Bio-Progressive Therapy, Part 9: Mechanics Sequence for Class II Division I Cases

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The mechanical procedures that are prescribed in Bio-Progressive Therapy treatment are designed for the specific patient and are individualized to accomplish the objectives set forth by the visual treatment objective for that particular patient. Therefore, the treatment plan and sequence of mechanical procedures that are designed are planned in "progressive stages" that will unlock the malocclusion and establish a more normal function. Many malocclusions have developed in such abnormal environments that they may never have, enjoyed a "normal" development. The "ideal normal" may be impossible to achieve in every case, but treatment should progress toward the normal and be within the accepted range of normal variation as much as is possible.

The planning procedures that are used in establishing a specific treatment design were explained in the first three articles of this series. They begin with the clinical examination of the patient and a description of the malocclusion and its function, and facial structure. From the cephalometric analysis a forecast is made and a visual treatment objective is drawn up. The visual treatment objective includes *changes* that are expected with: (1) normal growth, (2) orthopedic alteration, (3) alignment of the teeth, (4) and functional and soft tissue changes. It is a cephalometric setup which shows us where we are now and where we want to be.

The basic moves to unlock the malocclusion and proceed toward a more normal functioning stable occlusion are best visualized from the treatment objective where the mechanical needs are anticipated and prescribed. The progressive process from knowing where you are now to where you intend to end up allows unlimited possibilities in designing various procedures to get there.

In order to communicate the anticipated changes, five areas of superimposition are used to "visualize" the treatment alterations proposed by the visual treatment objective. The mechanics prescribed to accomplish these specific objectives are selected from eight areas of evaluation that show: (1) the present location of the jaws and the teeth, (2) where they would be without treatment, (3) and where they need to be moved to reach the proposed objectives. The visual treatment objective compares the three tracings, which helps us to visualize the change and design the treatment mechanics to accomplish it.

Planning Logic

In establishing the sequence of treatment mechanics that will unlock the malocclusion in a progressive manner and establish a more normal function, we use a planning logic that:

1. considers functional correction and prescribes its treatment;
2. considers orthopedic alteration and prescribes its treatment;
3. evaluates the alignment of the teeth, including arch length analysis and a decision on

extraction or nonextraction of teeth along with their resulting anchorage requirements; and

4. incorporates management concepts with the key factors that are important in monitoring the treatment's progress to a successful conclusion-- the conclusion that has been proposed in the visual treatment objective.

EIGHT AREA EVALUATION

FOR TREATMENT DESIGN TO EVALUATE SPECIFIC MOVEMENTS IN DIRECTION AND AMOUNT

POSITION	EVALUATION	TREATMENT DESIGN
1 BaNa AT CC	1 DIRECTION OF CHIN ROTATION	EFFECTING MANDIBULAR
CHIN	2 AMOUNT OF GROWTH (MM)	ROTATION AND MOLAR
	3 UPPER MOLAR CHANGE	MOVEMENT

2 BaNa AT Na 1 AMOUNT OF POINT A REDUCTION TYPE OF HEAD GEAR NEEDED

MAXILLA 2 AMOUNT OF PALATE TIP ORTHOPEDIC EFFECT EXPECTED

3 FACIAL TYPE

3 CORPUS AXIS AT PM 1 VERTICAL TO OCCLUSAL PLANE LOWER UTILITY ARCH DESIGN LOWER INCISORS 2 HORIZONTAL TO APO PLANE INTRUDE OR EXTRUDE 3 ARCH LENGTH NEEDS ADVANCE OR RETRACT

4 CORPUS AXIS AT PM 1 VERTICAL TO OCCLUSAL PLANE LOWER UTILITY ARCH DESIGN LOWER MOLAR 2 HORIZONTAL - ANCHORAGE MOLAR ANCHORAGE REQUIRED 3 EXPANSION - TORQUE ARCH FORM - CHANGE

5 ANS - PNS 1 VERTICAL WITHIN MAXILLA ORTHODONTIC VS. ORTHOPEDIC

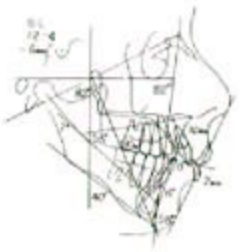
UPPER MOLAR 2 HORIZONTAL WITHIN MAXILLA TYPE OF HEAD GEAR OR ELASTIC

3 CHANGE ALONG FACIAL AXIS & CHANGE FROM CRANIAL BASE PTV

6 ANS - PNS 1 VERTICAL WITHIN MAXILLA UPPER UTILITY DESIGN UPPER INCISORS 2 HORIZONTAL WITHIN MAXILLA TORQUE NEEDS 3 FACIAL TYPE. FACIAL AXIS PARALLEL TO FACIAL AXIS

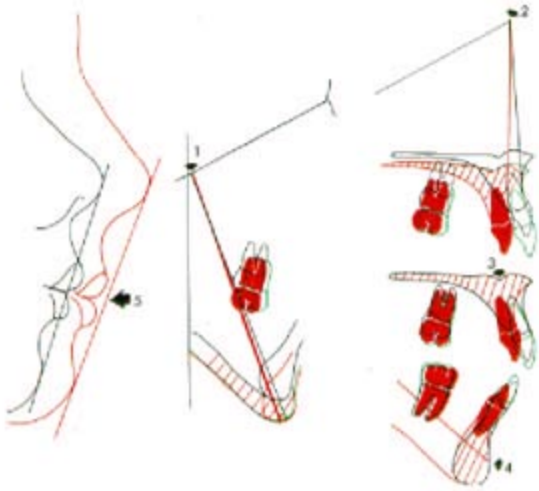
7 ESTHETIC PLANE 1 UPPER LIP LENGTH OCCLUSAL PLANE POSITION AT LIP EMBRASURE 2 LIP STRAIN IN POSTURE LOWER INCISOR - LOCATION SOFT TISSUE 3 MENTALIS LOWER FACE HEIGHT PROFILE

8 LOWER ARCH FROM 1 MOLAR - BICUSPID WIDTH MOLAR BUCCAL EXPANSION FRONTAL ANALYSIS 2 CUSPID WIDTH. INCISOR SIZE NEED FOR STRIPPING 3 NEW ARCH FORM FUNCTION IDEAL ARCH FORM



BEFORE TREATMENT

TREATMENT DESIGN



GROWTH FORECAST W/O TREATMENT

GROWTH FORECAST W/TREATMENT

Patient S.L.-- Diagnostic materials.

Photos show retrognathic profile, narrow mouth, protrusive upper lip, and lip strain.

Models show Class II malocclusion with crowding, right crossbite, and 6mm of lower arch length discrepancy.

Beginning cephalometric tracing (black) shows severe vertical pattern (-2 C.D.) and 10mm of convexity. Tracing without treatment (green) shows extrusion of present problem. Tracing with treatment (red) is the VTO, which anticipates expected normal growth, orthopedic alteration, alignment of teeth and their effect on soft tissue profile change.

Five positions of superimposition allow us to "visualize" the anticipated change comparing the 3 tracings and to analyze 8 areas of evaluation (see below) which allow us to prescribe treatment procedures that will accomplish the proposed results.

