Bio-Progressive Therapy, Part 2: Principles

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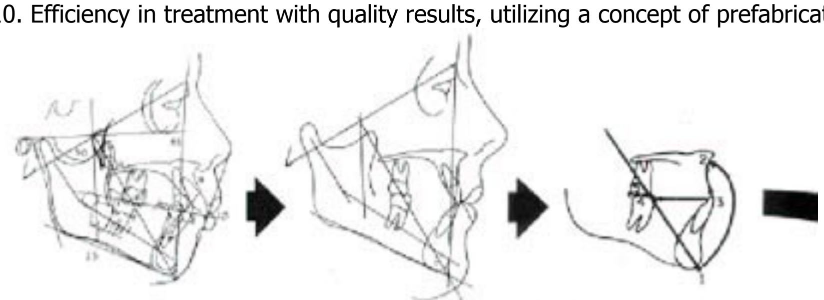
The clinician needs to base his treatment mechanics on the results he wants to achieve with the goals and objectives he has in mind. He then should select the mechanical procedure or devices that will accomplish his goals, rather than follow a mechanical technique blindly and settle for whatever results it may arrive at. The diagnosis and desired results should guide us in our selection and use of mechanical procedures. We should not settle for or be limited in our final result by whatever a wire, band or gadget can produce.

Ten principles have been developed in an attempt to communicate an understanding of the mechanical procedures that Bio-Progressive Therapy may use in developing a treatment plan, including appliance selection and application, specific to each individual patient. The same appliance, because of the way it is activated in different facial types, may be expected to produce differing results in different patients.

TEN PRINCIPLES OF BIO-PROGRESSIVE THERAPY

1. The use of a systems approach to diagnosis and treatment by the application of the visual treatment objective in planning treatment, evaluating anchorage and monitoring results.
2. Torque control throughout treatment.
3. Muscular and cortical bone anchorage.
4. Movement of all teeth in any direction with the proper application of pressure.
5. Orthopedic alteration.
6. Treat the overbite before the overjet correction.
7. Sectional arch therapy.
8. Concept of overtreatment.
9. Unlocking the malocclusion in a progressive sequence of treatment in order to establish or restore more normal function.
10. Efficiency in treatment with quality results, utilizing a concept of prefabrication of appliances.



Tracing of the beginning lateral cephalometric x-ray allows the clinician to evaluate the chin, maxilla, teeth and soft tissue in the original facial morphology. From this original tracing, a proposed Visual Treatment Objective is designed.

The Visual Treatment Objective (VTO) represents a "cephalometric setup", which includes the expected growth and treatment changes as projected from the original malocclusion and facial morphology.

The Visual Treatment Objective allows the clinician to evaluate the inter-relationship of the changes as they effect each other in the proposed adjustments — first, chin; second, maxilla; third, lower incisor; fourth, lower molar; fifth, upper molar, upper incisor and soft tissue.

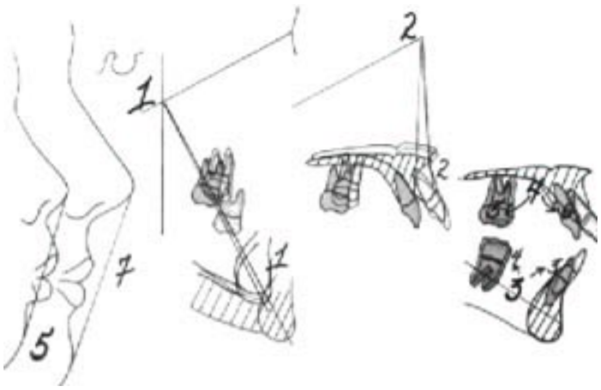
#1 The use of a systems approach to diagnosis and treatment by the application of the visual treatment objective in planning treatment, evaluating anchorage, and monitoring results.

In Bio-Progressive Therapy, a planned systematic approach is followed in constructing a cephalometric setup similar to a plaster setup in order to anticipate those changes expected in the individual patient. To plan properly for the changes that will occur, the clinician must understand the present condition, anticipate the expected growth, and know the specific effect of his orthodontic-orthopedic treatment. This treatment forecast, developed by Ricketts and called a Visual Treatment Objective by Holdaway, allows the orthodontist to visualize the changes that should occur and to prescribe the necessary treatment to cause it to happen.

