Alexander's Discipline:

A Simple Decision

Eduardo César Werneck

FIRST EDITION

ISBN 978-85-98957-05-0

I.E.P.C. Publishing House

Alexander's Discipline: A Simple Decision

Eduardo César Werneck

First Edition

Cruzeiro, 2009

Eduardo César Werneck

- ***Specialist in Orthodontics***
- ***Masters Degree in Orthodontics***
- ***PhD (student) in Orthodontics***
- ***MBA in Healthcare Management***
- ***"Arthur do Prado Dantas" Honours Award in Orthodontics – Sociedade Paulista de Ortodontia (SPO)***
- ***Director of I.E.P.C. – Cruzeiro Institute for Education and Research***

I.E.P.C. Publishing House
Av. Nesralla Rubez, 1324
Cruzeiro – S.P. – CEP 12.710-070
Tel: (12) 3144 – 4255
http://www.iepc.org.br
email: drwerneck@uol.com.br

Note from the Author

About 10 years ago was on a Florianopolis (Brazil) Course taught by Professor Alexander, in particular when the honourable speaker offered a time to answer the written questions of the participants that meeting.

That was when a particular individual, more for cowardice, for which that lack of education, with no sign that said "Your technique does not treat the deep bite"!

Professor Alexander said it was simply a untruths...

We lost all clear, because it was a serious question about how to handle these issues, rather than just throw a stone on the glass in a coward, then certainly all present know more about this philosophy !

No tire of learning more, when I bond of each bracket the Alexander's Discipline, and even put on each archwire in order to move the tooth.

And increasingly discover how this philosophy of work changed my life forever...

In this volatile world of passions and easy, and short lived... always Alexander!

Eduardo César Werneck

Acknowledgements

Throughout my professional life I came across many doors ... Some opened, some closed ... But what really matters are the people who were willing and able to open them for me ...

So I start by thanking Dr. José Teixeira Ervilha, who really showed me that there was an opportunity for me within Dentistry, by introducing me to the practice of Orthodontics ...

My colleague Dr. Geraldo Arthur Tibúrcio because his generosity has allowed the means necessary to allow my journey to begin, my eternal gratitude

To Professor Flavio Vellini Ferreira, because when I decided to do my Masters, he opened the doors of his Establishment, welcoming me with professionalism and affection...

To Professor Flavio Augusto Cotrim-Ferreira, an example that I like to admire and follow in Orthodontics and in life, in science and trade...

To my special friend Cliff Alexander, and of course, I hope one day to have your presence in my country again...

To my team, employees, colleagues, students and companions, because such work could never be accomplished by one person alone ...

To the great many Orthodontists that came before me, and who made my dream possible, Angle ... Tweed ... Broadbent ... Andrews ... Ricketts .... Roth ... Interlandi … and of course, Alexander .....

And finally, to Dr. Jairo Corrêa, our eternal Don Quixote, may God give him the strength to continue his eternal struggle...

SUMMARY

CHAPTER 1

INTRODUCTION

I - Introduction

When we started in the practice of Orthodontics, our knowledge was going through a moment of transition in which past wisdom from Angle, and even Tweed, was beginning to suffer strong influences mainly by the unrivalled advancement in recent years of, among them: brackets with built in torque, the relevance of the profile in the process of diagnosis, and in particular, of the function, which began to take precedence, with the "old" articulator being no longer a gadget restricted to those professionals working prosthetics rehabilitation.

It was not that Angle or Tweed were superseded, on the contrary, but their knowledge was being affected by reformulations and improvements brought by a greater standardization of the mechanics, with the aim of reducing the chances of errors in orthodontic treatment, without forgetting the value of each within the evolutionary process.

In addition, some theories were being questioned with some orthodontists presenting alternatives in the formulation of the diagnostic process; after all, modern times brought a strong preoccupation with the final profile resulting from orthodontic treatments.

And having graduated around that time, I decided in principle to conduct Orthodontics in a way that included old concepts – mainly because in the beginning I did not feel apt to question or even discuss certain

theories. But in the search of an ideal in Orthodontics that wasn't an the end in itself, but in the resolution of problems normally faced in the day-to-day of my practice, I took to treat my patients using a mixture of concepts by Tweed, adding further knowledge from Andrews, and later, Roth, to finally, decide on a an interpretation of Orthodontics from the perspective of Alexander.

Today, however, I realise that there is no ideal technique, on the contrary, what exists is the simplest solution for each case, and therefore I believe that there is no unique truth but common sense so that the many problems faced by the Orthodontist can have a formula clinically applicable, preferably low-cost, and that brings satisfactory results in a reasonable time. That is to say, a device may have one thousand of the latest generation of ideas added to its design, but which of these to use and when to put them into practice is a task left to our individual experience and will always influence certain standards and procedures in the development of a successful Orthodontic treatment plan.

Chapter 2

THE VARI-SIMPLEX

II - The Vari-Simplex

Since these do not employ folds of first, second and third order in the construction of the arches, because these properties are included in brackets themselves, the body of information stated by Alexander, simplifies the procedures of orthodontic treatment.

It is about a philosophy of treatment designed to produce excellent results in a simple and organized way, where some traditional concepts are broken.

Hence a less extractionistic philosophy is sought, especially when the discrepancy in length of the initial arcade is not pronounced, obviously never at any cost, and always respecting the biological limits, where the final positioning of the teeth should respect a angulation compatible with the, of dental periodontal support, and not exposing it beyond the tolerable limit, so that the placement does not relapse after completion of the treatment.

Another important concept, will be to work with .018" slot brackets because from there we can work with lighter forces, resulting among other advantages, in a less discomfort for the patient, leading to a shorter duration of treatment with less drastic consequences, whether for the periodontal of insertion or for the periodontal of protection of dental units.

However, if we work with brackets of smaller slots, where smaller wires are used, we must not forget also, that the forces normally applied in orthodontic treatment are not always those that would be biologically ideal, with a strong tendency, therefore, to implement angles of deflection that could have difficult resolution, with undesirable consequences for the evolution of the mechanics of orthodontics.

This reported deflection will be dealt with fully later on, as it is one of the major questions being addressed

in our technique, mainly because we work with sliding movements, either in distalization of upper canines, or in the incisor retraction where this effect can also be observed.

We would also like to highlight in the technique, the principle of ***"driftodontics"*** which is based on the fact that in the mandible, the anterior teeth tend to migrate to distal, in the presence of space, while the movement of posterior teeth to mesial is usually very small, being even clinically insignificant during the levelling phase. This concept can thus be implemented in cases of crowding, where extractions are part of the treatment, and patients whose whole muscle lip/tongue are in good tone condition.

This factor is essential to the successful implementation of this concept, therefore, it must never be used in cases of heavily hypotonic lip muscle, a fact common in patients with bi-protrusion, or, in patients with buccal breathing.

In the maxilla, on the other hand, the loss of anchorage is considerable (we will deal with the issue of upper anchorage further ahead); thus this type of orthodontic treatment, when performed with extractions in the lower arches as well, could in the same procedure show a spread of time between the start of treatment of the upper arch in relation with the lower arch (Figures 1.1; 1.2; 1.3; 1.4).

Figure 1.1 - Front view

Figure 1.2 -Left intra-oral view. Showing crowding of the anterior lower, with the second lower premolar strongly inclined to mesial.

Figure 1.3 – Front view with treatment already under way.

Figure 1.4 – Left view, showing that extractions had not been out 18 month earlier: the loss anchorage in the lower arch did impede the improvement of levelling of the arches.

The start of treatment may be postponed, in the lower arch in most cases, mainly in class II malocclusions, because the upper canine in these malocclusions, occludes with the inferior canine in very unfavourable position, moreover, is not uncommon in these patients to find a relationship of clinical deep bite, which could render impractical the correct positioning of the lower brackets.

Thus through the concept of driftodontics, we will extract also in the lower arch, even though it had not been included in the active treatment from the beginning, because in this way we would achieve a significant improvement in the levelling the lower arch through the distal migration of the anterior teeth that will occupy the space of exodontias, having as support for this motion the physiological action of the lip and tongue muscles, which should offer a normal muscular tone.

The levelling of the lower arch occurs even if there is not yet a sequence of levelling arches. This is very important, because it diminishes the complications observed in conventional orthodontic treatment such as root resorption, and the problems related to lack of hygiene during treatment.

Another concept of the technique deals with the vertical positioning of the lower incisors in the basal bone, so

the expected sharing in the levelling phase, can be minimized by the lingual torque which is included in brackets (from 5,0°, in the lower incisors' area, and 7,0°, in the lower canines), thus controlling the sharing movement of the anterior teeth, an expected outcome in the case of a long levelling phase with rounded wires, especially if we take into account that we would rarely apply wires with omega folds to control the perimeter at the time of levelling

In the Vari-Simplex Discipline (VSD), are combined twinned brackets, with those of Lang and Lewis (both with a single ala tie), and all presenting specific torques of the technique, differentiating itself from other techniques also by the small number of arches used in each case, as the Alexander Discipline, frequently makes use of three groups of arches during treatment, and we can modify this procedure, according to the needs of each case.

Thus a possible sequence would be:

.016" nitinol (Figure 1.5);

.016" x .022" steel (Figure 1.6);

.017" x .025" nitinol (Figure 1.7),

or .017" x .025" steel,
for the whole corrective orthodontic treatment.

However, depending on the presence of overbite, whether it is noticed before the start of the levelling phase or as a consequence of retraction of upper canines with heavy forces, in cases where exodontias are scheduled, we can make a small change in this basic procedure.

Figure 1.5 -.016" nitinol wire inserted in the initial stage of levelling in adult patient, treated with four extractions.

Figure 1.6 - upper arch: being applied in the same .016" x .022" wire which we made a retraction of the upper canines, for better control of the expected deflection of the arches.

Figure 1.7 - upper arch: .017" x .025"nitinol applied to coreect the deflection during retraction of the canines, and already marking the initial torsion, permiting future incisors retraction.

Still in the early stages of levelling, unless we can treat the deep bite, we will be unable to bond the brackets to the lower teeth, or even make a start on the levelling of the lower arch.

Here to address this issue, we can change the basic sequence of wires by applying two other types of wire, such as, .016'', and/or .018'' steel, and in the same, we will include a discrete Spee curve, replacing the .016" nitinol, and/or the .0,16" x .022" respectively.

It is also worth noting that although we have described the use of some arch groups for the basic development of orthodontic treatment, it will always be a mix of common sense and need of each individual case that will dictate the criteria and logical sequence of use of the levelling wires,

after all if we know that the round nitinol arches enable greater sharing between the anterior teeth in the levelling phase, shouldn't we give special attention to the cases of class III malocclusion when the control of the positioning of the anterior-inferior teeth would be essential for the success of the case being treated ?

Or even, what would happen in a malocclusion treated with four exodontias, if we didn't control the torques of the anterior-upper teeth, and for that matter, what would be the possibility of making anterior retractions (incisors) successfully ?

Finally, with regard to bonding we must stress that in this technique will be used as reference for determining the "x", the crown of the pre-molar corresponding to the arch where we want to operate, in this way we would preferably use the first upper pre-molar for the superior arch.

The stipulated "x" for pre-molars (which actually represents the correct spot in the clinical crown towards gingival-incisor, where will the levelling wires will pass) will be used as a reference to determine the "x" of the other dental groups, being that the central incisors (Figures 1.8; 1.9) have the same "x" of the pre-molars, and the lateral incisors (x - 0.5 mm), the canines of (x + 0.5 mm - Figures 1.10; 1.11), and molars (x - 0.5 mm).

Figure 1.8 - Front view of twinned brackets of central upper incisor

Figure 1.9 - Occlusal view of central incisors brackets in place to check the positioning of these in the mesial -distal direction.

Figure 1.10 - Front view of installed canine bracket, showing that the tip of the cuspid must coincide with the centre of the bracket.

Figure 1.11 - Occlusal view of the installed canine bracket, t check o positioning of the correct in the mesio distal direction.

With reference to the placement of brackets of the lower teeth, we will take as a reference the lower pre-molar, and from the stipulation of "x" in the lower premolar, use this reference for determining the "x" of the other dental groups, a that for the lower incisors we would have (x - 0.5 mm) for the canines (x + 0.5 mm) and the molars (x - 0.5 mm).

NOTE:
In the case of anterior open bites, or even deep bites, we can modify the positioning of the anterior teeth (incisors) in 0.5 mm for cervical (in anterior open bites), or, from 0.5 mm for incisor (in cases of deep bite) so that we can, at the levelling phase, implement a first approach to the front malocclusions being treated.

Intra and Extraoral Anchorage

Usually, we would employ the intra-oral anchorage in our methods, with the palatal bar as part of the model of POSTERIOR ANCHORAGE UNIT, acting as reinforcement in cases of fixed orthodontics, where a treatment with exodontias is planned.

Thus in order to better understand the concepts relating to the value, types and indications of the anchoring procedures, we will be discussing various forms of anchoring that can be used, whether intra-oral, or extraoral.

THE USE OF EXTRA-ORAL APPLIANCE

The extra-oral appliances are devices that are supported outside the oral cavity, and consist of a head cap or cervical strap, and a moulded facial arch, which transmits the elastic force, according to the set traction.

The extra-oral supports can be: cervical (i.e. Klöhen low traction - Figure 1.12), intermediate, and high (high-pull) (Figures 1.13; 1.14).

The face bow which has an internal arch, will be used for the application of forces in the upper molars (90% of cases), in premolar excess (very rarely), in the upper incisors (Schudy type appliances), in the canines, and lower molars (virtually dismissed clinically).

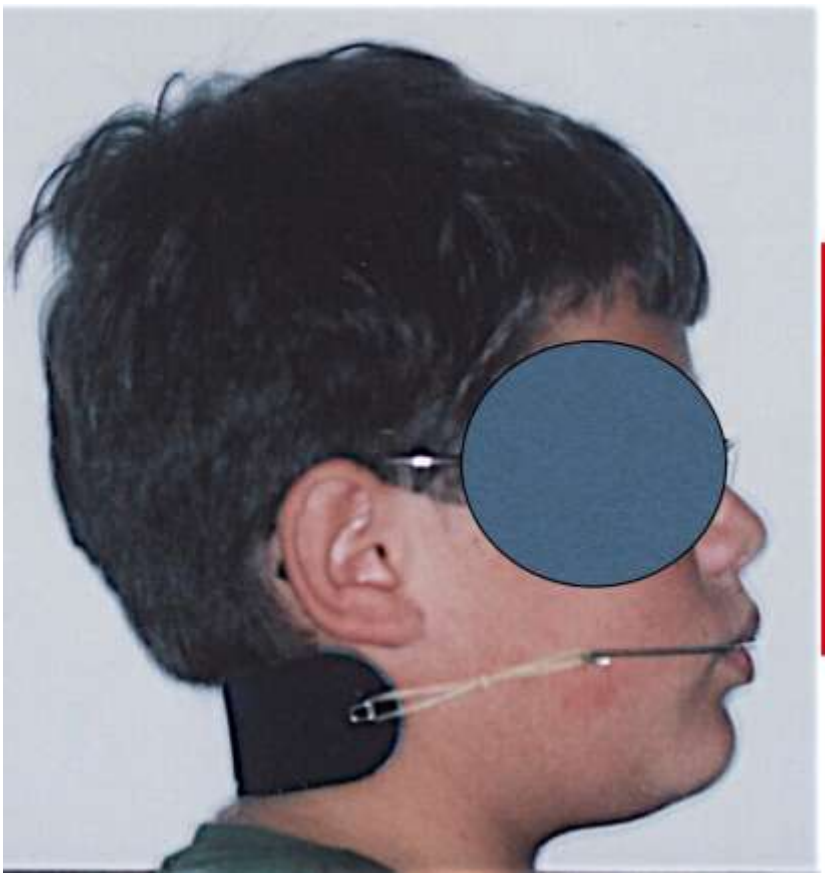


Figure 1.12 - Extraoral appliance - low traction.

Figure 1.13 – Extraoral appliance/ Interlandi Head Gear, medium-high traction ---- front view

Figure 1.14 – Extraoral appliance/ Interlandi Head Gear (IHG), medium traction ---- lateral view

APPLICATIONS OF EXTRA-ORAL FORCES

The use of extra-oral forces during orthodontic treatment serve in principle:

- To alter the growth process of the facial complex, requiring the same to be instituted during the period of active growth of the

patient. These forces when applied on the teeth, or even, on the combined maxilla and teeth, permit skeletal modifications, altering the growth of the maxilla; changing the facial axis of mandibular growth, with consequent clockwise or anti-clockwise mandibular rotation; finally allowing alteration of the plans: palatal, functional occlusal.

- During orthodontic treatment, whether in patients in the growth phase or in adulthood, when the movement of upper molars to distal is required, or even the dental intrusion or extrusion of the upper superior teeth.

- Or, as a resource for anchoring, in cases of fixed orthodontic treatment when minimum movement of the posterior segment to mesial is required, maintaining them in position as much as possible, in cases of extractions.

Nevertheless, it must be emphasized that in our form of treatment, this last option for the application of extra-oral appliances does not correspond to the conventional way of addressing the ANCHORAGE CONCEPT.

And our concern is based on the fact that patients orthodontically treated with exodontias, for a possible compensation of growth deviations, will only be possible in adults, excluding the use of the plan for growth with the aim of seeking permanent alterations in the face.

Therefore we will treat patients with the use of exodontias, aided by mechanical devices that reinforce the unity of posterior anchoring.

Thus full cooperation is required from the patients in these cases, it would certainly be disastrous if it were based on devices of removable application, because it would entail undesirable implications if not properly used.

As the extraoral appliances will be used in different facial patterns, it is important to consider:

1. Intensity of the force applied,
2. The point of application
3. And the direction of the forces applied

After all, we can produce a pure translation, or translation with rotation, where the concern is to observe where in the facial patterns these are occurring, because we would need to give special attention to the brachyfacial patient, which will certainly be different from what we would want for a mesofacial patient, or even for a dolichofacial patient.

The extraoral forces could produce the following movements:

Transverse Plane

- Allowing correction of dental crossbite, or even, if we are not careful we can facilitate the posterior crossing which is always to be expected with molar distalization.

Vertical Plane

- Movements of intrusion or extrusion of the dental-alveolar complex, or even with responses of skeletal nature.

