Bio-Progressive Therapy, Part 10: Mechanics Sequence for Class II Division II Cases

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The Bio-Progressive Therapy has long been thought of as a sectionalized approach. While, in the minds of most clinicians, a sectional approach to mechanics seems useful only in extraction therapy, it is the converse that is true. When a full complement of teeth is maintained, the possibility of a segmental approach to mechanics is greatly enhanced. A beautiful harmony of individual tooth and jaw movements results from a sequential unraveling of the original malocclusion in an organized sequence of sectionalized movements.

It is important that the basic principals of the Bio-Progressive Therapy be adhered to both in treatment planning and in the chairside decision-making process. The universal concept of control must be altered slightly in the mind of the clinician to take into account the individual movements of teeth in the different planes of space.

This concept is somewhat akin to walking through a series of rooms and unlocking each individual door in order to get to the next room. The succession of doors can be opened only when each individual door is separately unlocked. It is important that the clinician have clearly in mind the objectives of each individual step of treatment, in order to be able to progress effectively to the next stage. Failure to adequately unlock the individual phases of treatment only means that valuable time is wasted and results are often compromised.

Thinking in Terms of a Sectionalized Approach

Not only are the teeth within each arch considered to be separate segments, requiring individual movements in their own plane of space, but the individual arches, themselves, are to be considered as separate sections. It will be noted, at times, that for pure simplicity and efficiency of mechanics, each individual arch may be in a completely different phase of treatment. Band or bracket placement, as well as individual wire selection, is an important part of the decision making process in nonextraction therapy (Fig. 1).

One should consider the correction of the deep curve of Spee in the lower arch. The leveling problem is simply this: the lower incisors have extruded or supererupted due to their loss of antagonists; the lower molars are tipped and rotated mesially; the lower canines are often tipped mesially and extruded; the lower bicuspids are usually narrow, rotated, and at different occlusal heights. For each of these individual malpositions of teeth, there is a separate force application, which is ideal to move each tooth, or section of teeth, directly to their final ideal location. Since force applied must also have an equal counterforce, force/moment delivery systems that allow the reciprocal of these force moments to be pitted against each other is ideal (Fig. 2).

A prime example of this theory is the use of a simple utility arch. Its proper management pits the

light intrusive force applied to intrude the supererupted lower incisors against a tipping moment to upright, torque, and rotate the lower molars. By utilizing simple mechanical principals, it is also possible to use the forces of occlusion and/or numerous teeth against the extruded lower incisors to gain tremendous mechanical advantage. The lower canines, which are in a different plane of space from the lower incisors, should be intruded and aligned separately. The lower bicuspids, which normally dictate the line of occlusion, are brought into the mechanical sequence only when needed.

Sequence of Mechanics

Forgetting about the upper arch for the time being (usually orthopedic reduction of the maxilla is taking place), it is propitious to level and align the lower arch as rapidly as possible. If it is possible to band/bond the lower arch and place a lower ideal arch in the first sitting, this should be accomplished. This would allow for the maximum period of time for dictating arch form and working out details. This situation, however, would obviously be rare in Class II malocclusion. Most often a series of individual tooth movements is needed to intrude and align incisors, upright and rotate molars, and allow for space redistribution and arch form change (Fig. 3).

As has been noted previously, the most efficient wire for applying ideal forces, in both direction and increment, is the lower utility arch. A glance at the visual treatment objective (V.T.O.), which dictates whether or not the lower incisors are to be intruded, advanced, or retracted, is necessary to determine the configuration of the initial utility arch (Fig. 4). Where a straight intrusive force is to be applied to the lower incisors, normally a plain .016 X .016 lower utility arch is placed (with no loop systems

involved). In most cases, it is possible to intrude the lower incisors to the level of the functioning buccal occlusion (bicuspids), within a three-to-four-month period. If the lower molars are tipped mesially, 10° to 20°, it is usual that the reciprocal uprighting effect of the lower molar simply counterbalances the intrusive moment necessary to level the lower incisors.