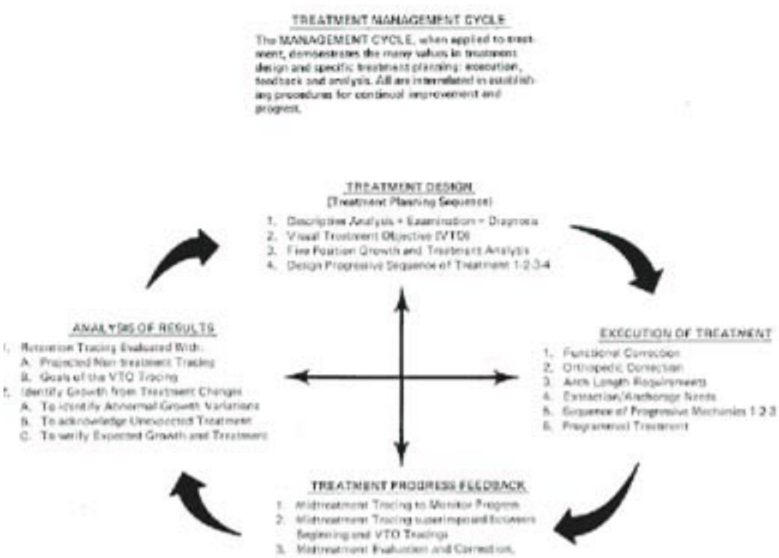
It is important to appreciate those changes that are going to be helpful in the correction of the problem and respect those growth factors that will make the problem worse or severely complicate treatment. During the average two-year treatment experience, treatment changes will account for 70-80% of the change, while growth changes are limited to 20-30%. Therefore, in our planning, the major factor is to understand the specific alteration that our mechanical therapy will produce. For this purpose, the Visual Treatment Objective is like a blueprint or design of the final result. It is a management tool to permit evaluation of change that is proposed in each area, and the effect that change will have upon the other areas. We must consider the inter-relationships, first with the chin and its effect upon the maxilla, then their combined effect upon the lower molar, then the effect of lower molar change on upper molar, upper incisor, and soft tissue profile.

One of the greatest values of the Visual Treatment Objective is its use in understanding this inter-relationship of the various changing parts, and the influence that one area has upon another. This inter-relationship of change is unique to the Visual Treatment Objective, and is of great advantage in prescribing a treatment plan that is the most efficient in producing quality results. The

proposed orthopedic movement in one area often is sufficient to effect the anchorage needs in another and the treatment moves can thus be coordinated and maximized.



Five areas of superimposition for analysis of change are shown in the treatment design chart, with seven areas of evaluation to visualize the treatment necessary to accomplish those proposed changes.



Five areas of superimposition and analysis have been selected to evaluate the changes that have been forecast to visualize the difference between the expected (untreated) growth and the proposed treatment alterations. The greatest difference would be the required change due to the treatment alteration, since the expected growth changes have already been included in the forecast.

Seven areas of evaluation are used to determine the major moves needed to accomplish the forecast objectives and to design treatment with a priority sequence for quality results and maximum efficiency.

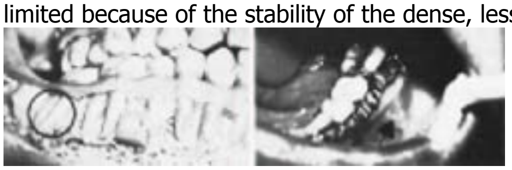
#2 Torque control throughout treatment.

Some treatment techniques, in an effort to move teeth more efficiently, have designed brackets for a limited contact between the archwire and the bracket or recommend the use of round wires in an attempt to limit the control and allow more freedom and movement of the tooth. Bio-Progressive Therapy suggests that movement of teeth can be more efficient and various treatment procedures more effectively carried through when control of the direction of root movements is available. The edgewise slot bracket (.018 X .030) is used in order to keep the bracket and wire sizes smaller, but still have torque control available throughout various stages of treatment. Consider four treatment situations where torque control of the root movement is necessary:

1. Keep roots in vascular trabecular bone-- for efficient movement.The major tooth movements during the beginning stages of treatment may be forecast from an analysis of the Visual Treatment Objective. For beginning movements, such as incisor intrusion or cuspid retraction-- where movement through a less dense trabecular bone structure is desired because it is more efficient-- torque control allows us to steer the roots away from the denser, thicker cortical bone, and through the less dense channels of the vascular trabecular bone.

The lower incisors are supported by the lingual cortical bone and require buccal root torque for their efficient intrusion through the more vascular trabecular bone.

2. Place roots against dense cortical bone-- for anchorage. A treatment situation arises where teeth are being anchored or stabilized against movement by placing their roots in juxtaposition against the more dense cortical bone. Therefore, torque control of these teeth is used to maintain this root placement if possible under a heavier force, so that their movements will be limited because of the stability of the dense, less vascular cortical bone.



The lower morals are anchored by expending their roots into the more dense cortical bone.

3. Torque to remodel cortical bone. Certain desired repositionings of the teeth often require that the

roots must be moved into the dense, less vascular cortical bone structure. Examples of such situations are: a. Upper and lower incisor retraction through the dense lingual cortical plates; b. Upper incisor root torquing movements; c. Impacted upper cuspids, either in the palate or high in the labial vestibule; d. Forward movement of lower molars to close spaces created by missing or extracted teeth. Movements of this nature require longer time to allow the more dense, less vascular bone to be remodeled. Very light sustained forces are required under directional control to keep the roots properly positioned during this critical time of treatment. Lack of control may cause excess tipping, which will need to be recovered, further complicating and delaying their efficient movement.

4. Torque used to position teeth in final occlusion details. The fourth situation where torque control of the root is desired is during the final stages of treatment where the final details of occlusion are being established, where fit and mesh of the teeth require proper root alignment for proper function and better stability.

#3 Muscular and cortical bone anchorage.