8 AREA EVALUATION-- PATIENT S.L.

1ST EVALUATION AREA: Ba-Na at CC PointShows 2° of mandibular rotation due to crossbite correction and orthopedic alteration. Molar is held to present A-P relationship.Treatment Design -- Care in crossbite correction because of vertical pattern. Combination headgear

to hold molar and not open bite.

2ND EVALUATION AREA: Ba-Na at Nasion Shows Point A reduction of 3mm in a vertical pattern.

Treatment Design -- Requires orthopedic correction (combination headgear). Longer wear will be required because of vertical pattern.

3RD EVALUATION AREA: Corpus axis at PMShows lower incisor is being intruded 2mm and retracted 2mm.Treatment Design-- Lower utility arch to intrude incisor. Retraction in parallel root movement in extraction case.

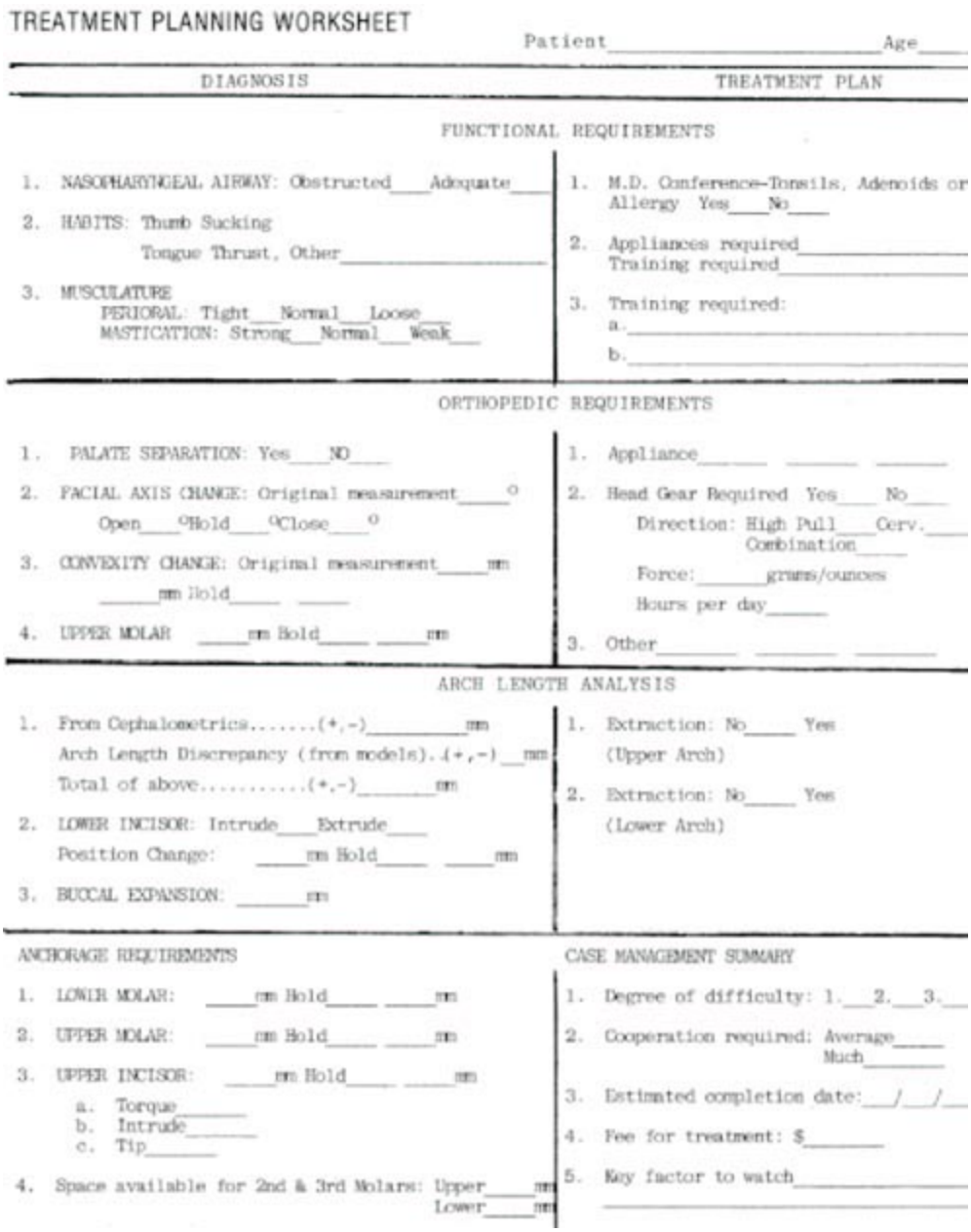
4TH EVALUATION AREA: Corpus axis PMShows lower molar comes forward 2mm.Treatment Design -- Maximum lower molar anchorage in extraction case because of severe vertical pattern.

5TH EVALUATION AREA: ANS-PNSShows upper molar being held from coming forward.Treatment Design-- Requires maximum anchorage on upper molar. Upper molar does not have to be distalized; only held.

6TH EVALUATION AREA: ANS-PNSShows upper incisor to be retracted parallel and intruded.Treatment Design -- Will require intrusion and torque control during incisor retraction .

7TH EVALUATION AREA: Esthetic plane at lip embrasureShows retraction of protrusive lips behind E plane.Treatment Design -- Good profile change. Must watch lip strain due to mentalis habit in severe vertical pattern.

8TH EVALUATION AREA: Lower arch formShows 6mm of crowding in lower arch with cuspids blocked out and laterals lingual.Treatment Design -- Extraction of 1st bicuspids. Lower incisor retracted 2mm. Lower molar advanced 2mm. Cuspid and molar width remain the same.



TREATMENT PLANNING WORKSHEET

Patient_____Age____

DIAGNOSIS	TREATMENT PLAN
FUNCTIONAL REQUIREMENTS	
1. NASOPHARYNGEAL AIRWAY: Obstructed___Adequate___	1. M.D. Conference-Tonsils, Adenoids or Allergy Yes___No___
2. HABITS: Thumb Sucking Tongue Thrust, Other_____	2. Appliances required_____ Training required_____
3. MUSCULATURE PERIORAL: Tight___Normal___Loose___ MASTICATION: Strong___Normal___Weak___	3. Training required: a._____ b._____
ORTHOPEDIC REQUIREMENTS	
1. PALATE SEPARATION: Yes___NO___	1. Appliance_____ _____ _____
2. FACIAL AXIS CHANGE: Original measurement____° Open___°Hold___°Close___°	2. Head Gear Required Yes___ No___ Direction: High Pull___Cerv.___ Combination____ Force:_____grams/ounces Hours per day_____
3. CONVEXITY CHANGE: Original measurement____mm _____mm Hold_____ _____	
4. UPPER MOLAR _____mm Hold_____ _____mm	3. Other_____ _____ _____
ARCH LENGTH ANALYSIS	
1. From Cephalometrics.....(+,-)_____mm Arch Length Discrepancy (from models).(+,-)__mm Total of above.....(+,-)_____mm	1. Extraction: No_____ Yes (Upper Arch)
2. LOWER INCISOR: Intrude___Extrude___ Position Change: _____mm Hold_____ _____mm	2. Extraction: No_____ Yes (Lower Arch)
3. BUCCAL EXPANSION: _____mm	
ANCHORAGE REQUIREMENTS	**CASE MANAGEMENT SUMMARY**
1. LOWER MOLAR: _____mm Hold_____ _____mm	1. Degree of difficulty: 1.___2.___3.___
2. UPPER MOLAR: _____mm Hold_____ _____mm	2. Cooperation required: Average_____ Much_____
3. UPPER INCISOR: _____mm Hold_____ _____mm a. Torque_____ b. Intrude_____ c. Tip_____	3. Estimated completion date:___/___/___
4. Space available for 2nd & 3rd Molars: Upper_____mm Lower_____mm	4. Fee for treatment: $_____ 5. Key factor to watch_____ _____