Sagittal Plane

- Produce translation or dental skeletal rotation of the maxilla, with consequent repercussions on the final mandibular positioning, in an indirect way, when the mandible can show a clockwise or an anti-clockwise rotation.

NOTE:

Finally, each of these movements can be monitored, together or in isolation, depending on the need for the orthodontic treatment employed.

EXPECTED EFFECTS OF EXTRAORAL APPLIANCES

Depending on the level of forces applied and the age of the patient being treated, we can observe levels of responses dental-alveolar or skeletal.

At a dental level we can have distal inclination, distal translation (Figure 1.15), and the intrusion, or extrusion.

Figura 1.15 - Openning of diastema between the first permanent molar and second premolar, an example of dental aveolar action, when is intended to gain space.

Figura 1.16 - Front view at pre-treatment showing muscle incompetence with lack of lip seal, and appearance of upper incisor.

Figure 1.17 – Side view before treatment showing excessive mandibular rotation.

Figure 1.18 – Intraoral view before treatment

Figure 1.19 – Intraoral view post treatment

In relation to the maxilla, in an orthopaedic action with extraoral appliance, we will move away from point A, influencing the facial convexity, and acting on the angle of the jaw depth, with a consequent modification also of the palatine plane, and even, on the sagittal position of the maxilla which could be altered (Figures 1.16; 1.17; 1.18; 1.19; 1.20; 1.21).

Figure 1.20 – Front view post treatment showing the change produced with the extraoral appliance, allowing a decrease in anterior facial height, and the consequent possibility of closing the lip

Figure 1.21 – Side view after treatment, showing the increase in the angle chin/neck in response to posterior maxillar retrusion

In the mandible, depending on the forces orientation, we will have clockwise rotation (increase of the lower facial height), or countclockwise in the same (allowing for the reduction of the lower facial height).

TWIN BLOCK EXTRAORAL APPLIANCES

It is about the combined extra-oral forces, with the aim of acting on both apical bases simultaneously: maxilla and mandible (Figures 1.22; 1.23; 1.24; 1.25).

Thus we can change the facial convexity, by the sum of two effects:

1. Maxillary retrusion by the action of the horizontal force vector of orthopedic maxilla nature,
2. Resulting countclockwise movement of the mandible.

The anti-clockwise rotation of the mandible occurs due to the intrusion of the dental posterior/upper region, where it will be observed: decrease of the mandibular plane, and alteration of the palatal plane through the clockwise maxillary rotation.

1.22 – Side view of the class II malocclusion, which etiology is based in maxillary protrusion and mandibular retrusion, resulting from the diferential growth between both apical bases.

Figure 1.23 - Maxillary splint or Thurrow appliance

Figure 1.24 - Intraoral, right side view illustration of maxillary splint in position.

Figure 1.25 - Intraoral, left side view illustration of maxillary splint in position.

1.26 – Teleradiography of patient treated with splint, prior to therapy

1.27 – Teleradiography of patient treated with splint, after to therapy

ASYMMETRIC EXTRAORAL FORCES

When employing the concept of asymmetric forces, in Orthodontics, we make the assumption that differential responses are required from one side of arch in relation to the other.

The asymmetric action may be of orthopedic or orthodontic nature, however, within the period of growth of the facial complex, the use of differential heavy forces, could result in the treatment of asymmetries in the development of the maxilla.

This fact will have great relevance, as facial asymmetry could have reflexes not only for the function, but also for the final profile of the patient orthodontically treated.

To achieve the objective of extra-oral asymmetric forces, to the side which greater force is required, we will put a shorter external stem (Figure 1.28), while in the opposite side, which smaller force is required over the molar region, the external stem of the extraoral appliance will be elongated (Figure 1.29).

Figure 1.28 – Left side view showing the extraoral appliance (EOA) with the external arm ending on the side of the eye.

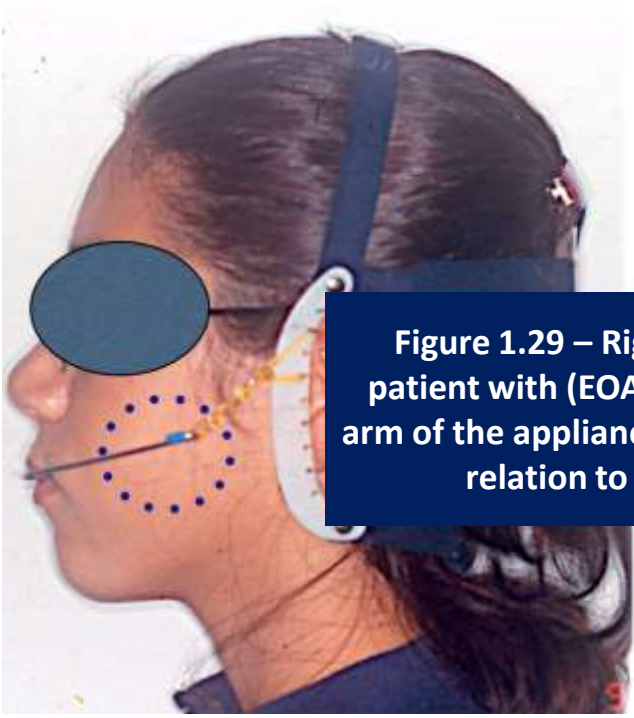


Figure 1.29 – Right side view of a patient with (EOA), and the external arm of the appliance more elongated in relation to the left side.

INTENSITY AND DURATION OF EXTRAORAL FORCES

The authors have differentiated "light" forces as those varying between 180 to 300 grams, ON EACH SIDE; and 'heavy' forces with variation above 450 grams.

Moyers prefers to initiate the application of extra-oral forces in mixed dentition, when the second molar gets to the level of the top of the first molar.

We have the habit of starting with lighter forces, which are better tolerated in the beginning, to then gradually, increase this force to the limit determined for the treatment of a particular patient.

We must always remember that if we need an orthodontic result, the extraoral forces should be of a lesser degree (between 180 to 200 grams where used as anchorage, and that usually does not occur in our proposed work, and from 250 to 350 grams in the case of molars distalization), and used for a longer number of hours during the day (14 to 16 hours).

However, if you need an orthopaedic result first make sure that the patient is in the active growth phase, and then establish a greater force (from 450 grams, being that on average forces between 500 to 600 grams are used) for a shorter number of hours during the day (about 12 hours).

INTRAORAL APPLIANCES

Transpalatal Bar

This is a component present in orthodontic treatment in our method, consisting of an arch that crosses the palate preferably in the molar region (Figure - 1.30), becoming a very efficient device for anchoring.

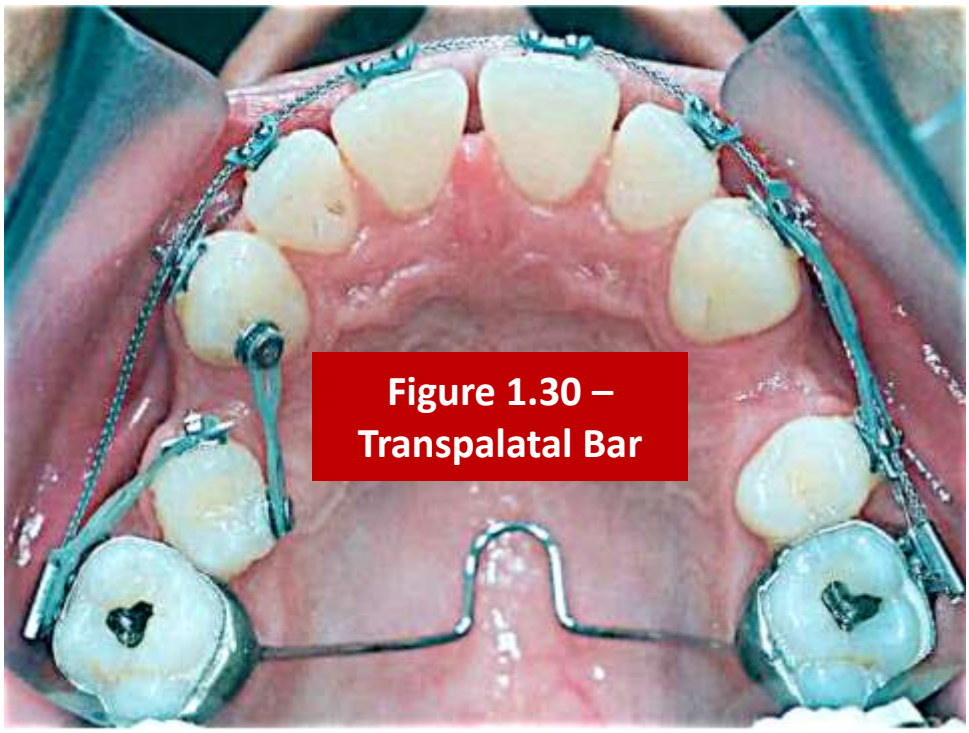


Figure 1.30 – Transpalatal Bar

Correction of molars rotations:

Andrews states that the upper molars must make three points of contact with the antagonist.

And to confirm the position of the molar, in ideal occlusion, the vestibular surfaces of the upper first molar should be parallel to each other.

Stabilization and Anchorage:

Once corrected the position of the upper molar, the transpalatal bar serves as anchor resisting the movement of the molars to mesial, especially when you intend to use elastics of retraction, be it in the movement of the canines, or even at the stage of incisor retraction, as in these cases we usually use the elastic chain, with an aid of a sliding jig for the control of the posterior anchoring unit.

It can also serve as anchorage in cases of extraction and in cases where maximum anchorage is required; some authors have indicated the need to use it with extraoral forces.

Although we do not understand how a clinical procedure that can be used on a large scale, through the inherent difficulties of the prescription of extraoral appliances, particularly in relation to cooperation on the part of patients in the number of hours necessary for its activation.

It may also serve as maintainer of bilateral space after premature loss of a second deciduous upper molar.

Indications and contra-indications:

* Used in both the mixed and in the permanent dentition, including cases of extraction or non-extraction;
* Used together with extraoral force;
* Used as space maintainer at the change of the second deciduous molar for the second permanent pre-molar;
* It is contra-indicated in cases of class II treated with the premolar extractions during the closing of space phase, when the loss of anchorage is required.

Construction of the Palatal Bar:

* Adjust the bands of molars, and then shape the upper arch with the bands in position.
* After adjusting the bands in the alginate mold, and obtaining the plaster model the model of the arch with the bands in position will be made.
* Assemble the palatal bar with 0.9mm of steel wire, making it touch the bands and then mold it to them (Figures 1.31, 1.32, 1.33, 1.34, 1.35).

NOTE :

For the activation of the palatal bar there will always be a need to remove it from the mouth.

Figure 1.31 – Initial adjustment of the transpalatal bar

Figure 1.32 – Construction of the transpalatal bar: adjustment of the wire to the band of the upper right molar

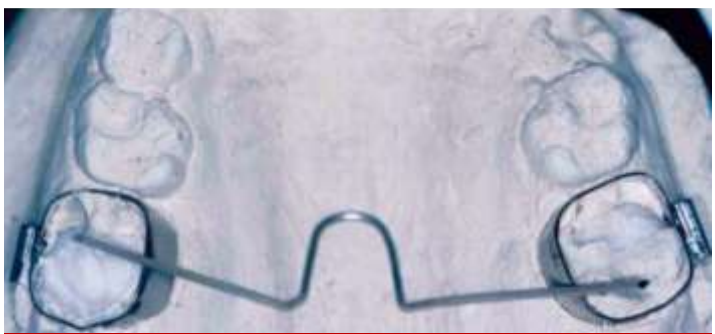


Figure 1.33 – Construction of the transpalatal bar: adjustment another segment of the wire to the band of the upper left molar

Figure 1.34 - Insertion of molten silver weld (red arrows).

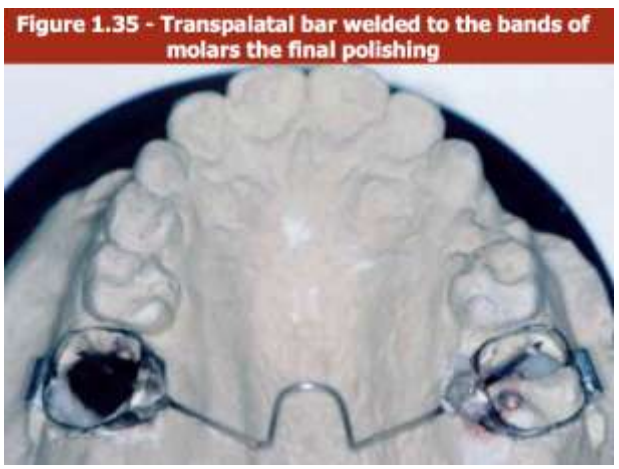


Figure 1.35 - Transpalatal bar welded to the bands of molars the final polishing

The most common clinical problem may be a slight irritation in the mucosa adjacent to the location of the palatal bar, and that must always be alleviated to avoid future necrosis of the region.

LINGUAL ARCH

It is a flexible arch of 0.9 mm steel wire welded to the bands of the molars, supported on the lingual faces, in the cingulum region, of the lower teeth (Figure 1.36), which may or may not incorporate handles for compensation in order to facilitate the activation of the same.

Figure 1.36 - Lingual arch

Indications:

In our work, the lingual arch is normally used maintainer of space, or arch of final containment, and very rarely, as anchorage in active phase of orthodontic treatment in cases with planned extraction.

This is due to the concept of ***"driftodontics"***, applied in the lower arch, nevertheless the lingual arch can increase the anchoring of the lower molars, especially in cases where it is needed at all costs to avoid the loss of anchorage.

It also allows a small lateral expansion or even contraction of crossed molars through the activation of it; withstanding controlled inter-maxillary elastic traction in cases of class II.

It is completely contra-indicated in cases where loss of anchorage is required.

For the construction of the lingual arch, the laboratory procedures will be similar to those implemented in the production of the palatal bar.

THE NANCE BUTTON

Indicated as an anchoring aid in patients with face-bow pattern, or for the mesial-vestibular rotation of upper molars, and can also cause minor expansions by activation.

It is completely contra-indicated in cases of extraction, at the stage of incisor retraction due to the existing resin in the anterior region of this appliance, which in contact with the mucosa of the palatal folds, with strong forces may cause necrosis of this region, which would be highly undesirable (Figure 1.37).

Figure 1.37 –
Nance Button, in laboratory stage, before the final polishing.

USE OF ELASTIC FORCES

These are excellent aid in the treatment of dental anomalies or even cephalometrics, and can be either intra or extraoral.

However it must be remembered that they can lose much of their effectiveness, especially when in contact with the oral environment, either by the characteristics of chemical constitution of saliva, or even by the change in temperature observed in the oral environment.

Therefore its force is never constant, due to the fact that its activation is directly linked to cooperation of the patient, who should use them in the correct way, in the correct position and for the length of time prescribed by the orthodontist.

For a better understanding we will sub-divide the various possibilities of implementation of the elastic forces within the concept of intra-oral use.

INTER MAXILLARY ELASTICS WITH CLASS II ACTION

These are inter maxillary oblique elastics, supported over 1st or 2nd lower molars, and applied depending on the technique, in canines or upper lateral incisors (Figure 1.38).

Can promote forces between 160 to 190 grams (with this variation dependent on the patient being or not with the mouth open), being that on average we find force intensity of 170 grams, meaning, forces purely dental, without any possibility of orthopaedic action.

It is not expected, at any time, therefore in class II malocclusions with cephalometrics characteristics orthopaedic responses by action of class II elastics.

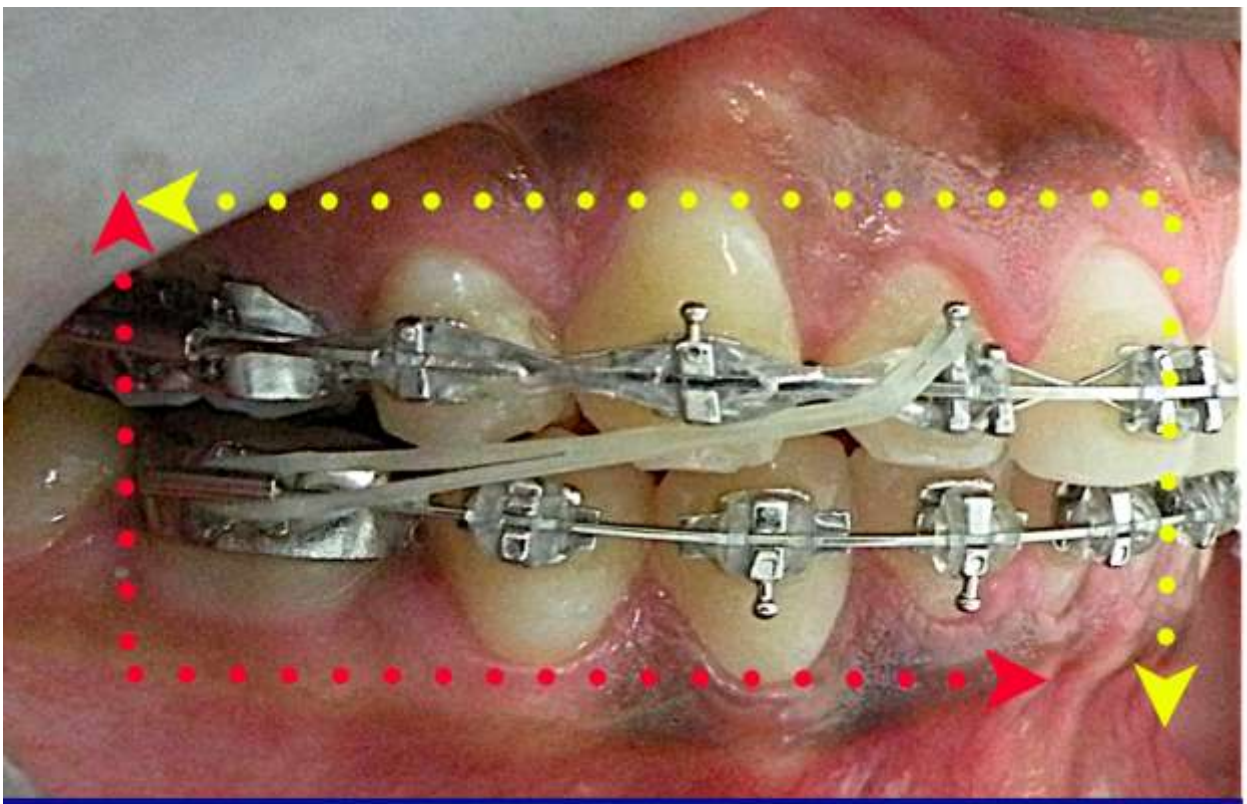


Figure 1.38 - Class II elastic, with evidence of vector of dissipation of forces in the lower arch (shown in red) and the arch top (shown in yellow).