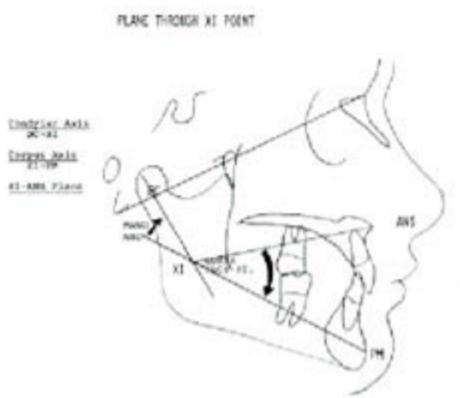
Muscular Anchorage

Anchorage here is considered in terms of stabilizing the molars and positioning teeth against movement during the various stages of orthodontic treatment. Stabilizing the teeth against the horizontal movements and also against vertical or extruding forces produced by a cervical headgear to the upper molars is countered by the posterior muscles of mastication, primarily the masseters and temporalis. Class II elastics to the lower molars produce similar effects and require the same supportive physiology of the musculature. In certain facial patterns this musculature seems stronger and able to overcome most orthodontic treatment forces, while in others the musculature is weaker and is easily overpowered by the orthodontic treatment forces. Treatment procedures in the latter cases must be closely monitored or modified to respect the weaker anchorage support.

It has been observed by numerous clinicians that those facial types which exhibit the stronger musculature are characterized by the deep bite low mandibular plane brachyfacial structures. While those with a high mandibular plane angle, vertical pattern, open bite, dolichofacial characteristics have a weaker musculature and are less able to overcome the adverse orthodontic treatment forces that tend to open the bite and rotate the mandible.

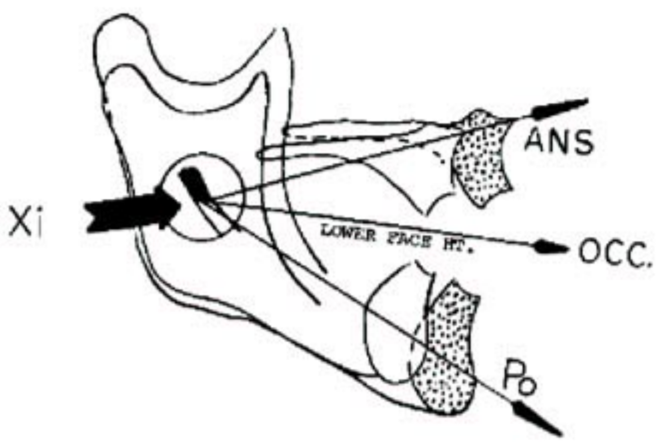
Recent evaluations of the morphology of the mandible and lower facial structures suggest cephalometric measurements that can be used that are more critical describers of these facial types and alert us to those types which may require that we modify our treatment procedures, not only to support the anchorage when that choice of treatment is desired, but lessen the anchorage support when it may be in excess. Cranial base measurements to the mandibular plane, or the facial axis to the chin have given us general clues to these anchorage and facial types, but by using those measurements more directly involved with the internal mandibular form and the lower vertical face height, we can be more specific in defining those structures which describe the function or muscular support so critical to anchorage and treatment planning. XI point located in the center of the ramus of the mandible opposite the mandibular foramen becomes a point from which a mandibular arc

angle is constructed. This mandibular arc from the ramus of the mandible through its corpus axis describes the internal form of the mandible and is more characteristic of its true function, rather than the distant cranial points which also may reflect variations in cranial base morphology.



New measurements through XI point in the center of the mandibular ramus describe the lower face height (46° ± 4°) and the mandibular arc (27° ± 3°). They are better describers of muscle function and anchorage, since they are located within the mandibular structure, rather than a distant cranial landmark. They aid in the selection of the type of headgear prescribed and give an indication of lower molar anchorage needs.

XI point also becomes the apex of an angle describing the lower face height from the corpus axis of the mandible as its lower boundary to the anterior nasal spine of the palate as the upper limit of this oral gnomon. During normal growth this angle of lower facial height does not change and therefore gives a good indication of the present status as well as future potential of oral form and physiology.



The lower face height angle does not change with growth, but remains constant and is a good indication of facial muscular function.

Cortical Bone Anchorage

Teeth move more slowly through cortical bone. For this reason, orthodontists often speak of cortical bone anchorage or support. The cortical bone is characterized by being more dense and laminated, with a very limited blood supply. The blood supply in the bone is the key factor in tooth movement, since it carries the cellular elements that resorb away bone and also the cellular elements that build up new bone. In cortical bone, where the blood supply is limited, the physiological process is delayed and tooth movement is slower.

Tooth movement can be further delayed where excess forces against the cortical bone can press out the blood supply and limit the physiology and the tooth movement. Bio-Progressive Therapy applies this principle of cortical bone anchorage in stabilizing the teeth in those areas where it desires to limit their movement. Lower molar anchorage is enhanced by expanding the molar roots into the dense cortical bone on their buccal surface. Excessive buccal root torque and expansion is placed in the archwires to locate the roots into the cortical bone. Bio-Progressive Therapy desires to have torque control in its appliances in order to support anchorage in those areas where it is necessary.