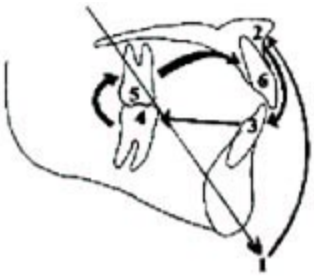
The treatment planning worksheet is a logical sequence to evaluate treatment needs by thinking:

1. Functional correction.
2. Orthopedic need.
3. Arch length analysis (? extraction).
4. Anchorage requirements.
5. Management summary.

Treatment Combinations

Bioprogressive mechanics proposes various treatment sequences. However, it further suggests that more value is gained when an application of the ten basic principles (as presented in the second article) are applied, rather than blindly following a "cookbook" approach to treatment. By having developed a treatment forecast with detailed specific objectives to be accomplished, much planning has already taken place, but then the real value comes in the creative process of designing "combinations of treatment" to reach those objectives. Visualizing the proposed changes suggests many combinations in treatment that can be planned to achieve them. These combinations of treatment procedures can overlap to accomplish more that one basic move at a time; for instance, incisors can be intruded while cuspids are being retracted in extraction cases. By the creative use of the spanning utility arches and retraction sections, a deep incisor overbite can be corrected with the simultaneous retraction of the cuspids, while the incisor intrusion action helps to stabilize and anchor the molars in this combination of mechanics. Further, while these two actions

are taking place, lingual arches can be activated to expand and rotate the molars in anticipation of their final position in the finishing occlusion. Orthopedic headgear application of various designs can be selected that will accomplish the proposed orthopedic alteration, while the above combination of basic moves are also in process.



PLANNING TREATMENT COMBINATIONS

1. CHIN POSITION

Facial type. Direction of growth. Muscular function. Anchorage significance.

2. POINT A

Convexity. Headgear selection. Upper incisor torque effect.

3. LOWER INCISOR

Position between chin and Point A.

4. LOWER MOLAR

Four anchorage possibilities, reciprocal to lower incisors.

5. UPPER MOLAR

Position to PTV, facial axis, and lower molar. Headgear type. Point A anchorage need for incisor torque.

6. UPPER INCISOR

Position parallel to facial axis. Torque and intrusion .

Treatment combinations are selected by considering the various needs of the visual treatment objective in a six-stage treatment planning sequence. This approach to treatment planning requires more time in the beginning phases in order to "see" and anticipate the various combinations of treatment, but it is the most valuable time that can be spent in the planning process in which we selectively choose from the broad armamentarium of treatment procedures and place them in progressive sequences in order to combine the basic moves that bring us toward the final finishing stages of occlusion and normal function.

The planning ideally should anticipate every appointment with a scheduled sequence of programmed treatment. When we proceed this far in our planning, then the treatment itself becomes a matter of carrying out the plan by guiding and monitoring its progress.

Sectional Arch Treatment

Extraction mechanics in Bioprogressive Therapy takes advantage of sectional arch treatment. Sectional arch treatment is characteristic of all of Bioprogressive Therapy treatment procedures whether nonextraction treatment, mixed dentition treatment, adult treatment, or extraction treatment. The advantages of sectional arch therapy are numerous and deal with basic fundamentals, including the anatomical structure, the physiology of tooth movement, and the mechanics of proper force application, both in direction and amount. By breaking up the arches into the various segments during treatment, we are able to evaluate all three planes of space: the anterior/posterior movement, the vertical movements, and the buccolingual or transverse movements. Maxillary orthopedics, with adjustments at the midpalatal suture and posterior pterygoid buttress verifies the need to consider the segments of the maxilla in its applied mechanics. Upper and lower incisor movements of intrusion, retraction, advancement, and torquing, further suggest that sectional arch treatment mechanics can best deliver the proper force application, both in direction and amount, through the use of the utility arch to the anterior segment.

Cuspid retraction around the corner is also best handled on a sectional arch in order to respect the supporting structures and avoid the complication of full arch mechanics. Wax typodont

demonstrations fail to show the limitations of full arch treatment since wax is homogeneous and doesn't reflect the variations in bony anatomical structure. Treatment mechanics that are designed to respect the variations in anatomical structure are much more efficient. Biomechanical principles should respect and appreciate these factors.

Extraction Mechanics

Bioprogressive Therapy applies a variety of treatment procedures in its extraction mechanics. The final selection is based on the specific need of the individual patient as prescribed from the visual treatment objective. Extraction of teeth during treatment is prescribed because of the arch length requirements within the dental arches. Severe crowding in the dental arch or double protrusive incisors require the extraction of teeth for their proper alignment within the jaws and environment of the face.

The extraction sequences in Bioprogressive Therapy can best be organized into four general procedures that can be individually evaluated and analyzed as to the needs of the specific case.

1. Stabilization of upper and lower molar anchorage.
2. Retraction and uprighting of cuspids with sectional arch mechanics.
3. Retraction and consolidation of upper and lower incisors.
4. Continuous arches for details of ideal and finishing occlusion.

I. Stabilization of the upper and lower molar anchorage.

UPPER MOLAR ANCHORAGE

The upper molar is stabilized and anchored in various procedures from maximum anchorage where the molars are not allowed to progress forward, to a minimum anchorage where they may be advanced the whole distance of the extraction site.

Maximum upper molar anchorage. A modification of the Nance lingual arch is used in maximum upper molar anchorage planning. The modification to the Nance lingual arch, with the plastic button against the rugae region of the palate, is the addition of a distal loop on the mesial lingual of the upper molar bands, which allows the molar teeth to be expanded and rotated more easily. The expansion and rotation of the upper molars present three advantages in treatment.

1. Expansion places the molar roots out under the zygomatic process where cortical bone support resists change and thus anchors and limits their movement.
2. The molars, placed in distal rotation, tend to resist the forward mesial pull as the cuspids are being retracted on sectional arch springs.
3. The third value is the distal rotation of the molar crowns for final positioning in the finishing occlusion. The finishing alignment and details of occlusion should be kept in mind even in the first basic treatment movements.

