Nonextraction Treatment An Atlas On Cetlin Mechanics

Author: Raffaele Spena

Part IV
Space utilization

Chapter 11
Introduction

Once the objectives of the space-gaining phase have been reached, the second and final phase of space utilization follows and is carried out with fixed multibracket orthodontic appliances.

The objectives of the space utilization phase are correction of the overbite, overjet and individual dental malposition and closure of the spaces. Dental position should fulfill the anatomical requirements of Andrews' six keys(with some modification - see Chapter 14) and functional requisites of a mutually protected occlusion.

Any fixed appliance may be used to treat, finish and detail cases, even though the Ovation appliance is certainly preferred and used in our practice.

Control of upper and lower permanent molars, careful evaluation of all three dimensions and esthetics, discrimination between positive changes and eventual undesired side-effects of the space gaining phase are crucial at this phase.

The appliances used during the initial part of the treatment may or may not be used during the space utilization phase.

It is advisable to re-evaluate the case with new panorex, lateral cephalogram and study models before deciding the path to follow in the final part of the therapy.

Chapter 12
The intrusion of the upper incisors

Most of Class I and Class II malocclusions present a deep overbite. This problem may be corrected with the intrusion of the incisors, extrusion of the posterior teeth or a combination of the two. The choice depends on the nature of the problem, diagnostic results and the treatment objectives.

Many clinicians, however, have debated about the effectiveness of one or the other therapeutic method, reporting different experiences in the long-term stability of the correction of a deep overbite. It seems that almost everybody agrees on what should be avoided in correcting a deep overbite: a) increasing lower facial height; b) impinging freeway space by extruding molars and premolars c) proclining lower incisors because they may tend to upright with a relapse of the overbite.

Several clinical studies have shown that excessive overbite is mostly due to an extrusion of the upper incisors and is often associated with a "gummy" smile. This is why the intrusion of the upper incisors is an important, integrated part of this non-extraction approach.

Furthermore, the intrusion of the upper incisors helps to: a) avoid clockwise rotation of the occlusal plane; b) reduce or avoid the need of Class II mechanics to correct canine and molar relationships; c) eliminate inhibitor factors in mandibular growth; d) reduce needs of incisor torque and risks of root resorption.

Laminographic studies have shown that a frequent cause of root resorption is movement of the incisor roots in the labial or palatal cortex of the premaxilla during retraction and torque of the frontal teeth. The alveolar process tends to become narrower from its apical to its coronal aspect. If incisors are extruded, the risk of cortical interference is greater. On the contrary, after intrusion the roots are in a larger area of marrow bone and retraction and torque can be obtained with fewer risks.

Ten Hoeve and Burnstone have shown that the intrusion of the upper incisors is possible only with segmental mechanics. It is necessary to follow certain principles.

In the following paragraphs, these principles are described, as well as three different biomechanical systems to intrude the incisors when they are normally inclined, labially inclined (as in some Class II, division 1 malocclusions) or lingually inclined (as in some Class II, division 2 malocclusions).

12.1 Basic principles

In order to intrude upper incisors, it is necessary to use an appropriate, effective and clinically reproducible biomechanical system.

Burnstone Principles:

1. apply light and constant forces
2. use a single point of force application
3. use selective intrusion
4. control the anchorage
5. carefully analyze forces and moments involved in the biomechanical system

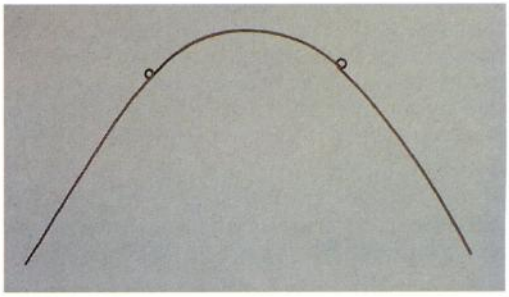
12.1.1 Light and constant forces

Twenty grams are necessary to intrude an upper incisor. If heavier forces are applied, movement may be inhibited and their is greater risk of root resorption and/or anchorage loss.

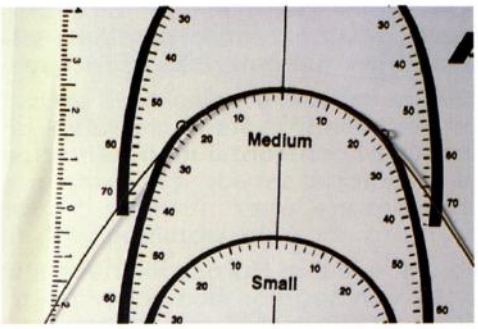
The biomechanical force should be constant, alleviating reactivation. It is necessary to use a wire with a low load-deflection rate and low energy loss per millimeter of movement.

The Cetlin technique uses the 0.018" Australian Special Plus.

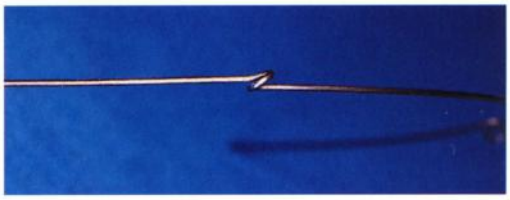
The intrusion archwire is bent with bird-beak Begg pliers, with grooves on the tip. Two helices are formed in the canine area.



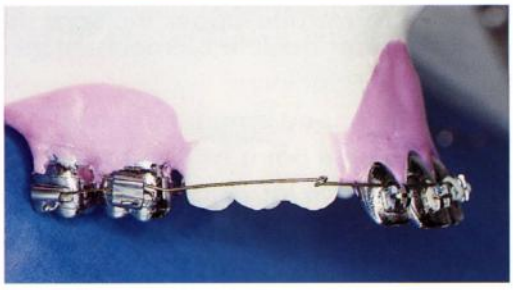
The anterior segment of the archwire has a smooth round curvature while the posterior segment is left straight and divergent. In this way, when inserted, the wire will bow-out and not impinge upon the soft tissues.



The two helices are used for light retraction elastics and may be opened as shown to facilitate insertion and removal of the elastics.



Intrusion forces are given with two tip back bends at 2.0-2.5 mm. in front of the 0.030" molar auxiliary tube. This will allow sliding while incisors are intruded and retracted.



The activation should exert approximately 40 grams of force to intrude two incisors or 80 grams to intrude all four incisors. When the arch is inserted into the tubes, the anterior curved section should lie up in the fold of the vestibule, at approximately 16 mm. from the slot of the incisor brackets. This will allow ideal force application.

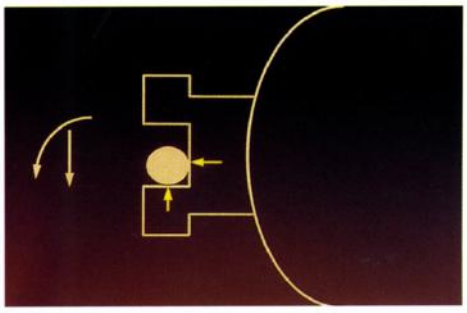
On the left, the upper second molar tube, and on the right, the upper first molar triple tube, with the gingival 0.030" auxiliary tube for the intrusion arch and the occlusal 0.045" tube for the headgear.

Proper activation occurs when the wire enters the tube at 6:00 and exits at 12:00.

The average distance between molars and incisors is approximately 30 mm. With such a lever, the Australian wire has a low load-deflection rate that helps to maintain the force relatively constant during the intrusion, and no reactivation is generally needed. The archwire can be heated at both ends to cinch it back.