There are cases that demonstrate a different molar-to-incisor problem. For example, when the lower molars are in the correct axial inclination, but the lower incisors are extruded, it is not efficient to intrude the lower incisors at the expense of overtipping the molars. This problem may be solved quite simply by stabilizing the tipping effect at the lower molars by banding/bonding the lower bicuspids earlier than would be routine (Fig. 5). An .016 X .016 stabilizing section is then placed in the occlusal tubes of the molars and extended to the first bicuspids. It is not the function of this wire to align the lower bicuspids, but merely to stabilize the tipping effect of the utility arch on the molars. This will, in effect, utilize the entire buccal segment to intrude the lower incisors (Fig. 6).

It is not efficient to overtip, over torque, or overrotate the lower molars, as these movements need to be accounted for at a later time. Once an individual tooth has reached its ideal location, it is important that it be stabilized in that particular location (Fig. 7).

The Lower Stabilizing Utility Arch

The routine .016 X .016 lower utility arch serves one great function. It allows for the application of a light, continuous intrusive force to the lower incisors as well as a light, continuous force uprighting the lower molars. Once these movements have been achieved, the initial utility arch no longer serves an efficient function, since it does not possess definitive torque control and is easily

deformed. At this time, an .016 X .022 stabilizing utility arch is placed to allow for improved torque control and improved stability, and to create a stable base from which alignment of the lower buccal segments can be accomplished. It is not an efficient arch for intrusion, alignment, advancement or retraction, but serves in a long-range function to stabilize the previously aligned incisor and molar segments.

Cuspid Intrusion

In approximately 50 percent of the deep bite cases, the lower canines must also be intruded slightly to bring them to the level of the functioning buccal occlusion. This is normally accomplished by lightly tying these teeth to the stabilizing utility arch with an elastic thread (Fig. 8).To keep the elastic thread from sliding along the utility arch, a small vertical loop is pinched into the wire (this can be done intraorally with a large three-prong plier). This elastic thread is brought around the vertical loop and tied prior to encircling the cuspid bracket. The elastic thread should completely encircle the cuspid bracket and a knot tied behind the base of the bracket so that it does not irritate the buccal mucosa. Normal intrusion time for the lower cuspids should be no more than one month.

Alignment of the Lower Buccal Segments

When cuspid intrusion has been completed, the lower arch is essentially level. At this point, arch form and alignment characteristics in the lower buccal segments should be accomplished. Depending upon the amount of rotation, space, and/or crowding evident in the lower buccal segments, a series of light leveling arches are overlayed to the stabilizing utility arch in order to achieve final buccal segment alignment. The arches typically used for the alignment are .015 Twistoflex, .0175 Twistoflex, .012 round, .014 round, .018 round, .016 X .016 triple "T" sections, and .016 or .018 Nitinol (Fig. 9).

Buccal elastomers or lingual elastic thread is utilized to close spaces, effect rotation, and assist in alignment of the lower buccal segments. Some time must be taken to complete this phase of treatment, because the clinician moves from the stabilizing utility, arch and overlays directly to a lower ideal arch. In this manner, torque control is maintained completely throughout treatment without having to resort to continuous round arch therapy and its detrimental responses.

It is at this point that most neophyte Bio-Progressive clinicians have difficulty in the lower arch. It is quite often cumbersome to move from the lower utility arch and overlay directly to the lower ideal arch without some intermediate leveling and arch form changes. This is one area where the

newer, more flexible edgewise arches are of great value. .016 X .022 or .017 X .025 Nitinol arches in the straight wire mechanism allow for this transition in a very comfortable manner. This effects no

loss of torque control (as a matter of fact, they enhance torque control) while allowing the flexibility needed to continue minute arch leveling as well as start to dictate a more normal arch form.

From the practical standpoint, most Class II division I cases are overcorrected with elastic traction. It is not unusual, however, for Class II elastics to be started prior to engagement of the entire lower arch with a torque control wire.

Upper Arch Alignment

Again, a glance at the Visual Treatment Objective (V.T.O.) will demonstrate that most Class II division I cases do not need a lot of torque in the upper incisor region. Clinicians have complained about the apparent excessive torque in the upper incisors in the Ricketts mechanism. This is true when the upper incisors are banded/bonded early in treatment and engaged with a square or rectangular wire for a long period of time. It is not efficient to band/bracket these teeth early in treatment in most Class II division I cases, where minimal torque is needed in the upper incisors. Again, it is best to treat the separate sections in order to allow for their most efficient and, in the long range, effective movement (Fig. 10).