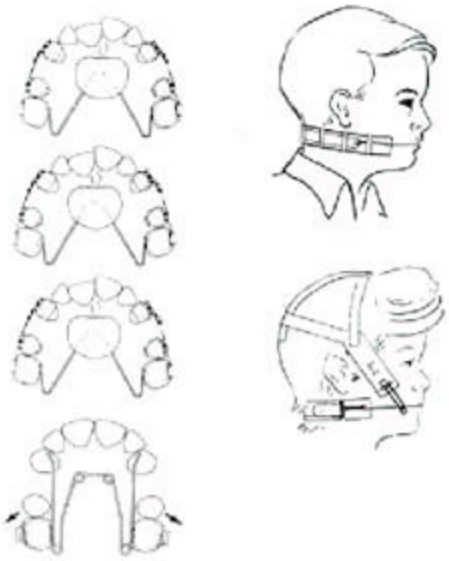
Moderate upper molar anchorage may not need to hold the upper molar completely stable, but will allow it to be advanced forward up to half of the extraction space during the treatment

BIOPROGRESSIVE THERAPY / PART 9

UPPER MOLAR ANCHORAGE DESIGN

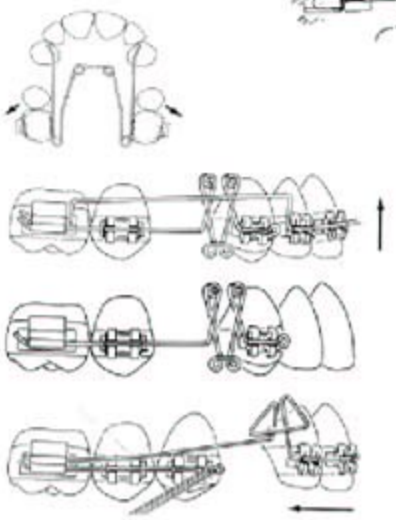
MAXIMUM ANCHORAGE

1. Nance Plastic Button Followed By Head Gear
2. Head Gear Directional
3. Nance Plastic Button Alone



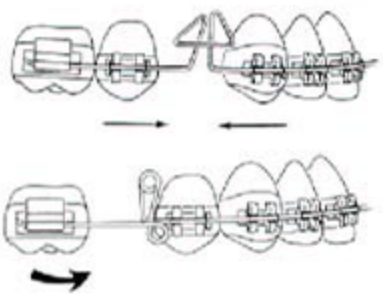
MODERATE ANCHORAGE

1. Quad Helix Expansion Arch
2. Upper Utility Arch
3. Sectional Retraction Then Anterior Retraction



MINIMUM ANCHORAGE

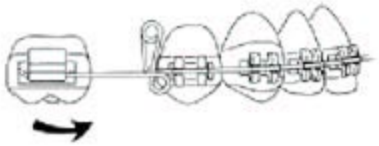
1. Reciprocal Closure
2. Extract 5|5 Molar Forward



Article Text

1. Reciprocal Closure

2. Extract 5|5 Molar Forward



MODIFIED NANCE LINGUAL ARCH
FOR UPPER MOLAR ANCHORAGE CONTROL

The original Nance lingual arch design is from the palatal plastic button directly to the lingual of molar band.

Modified Nance lingual arch has a distal loop designed for molar expansion and rotation. Large lingual button is necessary for added stability.

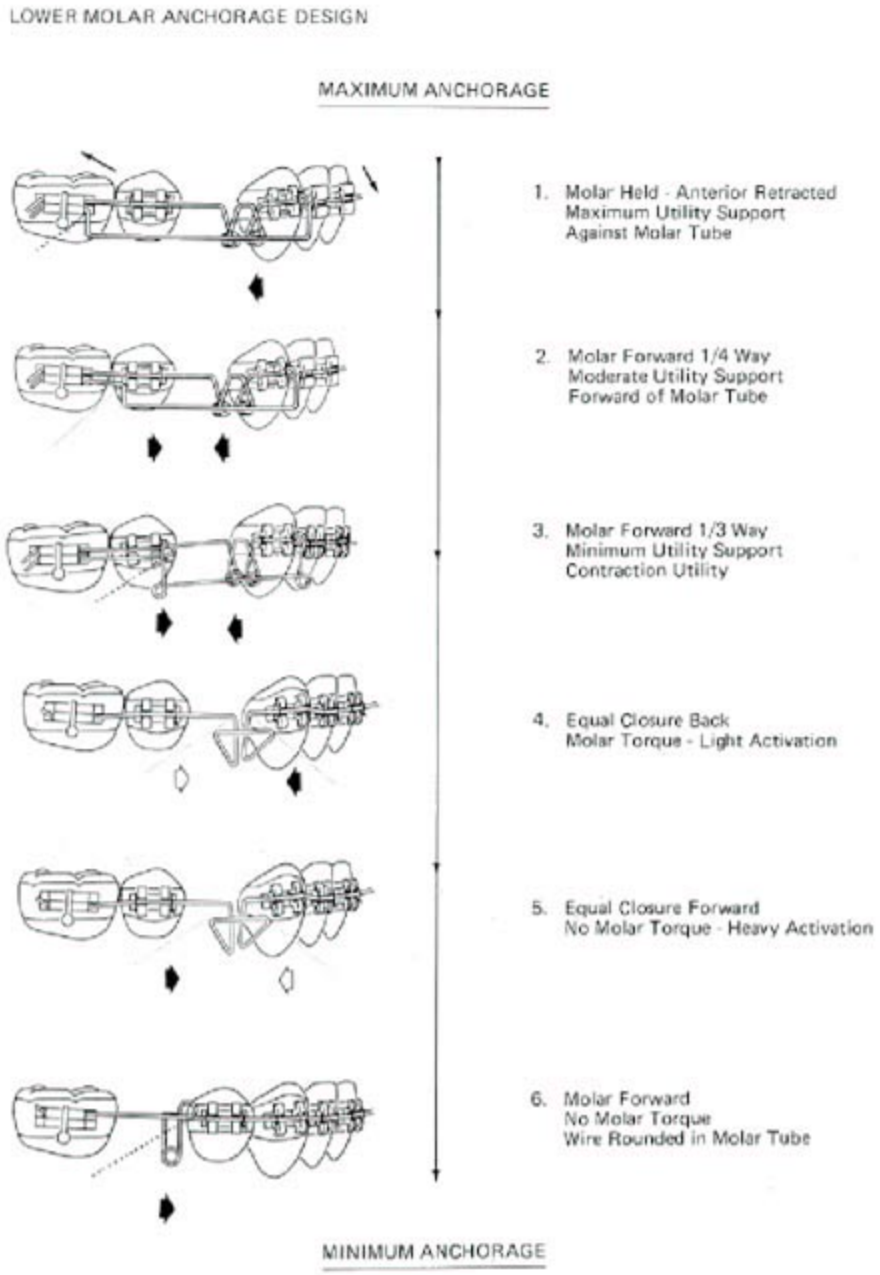
Helical loop in the modified Nance lingual arch gives additional rotation to the molars. Molar attachment is on mesial lingual surface for further rotation.

