontal force acting at each molar. A toe-in bend, as seen in Figure 5-1, would produce the desirable moment on the molar plus a buccal force. The in-bend would produce a lingual force, but technically this force would not cancel the buccal force associated with the molar moment because of the larger wire-bracket angle at the molar. This does not complicate the issue. The whole idea is to create a process that is simple and can be repeated. So if the patient leaves following the placement of these bends, when the patient returns with the rotation corrected, the toe-in bend would then be removed. If the molar has shown any buccal displacement as a result of the net buccal force, the in-bend, which is still present, will provide the corrective force required. In other words, do not spoil a simple approach by worrying about absolute precision. The problem simply takes care of itself if followed in the prescribed manner.

Let us take a look at how unnecessary it is to be absolutely precise. For anyone feeling such a need, the toe-in bend could be reduced to 35°, which would create equal and opposite wire-bracket angles. The molar rotation of 10° plus the 35° bend in the wire would equal the 45° we have been using. Likewise, we could go to the opposite bracket and increase the in-bend by 10°, making a total angle of 55° at that bracket. This would then be equal and opposite to the 55° at the molar, when adding its 10° rotation to the 45° bend in the archwire. Not only would this require additional effort on the part of the orthodontist, but it also means that every patient in the practice would require archwire removal to determine the angular bends in the wires. On the other hand, my recommended practical approach permits the orthodontist to look into the mouth of the patient and observe the force system without archwire removal, because *all* bends are 45° and the wire-bracket angle will be apparent. Keep in mind that we are talking about developing procedures that can become a *constant* part of daily practice for a lifetime. Minutes saved will become hours saved and ultimately months and, yes, years. My emphasis, however, is not on seeing more patients or increasing income. Obviously, there are those who will consider these to be the primary benefits. But the real benefit is in enjoying the practice more, living with less stress, having the time to spend with family and community affairs, and living a happier and healthier life. The other matters, such as practice size and income, take care of themselves when emphasis is placed where it should be.

It is time to demonstrate how these bends

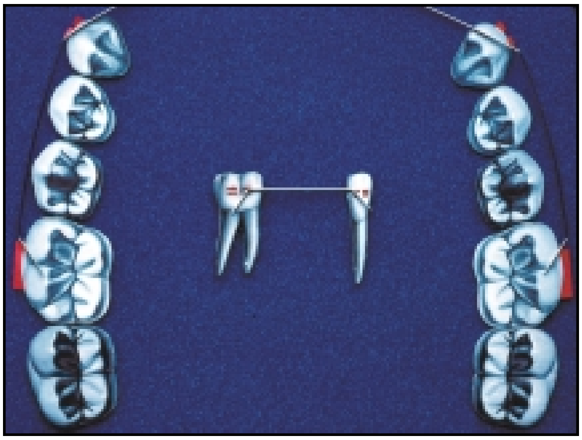


Fig. 5-4 Occlusal and sagittal views of two off-center bends acting as center bend.

apply to the rotational problems of molars. Figure 5-4 shows both occlusal and sagittal views of the two off-center bends acting as the equivalent of a center bend. The same force system will be produced in each plane of space. Only the terminology is different. When we use different terminology to discuss the same force systems in different planes of space, we tend to confuse ourselves in mechanics.

Case 13

In this patient, toe-out bends were combined with out-bends on each side (Fig. 5-5A). The lower right second molar has a slight distobuccal rotation, as evidenced by the divergent central groove. The left second molar shows no divergence. Dr. Peter Dawson has discussed the stability of such divergences; as long as these teeth occlude properly with their opposing teeth, no effort need be made to rotate them into ideal positions. If your preference is to rotate such teeth, the choice is yours.