The upper molar that is adjacent to the zygomatic ridge, the maxillary sinus, and the cortical bone shelves of the alveolar process needs to be anchored and stabilized for use in orthopedic alterations. The heavy forces of the orthopedic headgear, when expanding the roots into the cortical bone, help stabilize it for the needed support of the whole maxillary orthopedic movement. To accomplish this, the inner bow of the headgear is expanded 5-10mm before placement.

While cortical bone support is used to anchor the teeth against movement, it is equally important

that it be respected when it is desirable to allow the teeth to move efficiently. Their movement can be enhanced by understanding where the cortical bone support is located and avoiding its interference.

#4 Movement of any tooth in any direction with the proper application of pressure.

To move a tooth in any direction may seem to be a presumptuous undertaking. It may seem impossible to consider the intrusion of upper or lower molars. Many clinicians feel it is impossible to even intrude lower incisors and suggest if they are intruded they will not stay. Yet, they will readily agree that cuspids can be retracted and anterior teeth can be rotated or torqued and moved into alignment.

We appreciate that these movements are allowed to occur because of the cellular physiology that takes place in the supporting bony tissue. It is the osteoclastic and osteoblastic action of the blood cells that changes the bone and allows the tooth movement to occur. The key factor to the rate at which tooth movement will occur is the blood supply that sustains the physiological action that takes place within the bone itself. Forces that effect the blood supply and cellular physiology, therefore, are important to tooth movement. Forces that are too heavy cause an ischemia of the blood supply to an area and tooth movement is delayed because of the slower back action resupportive process that must progress. Even under the lightest forces, the ideal continual front surface resorption is hard, if not impossible, to attain and resorption will come from the side.

Brian Lee, following the work of Storey and Smith in Australia, has suggested that the most efficient force for tooth movement is based upon the size of the root surface of the tooth to be moved, which he called the enface root surface or the portion of the root that is in the direction of movement. He expressed the theory that 200 grams of force per square centimeter of enface root surface was the optimum force for efficient tooth movement. Bio-Progressive Therapy suggests that the force can be reduced by one half, to 100gms/cm2 of enface root surface. We have found that cuspids can be retracted with forces of 75-100 grams and clinical observations have shown that all four lower incisors can be intruded with a force of only 60-80 grams, or 20 grams per tooth. Upper incisors, being twice as large as the lower incisors in cross-section, require 160-200 grams for their intrusion.

The lower incisors are intruded by a force of 60 gms to all four teeth, or 15 gms per tooth. The roots of the lower incisors should be torqued buccally away from the dense cortical bone.

When calculating the optimum force to apply, the direction of movement should be evaluated and the enface surface exposed to movement considered. Differing movements in different directions exposing different-sized surfaces therefore require different forces, based on pressure of

100 grams per square centimeter of exposed enface root surface.

X-rays show that even third molars can be moved from a horizontal impaction position, when a light force of 100 gms/cm2 of enface root surface is applied in a continuous manner and cortical bone support is avoided.

Density of the supportive bone is also an influencing factor in the rate of tooth movement. Movement of teeth through the dense laminated cortical bone where circulation is limited requires even lighter forces to allow an adequate blood supply.

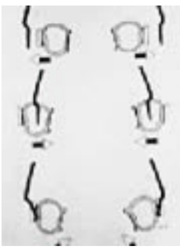
Bio-Progressive Therapy mechanics are designed to respect the supporting bony structures and the size of the root of the individual teeth in applying the proper amount of force for optimum tooth movement. Archwires and loop systems that will deliver lighter and more continuous forces are the

most effective in eliciting the biological response that we desire. The smaller .016 X .016 chrome alloy archwires, with designs that allow more wire either through spanning arches, sectional arches, or multiplelooped arches, have been found to apply the lighter continuous force required. Separate articles will describe these arches and our various force delivering systems.

#5 Orthopedic alteration.

Bio-Progressive Therapy subscribes to, anticipates, and plans for orthopedic change as part of its treatment procedures. Orthopedic alteration changes the relationship of the basic supporting jaw structure, as contrasted to tooth movement in the more localized area of the alveolar process .

Orthopedic change or alteration of the supporting structure usually is associated with treatment of the younger child, where the treatment is more effective because of the development still associated with these basic structures. Numerous research reports over the last thirty years have shown the alteration of the maxilla by the use of extraoral headgear appliances. This appliance can produce heavy forces in excess of 450 grams and show alteration in the direction of growth in these structures. Lateral forces across the mid-palatal suture are able to encourage its alteration beyond what would normally be expected without treatment intervention. The mid-palatal suture can be separated and widened with various appliances, producing orthopedic changes.



By expending the inner headgear bow, expension will result across the mid-palatal sutur, if the incisors are not banded and sutural adjustments are allowed to occur.

While heavier forces are usually associated with the concept of orthopedic alteration, more recent reports of the removable functional appliances show that they may also influence areas beyond the teeth-- areas associated with basic supporting structures, including the condyles of the mandible as well as the palatal plates and basic maxillary structures. An understanding of how these basic structures grow and develop normally without treatment is essential in evaluating the changes that can be effected by various appliances using varying force levels in different directions. Understanding the response in the supporting musculature is important in planning for orthopedic alteration. In construction of the Visual Treatment Objective and in using it in designing treatment procedures, orthopedic change is considered in the second area of superimposition to analyse maxillary point A and palate tip change. These influences also affect the nose tip and even the soft tissue profile.