12.1.2 Single point of force application (PFA)

A wire, although round, when inserted in an edgewise slot, tends to produce torque because there are two points of contact. The derived biomechanical results are unpredictable and secondary undesired effects that limit incisor intrusion may occur.



Anchorage loss during intrusion is usually due to the moments that determine distal inclination of molar crowns, more than to the vertical forces that tend to extrude the molars. Extrusive components, if light, are well controlled by the masticatory muscles and the occlusal forces.

The biomechanical system must be simple and reproducible and should not change during tooth movement. Forces should not be dissipated. This is one of the reasons why the intrusion arch is never tied into the slot, but to a sectional wire that varies according to the inclination of the upper incisors, and that helps to obtain as much intrusive force as possible.

12.1.3 Selective intrusion

Intrusion should be started from the most extruded tooth and continued, including sequentially all four incisors.

Usually, central incisors are lower than lateral incisors. An initial sectional wire should be tied to the central incisors to intrude them to the level of the lateral incisors. Then the sectional wire should be extended to all four teeth to complete the intrusion.

If intrusion is attempted with a continuous leveling arch, the lateral incisors will be extruded, while the central incisors will be slightly intruded. At the same time, the roots will tend to converge, while spaces open at the coronal level.

12.1.4 Anchorage control

Control of the reacting unit is crucial.

While intrusion is attempted on the upper incisors, upper molars receive forces that tend to extrude them and tip them distally. In any case, molars become more prominent and, if not controlled, two things may happen: a) the intrusion of the incisors is diminished; and/or b) sagittal and vertical dental and skeletal relationships get worse.

In order to counteract these undesired movements, forces must be kept light. Anchorage on the upper first permanent molars may be implemented by adding:

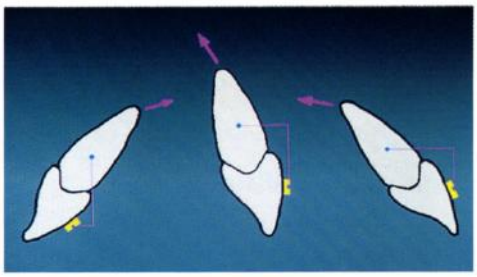
1) A low palatal bar to counteract the extrusive components

2) A high-pull headgear to counteract both extrusive and tipping components

3) A sectional wire between first and second molars to counteract the tendency to tip distally

12.1.5 Analysis of the biomechanical system

Theoretically, in order to intrude an upper incisor, a vertical force from coronal to apical should be applied to its center of resistance (CR). Unfortunately, this is impossible to achieve.



The spatial relationship between the CR and the PFA of a frontal tooth, or a frontal group of teeth varies depending on the labio-lingual inclination of the incisor(s).

Intrusive forces applied at the bracket slot produce a moment that tends to rotate the teeth.

Most of the time, the PFA is labial to the CR, so the produced moment is counterclockwise and tends to make the incisor(s) more horizontal.

In rare Class II, division 2 malocclusions, the upper incisors may be severely lingually inclined and their CR lingual to the PFA. In these cases, intrusive forces applied at the slot(s) may tend to rotate the incisor(s) clockwise and worsen its(their) lingual inclination.

A careful analysis of the upper incisor biomechanical situation and the forces involved is therefore necessary.

Three different situations are possible and each one needs a different system:

1. Normally inclined incisors
2. Labially inclined incisors
3. Lingually inclined incisors

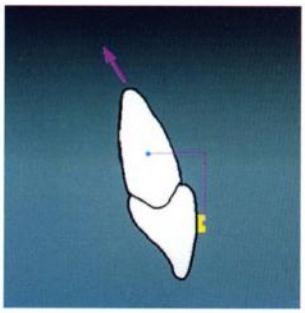
The three systems are described in the following sections.

The appropriate selection will always provide the possibility of obtaining "true intrusion" as shown in these radiographs.

12.2 The intrusion of normally inclined incisors

When the upper incisors are normally inclined, their CR is slightly posterior to the PFA.

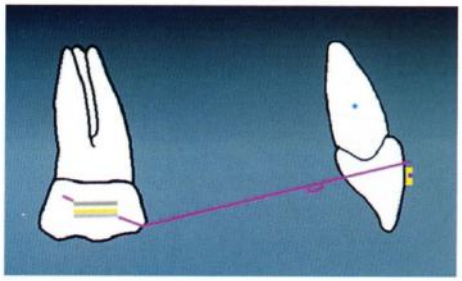
An intrusive force applied at the slot level will produce a moment that, even if small, will tend to move the crown forward and the root palatally.



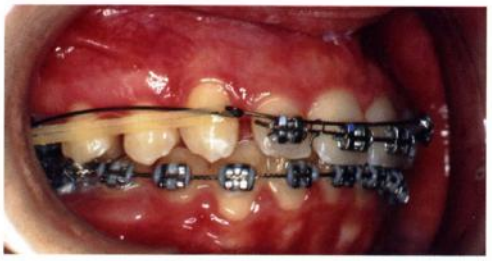
The biomechanical system used in these situations is as follows:

a) A rectangular sectional wire (either a multibraided or better, a stainless steel wire) tied into the slot of the two central incisors or all four incisors

b) An intrusion archwire is tied to the sectional wire between the central incisors or, if the lateral incisors are included, between the central and lateral incisors, maintaining a single PFA.



c) A light elastic (2 ounces, 3/4 ") between molar hooks and helices on the intrusion arch to counteract the moment on the incisors. This elastic is changed by the patient every day and helps to slightly retract the incisors during intrusion with minimum anchorage requirements on the upper molars



Clinical case

Fig. 12-1

Class II malocclusion with a bilateral cross-bite, deep overbite, upper midline deviation to the left and severe space deficiency in both upper and lower arch.

Fig. 12-2

After 14 months of palatal bar, cervical headgear and a lower lip bumper. Notice the remarkable space-gaining and the spontaneous alignment of the permanent teeth as they erupt.

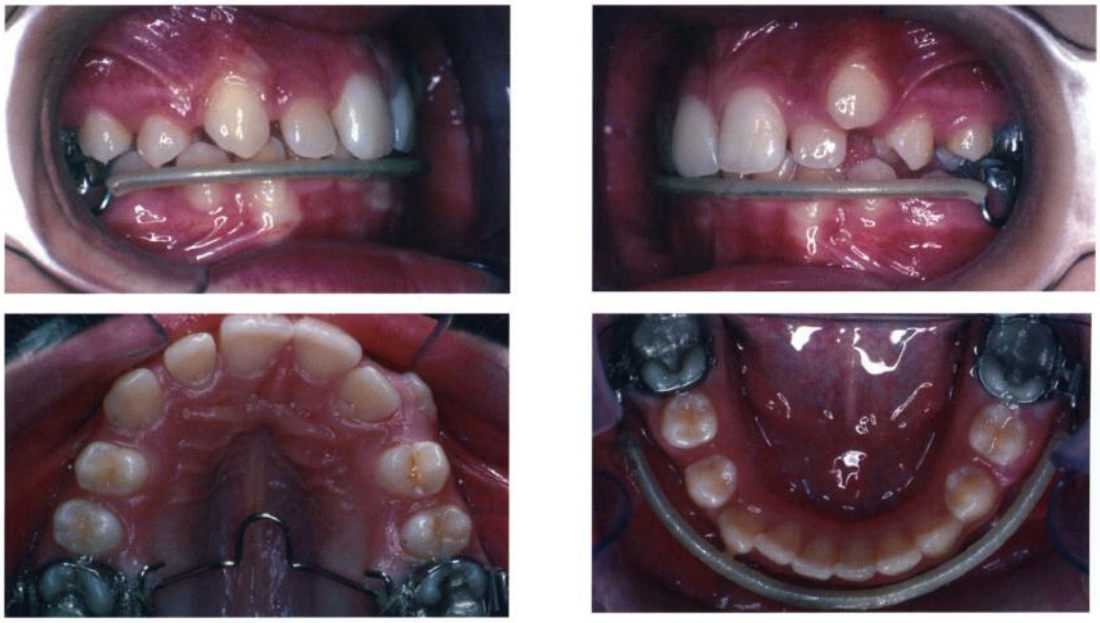


Fig. 12-3

Correction of the deep bite is started at this time with an intrusion system for normally inclined incisors. A light horizontal elastic has been added on the right side only. This will help to correct the upper deviated midline.