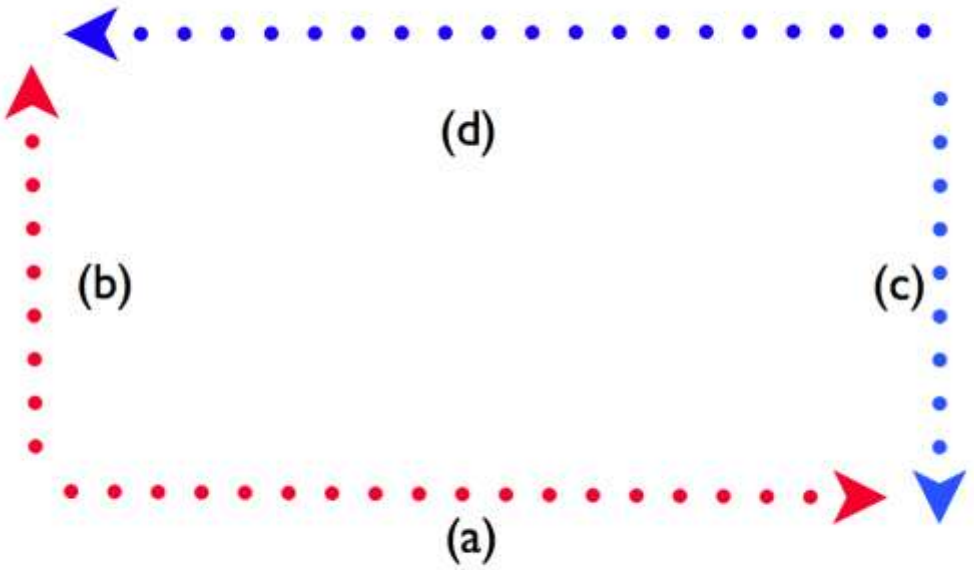


Figure 1.39 - Diagram of the force vectors dissipated in the action of class II elastics.

Present two vertical vectors:

1. With a first vertical vector, active in the mandible in the molar region (b)
2. And a second vertical vector in the maxilla, in its anterior region (c)

Also present two horizontal vectors, being:

1. The first vector, mesially to the lower arch, producing incisors sharing (Figure 1.38), vector (a);
2. And a second vector, distally in the upper arch, with this force vector more likely, which will be essential in closing diastems resulting from the exodontias, assisting in controlling the loss of anchorage, and obtaining the canines key in class I (Figure 1.39), vector (d).

As well as the extrusion in the region of the molars, the elastics also tend to promote the crossing of the same, and in practice, what we observe is a three-dimensional action, with components sagittal, transverse and vertical acting simultaneously.

For this reason, we usually implement the use of class II elastics when we are in a position of applying rectangular arches well adjusted in the arches, especially in the lower arch (Figures 1.40; 1.41).

Figure 140 - Front view of the class II elastic at the time of incisor retraction, together with the elastic chain, and wires 0.17"x 0.25" (dimension of last wires of our technique) positioned in the upper and lower arches.

Figure 141 - Class II elastic in side view, during the incisor retraction, with the implementation of the same from the first lower molar, to the upper lateral incisor, being careful to use . 017"x .025" wires in the upper as well as the lower arch.

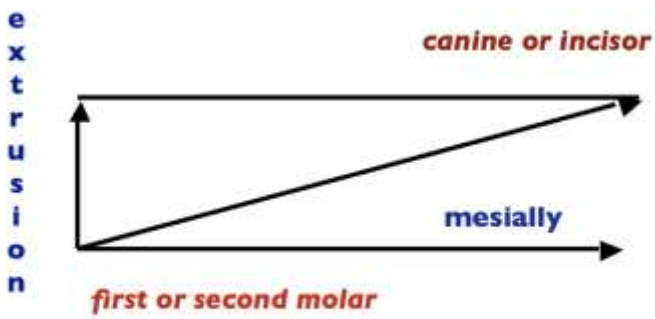
In addition, the prolonged use, associated with heavy forces should rarely be indicated, because of real possibility of causing the root resorption of the teeth involved with this therapy.

So in the use of class II elastic we must rigorously respect the biological criteria, with their use restricted to:

* Class II malocclusions, with planned extractions, where there is an option for it to be used to assist the closure of the spaces, and control of the anchorage. However, the actuation time with these devices should not be excessive (never exceeding more than six months of use). Or worse, if they are being used as a sub-treatment in the hope of avoiding the necessary exodontias; because in our technique, they will be applied against the lateral incisors, which could result in disastrous root resorption in that region;

* Treatment of midline deviations, of dental etiology, and used asymmetrical.

DIAGRAM 1 - PROVISIONS AND EFFECTS OF CLASS II ELASTICS



As a general rule, the elastics must:

- Be changed daily,
- Be of used in size 3/16,
- Be removed at meal times,
- Be used for as long as possible, stressing to the patient, the need for sleeping with elastic in position,
- Totally contra-indicated for individuals with severe vertical malocclusions, especially those presenting cephalometric open bite, associated with clinical diagnosis of open bite.

Your indication is linked to:

A. Distal translation of the upper incisors segment in cases of extraction, at the time of incisor retraction;
B. Mesial movement of the lower arch, regardless of whether lower exodontias have taken effect;
C. To aid in the correction of the midline;
D. To open the bite;
E. To assist in the anterior torque;
F. For molar extrusion;
G. As an aid in the preservation of molar anchorage.

CLASS III ELASTICS

As with class II elastics, the class III elastics also presented obliquely, but are applied from the first upper molars to the lateral incisors or lower canines (Figure 1.42).

Class III elastics cause a movement of extrusion and lingual inclination of lower incisors, with the whole lower arch tending to a complete dental movement.

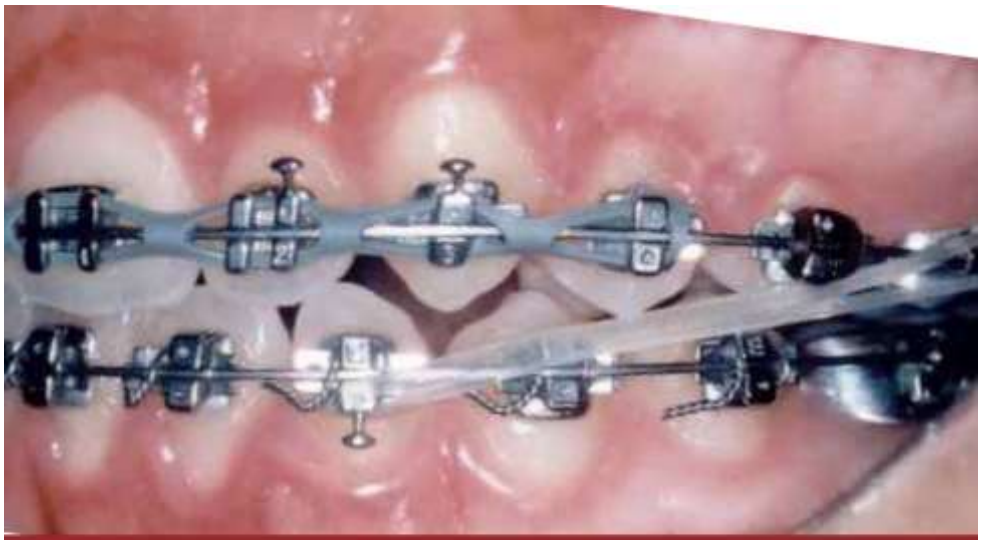


Figure 1.42 - Class III elastics

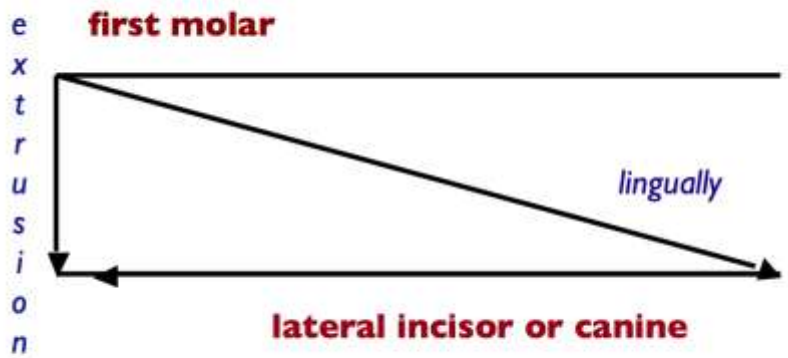
It is also composed of another set of vector forces related to its effect in the maxilla, which will produce:

- Mesialization movements of the upper posterior segments
- Molar extrusion

Usually indicated in cases where it is required:

- The loss of anchorage, especially in cases clinical open bites
- Or as important aids in the treatment of dental or skeletal class III malocclusions, when it can assist in controlling the sharing of the lower incisors in the early stages of levelling.

DIAGRAM 2 - PROVISIONS AND EFFECTS OF CLASS II ELASTICS



Depending on the point of application forces of up to 160 grams on average may be achieved, not presenting therefore any orthopaedic responses for its activation.

The elastic-class III must:

- Be used in size 3/16,
- Be changed daily
- Be removed at meal times,
- Be used for as long as possible

Their dental effects are shown in diagram 2

MEDIAN LINE DEVIATION

A good, correct median line of the maxillary is always important for good facial aesthetics; in addition to that, it is evidence of an optimum relationship between the apical bases, the maxilla and mandible.

The alternatives of treatment in these cases will be based on two

options, to promote a discreet camouflage in cases of dental midline deviation, or as a surgical solution in skeletal cases.

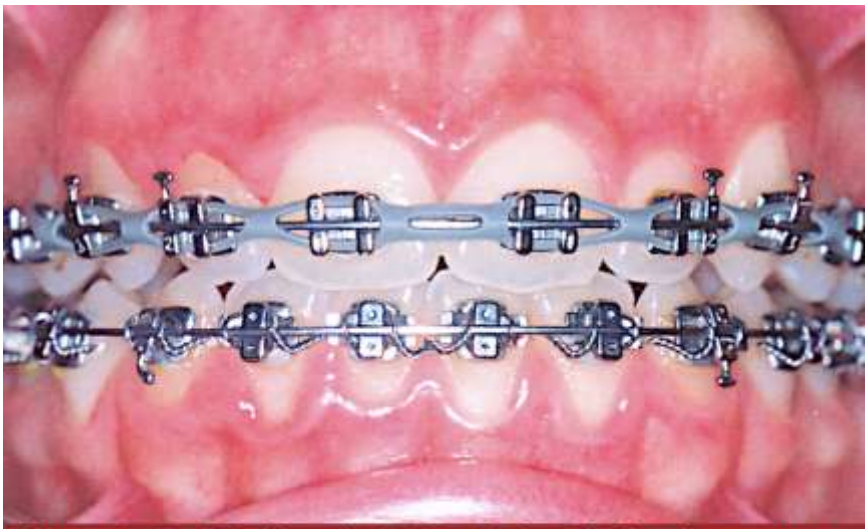


Figure 1.43 – Medline deviation of dental-alveolar nature observed during the adjustment of the canine relationship.

In cases of dental deviations (Figure 1.43), the treatment would usually employ the application of asymmetric inter-maxillary elastics, or class II elastic on one side (Figures 1.44; 1.45) and class II elastic on the opposite side.

Figure 1.44 – Class II elastics applied from the first lower molar to the upper lateral incisor

Figure 1.45 - Class II elastics applied from the first molar to the lateral incisor, with the mouth at maximum openning

The class II or class III elastics, can be used in cases of midline deviation of dental etiology, when this is found at the start of treatment, or, for the treatment of midline deviations caused by undesirable asymmetric forces, that occurred during the orthodontic treatment especially at the stage of incisors retraction.

To this end it will be important define, which arch is showing deviation, the maxilla or mandible, and from this finding define the therapeutic strategy.

Thus if the midline deviation is related to the maxilla, we will utilize class II elastics for the treatment of the same, and if the midline deviation is related to the mandibular arch, then we would use class III elastics.

The standard use of these elastics for the treatment of midline deviation must follow a strict protocol and is completely contraindicated in levelling phase. And this treatment would only be employed rectangular wires are present in the wires.

As for the side on which the elastics should be applied, will be dependent on the extent of the deviation, and the time for the treatment of the same. Allowing the transfer of the application of class II elastics positioned from the superior lateral incisor to the canine (Figures 1.46 and 1.47).

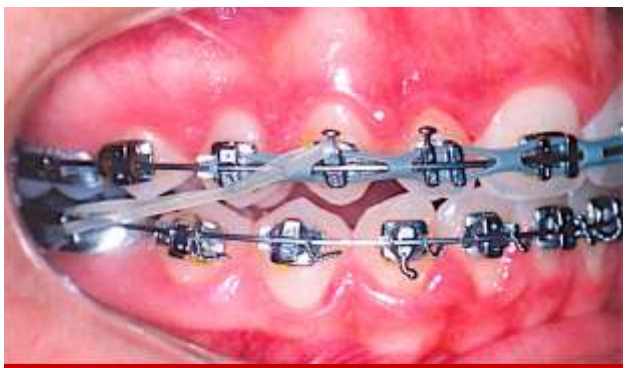


Figure 1.46 – Class II elastic applied from the first lower molar to the upper lateral incisor

Figure 1.47 – Class II elastic applied from the first molar to the canine

In cases with extractions, taking advantage of the possibility of available space, we try to treat the midline deviation, always during the incisor retraction, using asymmetric elastics (Figure 1.48), the same can be applied bilaterally or unilaterally for the treatment of midline deviations (Figure 1.49).

Figure 1.48 – Front view of patient, where elastics are being asymetrically, with class II on the right, and class III on the left

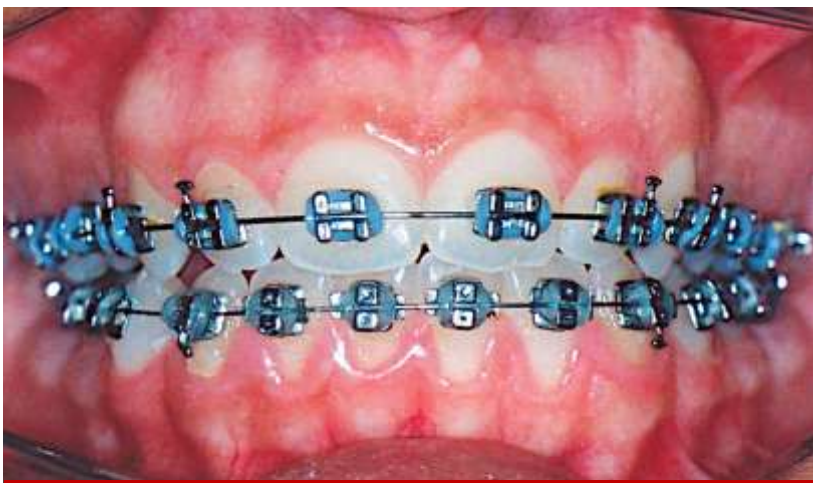


Figure 1.49 – Front view of patient, without the asymmetrics elastics

In some cases we may use the anterior cross-elastic (size 3/16), in addition to the asymmetrical elastic, for the treatment of midline deviations, however these cross-elastics, are generally indicated for a smaller number of hours, and preferably at night so that there is better cooperation by the patient (Figures 1.50; 1.51; 1.52).

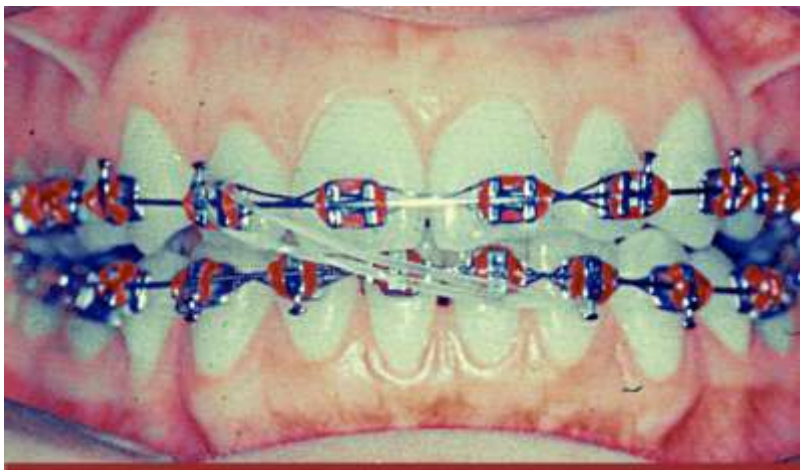


Figure 1.50 – Anterior cross elastic applied from tooth 12 to tooth 32.

Figure 1.51 – Anterior cross elastic, applied from teeth 12 to teeth 32

Figure 1.52 – Anterior cross elastic - right side view.

Great care should be taken to assess where the midline diversion in the retraction phase is present, if there is a perfect levelling of the arches, and in a similar way on both sides, because a bad levelling certainly could be the etiologic factor that triggers the midline deviation in the anterior retraction phase (Figure 1.53).

Figure 1.53 – Alteration of midline deviation during the anterior retraction phase

In cases without extraction, because of the difficulty in treating midline deviations due to lack of space, we will try treating the patient, following all the protocol of the technique, until we come to the rectangular wires in both arches.

Only after we tackle the midline deviation, and on the arch where the deviation is found, we would apply a more flexible wire; and on the arch in which does not show midline deviation, which we will call the anchorage arch, we would keep the rectangular wire in position (Figures 1.54; 1.55; 1.56; 1.57).

Figure 1.54 – Upper midline diversion, in relation to the anterior nasal spine, etiology dental.

Figure 1.55 – Treatment of midline deviation of nature dental, where extractions have not been carried for the purpose of making space for the canine.

Figure 1.56 – Upper left canine in malocclusion, determining the midline deviation for this side.