Tracings before and after orthodontic correction, showing the changes affecting anterior nasal spine and soft tissue nose.

Expected mandibular rotation and facial type usually dictate the kind of headgear prescribed. Varying results are expected and planned for in different facial patterns and combinations of treatment. The cervical, combination, and hi-pull headgear each have special needs and uses that should be appreciated. Orthopedic alteration of basic skeletal structures is usually considered to be the maxilla-- point A-- and palatal plane change. But other influences such as temporomandibular joint function and lower arch development demonstrate that many alterations are occurring as a result of the changing occlusion and functional adjustment.

Headgear therapy for orthopedic alteration and change in the basic jaw structure should be contrasted to headgear wear that may be used to move teeth or to support maxillary molar anchorage in orthodontic treatment.

#6 Treat the overbite before the overjet.

One of the challenges in correcting the malocclusion and realigning the teeth is to correct the vertical incisor overbite relationship as well as the forward upper arch and the Class II molar relationship.

Most Class II malocclusions, which represent the majority of our orthodontic treatment problems, also have a deep bite incisor relationship as part of the dental relationship. Both the Division 1 protruding upper incisors and the Division 2 retruded upper incisors extend past the tip of the lower incisors into an overbite situation often diagnosed as 100% to 200% incisor overbite.

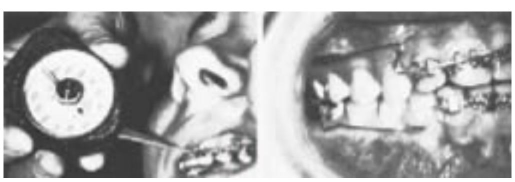
For stability in function and retention it is vital that the deep bite incisor relationship be corrected, to establish the proper interincisal relationship of overbite to overjet and interincisal angles. When the incisors are left with an overbite and a vertical interincisal angle, function often causes them to return to their original deep bite malocclusion. Incisor overbite correction can be accomplished by two methods. One method is by the extrusion of posterior teeth, which increases the lower face height by mandibular rotation. The second method is by the intrusion of the upper or lower incisor teeth, with little or no mandibular rotation. Those facial types that respond most easily to incisor bite opening by molar extrusion and mandibular rotation are the vertical facial patterns that become even more extreme by this treatment method. The already excessive lower facial height is increased, resulting in additional anterior lower face height. This increases the lip strain and compounds those situations where a short upper lip, lip protrusion or a mentalis habit would best benefit by decreasing the already excessive lower face height.

The short anterior vertical facial height type with a low mandibular plane and the most extreme incisor overbites are those that would best benefit from mandibular rotation, but their strong musculature function resists the molar extrusion that allows this type of opening. Often, following treatment, this pattern will return to its original facial height, even though treatment may have allowed some mandibular rotational opening. Another complication of overbite interference during treatment is the distal displacement of the condyle in the fossa resulting in temporomandibular joint dysfunction and incisor instability due to traumatic interference of the incisor deep bite occlusion.


Cases finished in deep overbite can produce displacement of the condyle.

Because of these biological and physiological responses in the vertical facial types as well as the closed bite faces, Bio-Progressive Therapy mechanics finds that incisor intrusion is the treatment of choice for the best results not only during treatment, but also for stability of results and optimizing function. By treating the incisor overbite before the overjet, incisor interference is avoided and the posterior teeth remain in their normal stable vertical occlusion established by the musculature. When the incisor overbite is not corrected before incisor retraction, the incisors come into interference resulting in a proprioceptive input that affects the patient's ability to close the posterior teeth. When this neuromuscular interference limits the patient's ability to occlude the posterior teeth, the molars are allowed to extrude and vertical opening occurs. When we have incisor interference, headgear will more easily extrude the upper molar and Class II elastics will extrude the lower molars.

Special treatment procedures for incisor intrusion, involving a spanning arch called a utility arch, are designed to be able to treat the overbite before the overjet and avoid the adverse results of incisor interference.


Upper and lower utility arches are used to intrude the overbite before overjet correction. 60-80 gms are needed to intrude lower incisors; 160-200 gms to intrude upper incisors.

Sectional arch therapy is used to aid in incisor control, so that tooth movement, particularly incisor intrusion, can occur under a proper force system that can apply the proper amount of force for the size of the teeth and the direction of their movement. Sectional arches are used to stabilize the buccal occlusion in conjunction with the spanning utility arch to the incisor teeth, where a lighter continuous force can be applied to the incisors for their intrusion or root torquing movements.


Incisor interference can be avoided by use of sections and utility arches, and allow over-treatment.

In the final finishing of orthodontic treatment, if incisors are in deep overbite the interference will usually not allow a good buccal occlusion.

#7 Sectional arch treatment.

Most fixed orthodontic procedures today band all of the teeth with full appliances and then prescribe a series of archwires to level, rotate, and align the teeth within each arch. Small round wires are most often used in the initial phases, progressing into the larger wires such as are used in the edgewise mechanics. The teeth are thus tied together along the archwire to effect their movement, in the name of maintaining contol of the arch in its alignment and function with the teeth of the opposing jaw. The force and leveraging action to move these malposed teeth comes primarily from the adjacent tooth along the arch and, because of the short span between their

brackets, very heavy forces of a short duration are usually applied.