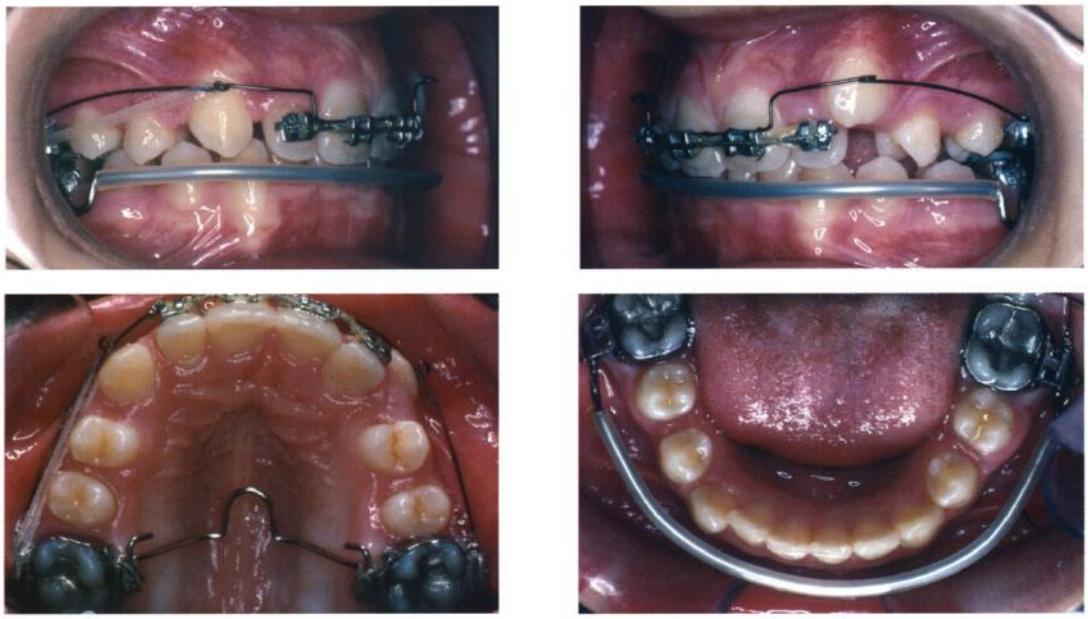


Fig. 12-4

After 4 months of therapy, the bite has been opened and the midline improved.

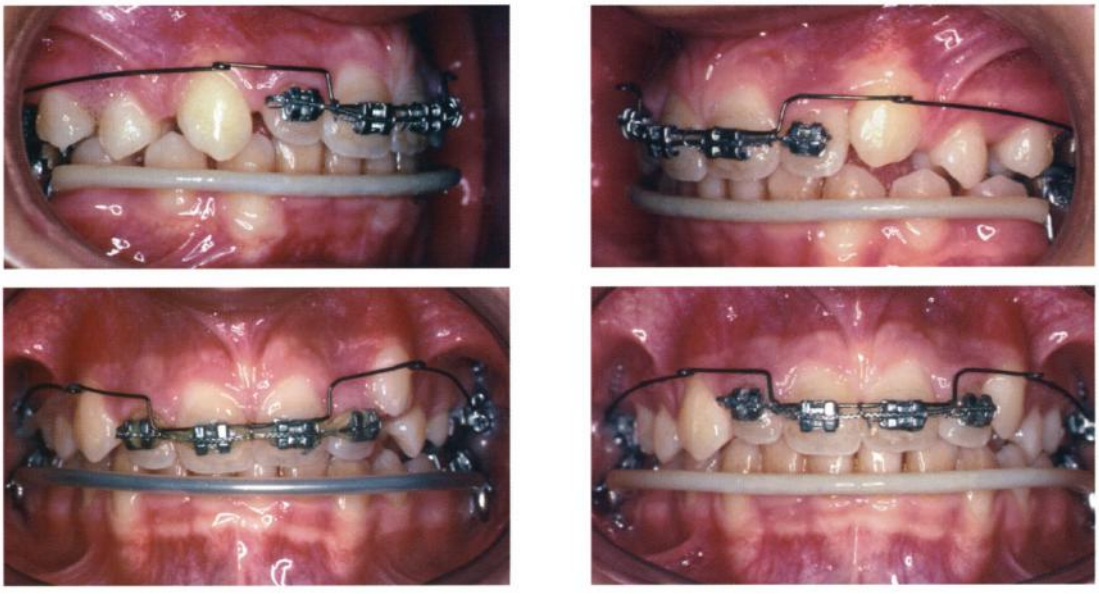


Fig. 12-5
Study casts at the beginning of treatment and at the end of space-gaining and intrusion of the upper incisors.