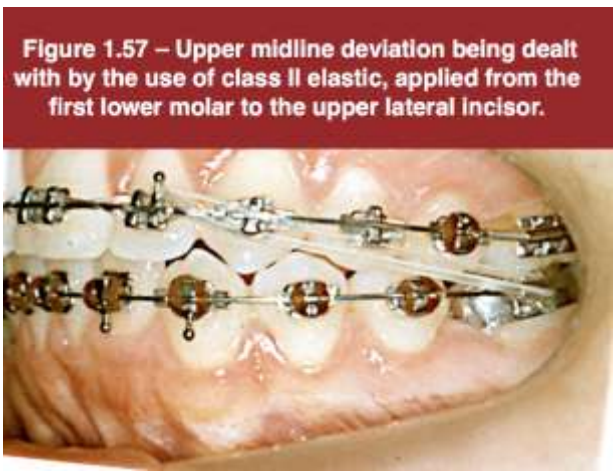


Figure 1.57 – Upper midline deviation being dealt with by the use of class II elastic, applied from the first lower molar to the upper lateral incisor.

Care in such cases must be doubled because we would be very close to undesired effects, in the case of inter-maxillary elastics, notably by the round arch installed, thus we will assess the treatment of these patients weekly, and when the midline deviation is treated, discontinue the elastic and resume the conventional treatment.

The midline deviation should always be a factor to be observed with respect to the quality of treatment implemented, however, more important than the midline deviation, will be the key of occlusion in canines of class I. Thus, if this factor is observed and even then, we find a midline deviation, this issue should not be a factor of concern, being important to alert the patient because there may be evidence of Bolton discrepancy (Figures 1.58, 1.59; 1.60; 161; 162).

Figure 1.58 – Class II malocclusion of nature dental unilateral in young adult patient.

Figure 1.59 – Intraoral view of the right side post treatment, showing excellent interdigitation.

Figure 1.60 – Intraoral view of the left side showing the relationship of class I of molars and premolars.

Figure 1.61 – Intraoral view of the left side post treatment, showing the relationship of class I canines.

Figure 1.62 - Intraoral view post treatment, showing the upper midline deviation.

The elastic used for the treatment of these issues are usually size of 3/16, and applied in a continuous way until the midline deviations are treated, bearing in mind the inherent precautions re related to expected, and sometimes undesirable, effects of applying the elastic forces.

In cases of skeletal deviations, when we find a strong horizontal rotation of the basal bone, the solution should be surgical (Figures 1.63; 1.64).

Figure 1.63 - Intraoral frontal view of adult, before the start of orthodontic treatment, showing anterior midline devation of skeletal nature.

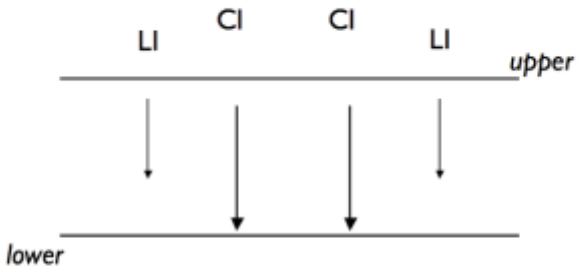
Figure 1.64 - Midline deviation of skeletal nature in adult patient during orthodontic treatment.

ANTERIOR VERTICAL ELASTICS

Used for the closing of anterior open bites in adult patients, being an excellent method for the elongation or extrusion of the teeth involved in this malocclusion (Figures 1.65; 1.66), however, it will never be effective for the control of the posterior vertical development.

The elastic normally used for this purpose are the size of 3/16.

DIAGRAM 3 - POSITIONING OF VERTICAL ELASTICS



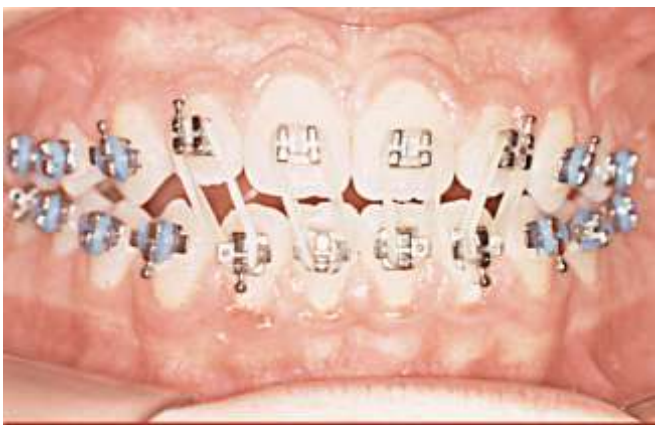


Figure 1.65 - Vertical elastics applied on the incisors, for the treatment of anterior open bite.

Figure 1.66 - Action on oppening mouth.

CROSS-ELASTICS

They can be used, in the anterior region of the arch, as an aid to the correction of midline deviation as previously described, or, in the posterior region for treatment of individual dental cross bites (Figures 1.67; 1.68).

However the use in individual dental cross bites produce highly extrusive responses and should be contra-indicated for adult patients with dolichofacial pattern, showing clinical anterior open bite.

Chapter 3

LEVELLING: THE FIRST PHASE

III - LEVELLING: THE FIRST PHASE

The conventional orthodontic treatment is normally divided into three major stages:

- **Levelling** (including the levelling phase itself as well as the alignment of the teeth);
- **Correction** of the relationship of canines (in cases of extraction where closure of posterior spaces is required),
- **Finishing** (interdigitation, containment and occlusal adjustments).

In cases where exodontias are scheduled as a requirement to provide space for correct alignment of all the teeth in the arch or, for the correction of clinical class II malocclusions, one of the major issues to be verified is the anchorage control.

Thus from a study conducted to assess the loss of molar anchorage in cases of distalization of upper canines, we progress to an alternative anchorage which is not actually the maximum anchorage, it could in fact be referred to as **POSSIBLE MAXIMUM ANCHORAGE.**

POSTERIOR ANCHORAGE UNIT

Knowing by the cephalometric assessment (Figure 1.69) that there is loss of molar anchorage during orthodontic treatment in cases with extractions, we decided to submit a proposal where through a series of

mechanical functional devices, we would at least be able to minimize this problem so that the spaces from the exodontias could be fully exploited not only for the correct positioning of the teeth along the arch, but also for the compensation of vertical skeletal malocclusions and existing anterior-posterior.

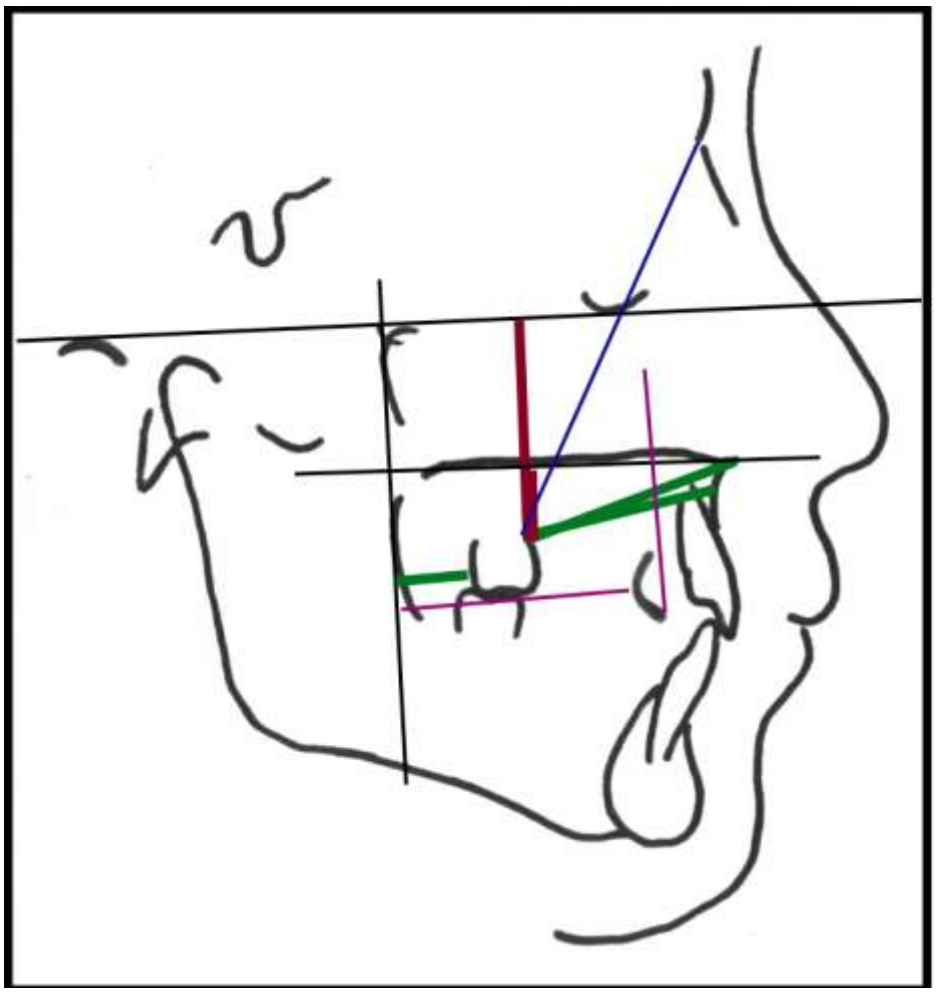


Figure 1.69 - Werneck Cephalometic tracing for the evaluation of molar anchorage:

1. Horizontal linear - through the lines 6-PTV; C-ENA; CA,

2. Vertical linear - through the lines C-PP; C-PF,

3. Horizontal and vertical angular - through PF-CN,

4. Degree of distalization of canines (3-PTV), and deflection of canines (3@).

However, the need for extractions to correct the various orthodontic problems requires a more careful analysis on the need to anchor the first upper molars, after all, without due caution after this initial levelling phase, as mesialization of upper molars is a biologically physiological factor, we would have enormous problems to achieve: the final orthodontic correction, and the conclusion of the condition treated in cases of Class I of canines and molars.

Thus our theory of anchoring includes some guidelines of a mechanical nature (the palatal bar), and others of a functional nature (a subdivision of the movement of anterior retraction and the strengthening of posterior anchorage).

The mechanical anchoring performed with the aid of the fixed palatal bar cemented on the first upper molars, is certainly not the best way to fix the posterior teeth, on the other hand, it is the only way to

establish a fixed device that is not reliant on the cooperation from the patient and may remain active throughout the orthodontic treatment especially in the retraction of canines and incisors.

Some authors report that the anchorage could be absolute and more effective when performed with the aid of extra-oral appliances, and we make clear, that we agree with this statement. What we believe is certainly misleading is to imagine that all patients would make the correct use of this device throughout the time needed to the orthodontic treatment, after all if it doesn't happen, we would be transferring to our patients much of the success, or the failure of orthodontic treatment.

Figure 1.70 – Cemented transpalatal bar on patient treated with extractios of upper premolars

Therefore, the extra-oral device will be an excellent unit, especially when used rationally in a phase of development of the individual to change the maxilla positions, and indirectly, act on the mandibular positioning.

Another reported method, relates to the Nance appliance, however since it is a hard/soft supported appliance, its ineffectiveness is apparent in the incisor retraction phase, because it might lead not only in discomfort to

the patient, but certainly lesions in the palatal mucosa.

The anchorage with mini-implants seems to be a good direction, but we still need longitudinal studies, and more information so that we could use it routinely, not forgetting that the costs should be accessible to all.

Thus we have used the palatal bar (Figure 1.70) as an enhancement of anchorage in the posterior unit, and knowing of their potential weaknesses we will add other information of a functional nature, that corroborate to a greater success in the control and preservation of the anchorage.

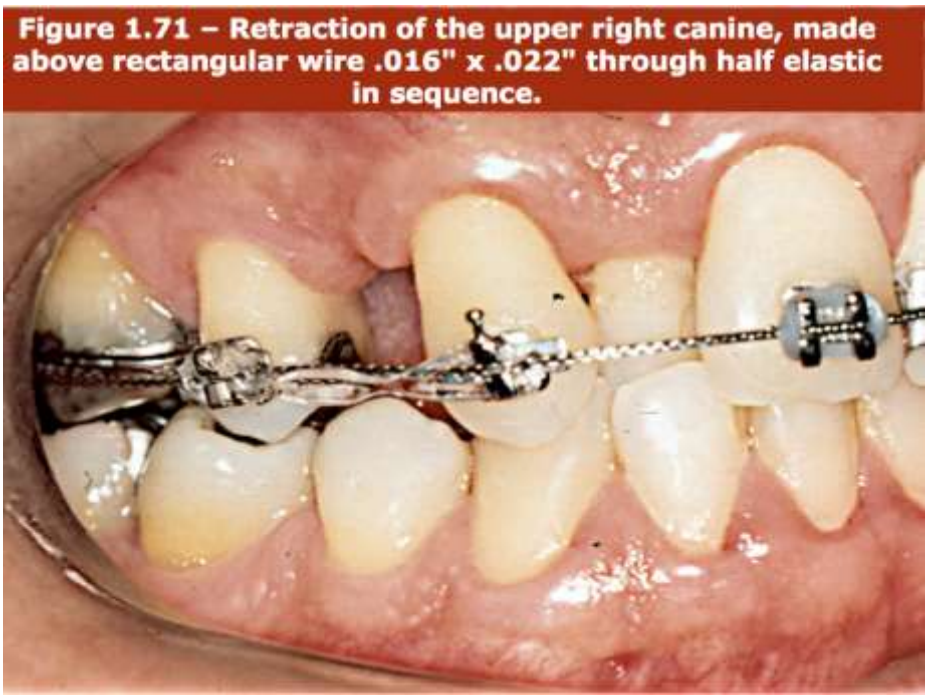


Figure 1.71 – Retraction of the upper right canine, made above rectangular wire .016" x .022" through half elastic in sequence.

This "device" of functional nature which we will give greater importance will be: a subdivision of the retraction movement and the strengthening posterior anchoring unit.

The subdivision of the movement is characterized by the retraction of canines, still in the levelling phase with rectangular wire (.016" x .022" steel T. Flex), with the aim of placing the tooth with the longest root in its final position at the beginning of the orthodontic treatment (Figure 1.71).

Care with this movement should be doubled because there is always the risk of causing deflection of the arch (Figure 1.72), the expected inclination of the canines crown to distal, which would mean the loss of contact in the area of pre-molars canines, and at the same time in the installation, or, worsening of the anterior overbite, which is highly undesirable.

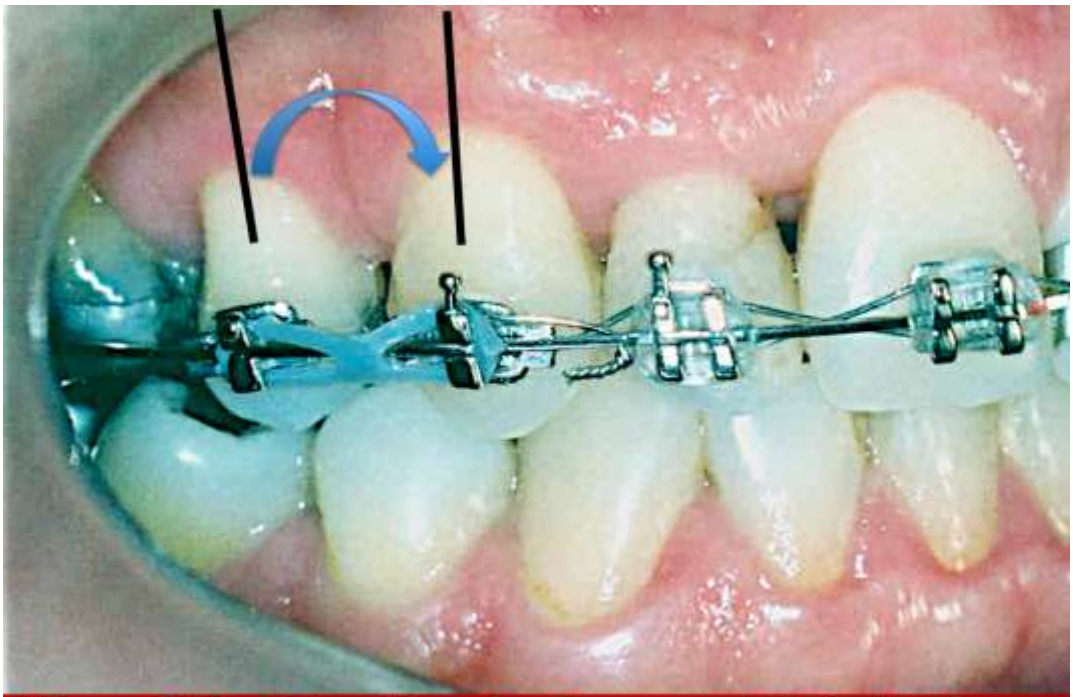


Figure 1.72 – Retraction of canines completed, showing the divergence of the roots the uper canine and second premolar.

Another factor in this movement of canines, relates to the level of forces applied because, if they are well above the capacity of assimilation of these forces by the periodontium, we would still be promoting the rotation of the canines (Figures 1.73; 1.74).