Leveling, Consolidation and Traction Sections

As the upper molar begins to move distally, it is normal for space to open in the upper buccal segments. Where the canine is blocked high and to the labial, it is usual that some leveling and space closure needs to be effected in the upper buccal segment prior to the start of Class II elastic traction. The upper buccal segments are banded/bonded (not the incisors). A series of sectional wires are utilized to first level the upper buccal segments, and then close spaces. Typical leveling sections that would extend from the occlusal molar tube to the canine would be .012, .014 or .016 round arches, .015 or .017 Twistoflex, or .016 or .018 Nitinol (Fig. 11). These arches are contoured ideally and have a bayonet on the upper molar, as well as bicuspid offsets and a small helix mesial

to the upper canine teeth. Consolidation sections (Fig. 12) are usually .016 X .016 blue Elgiloy and are utilized to retract the upper cuspid teeth within the buccal segments. Once the leveling procedure has been accomplished, the clinician should be able to go directly to the traction sections .

Segmental Correction of Class II With Elastics

It has long been routine in contemporary orthodontics to pit a lower arch and continuous archwire against an upper arch, with a continuous archwire. This results in several detrimental effects. First, there is a skidding effect that simply throws the lower arch forward while extruding and retracting the upper arch. The usual result is a detrimental effect on the lip line. Second, when a tendency for a deep bite still exists, the Class II elastics can bring the upper incisors back and start "jamming" the lower incisors as they are retracted. This will result in incisal trauma, lack of a functional buccal occlusion, and inability to correct the Class II buccal segment relationship. Third, it is difficult, if not impossible, to overcorrect the upper buccal segment without bringing the upper anterior teeth into lingual crossbite. When the upper buccal segment teeth are treated as a section, and the Class II is corrected in a segment, overcorrection can be accomplished without having a

detrimental effect upon the upper incisors.

At first inspection, it would appear to most that the Class II elastics would pull the upper buccal segments outward and that it is an absolute necessity to have the upper incisors tied to the buccal segments in order to achieve the correction. It will be found, however, that the forces of occlusion and the stabilizing effect of the labial and lingual cortical bony trough will allow for a controlled distal movement of the upper buccal segments as the Class II elastics are worn (Fig. 13).

Traction Sections

Specially designed wire segments, called traction sections, are utilized to counteract some of the negative responses that occur with Class II elastics to the buccal segment. There is a tendency for the downward, backward pull of Class II elastics to extrude and throw the root of the upper canine mesially. This can be counteracted by placing a small closed helix distal to the upper cuspid teeth with a gable or tipback of 30°. The anterior portion of the segment should also be rotated mesially 45°, and often a horizontal closed helix is placed at the molar region to maintain or accentuate distal

molar rotation. This sectional arch is typically fabricated from .016 X .016 blue Elgiloy wire. A molar bayonet should be incorporated into the helices .

The anterior helix of the straight or traction section (where the Class II elastic is going to be placed) should be rolled in the occlusal direction. This-will prevent the elastic from being caught in the helix itself, which could cause the patient to pull the band or bracket loose when trying to remove the elastics. There are, therefore, right and left side traction sections.

The traction sections also serve a second function. They stabilize the upper buccal segments against the impending intrusion and torque in the upper incisors. When the traction section is going to be used to stabilize the molars against upper incisor intrusion, there is a tipdown bend of 45° placed in the traction section at the lower molar bayonet. This will almost exactly counterbalance the 45° tipback that is going to be placed in the upper utility arch to intrude the upper incisors.

Upper Incisor Alignment and Intrusion

Once the buccal segments have neared correction of the Class II relation, the incisors are engaged to effect torque and/or intrusion prior to their final retraction (Fig. 14). It will be noted that as the buccal segments are moved distally, spacing occurs by

virtue of the distal movement of the upper buccal segments, which will allow for a slight functional realignment of the upper incisors. In fact, it is relatively easy to determine whether or not the patient is actively wearing the elastics by noting whether the space occurs mesial to the cuspids. If that contact remains tight, then it can be assumed that the patient has been lax in elastic wear.