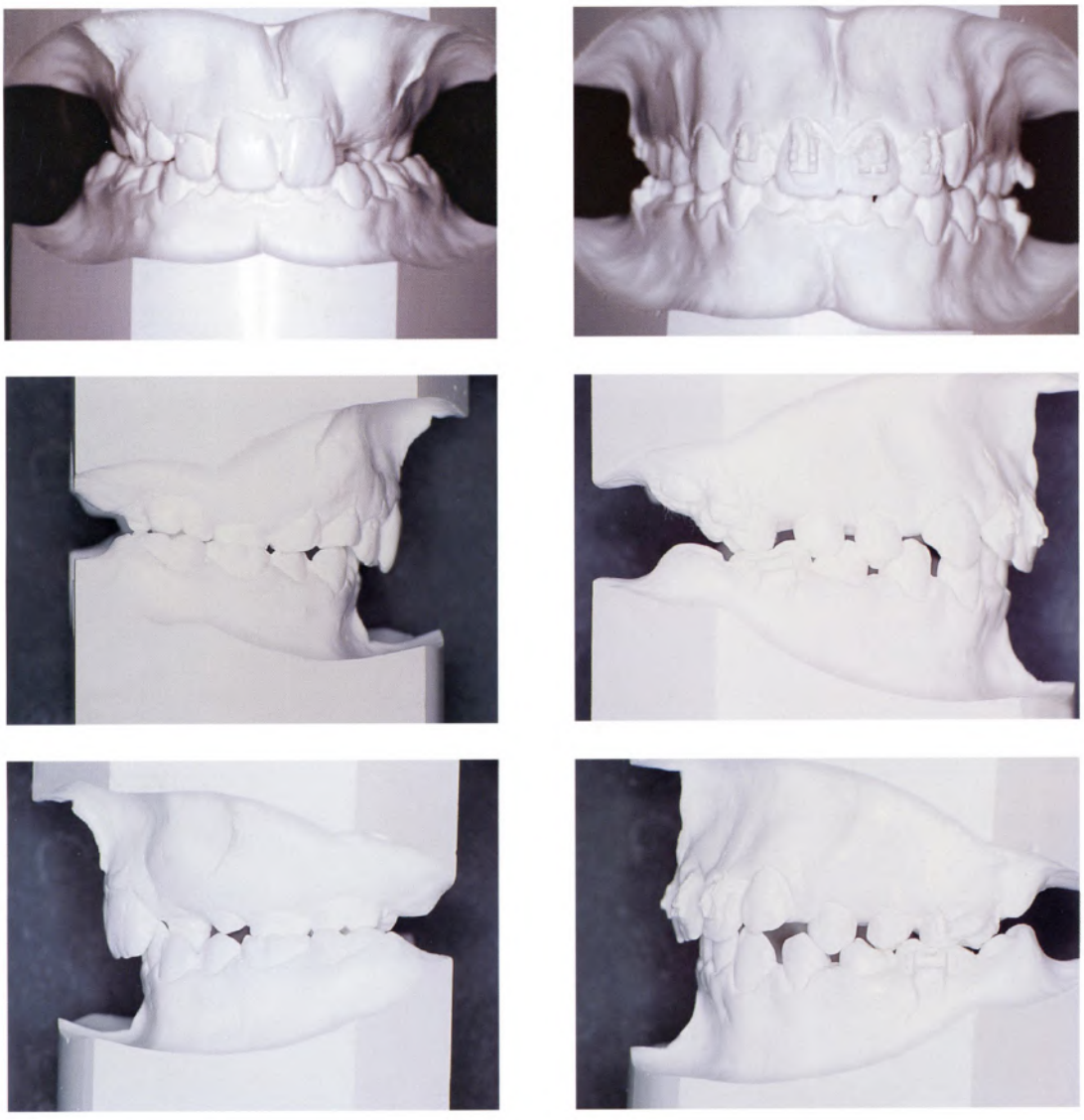


Fig. 12-6

Transverse changes in the upper arch after the space-gaining phase and the intrusion of the upper incisors.

Fig. 12-7

Transverse changes in the lower arch after the space-gaining phase and the intrusion of the upper incisors.

Fig. 12-8

Changes in the lower arch length after the space-gaining phase. Notice that the modifications are lower than 1.0 millimeter.

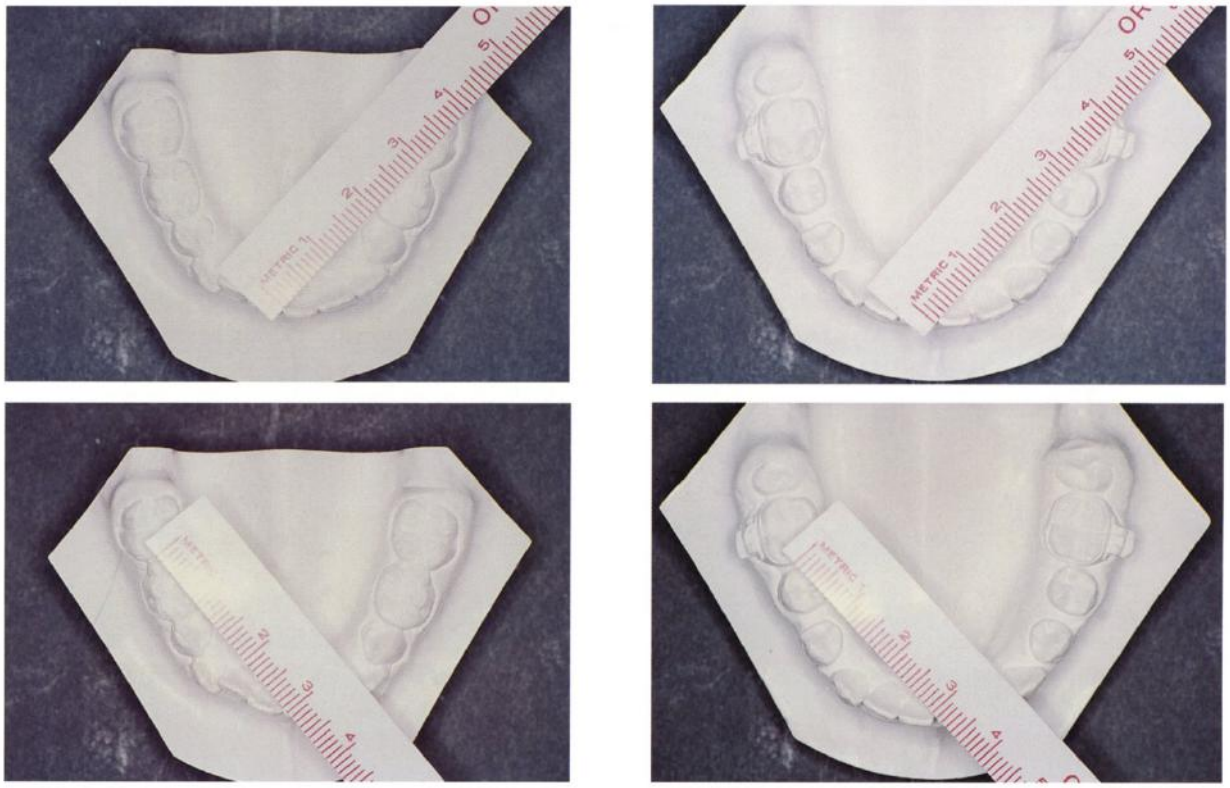


Fig. 12-9

The upper arch has been bonded and initial alignment is carried out. The intrusion arch has been kept in place to avoid any risk of vertical movement of the incisors.