Sectional arch treatment is a basic treatment procedure of Bio-Progressive Therapy in which the arches are broken into sections or segments in order that the application of force in direction and amount will be of more benefit in the efficient movements of the teeth. Consider four benefits of sectional arch treatment:

1. It allows lighter continuous forces to be directed to the individual teeth (for their efficient movement). As the arches are segmented and the buccal occlusion is sectioned from the incisors, very light continuous forces can be directed to the incisors through the long lever arm created by the utility arch, which spans from the molars to the incisors, bypassing the bicuspids and cuspids. Segmented arches allow the molars to be stabilized and supported by the bicuspids and cuspids against the torquing movement directed to the molars by the intrusion action of the long-levered utility spanning arch.

Sectional arch therapy allows lighter forces to the individual teeth, using utility arches to intrude upper and lower incisors, and sections to cuspids in extraction cases, or segmented elastic wear.

Class II elastic force is less when directed against the upper buccal segmented arch rather than a full upper arch and, therefore, produces less strain on the supporting lower arch anchorage. At the same time that the upper buccal occlusion is being aligned, the upper incisor positioning can occur through the utility arch action, where incisor intrusion, retraction or torquing may be necessary.

Retraction of the cuspids on sectional looped arches allows the force applied to their retraction in extraction mechanics to be reduced to the optimum of 100 to 150 grams, while the molar anchorage is supported through the spanning aspect of the utility arch off the incisors.

2. More effective root control in the basic tooth movements. Efficient lower incisor intrusion suggests that the roots be torqued buccally to avoid the supporting lingual cortical bone, while the roots of the cuspids around the corner of the arch also be torqued buccally to avoid the cortical bone on their lingual surface. These movements are very difficult to effect by traditional full arch round wire leveling. Round wire rolls the incisor crowns down and forward, tipping their roots lingually against the denser cortical bone, thus limiting their effective intrusion. The cuspid roots around the corner on a continuous arch are being tipped distally, which limits their intrusion and arch leveling action. The molars on round wire are often rolled mesially and upright away from their buccal cortical bone anchorage support.

Segmented arch treatment allows us to torque the lower incisor roots away from the lingual cortical bone which aids in their intrusion, and the cuspids can then be intruded separately along a route of least resistance and still maintain molar torque and rotational control for anchorage support.

Full arch treatment attempts to influence the incisor movements through the cuspids around the corner, but since the cuspids are in a different vertical plane of bony support because of their corner position, it becomes difficult if not impossible to design mechanics through the corner support and still direct proper incisor movements and keep the correct cuspid control. Efficient incisor intrusion is almost impossible on a continuous arch through the cuspids.

3. It supplements maxillary orthopedic alteration. Class II sectional arch treatment supplements the headgear effect in maxillary orthopedic alteration by allowing the buccal occlusion to be corrected without interference to the orthopedic adjustment site located at the midpalatal suture. Full archwires through the incisors tie the maxillary segments together and limit the adjustment and expansion desired in maxillary orthopedic treatment. Ten millimeters of buccal expansion often occurs across the molars or bicuspids when this adjustment is not inhibited by full arch treatment, but allowed the freedom to express itself as the dental bow of the headgear is expanded. Midpalatal expansion is dramatically demonstrated by the activation of a palatal jackscrew appliance, but similar buccal expansion is also possible when sectional arch Class II treatment supplements maxillary orthopedic headgear wear.

4. It reduces the binding and friction of the brackets as they slide along the archwire. The upper cuspids or other teeth are limited in their movement when they first must overcome the friction and binding force of the bracket in order to be moved along

an archwire. Sectional arch treatment allows the cuspid to move more freely without the binding effect of sliding around a continuous archwire. A segmented arch applied to the cuspids only, reduces the friction even more on the short segment and allows for its efficient retraction. In extraction mechanics, the multilooped retraction springs allow the cuspids to move freely without the binding limitation of the bracket sliding along the archwire. Whenever we can lessen the mechanical influences of friction and binding as teeth are being moved, then the applied force can be lighter, more effective and produce less strain on the supporting anchorage.

Sectional arch treatment allows the erupting buccal occlusion to erupt more freely into the functions of the face by reducing those limiting factors that restrict the normal development. When the arch length is maintained by the lower utility arch from the lower molar to the lower incisor and the buccal musculature shielded by its buccal bridge, then the buccal occlusion can unfold and erupt into the function of the face. We often see the lower bicuspids erupt 5-8 mm wider than the deciduous arch form when the utility arch supports their eruption.

#8 Concept of overtreatment.