Helical loop and lingual extension in modified Nance lingual arch gives additional molar rotation and bicuspid expansion.

The modified Nance lingual arch with lingual arch extensions and loops to the individual teeth allows added action.

Modified Nance lingual arch with individual springs from the palatal plastic button may also be designed.

LOWER MOLAR ANCHORAGE DESIGN



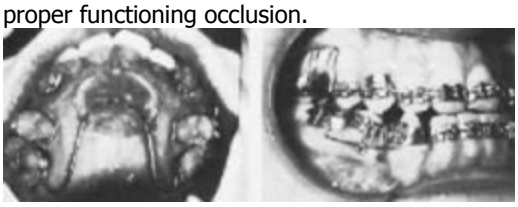
LOWER MOLAR ANCHORAGE

Lower molar anchorage also considers the need for complete maximum anchorage versus a moderate and minimum anchorage, where differing mechanics are needed in varying facial types and muscular patterns. Strong, muscular, deep bite facial types seem to exhibit a natural anchorage that needs to be appreciated and considered in selecting appropriate procedures. Anchorage factors discussed will be based upon the mesofacial type and need to be adjusted for the variations of the individual case. Thus, we use the more moderate anchorage concepts in the strong muscle patterns and the more maximum anchorage concepts in the vertical pattern where the musculature gives least support.

Maximum lower molar anchorage is maintained through the action of the long lever arm of the lower utility arch as described in the earlier articles. During cuspid retraction on sectional arches, the utility arch is used in extraction mechanics to intrude or stabilize the incisors, while the various molar anchorage needs are met by modification to the basic utility arch. Four mechanical adjustments are placed against the molars in establishing a maximum anchorage effect:

1. Buccal root torque that places the roots against the cortical support to limit their movement. Up to 45° of buccal root torque is placed in a .016 X .016 Elgiloy wire.
2. Buccal expansion of the molar section of 10mm on each side is necessary to support the buccal torque.
3. Tipback of 30°-40° keeps the molar upright and resists the forward pull in response to the cuspid retraction springs. The tipback is the reciprocal action that acts to intrude the lower incisors. (The molar step for maximum anchorage should be kept

against the molar tube.)
4. Distal molar rotation of 30°-45° is also placed in the molar section of the utility arch in extraction cases. The molar needs to be positioned to resist the forward drag on it during cuspid retraction, as well as to be positioned to receive the upper molar in a proper functioning occlusion.



Upper molars are stabilized with a modified Nance lingual arch. Lower molar anchorage is stabilized by the lower utility arch. Four variations of action in the molar area modify the lower molar from maximum to minimum anchorage.

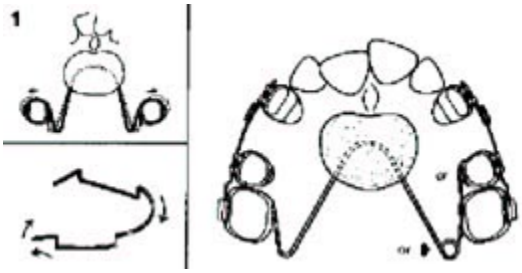
Moderate lower molar anchorage modifies the lower utility arch mechanics to allow the molar to come forward during cuspid and incisor retraction. A contraction utility arch stepped ahead of the molar tube modifies the four components of molar anchorage and utilizes the incisor retraction force to advance the molar. A proposed 3-4mm forward lower molar movement must respect the musculature which reflects the facial type. In the extreme vertical pattern open bite cases, 3mm

forward movement would still require maximum anchorage to hold; while 3-4mm forward movement in a strong, deep bite brachyfacial type would be minimum anchorage and require special efforts to advance the molar. The facial type which reflects this muscular anchorage is a critical factor in influencing the treatment prescribed.

treatment sequence of mechanics

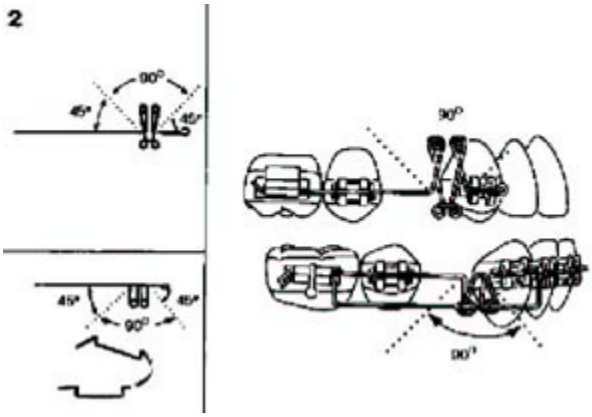
CLASS I EXTRACTION CASE (SEMI MAXIMUM ANCHORAGE CASE)

1.UPPER: Place Nance holding arch, fabricated indirectly. Acrylic button size of quarter and distal loops activated prior to cementation to effect molar rotation. The Nance appliance may have to be activated during subsequent appointments to keep the acrylic button in close contact with the palate. This can be done intraorally with a three-prong plier. Additional helical loops and extensions assist in molar rotation and bicuspid expansion.



LOWER: .016 X .016 blue Elgiloy utility arch is activated with 30° molar tipback, 30° distal molar rotation, and 30°-45° buccal root torque to stabilize the lower molars and level the lower arch by lower incisor intrusion when needed.

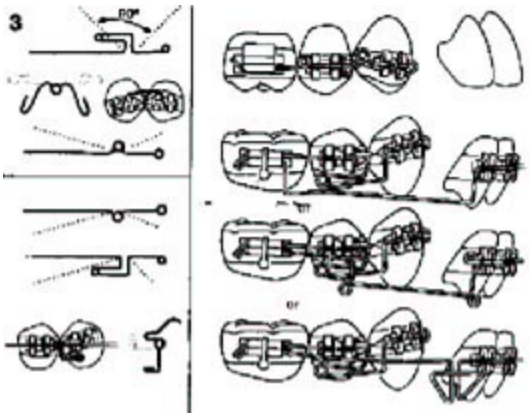
2.UPPER: .016 X.016 blue Elgiloy retraction sections placed in conjunction with Nance holding arch. Activated by 2-3mm cinch back to provide light continuous retraction force to cuspids. Do not overactivate retraction sections in order to avoid undue tipping and supereruption when cuspids are fully retracted to abutment with bicuspids. The lingual elastic thread from distal of first molar to mesial of cuspid can be placed after two-thirds of cuspid retraction has occurred.



LOWER: Place .016 X .016 blue Elgiloy utility arch in gingival buccal tube to intrude lower incisors and rotate, upright, and

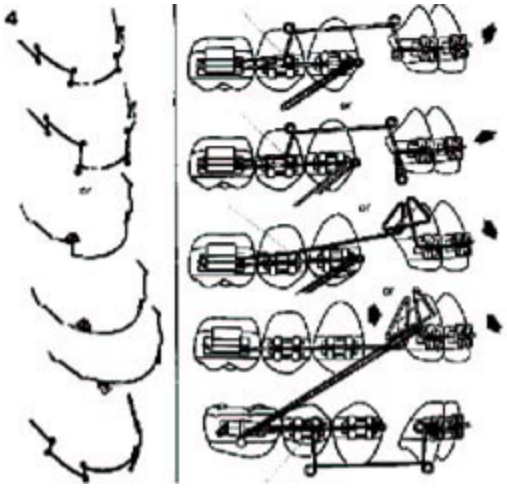
stabilize the lower molars. The severity of the tipback bend dictates the amount of incisor intrusion, which may be minimal in Class I malocclusion. .016 X .016 blue Elgiloy retraction sections are placed in the occlusal tube and activated 2-3mm by cinch back. The loops of the lower retraction sections should be inside the utility arch. Retraction sections are gabled before placement, to counter cuspid tipping.