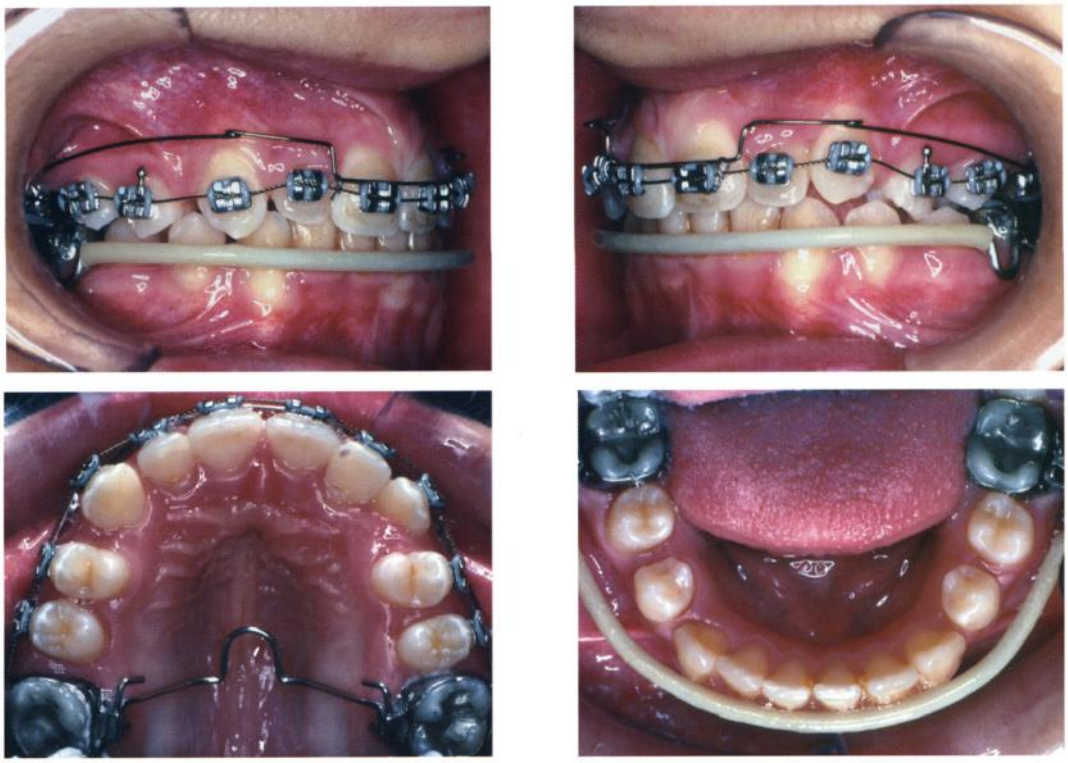


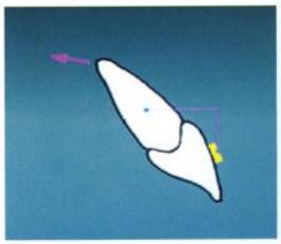
Fig. 12-10

Smile and frontal intraoral view at the end of the treatment.

Fig. 12-11
The occlusion and the arches three years post treatment.

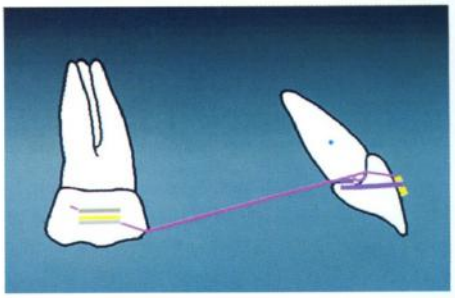
Fig. 12-12
The profiles of the patient at the beginning of treatment, at the end of treatment and six years post treatment.

12.3 The intrusion of labially inclined incisors



When the upper incisors are severely labially inclined, as in most Class II, division 1 malocclusions, their PFA is far anterior to the CR.

The large moment that is produced when intrusive forces are applied at the bracket, may worsen the labial inclination of the upper incisors.



Reduction of the labial inclination of the upper incisors before intruding them may cause: a) extrusion of the incisors; b) impaction of their roots on the labial cortex of the premaxilla, with risks of root resorption.

Therefore, it is necessary to move the PFA more lingual, closer to the CR, in order to create a system similar to the one for the intrusion of normally inclined incisors.

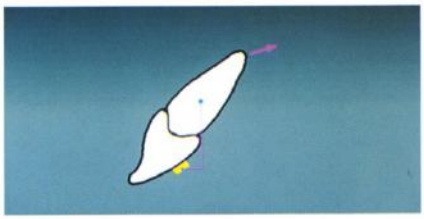
The biomechanical system is made of:

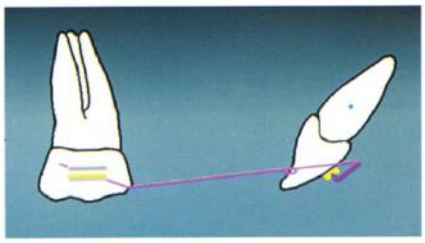
a) A rigid 0.018" x 0.025" or 0.022"x 0.028" stainless steel sectional wire is tied to the central incisors or all four incisors. This sectional wire is extended bilaterally to the distal, where two helices or hooks (PFA) are bent. The PFA is where the intrusion arch is tied and should lie slightly in front of the CR of the teeth to be intruded. The system can be verified on a lateral cephalogram or clinically: the PFA should be on a line passing through the cinguli of the central incisors when intruding the central incisors or the cinguli of the lateral incisors when intruding all four incisors

b) The intrusion archwire has two helices just anterior to the helices (or hooks) of the sectional wire. The helices of the sectional wire help to ligate the intrusion wire while the helices of the intrusion wire serve to hold the horizontal elastics and provide a stop for incisor retraction

c. A light elastic (2 ounces, 3/4") between the hooks on molar bands and the helices of the intrusion archwire to counteract the counterclockwise movement on the incisor. This elastic helps to slowly retract the incisors during intrusion with minimum anchorage requirements on the upper molars

12.4 The intrusion of lingually inclined incisors





Severely, lingually inclined upper incisors is a relatively rare clinical situation and it is limited to the two central incisors. It is found in some Class II, division 2 malocclusions and causes a position of the CR labial to the PFA. Intrusive forces applied at the slot of the brackets tend to rotate the incisors clockwise, thus worsening their inclination.

Proclination of the incisors before their intrusion may cause their extrusion and impaction of the roots on the palatal cortex of the premaxilla.

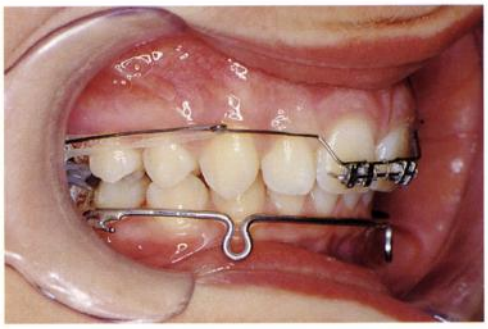
The clinical situation can be solved by moving the PFA of an intrusive archwire in front of the CR.

The biomechanical system is as follows:

a) A rigid 0.018"x 0.025" or 0.022"x 0.028" stainless steel sectional wire is tied to the incisors. This sectional wire is extended bilaterally forward and upward. Two hooks are bent in front of the CR of the two central incisors

b) An intrusion archwire with two helices at canine level. This wire is hooked to the sectional wire

c) A light elastic (2 ounces, 3/4") from upper molar to the helix. The horizontal elastics may be postponed if control of the inclination of the central incisors is crucial at the beginning of the intrusion



Chapter 13
Arch Form

Arch form is one of the most controversial problems in Orthodontics. Some authors believe that transverse intercanine and intermolar diameters cannot be modified without loss of stability. Treatment is carried out trying to change both form and dimension of the arch as little as possible.

Other authors have found a correlation between the arch form and facial characteristics. Treatment tries to adapt the arch form to the facial characteristics.

Andrews' studies and the clinical experiences of Roth, Frankel and Cetlin are in contrast with these dogmas. The arch form of normative patients' occlusions has been shown similar to patients treated with developmental shields. Therefore, the arch form should be changed to the normative.

In the 120 normative patients with untreated balanced occlusion, Andrews has found a relatively constant arch form, with the following characteristics: a) it is composed by one anterior arc from canine to canine, two lateral arcs from canine to second premolar and two posterior molar arcs; b) in the anterior area, the most external tooth is the first premolar and not the canine; c) in the posterior area, the greater transverse dimension is in the first molar and not in the second molar that is slightly constricted.

Roth, in his clinical studies, has found a similar arch form. This form is the most suitable protecting the occlusion, good function, sound TMJ, and stable results.

Cetlin and Frankel have shown that, when using an oral screen like the lip bumper or the vestibular shields of the Function Regulator that removes the labial and cheek pressure and leaves the teeth under the influence of the tongue and centrifugal pressures, the dentoalveolar arches develop and the arch forms change spontaneously. This form is constant in all the patients and is similar to the one found by Andrews and Roth.