Orthodontic treatment begins with the teeth in a malaligned occlusion, most often under abnormal function within disproportionate skeletal structures. Treatment proceeds to align the teeth and normalize the function within the limits allowed by the skeletal framework. Bony adjustments are occurring in the distant basic supporting sutures, as well as the local remodeling occurring around the individual teeth. In unlocking the malocclusion and establishing a more normal function, it is necessary for the clinician not only to appreciate the changes necessary to bring the teeth into a properly aligned functional occlusion, but to anticipate changes that follow when all appliances are removed and the post-treatment adjustments begin to occur. These adjustments and subtle changes

will continue under the dynamics of function. In order to help overcome the tendency for relapse, provisions for the post-treatment rebound as well as posttreatment growth changes need to be appreciated and planned for. There are certain cases where undertreatment may be needed in light of special growth or deformity problems. Bio-Progressive Therapy suggests four areas where the concept of overtreatment may help compensate for the anticipated post-treatment adjustments:

1. To overcome muscular forces against the tooth surfaces. The muscular influence of the tongue, lips and cheeks against the surfaces of the teeth often require overtreatment to compensate for the post-treatment changes, that are a result of the continued influence of this musculature as it "learns" to support the new occlusion.

When the narrow, collapsed upper arch is being expanded out of crossbite, overtreatment is necessary considering the relapse that may occur across the palate by the influence of the buccal musculature. Overexpansion is also needed to encourage the tongue to elevate and function in support of the dental arches in their new occlusion.

Very narrow V shaped upper arches are expanded to anticipate functional support adjustments.

An anterior open bite needs to be overclosed whenever possible to anticipate the rebound effect of abnormal tongue function, and the excessive lower face height that increases in the growth patterns of the extreme vertical facial types. This excessive lower face height has the effect of encouraging the open bite tendency. Overtreatment of the incisor overjet back to a proper interincisal angle is critical in cases where lip sucking has influenced the protrusion of the upper incisors and retracted the anterior portion of the lower arch, and where short upper lip, mentalis habits, or sublabial contraction continue to influence the position and stability of the incisors.

2. Root movements needed for stability. Overtreatment of the tooth movements in locating the roots beyond the ideal in a position of overtreatment anticipates rebound change in various areas. Incisor deep overbite treatment benefits in its stability by overintrusion and overtorquing. Paralleling of the roots of the teeth adjacent to extraction sites is important to the stability of space closure. Compressed tissue and fibers require time to reorganize to the new alignment. Severe rotation, where periodontal ligaments exhibit elastic action that can have prolonged post-treatment influence, needs over-rotation of the roots to help compensate for the relapse effect. Reorganization of the fibers often requires extended time, unless surgery is also used to assist or support the stability.

3. To overcome orthopedic rebound. Where heavy forces have produced orthopedic changes, the basic supportive structures are subject to rebound as these heavy restrictive forces are lessened or eliminated. These structures adjust as they are allowed to come under the influence of normal growth and function in the new environment. There still may persist functional influences that compounded this original malocclusion. Severe convexity in the extreme vertical facial types have additive effects, which seem to require more overtreatment and concern for stability of results.

Mandibular rotation or bite opening usually occurs in orthopedic correction by the extrusive action of the posterior teeth. In Class II treatment, the rebound effect which closes the bite and rotates the chin forward will help in the Class II correction and, therefore, this rebounding is beneficial. In Class III treatment, forward rotation of the chin and closure of the mandible would compound the Class III problem and make it worse. Some rebound adjustments can be beneficial, but most tend to complicate or return to the original problem. Therefore, overtreatment is in anticipation of these post-treatment adjustments.

4. To allow settling in retention. Overtreatment of the individual teeth within the arches allows them to "settle" into a functioning occlusion. The concept of retention at the completion of active treatment or debanding is not to hold or retain that which has been achieved, but to allow the teeth to settle back into occlusion from a point of overtreatment. Retainers then are considered active appliances and are adjusted to allow this settling action to take place, rather than to just hold or maintain the status quo. This not only anticipates the expected rebound that will occur because teeth have been moved, but encourages it by allowing them the freedom of movement back into their desired functioning position. It would be almost impossible to prescribe the exact delicate location and function of each incline, while this concept of guided adjustment anticipates it by overtreatment.

Molar rotation and incisor torque are overtreated at debanding to allow retention adjustments.

Overtreatment of the typical Class II correction begins with the molars by overtreating them into a "super Class I" through distal rotation of the upper first molar behind an uprighted distally rotated lower molar. Overtreatment proceeds along the buccal occlusion where the upper bicuspids and cuspids are distal to their opponents in the lower arch. The incisor overjet and overbite are overtreated by intrusion of whichever arch is over erupted. Overtorquing of the upper incisors is necessary in those deep overbite cases where function would allow the deep bite to return.

#9 Unlocking the malocclusion in a progressive sequence of treatment in order to establish or restore more normal function.

One concept of orthodontic treatment subscribes to the idea that the malocclusion is stable within the structure and function of the present environment; that the structure of the jaws and the function of the musculature have located the teeth in an arch form and alignment that is stable and should not be altered or changed during treatment. This form of treatment usually recommends conformity to the present arch form in order to maintain the alignment of the teeth to the present function for proper occlusion and stability of result. If any crowding exists extraction is usually necessary in order not to violate the present arch form, which is thought to be stable. Since function cannot be altered to any extent, treatment should conform to it.

Bio-Progressive Therapy takes exception to that approach and feels that many malocclusions have resulted because of abnormal function, and that the present malocclusion, while stable under its present abnormal function, may never have had the opportunity for normal development. Without normal development, normal function has not been possible and a self-limiting cycle is perpetuated as abnormal function causes abnormal development, which creates an environment that continues to encourage the abnormal function.