The toe-out bends create moments that are desirable for first molar rotations, but the associated lingual forces could cause the molars to move farther to the lingual. The out-bends reduce the lingual forces, but do not completely eliminate them for the reasons previously stated. In summary, pure rotations are corrected by first placing the necessary toe-in or toe-out bends,

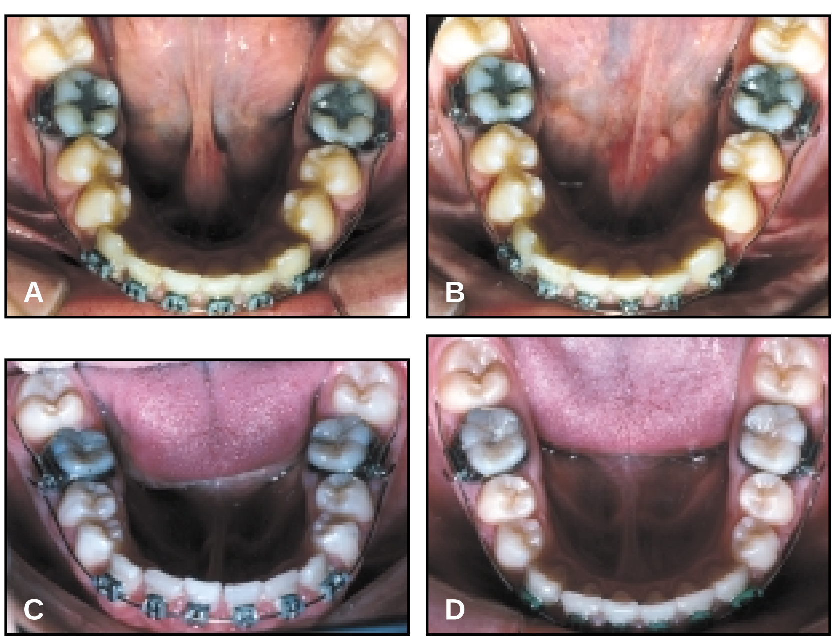


Fig. 5-5 Case 13. A. Toe-out bends combined with out-bends in lower arch to correct molar rotations. B. Mandibular right first molar movement not yet complete, but left first molar ready for removal of all bends. C. Distal extensions placed through first molar tubes and activated intraorally for lingual tipping of second molars. D. Normal curve of Wilson nearly established, with central molar grooves almost aligned.

which produce moments in combination with horizontal forces. Then, in-bends or out-bends are placed to produce horizontal forces in the opposite direction. Ideally, this would result in pure moments on the molars, but the forces associated with the moments are slightly larger than those associated with the in-bends and out-bends because the molar rotations create slightly greater wire-bracket angles. Remember, only equal and opposite wire-bracket angles create equal and opposite moments.

All archwires need to be removed whenever they are to be deactivated. This is unlike the activations, which can usually be done intraorally. Removal of archwires is also an important part of the clinician's learning process. Self-confidence will develop when it is repeatedly observed that desirable movements result from bends that appear entirely different from those seen in shape-driven appliances. Force-driven appliances are very effective, but not often understood by those trained to bend wire to conform with the desired shape of the dental arch.

On occasion, the lower second molars will have a reverse curve of Wilson, while the first molars may have a more normal functional curve. In such a case, a continuous archwire can be placed with distal extensions through the first molar tubes, which are then activated intraorally with 45° bends toward the lingual. These bends are placed just distal to the first molar tubes (Fig. 5-5C).

Upper second molars can be moved to the lingual in the same manner when an excessive curve of Monson is noted. This movement reduces the height of the lingual cusps and therefore helps eliminate balancing interferences. All molars, however, require banding whenever they need to be uprighted, rotated, or moved bodily for any reason.