In the non-extraction approach, change of the arch form is a primary treatment objective because it helps to gain space in the arch, as well as a more aesthetic and functional result. The modifications are gained by a functional and not a mechanical approach. Differences are primarily in the longer time of treatment and the results.

Changes of the archform by the use of brackets and wires is usually faster and tends to incline teeth labially and buccally. The instability of the result is related to the tendency of the teeth to slowly upright on the basal bone and crowd up again.

On the contrary, lip bumpers require several months to obtain notable clinical results. Teeth tend to move laterally, keeping their labiolingual inclination or slightly upright. These changes are to be defined as dentoalveolar lateral growth and not expansion.

In a Class II malocclusion, the most frequent characteristic is a retrusion of the mandible. The treatment objective is therefore, the correction of the factors that limit the growth and the translation of the mandible forward. An upper V shaped constricted upper arch, deep overbite, and vertical excess are structurally altered to obtain mandibular growth.

In an adult patient, orthognathic surgery may be the prescribed treatment. Distalization of upper molars and reduction of the overjet by distal movement of the upper incisors may be the equivalent of upper first premolars extraction; opening the nasolabial angle, flattening of the profile, and the chin still being retrusive.

Often, vertical excess is associated to the mandibular retrusion. Vertical control in these cases is necessary. A counterclockwise rotation of the mandible will help to reduce convexity of the profile and produce a more orthognathic relationship of the two jaws.

The following clinical case illustrates how a Class II malocclusion is properly corrected and skeletal equilibrium reached by changing the upper arch form, controlling the vertical position of the upper molars, promoting a counterclockwise rotation of the mandible, while intruding the upper incisors. Distalization of upper molars was also a part in the correction.

Clinical case

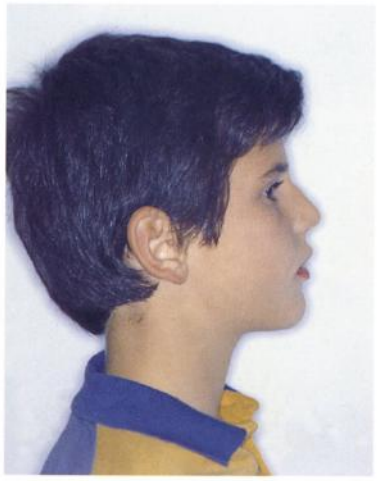
Fig 13-1

Class II, division 1 malocclusion with deep overbite and complete permanent dentition. Note the upper and lower arch form.

Fig. 13-2, A,B

The face of the patient. Lip incompetence, slight convex profile with mandibular retrusion. Notice the square form of the face.

A



B

Fig. 13-3, A,B,C,D

Treatment has been initiated with a PB and a four-looped lip bumper. Upper first molars have been rotated and arches begin to develop transversely. The upper arch form is changing and the mandible starts to move forward and upward.

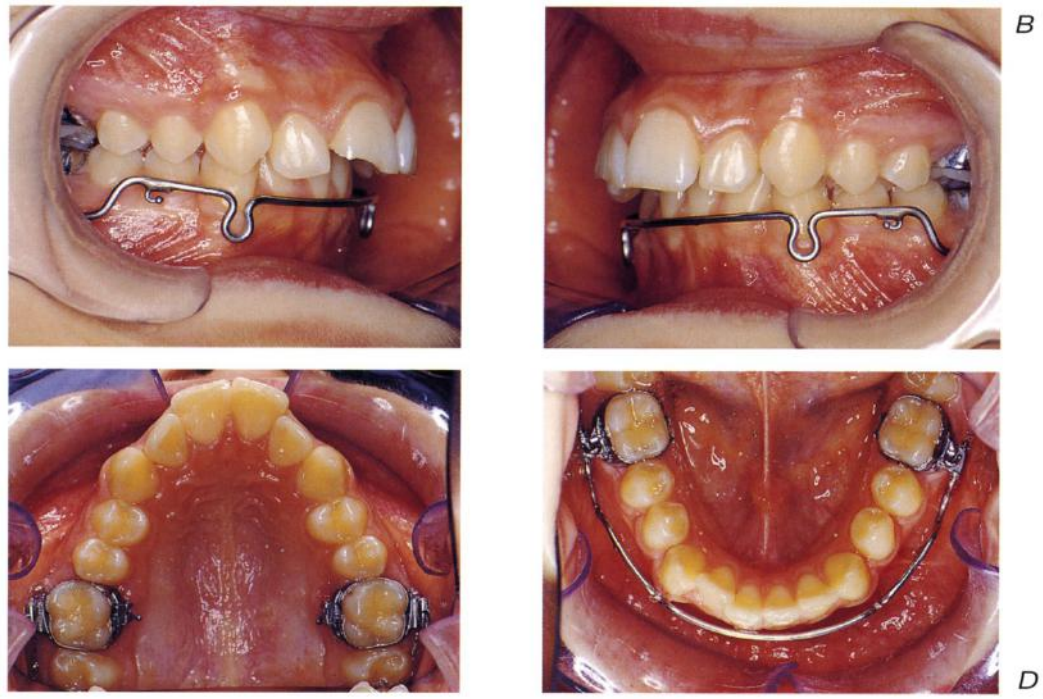


Fig. 13-4

The face of the patient with the appliances in place. The lip bumper gives support to the lower lip and helps to gain lip competence. Patient has been given exercises to improve lip competence.

Fig. 13-5, A,B,C,D

The patient a few months later. Patient has been wearing a cervical headgear. The headgear has been used initially with the PB and afterwards alone. Notice the spacing of the arches, the spontaneous alignment, changes in the arch-form and the improvement of the sagittal relationships.

Fig. 13-6

The face has improved dramatically.

Fig. 13-7

Beginning the space utilization phase. The intrusion of the upper incisors allows the correction of the overbite, but, most of all, the elimination of the limitation of mandibular growth and lower lateral and labial dentoalveolar growth.

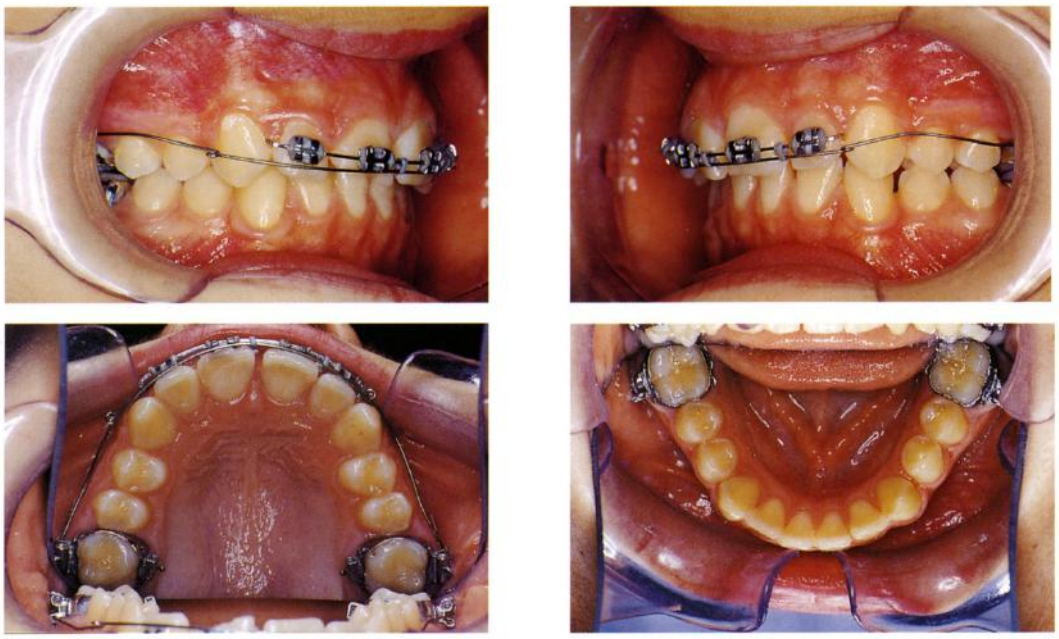


Fig. 13-8

The occlusion and the dental arches at the end of treatment.