At this point, the upper incisors are then banded/bonded and sectionally aligned preparatory to

placement of the upper utility arch. In most cases the .016 X .022 upper utility arch cannot be placed on the upper incisors at the first banding appointment, due to the malalignment of these teeth. Therefore, a contoured anterior section is utilized to level the upper central and lateral incisors and

to close anterior spaces prior to intrusion and retraction. The typical archwires used for this procedure are light, round wires, as no torque control is necessary at this point.

An .016 X .022 upper utility arch is then placed and the upper incisors are torqued and/or intruded as necessary prior to their final retraction. The ideal intrusive force applied should be in the range of 125 grams. Class II elastics are continued to the buccal traction sections as needed. These movements encompass the basic principal of treatment of overbite before resolution of overjet. It is

not unusual to have slight labial flaring of the upper incisors as the teeth are intruded. The .016 X .022 blue Elgiloy utility arch applies a light continuous pressure to effect intrusion and torque of the upper incisor teeth.

Consolidation of Upper Incisors

Following intrusion and torque of the upper incisor teeth, they are retracted to close any spaces that exist. It is not efficient to utilize a continuous arch that brings the incisors back down to the level of the functioning buccal occlusion. It is necessary to overtreat the overbite in order to overcorrect the buccal segments in most cases. There should, in effect, be a 2mm step between the cuspid bracket and the incisor bracket in order to create this relationship. In order to maintain the intruded position of the upper incisors, the closing arch should be overlaid and bypass the buccal segment teeth. The most frequently used arch to accomplish this movement is a closing utility arch (Fig. 15), but it is possible to continue torque on the upper incisors with the upside down closing arch or a very simplistic vertical helical closing arch. The selection of closing arch type is dependent upon the amount and direction of movement required of these individual teeth as dictated by the superimpositional analysis of the Visual Treatment Objective (V.T.O.). Class II elastics are continued to the upper buccal segments. It should be noted that at no point are the Class II elastics ever applied to the upper incisors for a protracted period of time. Depending upon the amount of space available, intrusion of the upper incisors should take place in a three to four month period, and consolidation within a one to two month period.

Following the consolidation of the upper incisors, an upper ideal arch is placed. Usual archwire

sizes would be .016 X .016 blue Elgiloy, .016 X .022 blue Elgiloy, .016 X .022 Nitinol, or .017 X .025 Nitinol. The stepup between the canines and the incisors is continued at this point to maintain an end-to-end relationship between the upper and lower incisors (Fig. 16) .

Idealization of Arches and Finishing Details

Following consolidation and torque control in the upper incisors, gross movements necessary to correct the malocclusion have been accomplished. An upper ideal arch, fabricated from .016 X .016 blue Elgiloy, .017 X .017 blue Elgiloy, .016 X .022 Nitinol, or .017 X .025 Nitinol, is utilized to place final arch form and torque adjustments in the upper arch. It is undesirable to continue long-term Class II elastics with two ideal arches in place due to the detrimental responses previously described (Fig. 17).

It is important that Class II elastic wear be discontinued at least two months before final debanding/debonding. This period will allow for physiologic rebound and is essential in the determination of centric relation. Quite often two light round arches (.014 or .016) bent in ideal arch form are utilized to allow for function to seat the occlusion. These light round arches are also quite beneficial in making minute adjustments for the band/bracket height discrepencies that are present in most situations. Ideal archwire fabrication and final debanding/debonding will be discussed in the article on finishing details (Fig. 18).

(TO BE CONTINUED IN NEXT ISSUE)

Figures

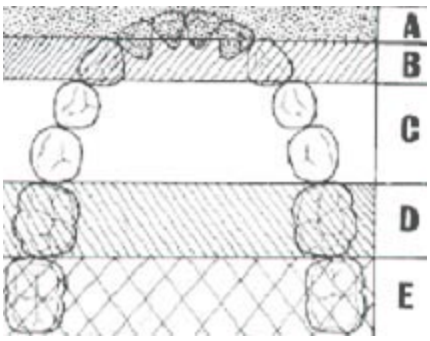

Fig. 1 The lower arch is treated in 5 distinct and separate sections. The lower incisors (A) which are in a different plane of space than the lower cuspids (B) are intruded and aligned against the lower buccal segments (C) and lower molars (D). The lower second molars (E) are usually brought into alignment in the later phases of treatment.