Bio-Progressive Therapy proposes treatment sequences that progressively unlock the malocclusion in order to restore or establish a more normal environment that will allow a more normal function to occur. A more normal function can now support the new environment and the aligned occlusion. In order to consider potential treatment changes, it becomes necessary at the initial examination and evaluation to consider three areas of diagnosis:

1. To describe the malocclusion and visualize the position of the teeth in terms of what functional influences have been responsible for their present alignment.
2. To describe the facial type and skeletal structure from the cephalometric x-rays, and the implied description of function.
3. To describe the present abnormal functional influences upon the dental arches; if not abnormal, then lack of normal development by default.

After the construction of a Visual Treatment Objective and its evaluation, the treatment procedures are prescribed by following a logical five step process, where various moves are considered and the appliances designed that will carry out the proposed changes.

The following process of evaluation is used in setting up a treatment plan and prescribing the various appliances and treatment:

First: Functional influences and their correction.Second: Orthopedic alterations that may be necessary. Third: Arch form-- arch length, extraction needs.Fourth: Tooth movements and anchorage planning.Fifth: Case management, with key factors to monitor during treatment.

There are many areas in orthodontic treatment where treatment changes alter the environment, which then allow an improved function to support it. Consider three major ones:

1. Upper Arch Expansion. This is observed in the underdeveloped, very narrow "V" shaped upper arches, where a respiratory syndrome and mouthbreathing may originally have altered the tongue posture and its normal function. The limited low posture of the tongue to the developing upper arch is seen as a contributing factor to its malocclusion. As the upper arch is expanded, the tongue posture and function are allowed to elevate and give support to the expanded arch. Growth alteration and orthopedic expansion also help improve the breathing to allow better tongue function. Bio-Progressive treatment has found the quad helix lingual arch an effective appliance to expand and rotate collapsed maxillary dental arches.

2. Incisor Protrusion Correction. Thumbsucking or severe skeletal convexity can alter the position

of the upper or lower incisors and create such severe protrusion that the lower lip becomes trapped behind the upper incisors and further compounds an already dysfunctional occlusion by causing the lower incisors to be further retracted and the upper incisors to protude even more. By correcting this severe overjet-overbite relationship of the incisors, the lip function is changed and is altered to support the new position of the teeth.

3. Temporomandibular Joint Dysfunction. Further restriction of a collapsed upper arch can develop into a functional crossbite where occlusal interference now blocks upper arch development and produces condylar shifts and changes in the temporomandibular joint function and development. Laminagraphic x-rays of severe Class II division I skeletal malocclusions show that 25% of the condyles are functioning forward in the fossa and treatment must progress further for their correction to a normal condyle fossa relationship. For this reason early treatment of functional crossbite and Class II skeletal problems is proposed in order to position the teeth in a better location that will allow better function and development of the temporomandibular joint.

#10 Efficiency in treatment with quality results utilizing a concept of prefabrication of appliances.

Experience shows that efficient treatment occurs when the clinician has a thorough understanding of all the details of his mechanical procedures, and when he understands and respects the influence that his mechanics have upon the underlying anatomy and physiology of the facial structures involved. Failure or inefficiency often results when we blindly follow a "cookbook" process that history or custom has popularized, rather than continually monitoring and upgrading our individual results which can be done by using the five areas of superimposition and the seven areas of cephalometric evaluation. Quality results must be considered from the beginning of any endeavor. The final finishing procedure of an orthodontic case must start with the original treatment plan. One must pay attention to the fine details that are necessary to produce a product or service of the highest quality. Without a clearcut vision of our goal, there is no definite goal and the required details can never be mastered and applied. Details such as the molar width, rotation, and torque become critical to the final finishing stages of treatment, and these should be designed in the initial arches that are placed. The details and refinements necessary to accomplish the end result have always taken an inordinate amount of energy and time of the clinician and his patient.

In an attempt to relieve some of the burden imposed by the myriad of procedures that are required in the construction and fabrication of orthodontic appliances, Bio-Progressive Therapy utilizes the concept of prefabrication and has appliances ready-made for clinical application. This allows the clinician to direct his energies in the details of their application, rather than in their construction. The clinician's energies are best directed in diagnosis and treatment planning, in efficient appliance therapy, and in the motivation of the patient. Edward H. Angle in his early text suggested that appliances could be prefabricated and today supply houses have produced materials that have reduced chair time tenfold.

(TO BE CONTINUED IN NEXT ISSUE)

Footnotes

. PART 1 The Management UmbrellaPART 2 PRINCIPLES OF THE BIO-PROGRESSIVE THERAPY.PART 3 Visual Treatment Objective or V.T.O.PART 4 The Use of Superimposition Areas to Establish Treatment DesignPART 5 Orthopedics in Bio-Progressive TherapyPART 6 Forces Used in Bio-Progressive TherapyPART 7 The Utility and Sectional Arches in Bio-Progressive Therapy MechanicsPART 8 Bio-Progressive Mixed Dentition TreatmentPART 9 Mechanics Sequence for Class II Division I CasesPART 10 Mechanics Sequence for Class II Division II CasesPART 11 Mechanics Sequence for Extraction CasesPART 12 Finishing Procedures and Retention