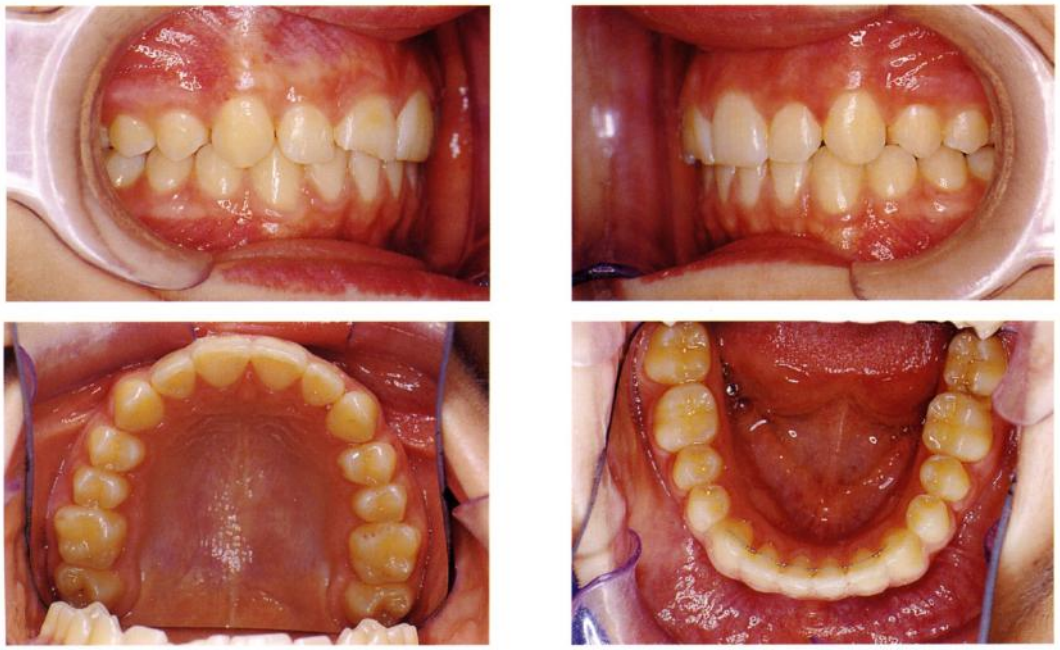


Fig. 13-9

Frontal intraoral view, face and smile of the patient at the end of treatment.

Fig. 13-10

Lateral cephalogram and panorex at the beginning and at the end of treatment.

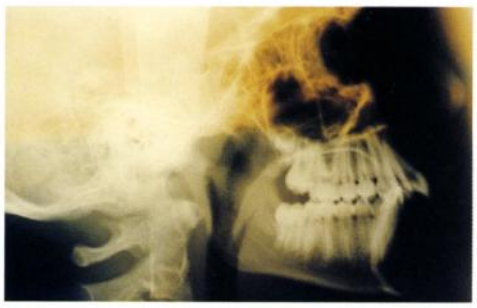


Fig. 13-11, A,B
Superimposition on the cranial base at Sella point of the tracings at the beginning and at the end of treatment.

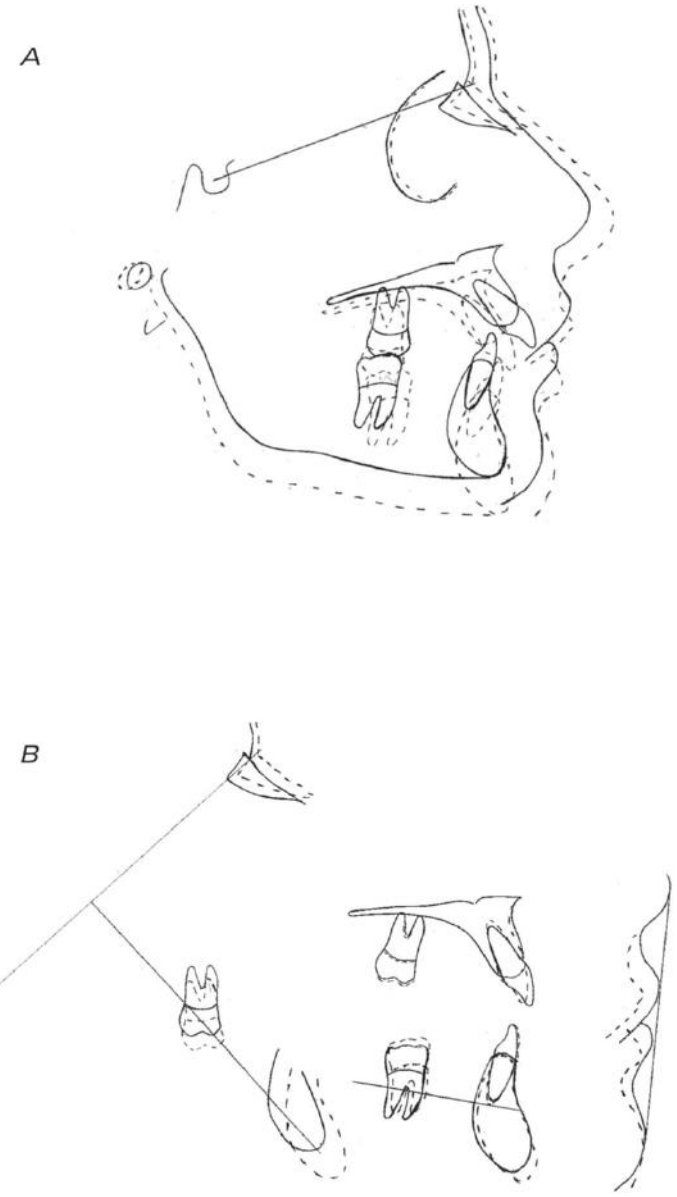
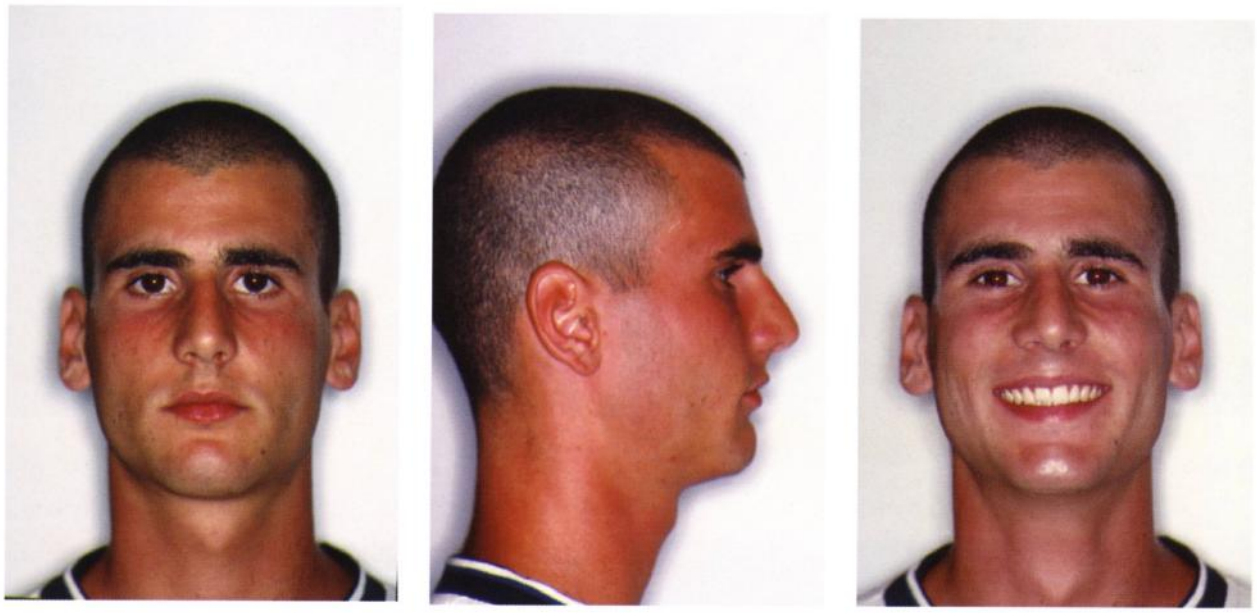
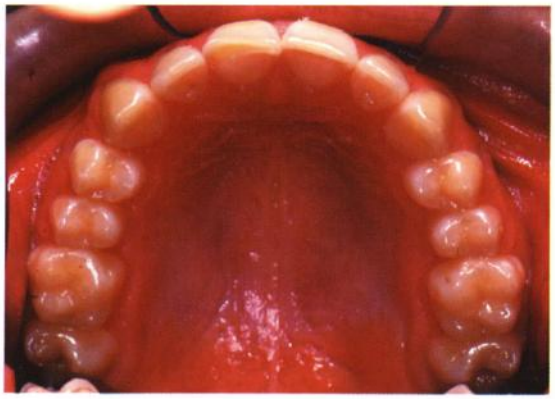