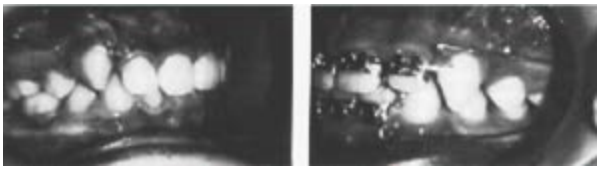

Fig. 2 Class I deep bite pattern demonstrating use of upper and lower utility arches to intrude incisors. Note height difference between intruded incisors and canines.

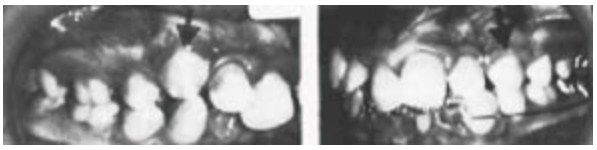

Fig. 3 Initial procedures to intrude lower incisors and orthopedically reduce maxilla. Following four months of headgear therapy, note position of upper cuspids (arrows). At this point major Class II correction has been achieved.

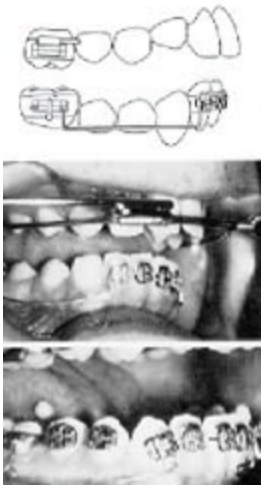

Fig. 4 Placement of a lower utility arch and headgear in the beginning phases of Class II division I mechanotherapy. The lower utility arch is fabricated from .016 X.016 blue Elgiloy and designed to upright the lower molars and intrude the lower incisors. The headgear is typically used by itself in the upper arch to orthopedically reduce the maxilla.

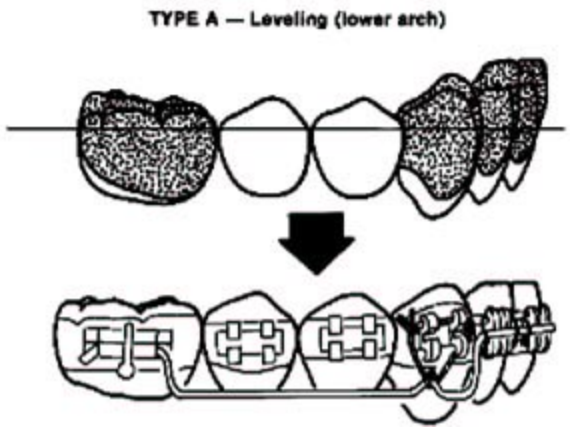

Fig. 5 TYPE A-- Leveling (lower arch). The typical deep curve of Spee involves mesial tipping of the lower molars and extrusion of the lower incisors and cuspids. Treatment involves uprighting the lower molars as a reciprocal moment to intruding the lower incisors and cuspids.

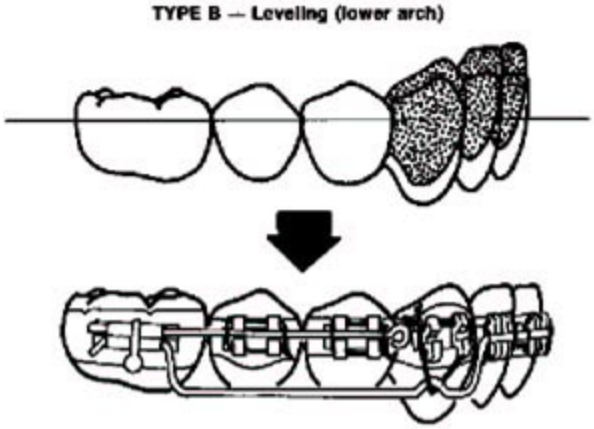

Fig. 6 TYPE B-- Leveling (lower arch). Involves upright lower molars and bicuspids with extrusion of the lower incisors and cuspids. Treatment is by stabilizing the lower molars to the lower bicuspids, which are then pitted against intrusion of both the incisors and cuspids.