Figure 1.73 – View the measurement of the force deployed by elastic chain

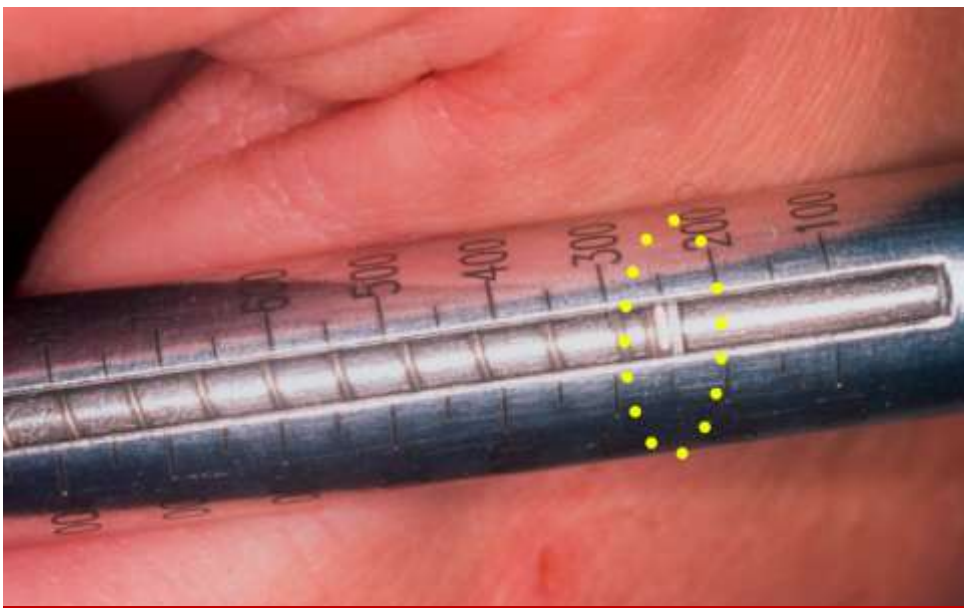


Figure 1.74 – Tensiometer showing the applied medium force (250g)

So that this does not occur it is imperative that the level of forces is controlled to the maximum, with the maintenance appointments spaced between 3 to 4 weeks, providing the time needed for the maximum level of force to be dispelled, before new re-activation of movement of distalization of the upper canines.

Having considered the potential problems, the retraction of upper canines can prove a safe alternative to the consolidation of POSTERIOR ANCHORAGE UNIT because its reinforcement with the addition of more tooth, certainly would imply two considerations of extreme importance:

(1) the formation of a block of teeth in the posterior segment, which would involve the first molars and the upper canines (Figure 1.75) teeth that are characterized by a high anchorage value. Furthermore, the posterior segment of one side would be attached to the other side through the fixed palatal bar.

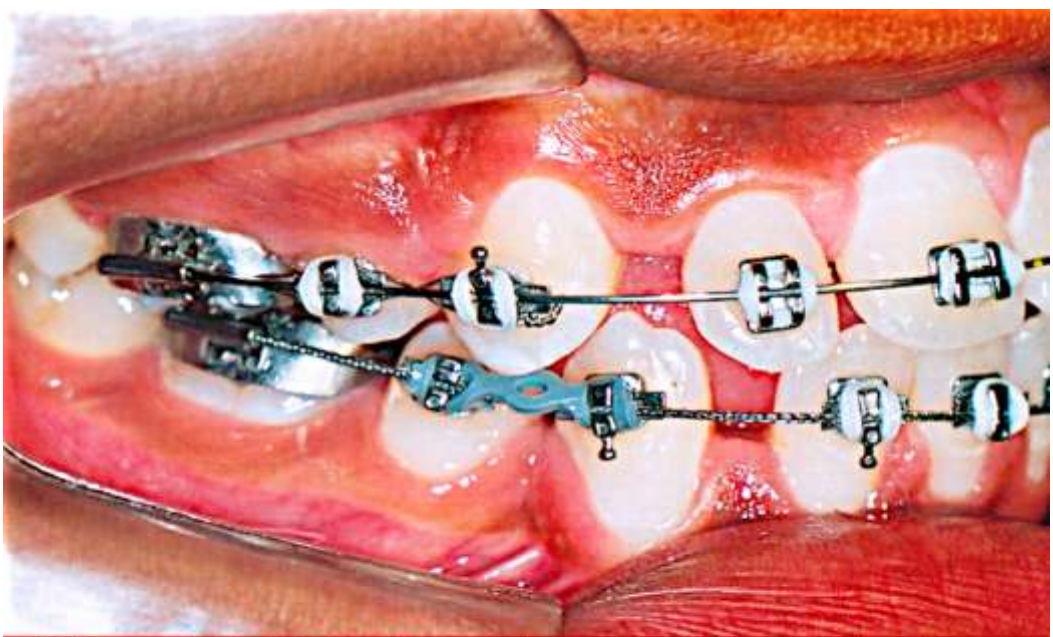


Figure 1.75 – Posterior anchorage unit formed by the first molar, second premolar and anine, on the right, attached to the upper left segment by the fixed transpalatal bar.

(2) the reduction of force at the time of incisor retraction (Figure 1.76), because upper incisors do not obstruct the distalization path, even taking into consideration that this movement does not constitute a physiological movement.

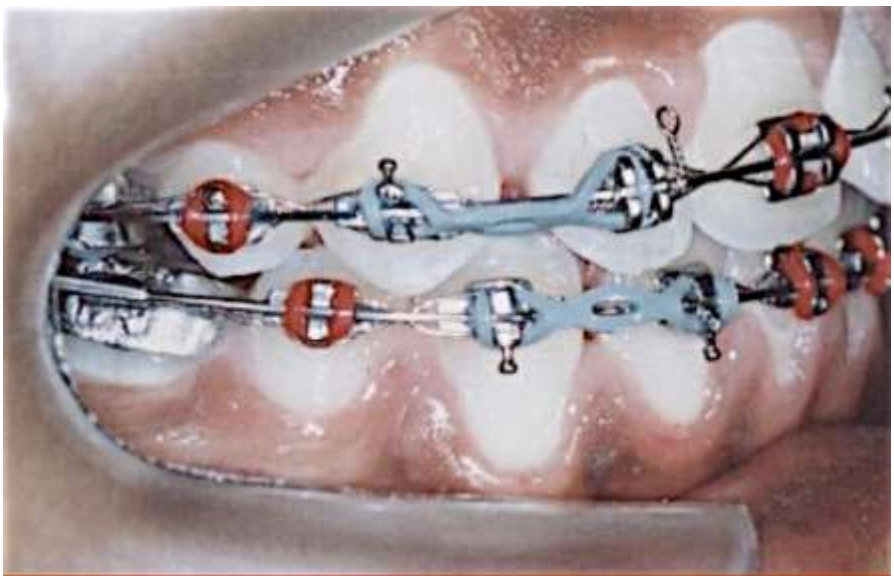


Figure 1.76 –View of the movement of incisor retraction, with the number of forces used this purpose in our Philosophy.

LEVELLING PROBLEMS

In almost all patients, regardless of the associated malocclusion we also note some space displacement, which causes bad alignment (Figure 1.77).

We may also find unevenness, observable in deep bite (Figure 1.78), or anterior open bite (Figure 1.79), and a lower curve of Spee, that depending on the associated malocclusion, can be severe or even absent.

Figure 1.77 – Severe upper and lower crowding in adult patient

Figure 1.78 - Deep bite.

Figure 1.79 - Anterior open bite.

Still, we can find the dental arches with transversal problems, either the dental cross (Figures 1.80; 1.81), or, with a skeletal cross, implying in these cases the presence of posterior cross bite (Figures 1.82; 1.83).

Figure 1.81 - Frontal view of adult patient (30 years old) .

Figure 1.80 - Maxillary atresia also treated with quad helix.

Figure 1.82 – Posterior cross bite|: intraoral frontal view (1), and occlusal (2), of adult patient

Figure1.83 – Cross bite: right (1) and left (2) view

Finally, the teeth may even be missing (due to agenesis or premature exodontias) (Figures 1.84; 1.85, 1.86); impacted (Figure 1.87), or even with anterior diastems (Figures 1.88; 1.89), and with rotation.

Figure 1.84 - Severe agenesis of the uuper lateral incisors and premolar (left side upper and lower arches).

Figure 1.85 - Panoramic radiography showing the absence of the upper lateral incisors, and second premolars from both arches.

Figure 1.86 - Panoramic radiography of the same patient two years after picture, where it shows absence of dental elements 12, 22, 25 and 35.

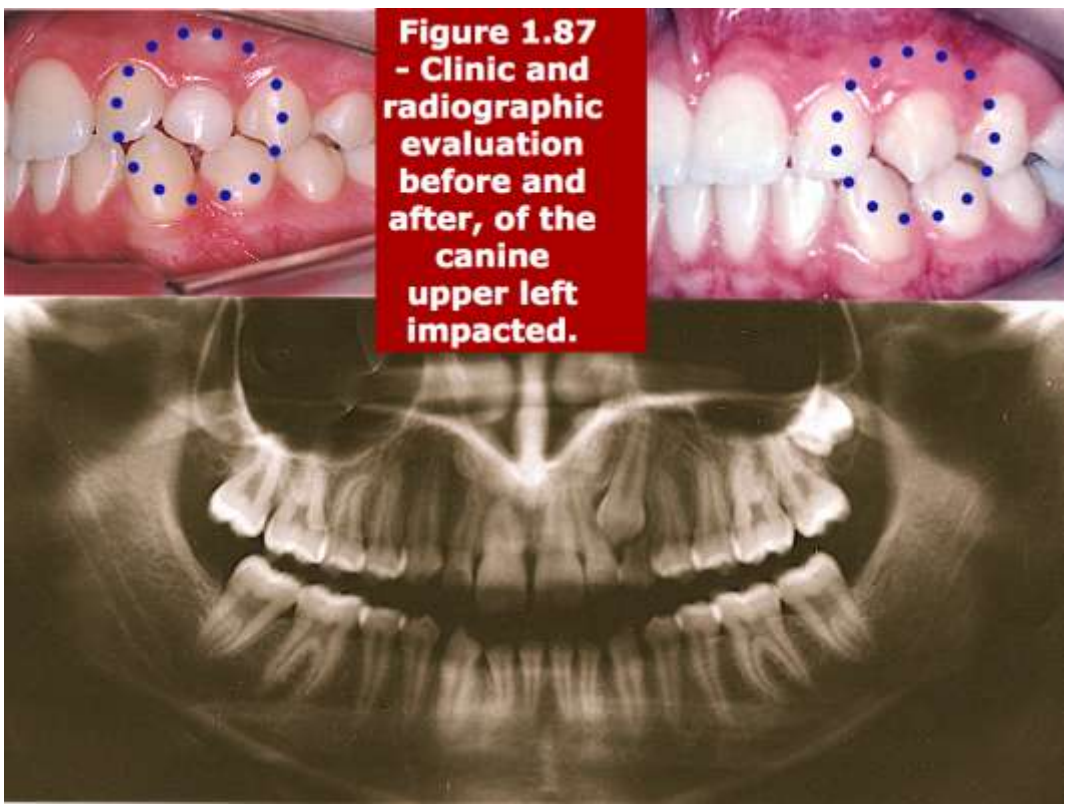


Figure 1.87 - Clinic and radiographic evaluation before and after, of the canine upper left impacted.

Figure 1.88 - Front view: presence on midline diastema and insertion of lip frenum in adult patient.

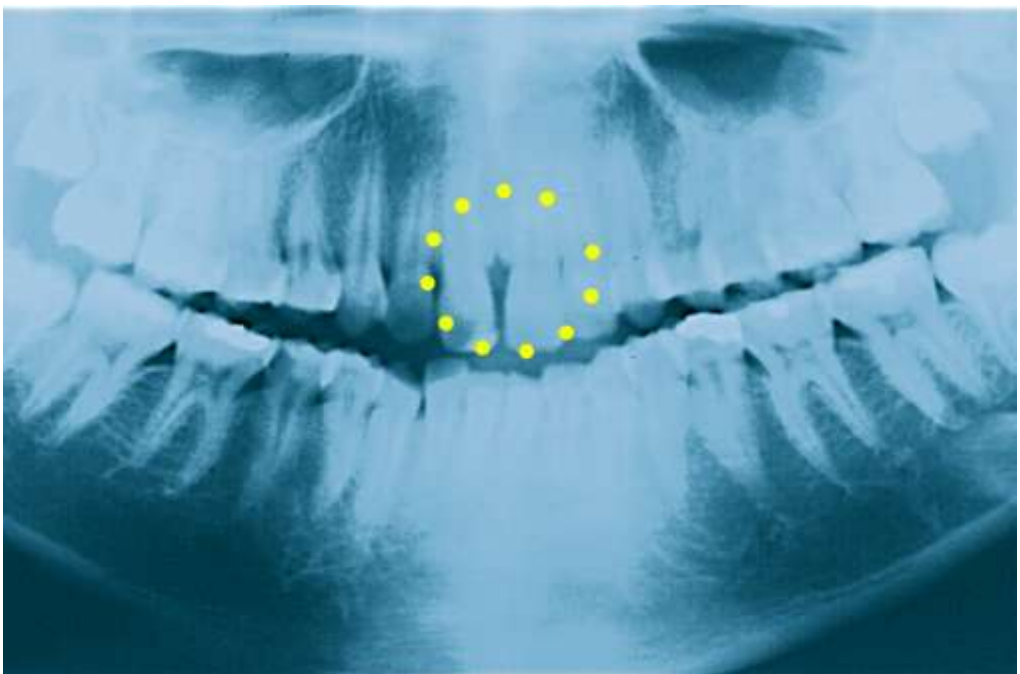


Figure 1.89 - Panoramic radiographic of the same patient showing bone condition and insertion of lip frenum.

Thus in the first stage of the fixed orthodontic treatment, at the levelling phase, we should correct all the basic issues, dental or dental-alveolar, and also depending on the severity of the case give priority to cases with evidence of structural problems.

SIZE OF WIRES AND INDICATIONS

Normally at this stage, two types of wire may be used, depending on the nature of malocclusion being treated.

So if we are facing a problem, which is necessary to control the torque of the anterior teeth, notably the incisors, it will be essential to apply the rectangular wire .016" x .022" at the earliest possible opportunity at the levelling stage (Figure 1.91).

In cases of class III malocclusions the application of rectangular wires in the lower arch will be essential for the preservation of the angulation of the teeth of this arch segment, in order to allow a compensatory treatment for this type of problem (Figure 1.91).

Figure 1.90 - Right side view of an adult patient with class III malocclusion before orthodontic treatment.

Figure 1.91 - Right side view of an adult patient with class III, using .017" x .025" nitinol wire, showing o maintenance of the angular positioning of the lower incisors.

However, under special conditions and in the presence of strong anterior crowding, the .016" nitinol wire can be used, however it is noteworthy that it is extremely resilient, enabling through memory in this type of wire, the addition of a larger number of teeth. It is also the case that without proper planning of these wires at the levelling phase, it could lead to an uncontrolled anterior sharing, which will certainly bring enormous problems in the phase of anterior retraction (Figures 1.92; 1.93).

Figure – 1.92 Right side intraoral view, showing . 16"nitinol wire in the lower arch (BE CAREFUL !), and shaping a marked vestibularization of the lower incisors, hindering the process of anterior retraction (I). In (II) same case two years later.

Figure 1.93 - Left side intraoral view, showing the same problem mentioned in previous pictures (I), and two years later (II).

On the other hand, if there is a requirement to work with lighter forces, it is important to remember that the fact we use the wire .016" x .022" from the start of treatment does not mean to say that all the teeth will

be involved in the same practice (Figures 1.94; 1.95).

Figure 1.94 - Intraoral view right at the levelling phase with care not apply the rectangular .016" x .022" wire in all the tooth from the beginning (I), and after of the levelling (II).

Figure 1.95 - Intraoral view left at the levelling phase with care not apply the rectangular .016" x .022" wire in all the tooth from the beginning (I), and after of the levelling (II).

Yet, in cases of pronounced crowding it will be first necessary to make enough space for the best possible positioning of all teeth (Figures 1.96; 1.97).

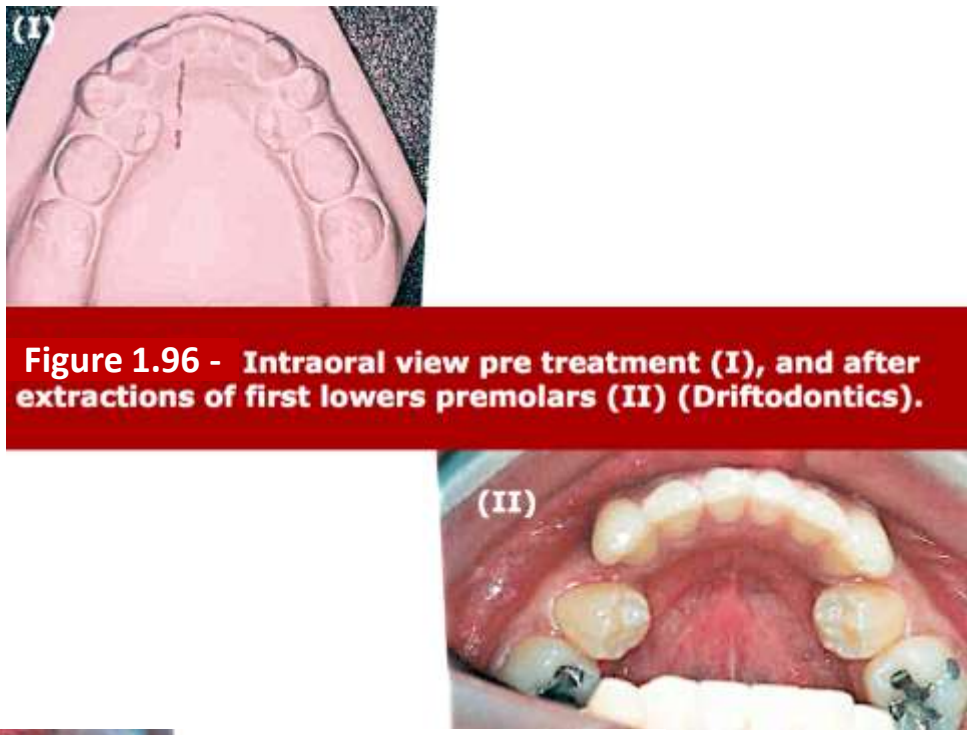


Figure 1.96 - Intraoral view pre treatment (I), and after extractions of first lowers premolars (II) (Driftodontics).

Figure 1.97 - Intraoral view now with enough condition to include second premolar to the levelling (I), and after that with the second premolar in the levelling (wire .016" x .022" nitinol) .

CARE IN THE LEVELLING PHASE

Early in our clinical practice we came to include the use of more flexible nitinol wires at the initial stages of levelling, in order to access the largest possible number of teeth in this period.

Hence the round .014" nitinol wire (Figure 1.98), came to be used in large scale, however we soon noticed a number of drawbacks in their application.