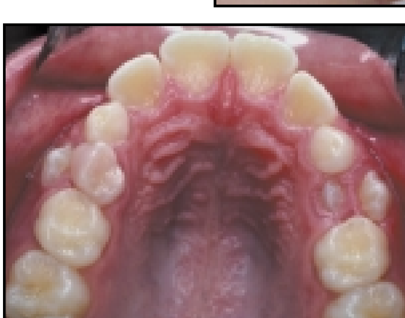
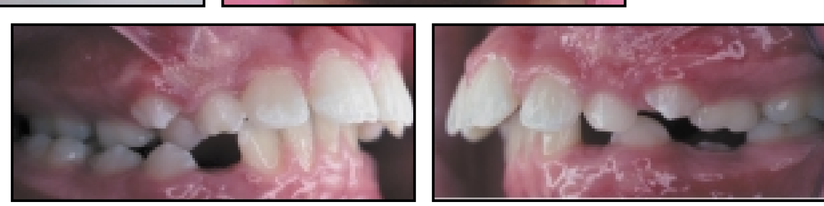




Fig. 5-6 Case 14. Patient with severe overbite, overjet, crossbite, and mandibular displacement.

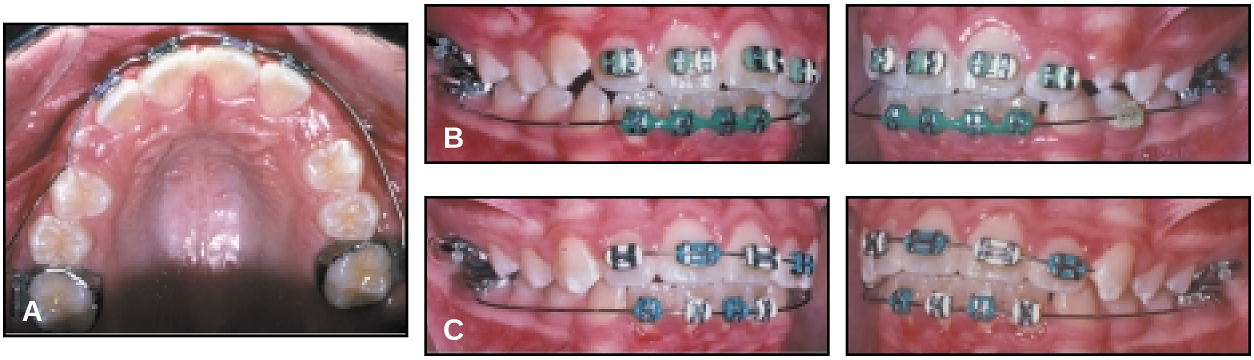


Fig. 5-7 Case 14. A. Toe-in and out-bends on right side, with only toe-in bend on left. B. Upper archwires removed after correction of crossbite and mandibular shift. C. Class I relationship on both sides, with upper anterior wire segment used for detailing.

Case 14

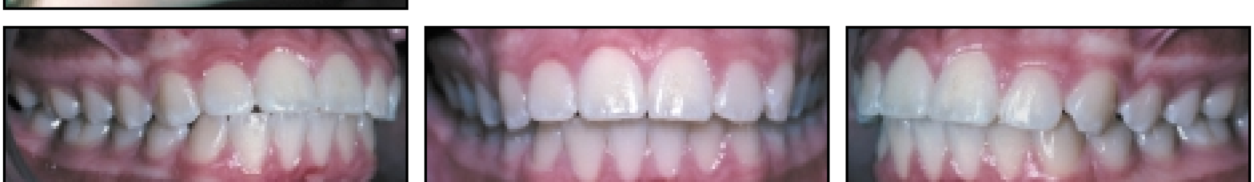
To conclude this series on molar control, treatment will be demonstrated for a patient who has a combination of problems involving overbite, protrusion, and crossbite. See if you feel confident enough at this point to keep treatment to a minimum by applying the various force systems discussed in the manner recommended.

The patient first visited the office with a severe overbite and overjet, as well as a severe crossbite that was bilateral, with the greater amount on the right side (Fig. 5-6). As is frequently the case, there was a lateral displacement of the mandible. Ask yourself which teeth you would consider banding or bonding, and in which order. Then ask yourself what sequence of treatment you would choose, which force systems would be necessary, and how you would obtain them. Remember, this is a "thinking person's approach" and not a cookbook formula.