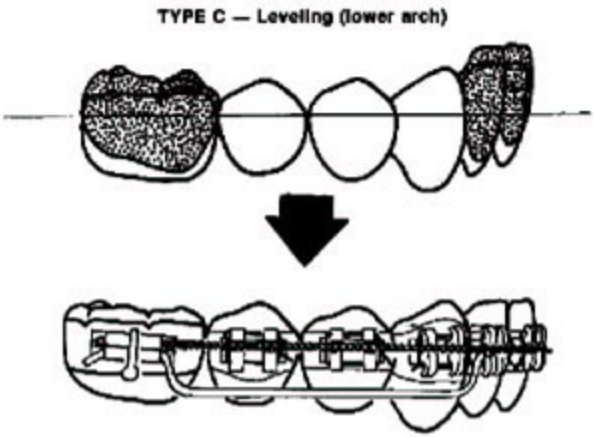

Fig. 7 TYPE C-- Leveling (lower arch). When the lower incisors are extruded and the lower molars tipped mesially, but there is not extrusion of the cuspids, the lower arch is leveled by first placing a utility arch and then a simple overlay arch to align the lower buccal segment teeth.

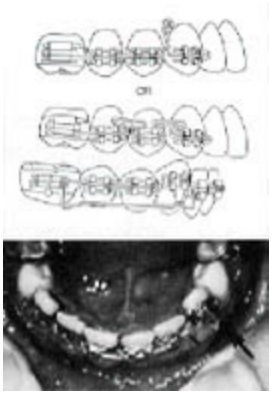

Fig. 8 Following intrusion of the lower incisors, the lower cuspids are intruded. To prevent overtipping of the lower molars, a stabilizing section is utilized in the occlusal tube and extended through the lower bicuspids. The upper buccal segment is leveled and consolidated prior to starting Class II elastic wear.

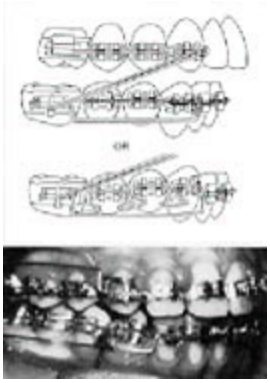

Fig. 9 Following intrusion of the lower canines, the lower buccal segments are aligned with a light round or Twistoflex overlay archwire. Once the lower buccal segments have been engaged, Class II elastics to an upper buccal traction section are started. Note the small closed helix distal to the cuspid which functions to prevent a distal tipping of the cuspid with Class II elastics.

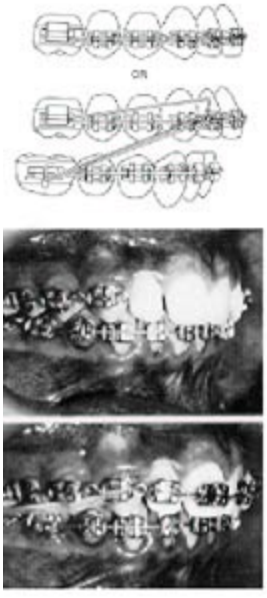

Fig. 10 When the lower buccal segments have been fully aligned and leveled, a lower ideal arch is placed. Following Class II correction in the upper buccal segments, the upper incisors are banded/bonded and aligned with a small round or Twistoflex section. The upper incisors are intruded with an .016 × .022 utility arch. Note that Class II elastics are still worn to the section and not the utility arch.

Fig. 10 When the lower buccal segments have been fully aligned and leveled, a lower ideal arch is placed. Following Class II correction in the upper buccal segments, the upper incisors are banded/bonded and aligned with a small round or Twistoflex section. The upper incisors are intruded with an .016 ´ .022 utility arch. Note that Class II elastics are still worn to the section

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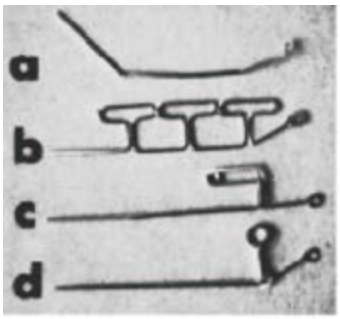

Fig. 11 Leveling and closing sections. a..016 x .022 (Nitinol) with elastomers. b. Triple "T" section (.016 x .016). c. Crossed "L" leveling section (.016 x .016). d. Simple vertical closed helical retraction section (.016 x .016).