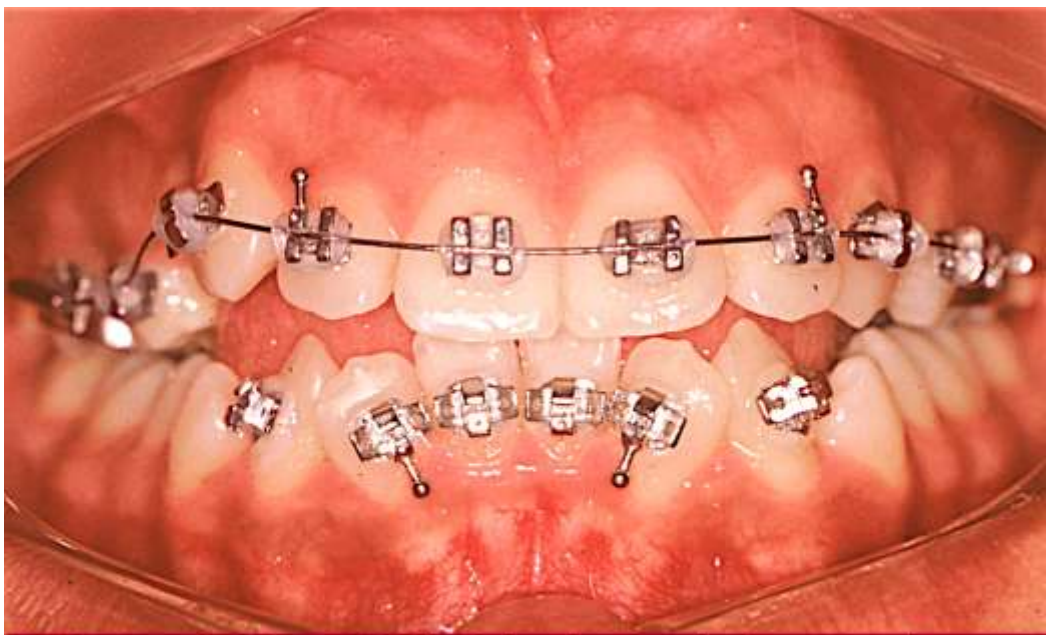


Figure 1.98 - .014" nitinol wire being used as the first wire of the levelling phase.

We expected this first levelling wire, by its own resilience and deflection ability, to correct the worst of the initial unevenness and misalignments.

However, since the .014" nitinol wire has a 'memory', when these are applied in cases of severe crowding we soon noticed adverse effects (Figures 1.99; 1.100), when treating absence

of space associated with malocclusions bites.
of anterior open bites, or of deep

Figure 1.99 - Front intraoral view: note the unevenness of teeth 13, associated with the anterior anterior open bite, a fact that clinically followed the cephalometric results of the same patient.

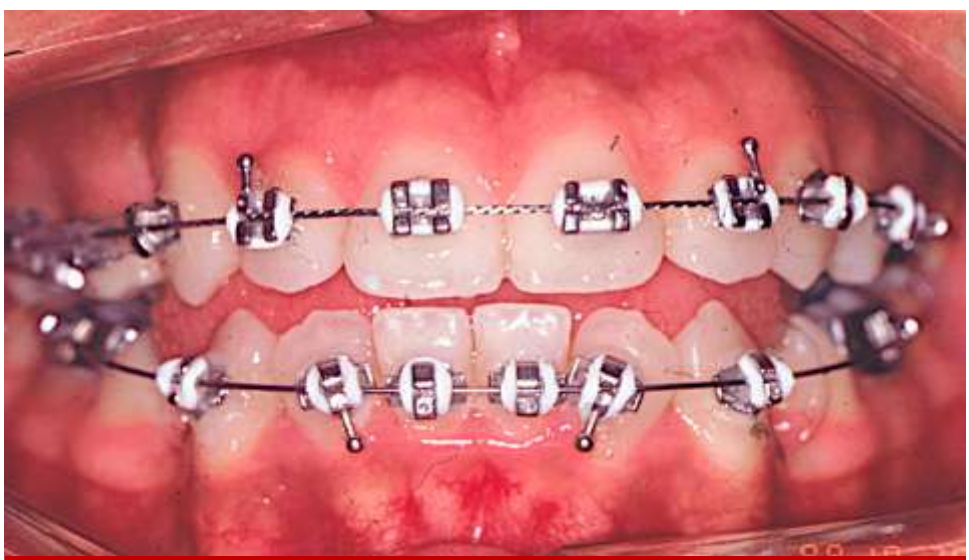


Figure 1.100 – Front intraoral view at the levelling phase showing .016" x .022" wire in the upper arch, and .014" nitinol wire in the lower arch.

In cases of anterior open bite, care must be taken in the choice of teeth involved in the initial levelling phase, because as we see in Figure 1.100, the inclusion of tooth 13, in a patient with a cephalometric relationship favourable to the development of anterior open bite (dolichofacial pattern), in conjunction with a clinical situation of great unevenness, all these two issues led to the opening of the bite in the anterior region.

Moreover, as there was a long levelling phase with round wires in the lower arch, the same does not control the incisor angle taking the patient to a situation of top-to-top.

Evidently, this issue could be sufficiently addressed; however, the degree of difficulty that has been added to the resolution of this problem is undeniable (Figure 1.101).

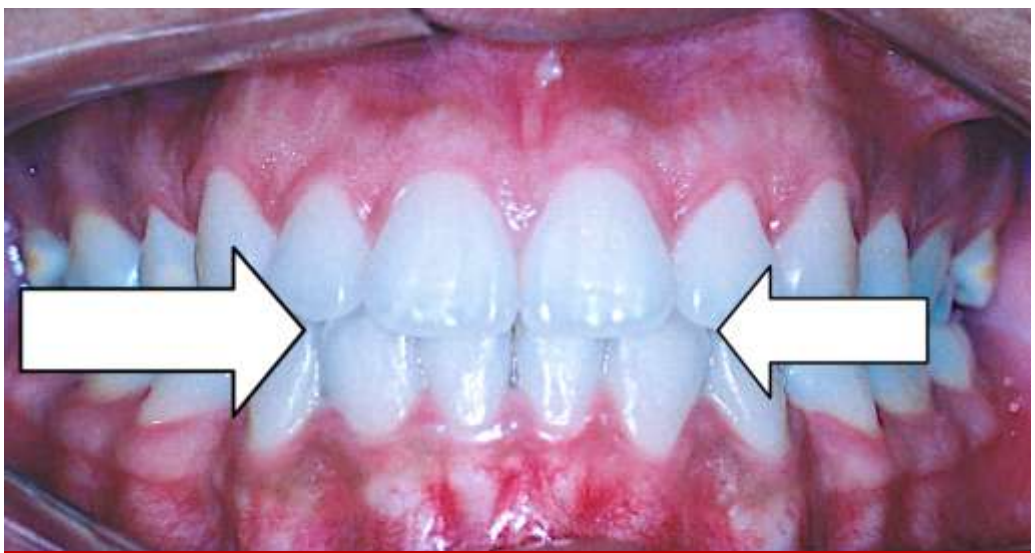


Figure 101 – Front intraoral view, post treatement showing corrected anterior openbite as well as the situation of initial crowding, and the previously existing midline deviation

In cases of deep bite it will be of extreme importance to introduce the lower arch in the treatment procedure as soon as possible, however, conditions should be fostered to make

this possible (Figures 1.102; 1.103; 1.104; 1.105).

So in cases with exodontias it is essential to control torque in the anterior region, and even more so, the maximum control of anchorage in the posterior segment.

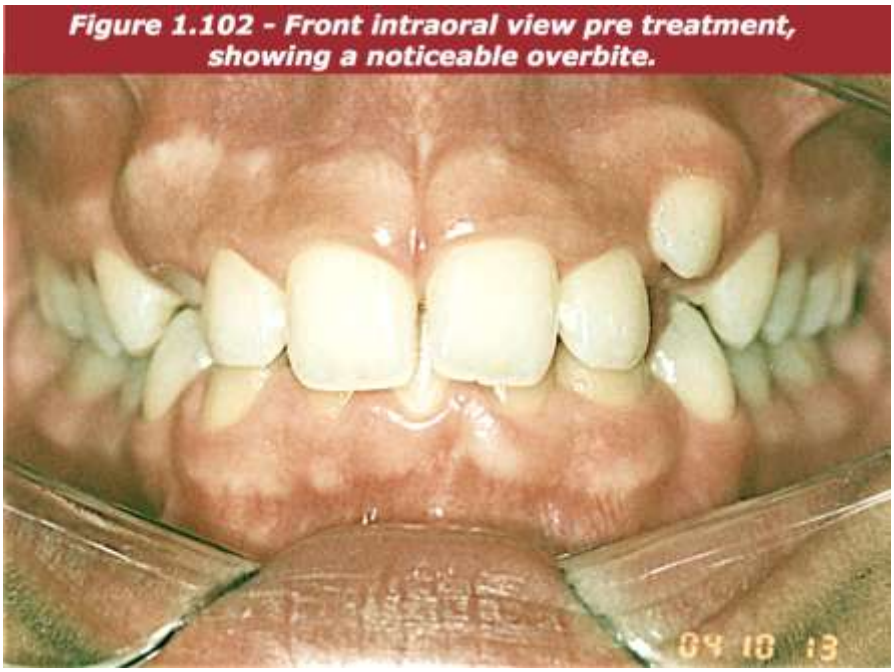


Figure 1.102 - Front intraoral view pre treatment, showing a noticeable overbite.

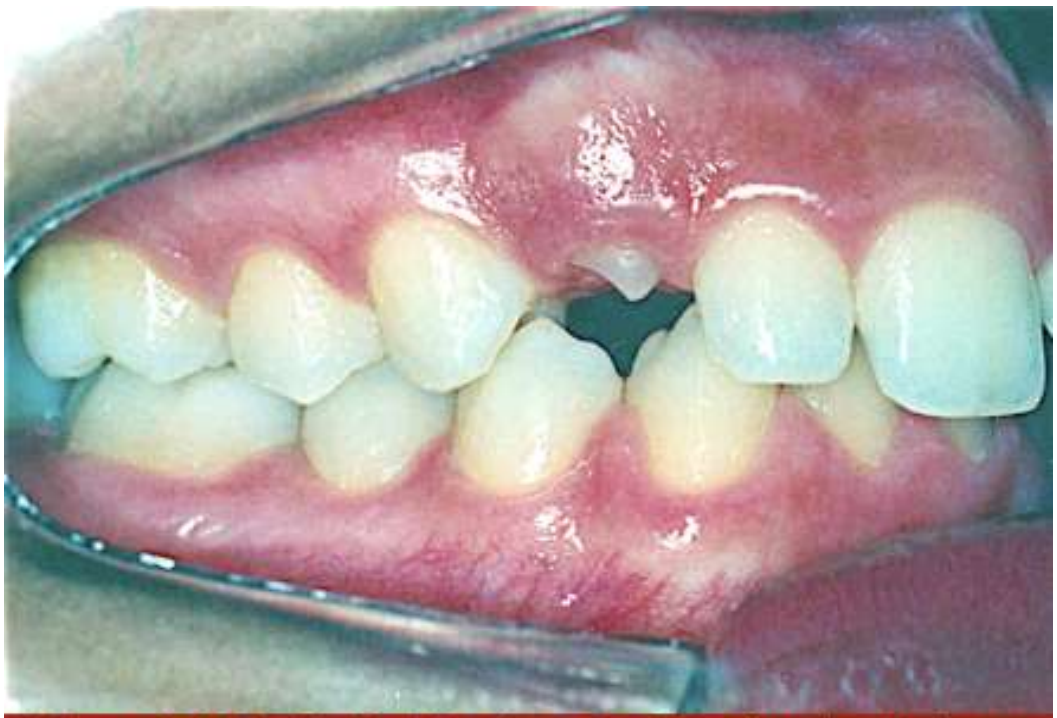


Figure 1.103 - Right side view of a Class I malocclusion + deep bite.

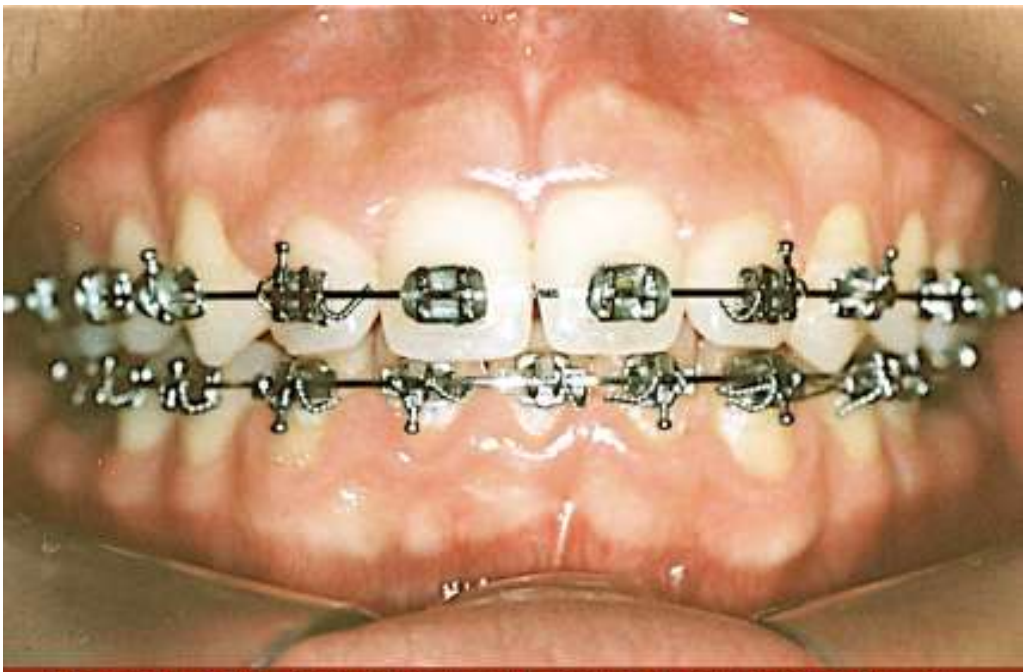


Figure 1.104 -Front intraoral view, showing the lower appliance already in place, which favours the effective treatment of the installed clinical deep bite.

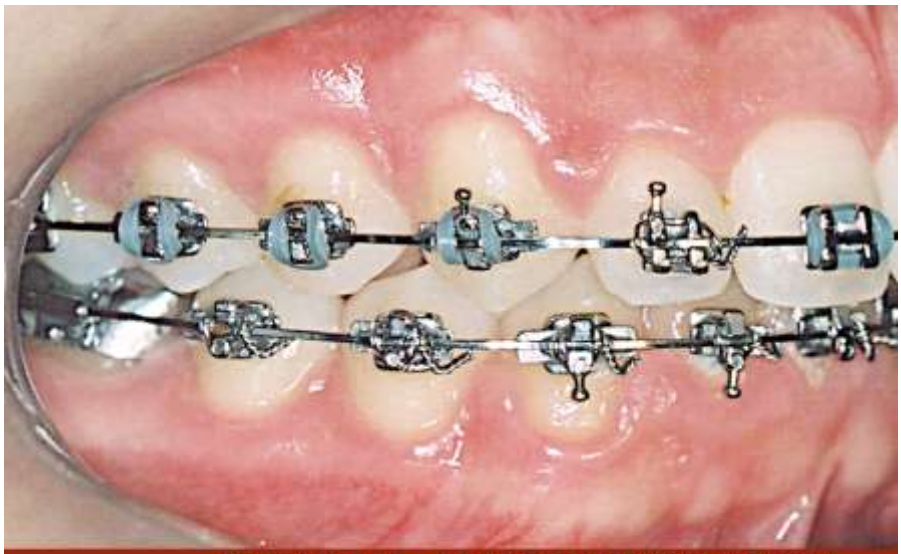


Figure 1.105 - Right lateral intraoral view the .017" x .025" steel wire in the upper arch, already adapted for the purpose of implementing the curve the Spee.

However two factors may be associated with the treatment of anterior open bites, or deep bites:

The first, the change of position of brackets,

and a second question, the application of special wires:

1. With curve of Spee (in the case of deep bite),

2. And the wires with extrusion folds in cases of anterior open bite.

Changing the bonding pattern has been widely used in our clinical experience in the position of the upper and lower incisors.

In anterior open bites usually after the definition of "x", using as reference the premolars, we would change in 0.5mm toward more cervical direction, a fact that favours the closure of the anterior open bite (Figures 1.106; 1.107).

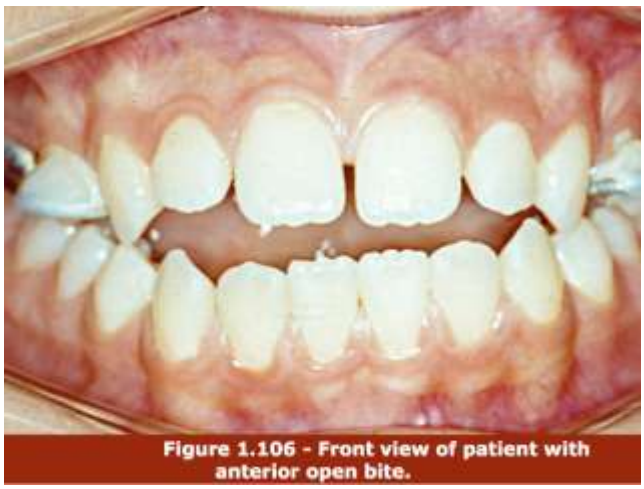


Figure 1.106 - Front view of patient with anterior open bite.

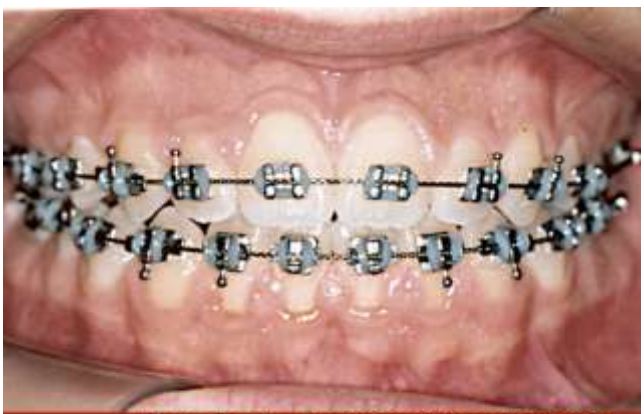


Figure 1.107 - Front view of the patient with treated anterior open bite, showing the brackets in the upper incisors, with the changed of positioning.