Fig. 13-12
Patient 5 years after post treatment. Improper brushing and stress have caused periodontal recession. Occlusion and archform are however, still stable. No TMJ problem was recorded at this time.





Chapter 14
The final treatment objectives

The final treatment objectives of a nonextraction treatment are the same as an extraction treatment. The difference is in the number of teeth at the end of the treatment.

The objectives are:

1. Good facial esthetics
2. Good dental esthetics
3. Sound dental health
4. Good function
5. Good stability

14. 1 Facial esthetics

Parameters for a good profile and facial balance are numerous and vary depending on patient's sex, age and race. It must also be said that esthetics change with the historical period.

Since Tweed, it has been said that nonextraction treatments give a full profile because of incisors proclination. This would be true if cases were still being treated Angle's way.

The nonextraction approach developed by Cetlin allows the possibility of gaining space in several areas. It adapts nicely with any profile and any esthetical objective.

Even though minor differences exist between male and female, male patients are finished with a flatter profile compared to female patients. This helps to produce a stronger chin.

Fuller lips are typical of a young patient. Lips tend to recede with age. For this reason, the younger the patient, the fuller the profile at the end of treatment.

Profiles are normally convex in a youngster and tend to become straighter as the mandible grows forward and reaches the maxilla.

It has always been advocated that nonextraction treatment and, especially, distalization of molars may alter the amount and direction of mandibular growth. This is true if no vertical control is maintained during treatment and if limitations to mandibular growth are set during treatment (i.e. lingual inclination of upper incisors and/or proclination of lower incisors to reduce overjet). Cetlin's nonextraction approach deals perfectly with what has to be obtained and what has to be avoided to let the lower jaw express its potential resulting in a good profile.

14.2 Dental esthetics

Well-aligned teeth are good looking. But not all aligned teeth look nice. Attempts are made to avoid an "orthodontic look" or a "denture look" at the end of the treatment.

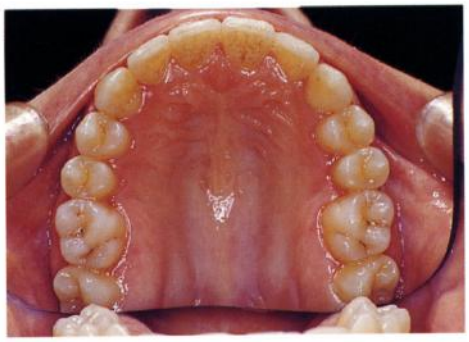
The six keys described by Andrews are the optimal dental arrangements. Some modifications for orthodontically treated cases are to be added. These modifications enhance the result and the stability.

14.2.1 First molars

At the end of treatment, the upper molars must be left with a mesial tip, otherwise they tend to upright and lateral relationships may be lost.

The upper molar's mesial buccal cusp occludes distal to the lower molar's mesial buccal groove. This helps produce good occlusion in the premolar and canine area, a good first and second molar interdigitation and improves stability.

Marginal ridges of the second premolars and second molars must be leveled. Upper first molars should have a good rotation so that their palatal surfaces are parallel to each other.



14.2.2 Premolars

The upper second premolar must occlude with the lower first molar and second premolar. The upper first premolar must occlude with the lower first and second premolar.

Upper premolars should have a slight distal rotation. Their palatal cusps must occlude with the distal fossas and not with the marginal ridges of the lower premolars.

14.2.3 Canines

Upper and lower canines need a mesial tip with the upper greater than the lower. This inclination helps to create good canine guidance in lateral excursions and to set the incisors in good position regarding the labiolingual inclination. The cusp of the upper canine is slightly mesial to the lower embrasure.

Lower canines should have a mild mesiolingual rotation behind the lateral incisors. The contact point between canine and lateral incisor may be flattened and modified into a surface.

This helps to:

a) maintain the position and the relationship between the six lower anterior teeth

b) avoid canine and incisor crowding and deepening of the overbite

c) have a broader smile

d) better canine function

14.2.4 Incisors

Upper incisors should have a mesial tip. The lateral incisors need a greater tip than the central incisors. The central incisors should have flat edges and the lateral incisors rounded edges.

The upper incisors all align at the same level. During the months following the end of treatment, the central incisors usually extrude until they contact the lower incisors and become spontaneously 0.5-1.0 mm. longer than the lateral incisors.

The lower incisors must have equal labiolingual inclination (show same amount of lingual surface in an occlusal view), flat approximal surfaces and flat incisal edges. They should provide good vertical stops to the upper incisors.

Good overbite and overjet should be established at the end of treatment. The interincisal angle should be between 124° and 132°.

14.3 Function

A mutually protected occlusion with anterior and posterior protection should be established. Centric occlusion and centric relation should be coincident.

14.4 Health

No dental, periodontal, articular and muscular problem should be created or left undiagnosed and/or untreated.

14.5 Stability

Short and long-term stability should be the final treatment objective. A self-maintained, nice looking occlusion is what a patient may expect from an orthodontic treatment.

Cetlin's nonextraction approach provides good stability. Ten Hoeve's and Cetlin's experiences prove the importance of the mechanical and clinical principles of this approach.

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