3.UPPER: After cuspids are fully retracted, several methods may be utilized to upright, intrude, elevate, and rotate the cuspid teeth. A horizontal helical or "L" loop sectional will provide both vertical and horizontal control of the cuspid. In situations where less flexibility is required, a simple helical loop in a straight section will provide excellent horizontal control in the uprighting of cuspids and molars. Light elastic thread is usually needed to effect mesial rotation of the cuspid.



LOWER: Cuspid uprighting and rotation sections are placed in the lower arch also. Intraoral adjustments are made in the utility arch to further activate intrusion and overcorrect incisor rotations. Cuspid-bicuspid ligation is required in all of the cuspid uprighting sections to avoid spacing in the extraction sites. Lingual thread may be further used to enhance buccal segment rotations.

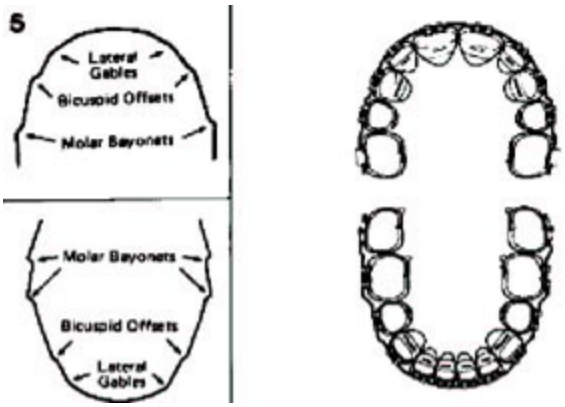
4.UPPER: After cuspid uprighting has been achieved, the Nance appliance is removed. The upper incisors are then banded (Some rotation and spacing of these teeth, due to lip and tongue pressure, may have already occurred). If there is excessive anterior crowding, an .016 X .016 blue Elgiloy multiloop leveling arch may be placed for one or two appointments to align the upper incisors. The upper incisor retraction is accomplished from a selection of four various consolidation utility arches: 1. The contraction utility for contraction to maintain torque. 2. The torquing contraction utility for additional torque during retraction. 3. The stepped-up double delta loop for straight retraction, and 4. the regular double delta to retract and close the anterior open bite The centrals, laterals, and cuspids have 22°, 14°, and 7° lingual root torque in the bracket slot.



LOWER: A contraction utility arch or double delta arch is placed to retract and level the lower incisors. Light Class II elastics may be used at this time to maintain the Class I buccal segment interdigitation. Lower Incisor retraction should be started and maintained slightly ahead of the upper incisor retraction. Avoid overactivation of both the upper and lower retraction arches to maintain anchorage, torque-control, and to prevent tipping. A light continuous force is ideal in all retraction wires.

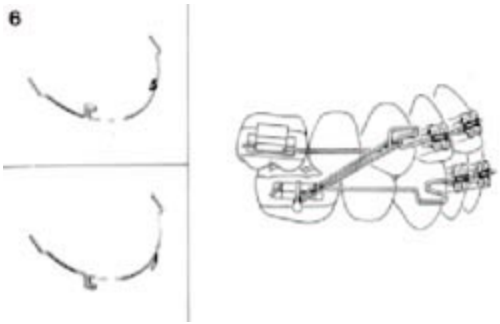
5.UPPER: Place 016 X .016 blue Elgiloy ideal arch. Definite buccal offsets for premolars and overrotation of upper molars. Rotations can also be overcorrected by means of intraoral arch bends or lingual light elastic thread. if further arch form or torque control is desired, larger sized

edgewise arches may be used. Careful arch form typal considerations (round, ovoid, etc.) incorporated at this stage.



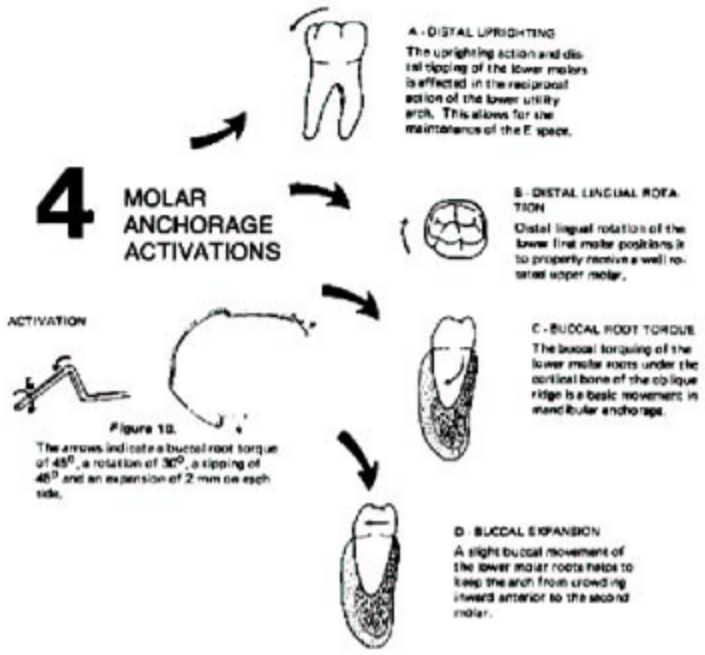
LOWER: Place 016 X 016 blue Elgiloy ideal arch. Definite buccal offsets for premolars and first and second molars. Labial gable bend or step to keep canines slightly behind lateral incisors. Also, lingual crown torque on molar, progressive from distal of canine. When second molar is banded, a definite offset and toe-in is required. .016 X 022 or 018 X 022 Elgiloy may be used for arch form control.

6.UPPER: Following debanding of cuspids and second bicuspids, an 018 X .022 blue Elgiloy closing horizontal "L" arch is placed. Definite artistic or "beauty" bends incorporated to achieve slight root divergence of both central and lateral incisors. Upper arch is not activated so that upper molars are not drawn forward in band space closure. Light Class II elastics applied to achieve overcorrection of buccal segment teeth.

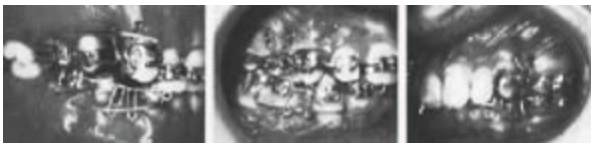


LOWER: Following debanding of cuspids and second bicuspids, an .018 X .022 blue Elgiloy closing horizontal "L" arch is placed. Activated 1-2mm to bring lower buccal segments forward in band space closure to achieve overcorrection of Class I molar relation. Light Class II elastics

also help to achieve this overcorrection. Patients are seen at two-week intervals at this time to maintain proper control in these finishing stages. Careful attention to midline and incisor detailing is important ar this point.