For the treatment of deep bites the more conventional way would be the use of arches with curve of Spee, in steel wires, either round (.016" or .018"), or .017" x .025" (Figure 1.108; 1.109)

Figure 1.108 - Front view of the upper arch with curve of Spee.

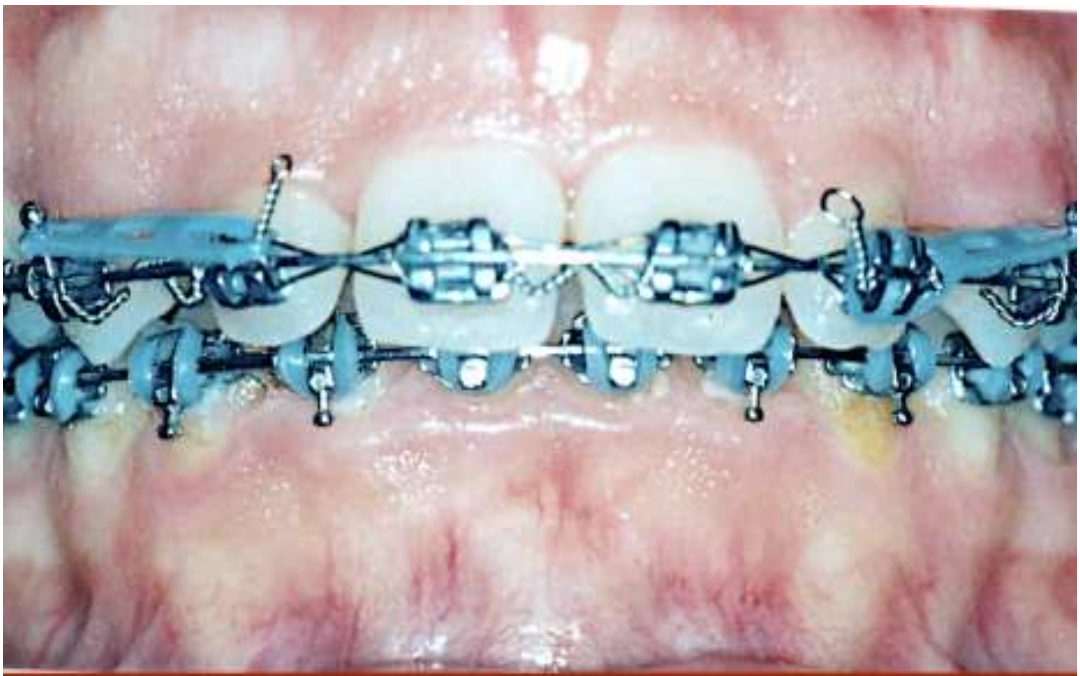


Figure 1.109 - Front view of the upper arch with curve of Spee already in place.

.016" ARCHWIRE – THE RELEVANCE OF ITS APPLICATION

The .016" wire, could be used in early stages of levelling depending on the degree of crowding found (Figures 1.110; 1.111).

It can be applied under special conditions, with attention to the fact it allows greater sharing, which in most cases will not be favourable, moreover in class II malocclusions, treated with extractions of upper premolars, or even in class III malocclusions, due to the potential of these wires to promote a marked sharing that could be disastrous for a good development of the treatment.

But perhaps if the patient presents deep bite of skeletal nature with clinical implications, we would use the .016" steel wire, because with this wire may be possible to adapt a curve of Spee, with the aim of favouring the initial sharing of anterior superior teeth, and through which it will be possible to decrease that overbite, increasing the over-prominence, and with this procedure allow sufficient space for assembling the appliance on the lower arch in a subsequent phase.

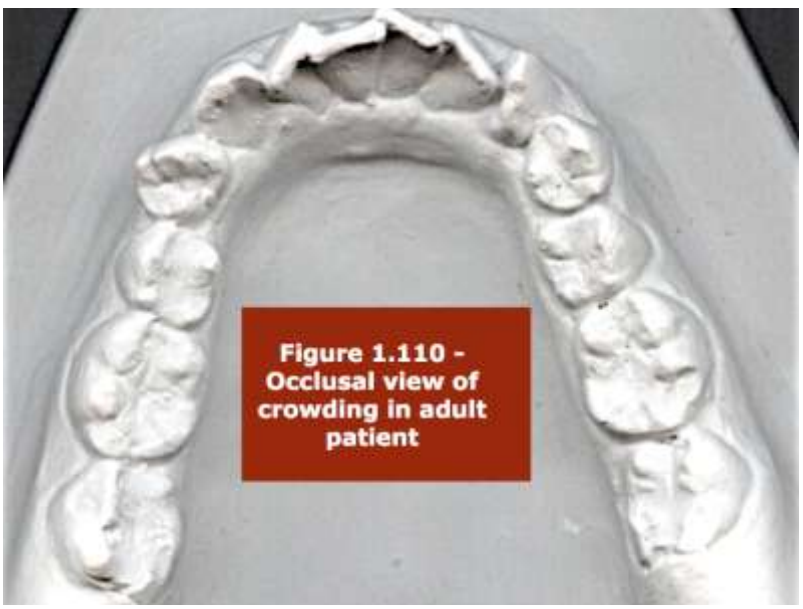


Figure 1.110 - Occlusal view of crowding in adult patient

Figure 1.111 - .016" nitinol applied in lower arch.

However if we are not faced with the above-mentioned conditions, and require a wire with greater power of deflection in order to reach teeth that are markedly out of alignment, the .016" nitinol wire can be applied (Figure 1.112).

Another application for the .016" wire, would be in cases treated with extraction, and that in our technique, we perform a full retraction of the upper canines during the levelling phase, being usually required around four months to complete the translation of the same.

The forces should be of minor magnitude so that it doesn't cause a movement only of the crown, but of the body, in this translation of the upper canines (Figures 1.113, 1.114, 1.115, 1.116).

Figure 1,112 - .016" nitinol wire: installed in order to better align the teeth 41.

THE 016" x .022" ARCHWIRE: ITS

At the time of completion of the retraction of the upper canines, the .016" x .022" twisted steel wire Twist-Flex (Figures 1.113; 1.114) should be applied, because it will allow us to achieve better verticalization of upper canines, simply by being a rectangular wire, which although flexible, by the friction that it causes to the sliding movement, it will not show an undesirable deflection of the arches were it to happen at this phase.

Figure 1.113 – Side view, before the canine retraction

Figure 1.114 – Side view showing .016” x .022” archwire, which provides some friction with the bracket’s slot of the canine (Be careful !). You have them to avoid a deflection of the upper arch, which can cause na increase in anterior overbite

Figure 1.115 – Side view with the upper canine already distalized in conjunction with the second premolar and first molar

With this wire in place, and with the canine performing a point of contact with the 2nd premolar, now we join with the with the metal tie-backs, so that we have a posterior segment formed by the upper canine teeth – 2nd premolar – 1st molar, with this wire now in position, with the

individual metal tie-backs (Figure 1.115).

In cases where it's found a deflection of arches due to retraction of the canines, or in cases with a deep bite already present at the start of treatment (particularly in brachyfacial patients), it will be indicated the placement of special wires, be it the. .017" x . 025" steel (where it will be possible to implement the curve of Spee), or, .016" x .016"' Cro-Co (blue elgiloy) wires to continue in the treatment (Figures 1.116, 1.117, 1.118).

Figure 1.116 – Initial deep bite

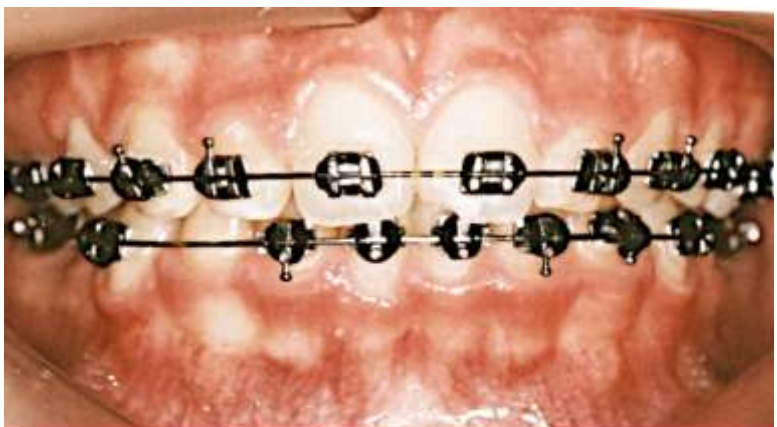


Figure 1.117 – Front view of patient in the levelling phase with nitinol .017" x. 025" (upper and lower arch).

Figure 1.118 – Right side pf patient in the levelling phase with Cr-Co .016” x .016” (upper arch)

Therefore:

The use of light forces in the levelling phase is essential to allow the orthodontic movement to occur through frontal resorption.

The notion of light forces, is not necessarily linked to more flexible wires, but to the frequency of activation of forces during orthodontic treatment, and above all, the number of teeth included in the same, because in combining the largest possible number of dental elements in search of alignment and levelling, if these movements are of great magnitude, we will certainly face a strong forces.

One very important detail is that if we seek dental alignment, either to correct rotations or crowding, it will be of great relevance to provide spaces

for these dental movements (Figures 1.119; 1.120).

Figure 1.119 - Occlusal view of lower arch, showing the required space provided for the inclusion of the tooth 42 on the alignment arch, and in this instance, the space is being maintained by a closed nitinol spring, while the tooth is being aligned.

Figure 1.120 - Occlusal view of the same patient with the tooth 42 already in a better stage of levelling.

CHAPTER 4

INCISORS RETRACTION

IV - INCISORS RETRACTION

Having completed the process of levelling of the arches, in cases of extractions of the premolars, and with the upper canines combined to pre-molars and molars, the next step in the protocol of treatment will be the closing of the exodontias spaces.

With this objective some factors must be present so that the closing of spaces take place at the end with the upper canines in class I relation to the lower canines.

Thus we enumerate some conditions we consider essential (Figure 1.121) such as:

* The perfect levelling of arches, both upper and inferior, especially when sliding movement for the closing of the spaces of exodontias is required. This perfect levelling, if not present, will be one of the first causes of midline deviations which occur at the time of treatment (Figure 1.121).

Figure 1.121 – Side view of a patient treated with four extractions, at the time of upper incisor retraction, with all the resources used in our technique installed

* Another important issue is the presence in both arches of rigid wires, and that in our technique .017" x .025" wires are used (Figures 1.121; 1.122; 1.123), which may be of nitinol or steel, and dependent or otherwise on the presence of deflection of the arches. Thus if deflection is found during use of nitinol wire, it is recommended that these be exchanged by steel wires to allow them to be inserted the curves of Spee.

* The third factor relates to the retraction appliances. We have previously used retraction handles, however, after a few years decided to opt for the retraction elastics so that they could initiate a sliding movement in the retraction phase. Great care must be taken not to cause deflection in the retraction arches because these elastics can produce forces averaging around 300g (Figures 1.124; 1.125). Usually they are applied from the upper canines on one side, which in this instant form part of the posterior segments of the arch, to the upper canines on the other side of the arch.

They should be replaced every session (three to four weeks' interval between them). And in the presence of deflection of the arches, the forces should be suspended until the complete the treatment of this issue.

Figure 1.122 – Front view, showing the start of the development of a midline deviation, on account of elastics forces that are not clinically behaving assimetricaly

Figure 1.123 – Front view, after the treatment.

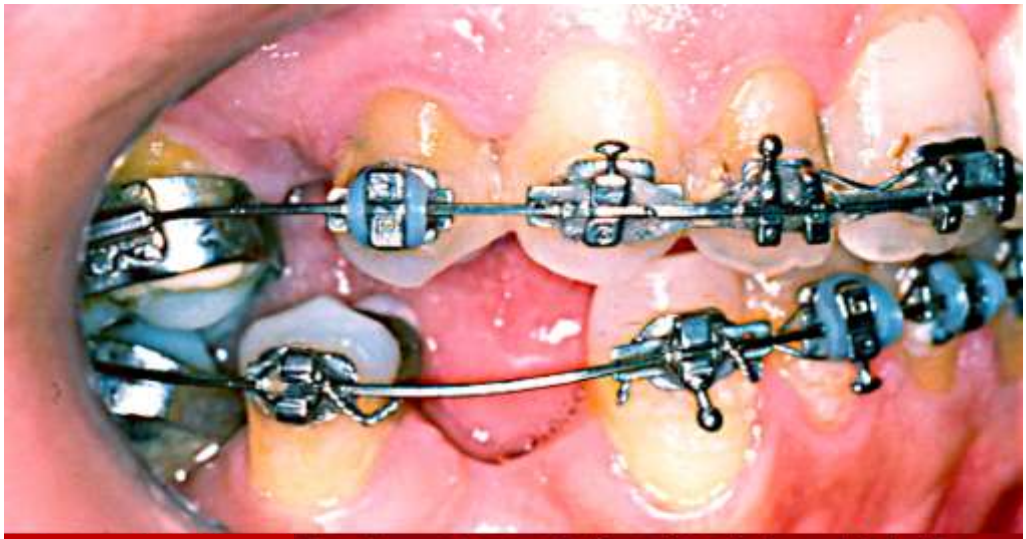


Figure 1.124 - de view of an adult patient, in which the chain elastic was used for the purpose of closing the spaces resulting from exodontia of upper pre-molar, showing a deflection of arches in the pre-molar position, characterized by the absence of intercuspidation between them (upper and lower).

Figure 1.125 - side view of the same patient, no longer using chain elastics, instead the interdigitation elastic of 3/16 is applied in the premolars region (upper and lower), with the aid of Kobayashi tie-backs.

* Another important point refers to the use of inter-maxillary elastics, and as we have seen before, they are made necessary by the need to preserve the maximum posterior anchorage. But we must remember that they have specific indications and contraindications, so we should exercise caution in its use. So while in our technique the use of inter-maxillary elastics (class II or class III), is preferably applied on the lateral incisors and molars, with the intention to accentuate the effect of horizontal vector of distalization, in some cases we can use the 'short' class II elastics (Figures 1.126; 1.127; 1.128).

Figure 1.126 – Intraoral right view of adult patients with class II malocclusion

Figure 1.127 – In the Panoramic, showing the bone condition.

Figure 1.128 – Intraoral right view of a patient where the "short" elastics will be applied from the second lower premolar to the upper lateral incisor

The use of short class II elastics has the advantage of acting in the finalisation of cases, either with or without extraction where we note the horizontal vector of distalization, adding vertical vectors that can help in the interdigitation.

This protocol it is necessary because the inter-maxillary elastic forces (mainly the class II elastic), which will operate during the closure of the existing spaces between the lateral incisor and canine, and provide for the control and preservation of the anchoring.

But the elastic forces can also promote the deflection of arches, and thus as we normally operate with levels of magnitude of the forces of the posterior anchoring around 300g to 400g on average, the rectangular arches applied at this stage in orthodontic treatment are undoubtedly obligatory.

The use of rectangular arches becomes obligatory because the class II and class III elastics cause undesirable movements both for the posterior and the anterior teeth, and in the case of class II elastic we find two force vectors acting, first horizontal vector, causes:

1) Mesial movement of posterior inferior teeth which can lead to share of the anterior teeth;
2) Distal movement of the anterior superior block (expected movement in incisor retractions).

A second vertical vector causes two highly undesirable movements in most cases:

1) The extrusion of the posterior teeth notably the molars, and another movement;

2) Extrusive in the anterior superior arch, which would cause serious problems, because it would lead the patient to show an increase in overbite during retraction, hindering the process of retraction.

With reference to class III elastics, its use would also present to important vectors, the first horizontal vector would cause:

Loss of upper posterior anchorage (expected in the action of these elastic forces);

Lingualization of the anterior inferior teeth (relevant in cases of class III malocclusion);

And a second vertical vector, which will allow:

1. Extrusion of the upper molar,

2. Extrusion of the anterior inferior teeth.

Thus due to all these often undesirable effects it becomes mandatory the use of wider diameter wires, and more specifically, wires that control the torque of the teeth along the arch to enable the use of the elastic forces, the favourable effects that aid the anterior retraction.

Under certain conditions:

- In cases of skeletal deep bites associated with clinical deep bites (Figure 1.129);
- Or in cases showing deflection of the arches, due to the levels of magnitude of forces employed (Figure 1.130);
- Or, when there is no more over - protuberance necessary for the evolution of the process of incisor retraction (Figure 1.131);

It should also be noted that the use of these elastics (Class II or III), in fact corresponds to necessary alternatives, however supplementary during the retraction because the real anterior retraction, regardless of the case needing or not of the loss of anchorage, can only be verified by the action of elastic forces given by the elastic chains linking canine on one side of the arch to the contra-lateral canine.

The actuation mechanism of these elastic chains causes the sliding movement of the arch enabling the anterior retraction, and consequently, the closing of existing spaces between the lateral incisors and canines, and for this the rectangular wire .017" x .025" steel.

- In this case it will be required in the implementation of rectangular steel wires, the curves of Spee, to continue with our sliding procedure, and consequently closing of the spaces from the exodontias.

Figure 1.129 – Right side view of patient, with clinical deep bite, where it was necessary for the implementation curve of Spee in the upper arch, to continue in the inicisor retraction

Figure 1.130 – Intraoral side view of patient with orthodontic treatment in the incisor retraction phase, showing a discrete deflection of the upper and lower arches, caused by the action of the elastics forces of anterior retraction with elastics chaim and class II elastics

Figure 1.131 – Intraoral right side view showing the absence of space between the upper and lower incisors and making it impossible therefore to progress of the incisor retraction

The activation or changes of these elastics should occur every three or four weeks, with the class II elastics used in the event of requiring an incisor retraction with maximum possible control of anchorage.

The class III elastics should be used in a reverse situation, when a greater loss of anchorage is required, especially in cases of anterior open bite, on which we must point out, no type of fixed anchorage should be present (Figure 1.132).

Nevertheless we usually don't use class III elastics because they typically promote a strong deflection of the arches, which could render impractical the continuity of orthodontic treatment, especially by less experienced clinicians.