Fig. 11 Leveling and closing sections. a..016 x .022 (Nitinol) with elastomers. b. Triple "T" section (.016 x .016). c. Crossed "L" leveling section (.016 x .016). d. Simple vertical closed helical retraction section (.016 x .016).

Fig. 12 Traction Sections (Top and Side Views). a. Stabilizing section (.016 x .016). b. Traction section (.016 x .016). c. Traction and molar rotation section (.016 x .016).

Fig. 12 Traction Sections (Top and Side Views). a. Stabilizing section (.016 x .016). b. Traction section (.016 x .016). c. Traction and molar rotation section (.016 x .016).

Fig. 13 Following complete alignment and leveling in the lower arch, a lower ideal arch is placed. Class II elastics, worn to an upper buccal traction section, are utilized to further overcorrect the Class II malocclusion.

Fig. 14 Following Class II elastic traction to correct the buccal segments, the upper incisors are banded/bonded and intruded. Note the small closed helix distal to the cuspid that counteracts the downward/backward pull of the Class II elastics.

Fig. 14 Following complete alignment and leveling in the lower arch, a lower ideal arch is placed. Class II elastics, worn to an upper buccal traction section, are utilized to further overcorrect the Class II malocclusion.

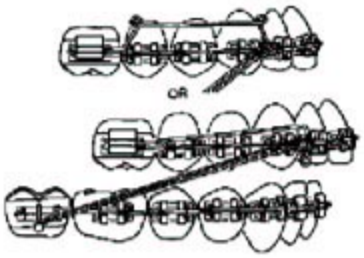

Fig. 15 Following intrusion of the upper incisors, the maxillary anterior teeth are retracted with an upper closing utility arch or an upside-down closing arch. The second molars are engaged in the lower ideal arch as soon as practical.

Fig. 15 Following Class II elastic traction to correct the buccal segments, the upper incisors are banded/bonded and intruded. Note the small closed helix distal to the cuspid that counteracts the downward/backward pull of the Class II elastics.

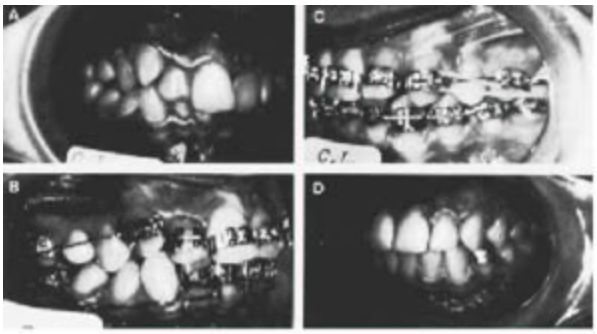

Fig. 16 A severely crowded Class II division I malocclusion (**A**), with division II upper incisal characteristics, treated with nonextraction therapy. Following upper incisor advancement, the lower incisors are intruded and advanced with a, lower utility arch (**B**). Space is created in the lower buccal segments while Class II elastics are utilized to correct the upper buccal segments (**C**). The final result showed a nonextraction resolution of 11mm arch length discrepency (**D**).

Fig. 16 Following intrusion of the upper incisors, the maxillary anterior teeth are retracted with an upper closing utility arch or an upside-down closing arch. The second molars are engaged in the lower ideal arch as soon as practical.

Fig. 17 Ideal arch placement in both the upper and lower arches.

Fig. 17 A severely crowded Class II division I malocclusion (A), with division II upper incisal characteristics, treated with nonextraction therapy. Following upper incisor advancement, the lower incisors are intruded and advanced with a, lower utility arch (B). Space is created in the lower buccal segments while Class II elastics are utilized to correct the upper buccal segments (C). The final result showed a nonextraction resolution of 11mm arch length discrepency (D)

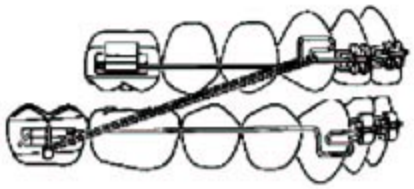

Fig. 18 Partial debanding/debonding procedure whereby the upper and lower buccal segments band space is utilized to overcorrect the buccal segments.

Fig. 18 Ideal arch placement in both the upper and lower arches.