In minimum anchorage mechanics the lower molar is being advanced to close spaces forward as in a lower second bicuspid extraction procedure or when lower first molars may be missing. To advance the lower molar forward the four anchoring factors of torque, tipback, expansion and rotation are minimized. Round wire in the molar tube may be used to eliminate the binding and torquing to the molar and thereby reduce the anchorage. Elastic string adds the continuous force needed when advancing the lower molar.



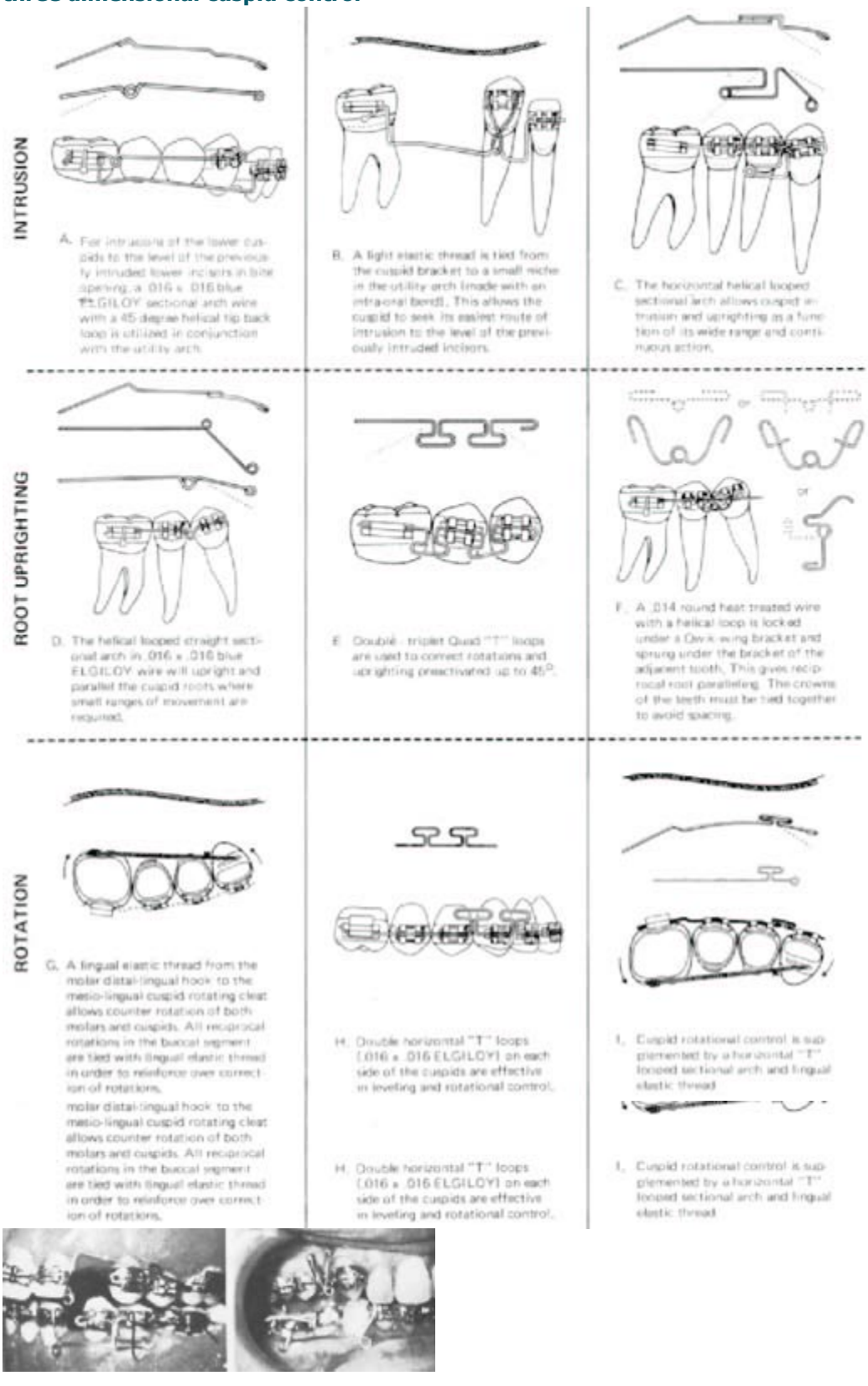
Upper and lower cuspids are retracted on multiloop sectional retraction springs, which allow free movement with little friction along the arch. Only 150-200 grams are required during cuspid retraction. 90° gable and 90° offset activations are placed to control cuspid retraction. Upper incisors may or may not be banded.

II. Retraction and uprighting of cuspids with sectional arch mechanics.

Bioprogressive Therapy proposes segmented arch treatment and retracts the cuspids on sectional arch retraction springs. The advantages of sectional arch treatment have been discussed elsewhere in this series and encompass many aspects of orthodontic treatment including orthopedic alteration, efficient force application to incisors, and anatomical variations at the corner of the arch in cuspid movements. Since the cuspid is located at the "corner" of the arch, it presents special problems during treatment. In its retraction it must be allowed to turn the corner in order to avoid the cortical bone support in both the upper and lower arches. In the lower arch, the planum alveolare on the lingual supports the cuspid. In the upper arch, the cortical bone on the lingual palatal surface of the alveolar process supports the cuspid lingually. Severe tipping of the cuspids which allows the root tip to move forward will complicate its retraction. The cuspids need to be kept in the narrow trough of trabecular bone and avoid the severe tipping or displacement into the cortical bone. When cuspids are retracted on sectional arch retraction springs they are free moving and not limited by the binding restrictions of a continuous archwire. For the additional value of free movement, less control can be maintained. Therefore, care must be exercised in sectional arch treatment to compensate for the tipping and rotational control in sectional arches. Extreme 90° gable and 90° offset antirotation bends are placed before the springs are placed and activated for the cuspid retraction. The activation of the cuspid retraction springs should produce 100 to 150 grams of force for cuspid retraction. Only 2-3mm of activation is required to produce the desired force. Heavier forces allow excess tipping and loss of control. Lingual string can assist in rotational control in the final one-third of cuspid retraction, after it has retracted around the corner.

Cuspid uprighting and rotational correction may be necessary following retraction. Tipping may occur when the retraction forces have been too high, in excess of 150 grams. Cuspid uprighting springs are preactivated with 90° of activation in order to generate a light continuous force to upright and parallel the roots adjacent to the extraction site. The crowns need to be ligated together during uprighting in order to prevent their separation from returning.

three dimensional cuspid control



Cuspid uprighting and rotation springs are placed in sectional arches to align and position the cuspids, while the incisors are being retracted with various retraction loop designs.