In this patient, toe-in and out-bends were used on the right side, but only a toe-in bend on the left (Fig. 5-7A). The upper archwires were removed after the crossbite and mandibular shift were corrected, with the teeth in a Class I relationship (Fig. 5-7B). The lower left first bicuspid was bracketed for individual crossbite correction. An anterior wire segment was then placed in the upper arch, allowing the other teeth to settle while adjusting to their new environment (Fig. 5-7C). Using such a segment permits additional adjustments to be made where needed.

The force-driven appliance produced the changes needed with a minimum of time and effort (Fig. 5-8). The teeth attained the cuspid

Fig. 5-8 Case 14. Patient after treatment, with midline corrected.



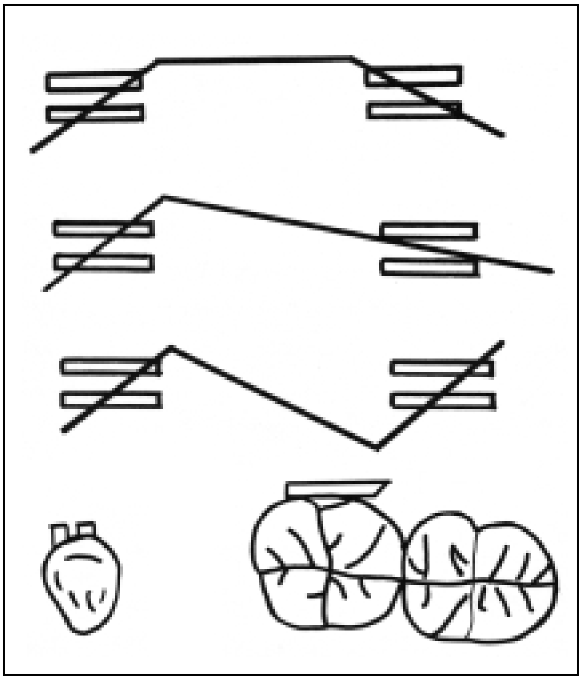


Fig. 5-9 Three wire-bracket relationships presented in this series.

and molar widths mandated by the environmental equilibrium during archwire removal.

Ask yourself at this point if you would have considered using the bends applied to produce the required force systems. I do not mean to imply that an entirely different approach would be wrong. There are many different ways to achieve the intended results. Some require more effort than others, and some require more patient cooperation than others. Throughout this series, for example, a crossbite elastic was never required or even considered. In more than 36 years of practice, a crossbite elastic has *never* been used in my practice. I simply haven't found the need for such elastics, not to mention the required patient cooperation that goes along with their use.

Conclusion

In Figure 5-9, the three wire-bracket relationships presented in this series are shown. Molar-control bends will help us create one of the force systems associated with these relationships. It is not necessary to know which of the three has been utilized, although in time it will become easy to recognize the one in use. Repeated use of these bends in the sequence demonstrated will lead to greater confidence in the use of force-driven appliances. Understanding mechanics will encourage the clinician to stay with the appliance of choice rather than making changes.

I don't want to challenge what you believe. What I do want to challenge—and perhaps change—are some of the things you do *not* believe.

SUGGESTED READING

1. Burstone, C.J.: The biomechanics of tooth movement, in *Vistas in Orthodontics*, ed. B.S. Kraus and R.A. Reidel, Lea & Febiger, Philadelphia, 1962, pp. 197-213.
2. Marcotte, M.R.: Prediction of orthodontic tooth movement. Am. J. Orthod. 69:511-523, 1976.
3. Burstone, C.J. and Koenig, H.A.: Creative wire bending: The force system from step and V bends, Am. J. Orthod. 93:59-67, 1988.