III. Retraction and consolidation of upper and lower incisors.

Utility arches treat the overbite before retraction. While the cuspids are being retracted with sectional retraction springs, the

upper and lower incisors can be aligned and either be intruded or extruded for better overbite control before their retraction. Upper and lower utility arches which span from the gingival tube of a double tube on the molar to the incisors are effective in producing the light continuous forces for incisor intrusion and alignment. The previous articles on forces and utility arch discussed their individual use. Here they are being used in combination with sectional arch retraction springs with the multipurpose action of molar anchorage control and incisor alignment. In the cases where the treatment objective shows little need for incisor intrusion, the utility arch would require very little tipback bend, but can still be stopped against the molar tube with the other three activations for molar anchorage.

Lower Incisor.

Lower incisor retraction must respect the cortical bony support on the lingual planum alveolare as the teeth are being retracted. Very light continuous forces (150 grams) need to be applied in order that the cortical bone can be remodeled. Heavy forces will anchor the roots against movement and produce tipping and extrusion of the incisors. The contraction utility is used in lower incisor retraction. Its construction and activation allow light activation forces and limited extrusion because of the molar tipback loop. The double delta retraction loop can be used for lower incisor consolidation either to the incisors from the molar as an overlay on top of the sectional arch or as a continuous arch through the buccal segments with the closing loop between the cuspid and incisors. The double delta loop produces more extrusion of the incisors and is used where incisor bite closure is desirable.

Upper incisors are retracted by a variety of loops. Here an inverted closing loop is used and activated to torque the incisors during their retraction.

Upper incisors can be consolidated by a stepped-up double delta loop, while the buccal occlusion is stabilized by a sectional arch.

The double delta closing loop is placed on a continuous arch to allow reciprocal closure and arch leveling in the upper arch. Adjustments and steps can also be placed to extrude or close the bite in special cases.

Upper Incisor.

When upper incisor retraction is begun, it is important to remove the Nance lingual arch to allow the alveolar process to remodel. Upper incisor retraction and consolidation has the additional problem of maintaining upper incisor torque control while the incisors are being retracted. The torque is applied through the long lever arm and loop on the utility arch from the molar. Various designs of the upper utility arch allow a choice of retraction loops depending upon how much is required. The long axes of the upper incisors are torqued until they parallel the facial axis line. This allows for incisor alignment that is individualized to the facial type. The deep overbite cases with a low mandibular plane angle and a Class II division 2 incisor relationship often require much lingual root torque to the incisor in order to be aligned parallel to a more horizontal facial axis. Incisor positioning and torque control usually begins by treating the overbite with incisor intrusion before retraction or overjet correction.

The upper incisors can be retracted by a regular contraction utility arch when directed consolidation is required. Where additional lingual root torque is necessary during incisor consolidation, then a torquing contraction utility arch is used. An upside down vertical closing loop gives additional torque when activated. Lingual root torque results as the loop expresses its activation. When little or no lingual root torque is required or buccal root torque is necessary, then round wire arches will roll the crowns back. This action will tip forward and advance the incisor roots. The double delta loop either as a utility arch bypassing the buccal occlusion or as a looped continuous arch has an extruding action and finds much use in open bite treatment where extrusion and bite closure is desired.

Bioprogressive extraction and nonextraction treatment stays segmented as long as possible in order to take full advantage of the efficiency that segmented treatment allows in accomplishing the basic moves that allow the unlocking of the malocclusion and moving to establish a more normal function. The basic moves include, for the most part, alignment of the buccal occlusion, and incisor overbite and torque control. The positioning of the buccal occlusion includes molar rotation, buccal expansion, crossbite correction, as well as the anterior/posterior alignment. Incisor overbite and torque control are best accomplished by the use of the utility arch.

Following the consolidation of the incisor segments to the buccal occlusion, the arch form and finishing occlusion are established with continuous arches. Slight variations in vertical height of the various segments as they are brought together can be accomplished by the double delta loop which has a vertical leveling component as well as a horizontal consolidating component. For slight variation, multistrand continuous arches are effective. Where slight overbites have developed during incisor retraction and consolidation, the standard utility is again used for minor leveling and intruding procedures for a period of time.

Ideal and finishing arch mechanics are consistent with the basic principles of occlusion. In the anticipation of the expected rebound effect, a concept of overtreatment is a principle of Bioprogressive Therapy. This evaluates the need for overtreatment from the original malocclusion. Thus, the Class II correction is overtreated. Deep incisor overbite is treated to an edge-to-edge occlusion. Open bite cases are left in deep overbite overtreatment where possible. The stability of overbite correction is dependent on incisor torque.

Ideal continuous arches are placed following incisor consolidation to complete the details of occlusion. Molar, bicuspid, and cuspid offset bends are placed in the continuous arches.

Finishing arches are placed during the final two weeks of treatment. The bands have been removed from the buccal segments in order to close the band space and handle the final finishing details.

The final finished occlusion in an extraction case shows the molar rotation, buccal occlusion, and occlusal arch form that are important to the proper function and stability of the case. It is important to have the finished occlusion in mind when the first activations for molar rotation and cuspid retraction are placed.

Finishing arches are placed during the final 2 weeks of active treatment. The bands have been removed from the buccal occlusion in order that band space closure can allow finer details in occlusion. Class II, Class III or vertical elastics may assist in the finishing process. Future articles will deal with the specifics of finishing and retention .

Summary of Extraction Treatment

Bioprogressive Therapy extraction mechanics are simply an extension of segmented arch therapy where a crowded arch length or protrusive incisors have required the extraction of teeth in order to reach the objectives of normal function, esthetic balance or stability. The visual treatment objective is used as a treatment planning tool to visualize and prescribe the necessary mechanics. The priority of treatment planning procedures are to consider:

1. Functional requirements or needs.
2. Orthopedic alterations.
3. Arch length analysis-- with extractions where necessary.
4. Anchorage requirements.
5. Management summary.

The selection of various appliances for treatment are evaluated as to their:

1. Functional effect-- both mechanical and biological.
2. Fabrication -- basic construction and preplacement activation.
3. Placement-- to avoid distortion.
4. Activation-- in the arch.

The selection of specific treatment procedures and their sequences in Bioprogressive segmented extraction mechanics involve:

1. Stabilization of upper and lower molar anchorage.

2. Retraction and uprighting of cuspids on sectional arches.
3. Retraction and consolidation of upper and lower incisors.
4. Continuous arches for details of ideal and finishing arches.

(TO BE CONTINUED IN NEXT ISSUE)

PART 9

PART 1 The Management UmbrellaPART 2 Principles of the Bioprogressive TherapyPART 3 Visual Treatment Objective or V.T.O.PART 4 The use of superimposition areas to establish treatment designPART 5 Orthopedics In Bioprogressive TherapyPART 6 Forces Used In Bioprogressive TherapyPART 7 The Utility and Sectional Arches In Bioprogressive Therapy MechanicsPART 8 Bioprogressive Mixed Dentition TreatmentPART 9 MECHANICS SEQUENCE FOR EXTRACTION CASESPART 10 Mechanics Sequence for Class II Division I CasesPART 11 Mechanics Sequence for Class II Division II CasesPART 12 Finishing Procedures and Retention