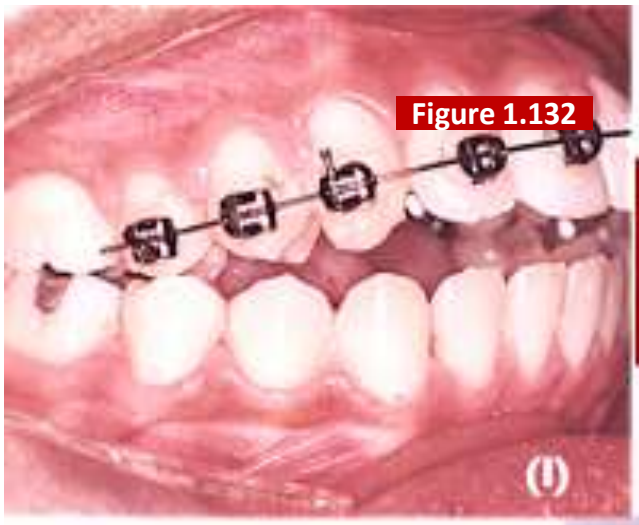


Figure 1.135 - Right side view showing orthodontic treatment with other technique (I), and after with Alexander Discipline (2).

In twice arches the presence of the .016" x .022" T. Flex., four extractions of the premolar, and anchorage loss in upper arch.

In cases with four scheduled exodontias (upper and lower pre-molars), the incisor retraction will preferably begin in the upper arch, unless there is an absence of space (in cases of class I malocclusion, or bi-protrusion, this fact can be verified) (Figure1.133).

Figure 1.133

Figure 1.136 - Right side view of a patient treated with four extractions of the first premolars (before of te extractions (I), and in the incisor retraction phase (2).

It may be necessary to apply the anterior vestibular torque sometimes in order to enable us to continue with the retraction, or the increase in the curve of Spee in the rectangular arches so that the overbite can be controlled, because the anterior retraction mechanism through the sliding technique of sliding predisposes the anterior arch to install or aggravate the overbite, and that would mean a great difficulty to complete the treatment.

CHAPTER 5

IDEAL ARCHES AND INCISOR TORQUE

V - IDEAL ARCHES and INCISOR TORQUE

In Vari-Simplex Discipline (Alexander), the ideal torques were projected from the medium torques of rectangular arches of 50 completed cases, and that presented ideal occlusion, with the system designed to have a maximization of its objectives when applied on rectangular steel wires .017"x .025" against "slots" in brackets .018".

Thus the torques applied in the VSD exhibits three negative degrees, mainly by the fact that in this technique in cases of pre-molars extractions the upper canine is retracted first, forming a protocol reference of the technique at the levelling phase.

Five degree negative torques (lingual) are also applied of to the lower incisors, and finally, in molars zero torques will be applied, and on the whole we can observe a progressive lingual in the lower arch, unlike the upper arch, where this feature it is less evident.

With the majority or orthodontic brackets currently presenting prescription of torques (Figures 1.134; 1.135) built on its construction, it minimizes the work of orthodontist. However, there will always be a discrepancy between the torque placed on the bracket slot, and that necessary for each individual case, because there will be many variants involved, since the torque present in these slots does not take into account the patient's age, nasolabial angle, facial pattern, pre-existing angulation, mechanics with or without extraction.

Figure 1.134 – Adult patient in intra-oral view, before orthodontic treatment.

Figure 1.135 – Adult patient in intra-oral view, in the finalising phase with the lower brackets already removed.

We know that no effective torque force is produced when a round wire is placed in an arch, as it lacks an edge or angle for the wire to make contact with the bracket slots.

And no rectangular wire with much smaller dimensions would produce an effective torque, as they do not fit perfectly in the bracket slots; it is possible to produce a significant torque, but below the needs of the cases being treated, and often acting as torque resistant to the unwanted movements, and much less as effective torque.

It must also be taken into account that if the wire is not well adjusted, the effective torque may decrease with time, which leads us to reflect on the need for metal tie-backs in this stage of treatment, and discard the use of elastic tie-backs because of the tendency to lose their elasticity over time, due to the action of various factors in the oral environment, such as differences in temperature and Ph of saliva.

We conclude that although the pleated wire .016" x .022" may have some torque action, it will be with wire .017"x .025" in slot .018 ", which will make the implemented torques effective during orthodontic treatment (Figures 1.136, 1.137 and 1.138).

Figure 1.136 – Thirty days after the torque applied in the second lower premolar segment, showing the opening of the mesial diastema, where we conclude that the tooth was not stable in that anterior position

Figure 1.137 – Left side view with evidence to the region of the second premolar, where there is a need for vestibular torque for better interdigitation.

Figure 1.138 – Ten years after the start of the orthodontic treatment, with case now finalized, and presenting good interdigitation.

The Twist Flex wire, or even, the TMA .016" x .022" show approximately 40% less rigidity than the rectangular wire .017" x .025" with the first being more used as a levelling arch (in retraction of canines, for example), when there is evidence of divergence of the canine crown in relation to the pre-molar, for the movement of retraction.

On the other hand, the .017" x .025" wire should be used as a final arch in all cases in our technique, and it is important that the final arch remains installed for at least five months, the time necessary for all of the force vectors present in the bracket slots are completed.

Another factor to be remembered is that the steel wires need a heat treatment, which will have the purpose of maintaining the characteristics imprinted on rectangular arch, as the stainless steel seems to have a memory when working thermally, causing a molecular rearrangement with this procedure.

This heat treatment, which we refer to as "annealed", should occur as often as is necessary, especially after each effective movement by the orthodontist on the rectangular or round steel arch.

CHAPTER 6

RETENTION AND RELAPSE

VI - Retention and Relapse

Containment begins when active treatment is complete !

In dental malocclusion it is accepted that the poor positioning is actually a state of equilibrium on the functional and neuro-muscular landscape, which they occupy, and the orthodontic treatment may not necessarily be a guarantee of a new state of equilibrium.

The related etiology, may also be multifactorial in nature, thus in the study of the etiology, we should always evaluate:

- The causal habits, because they can participate in the development of malocclusion, acting in a certain time in the patient's life;

- The persistent muscular pressures, because when we achieve a new position of the teeth, we must seek to achieve the muscular balance present prior to treatment;

- The cases insufficiently treated should always be considered, since a normal occlusion was not consolidated after treatment, the relationship of molars, and especially the canines, on both sides;

- Adverse growth after treatment, especially in cases of class III malocclusion may compromise the outcome of treatment, and more negative, in patients with mandibular growth with a vertical type component;

- We can also find relapse in patients with class II malocclusion, with the emergence of crowding in the sagittal, especially in cases which are completed in class I with small overbite;

- The non-parallelism of roots can also be increased, particularly among pre-molars and canines in cases of extraction, because if this is not achieved, we may be presented with opening of diastema in place of extraction;

- The actual periodontal ligament, for its characteristics of elasticity, particularly the fibres of the intra-alveolar group, responsible for relapse in the event of a rotation;

- And finally, one last cause, but very controversial, refers to the eruption of the third molars.

PRINCIPLES OF RETENTION

The distance between inter-canines and inter-molars

The distance between inter-canines and inter-molars should not be modified, especially in the lower arch (Figure 1.139).

We must always remember that the inter-canine distance does not change, whereas the inter-molars distance usually decreases in cases of exodontias due to mesial movement of teeth during orthodontic treatment.

Figure 1.139 – Occlusal view or the lower pattern, to demonstrate that the distance canine-canine lower, should be considered fixed.

Etiology of malocclusion

Containment of a case of abnormal swallowing cannot be regarded as complete until after the complete elimination of bad habits (Figure 1.140).

Figure 1.140 – Side view of tongue with muscle tone outside of the normal range, being one of the etiological factors in the development of anterior open bite in the young patient.

Over-correction

It is a classic saying that relapse is proportional to the over-correction.

Thus some procedures can be performed such as gingivectomy in cases of rotation, (though personally I don't see this procedure as necessary), while the search of the roots parallelism in the neighbouring teeth in cases where extraction is mandatory.

Age

It is an important factor, influencing the speed of reorganisation of the periodontium.

Occlusion

The occlusion is the most powerful factor in determining the stability of a new position, so we must seek a correlation between the centric relations with the centric occlusion the end of treatment.

Position of lower incisor

The lower incisor must always perpendicular to the basal bone.

Growth

The corrected malocclusions within a period of growth, present a condition of greater stability of the orthodontic movement made with consequent reduction of the possibility of relapse.

Finally the containment should be:

A) as short as possible;

B) should last, at least half the time of active treatment;

C) maintained until the problem of third molars is resolved;

D) as long as the patient allows;

E) the containment appliance must allow a dental movement in all directions, except in the one where the tooth was dislocated.

Apparatus of Retention

Fixed 3 - 3:

Generally from canine to lower canine, pasted by lingual and performed with steel wires (Figure 1.141).

Figure 1.141 –Lower fixed retention of type 3-3

2 – Hawley Retainer:

With slight modification in relation to the traditional Hawley retainer, as the wire in this new design pass by the distal of the upper second molar (Figures 1,142, 1,143, 1,144, 1,145, 1,146).

Figure 1.142 – Occlusal view of modified Hawley retention

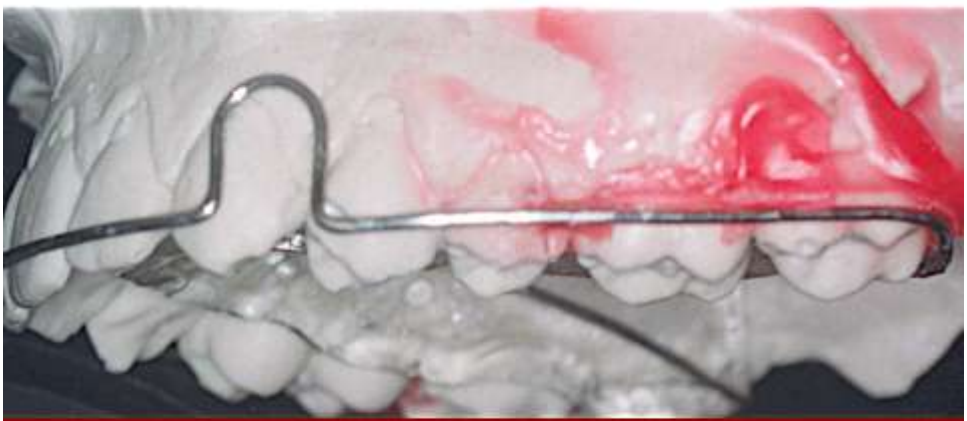


Figure 1.143 - Side view of modified Hawley retainer

Figure 1.144 - Front view of modified Hawley retainer

Figure 1.145 - Left side view of modified Hawley retainer

Figure 1.146 - Right side view of modified Hawley retainer

USAGE TIME

In the first six months in daytime use, with the appliance being removed only for washing, and after these six months the patient will use for a further six months in the nighttime.

After this period, the unit can be removed, but the patient must be observed, and if there are any signs of relapse, appointments may be scheduled less frequently, until the retainer can be discontinued definitely.

However, it will be extremely important that no orthodontic treatment can be considered complete, until occlusal adjustments are made.

Chapter 7

CONCLUSION

VII - CONCLUSION

Remember that no orthodontic treatment is considered absolute because the patient will suffer changes arising from the normal development and, in addition, changes resulting from future orthodontics treatments, particularly restorative, and may influence much on the stability of the cases treated.

So I would like to conclude by saying, good luck, and remember, the Orthodontics is the science of common sense and responsibility.

CHAPTER 8

REFERENCE

VIII - Referencê

ABELL PJ - *A study of the force degradation of periodically stretched and fixed distance stretched orthodontic elastics.* **AJO**. 65(6): 649-50, 1974.

ALBA JA, CHACONAS SJ, CAPUTO AA, EMISO W **-** *Stress distribution under high-pull extra-oral chin cup praction.* **Angle Orthod.** 52:69-78, 1982.

ALEXANDER RG - Ortodontia: ***Conceitos Contemporâneos e Filosóficos****,* Livraria Editora Santos 1ª ed., 444 p., 1997.

ALEXANDER RG - ***A Disciplina Alexander – Filosofia e Conceitos Contemporâneos***. Livraria Editora Santos. 2003; 1ª Ed. 443 p.

ALMEIDA GA. *et al.- Reabsorção radicular: considerações preliminares e apresentação de um caso clínico.* **Rev Odont USP** 3(l): 305-11, 1989.

ARAT M, ISERI H - *Orthodontic and orthopedic approach in the treatment of skeletal open bite***.** **Eur J Orthod.** 14:207 - 15, 1992.

ARBUCKLE J, SONDHI A. *Canine root movement: an evaluation of root springs.* **AJO.** 77(6): 626-635, 1980.

ARVYSTAS MC - *Treatment of anterior skeletal open bite deformity.* **AJO.** 72(2):147-64, 1977.

ATKINSON S - Open bite. **AJO.** 52(12)877-86, 1966.

BAETEN LR - *Canine retraction: a photoelastic study.* **AJO.** 67 (1):11-23, 1975.

BARROS OG - *O uso dos elásticos de classe II.* **Ortodontia**. 4(3): 201-d, 1971.

BECKER A, SHPACK N, SHTEYER A - *Attachment bonding to impacted teeth at the time of surgical exposure.* **Eur J Orthod,** 18(5): 457-63, 1996.

BECKS & MARSHALL - Apud; BREZNIAK N, WASSERSTEIN *A - Root resoption after orthodontic treatment: part l. Literature review.* **Am J Orthod Dentofac Orthop.** 103(1): 62-66, 1993.

BERNARD CLP, SIMOND-SAVOIE S - *Self-correction of anterior open bite after glossectomy - In a young rhesus monkey.* **Angle Orthod. Apr**, 137:43, 1987.

BLOCK MS, HOFFMAN DR - *A new device for absolute anchorage for orthodontics.* **Am. J. Orthod. Dentofac. Orthop.** 107 (3): 251-258, 1995.

BOBAK V, CHRISTIANSEN RL, HOLLISTER SJ, KOHN DH - *Stress-related molar responses to the transpalatal arch finite element analysis.* **Am J Orthod Dentofac Orthop.** 112(5): 512-518, 1997.

BOWDEN, B.D. - *A longitudinal study of the effects of a digital - and - dummy sucking.* **AJO.** 52(12):887-901, 1966.

BRANDT, R.E.; SAFIRSTEIN, G.R. - *Different extraction for different malocclusion.* **AJO.** 68(1):15-41, 1975.

BURSTONE, C.J.; KÖENIG, H.A. *Optimizing anterior and canine retraction.* **Am. J. Orthod.** 70(1): 1-19, 1976

BURSTONE, C.J.; KOENIG, C.B. *Precision adjustment of the transpalatal lingual arch: computer arch form predetermination.* **Am. J. Orthod. Dentofac. Orthop.** 79(22): 115-133, 1981.

CANSANÇÃO, J.M. & MARTINS, D.R. *Avaliação radiográfica da reabsorção radicular, consecutiva ao tratamento ortodôntico, pela técnica do arco de canto, relacionada com sexo, a idade, a duração do tratamento, o período de uso do arco retangular e do aparelho extrabucal*. **Ortodontia,** 14(2): 84-96, 1981.

CANGIALOSI, T.J. - *Skeletal morphologic features of anterior open bite.* **AJO**. 85(1): 28-36, 1984.

CHARLES, C. L.; JONES, C. R. *Canine retraction with the edgewise appliance-some problems and solutions.* **Br. J. Orthod.** 9(4):194-202,1982.

CLARK, D - *The management of impacted canines*: **Free Physiologic Eruption. J.A.D.A.,** 82 : 836,1975.

COPELAND, S & GREN, L.J. *Root resor ption in maxillary central incisors following active orthodontic treatment.* **Amer. J. Orthodont**., 89(1): 51-5, 1986.

DARENDELILER, M. A.; DARENDELILER, H.; ÜNER, O. *The drum spring (DS) retractor: constant and continuous force for canine retraction.* **Eur. J. Orthod.** 19(2):115-130, 1997.

DASKALOGIANNAKIS, J.; MACLACHLAN, K. R. *Canine retraction with rare earth magnets: An investigation into the validity of the constance force hypotesis*. **Am. J. Orthod. Dentofac. Orthop.** 109(5): 489-495, 1997.

DAVIS, H.D. *Retraction of canines using bonded tube-brackets*. **Br. J. Orthod.** 10(4):187-197, 1983.

DE SHIELDS, R.W. *A study of root resoption in treated Class II, division I malocclusion*. **Angle Orthodont.** 39: 231-45, l969.

DEMARCHI, R.F. ***Estudo in vitro da degradação de forças das cadeias elastoméricas.*** Tese de Mestrado. 2002; 82p. Faculdade de Odontologia, UNICID, São Paulo.

DERMAUT, L.R. & DE MUNCK, A. *Apical root resoption of upper incisor caused by intrusive toot movement. A radiographic study.* **Amer. J. Orthodont.**, 90 (4): 321-6, 1986.

DINCER, M.; ISCAN, H.N. The effects of different sectional arches in canine retraction. **Eur. J. Orthod.** 16(4): 317-323, 1994.

FERREIRA, F.V. – **Ortodontia: Diagnóstico e Planejamento Clínico.** Editora Artes Médicas. 1996, 1^0 edição, 495p.

GARNER, L.D.; AlLLAI, W.W.; MOORE, B.K. *A comparison of frictional forces during simulated canine retraction of a continuous edgewise arch wire*. **Am. J. Orthod. Dent facial. Orthop.** 90(3): 199-203, 1986.

GERON, S.; SHPACK, N.; KANDOS, S.; DAVIDOVITCH, M.; VARDIMON, *A. Anchorage loss – A multifactorial response.* **Angle Orthodontist.** 73(6): 730-737.

GIANELLY, A.A.; PAUL, I.A. - *A procedure for midline correction.* **AJO**, 58(3): 264-67, 1970.

GJESSING, P. *Biomechanical design and clinical evaluation of a new canine-retraction spring*. **Am. J. Orthod. Dentofac. Orthop.** 87(5): 353-362, 1985.

GOSHGARIAN, R.A. *Orthodontic palatal arche wires.* United States: Government Patent Office, 1972.

GRABER, T.M. - The three M's - *Muscles, malformation and malocclusion.* **AJO**. 49:418-50,1963,

GRABER, T. M.; VANARSDALL JR., R. L. ***Ortodontia – Princípios e Técnicas Atuais.*** Editora Guanabara-Koogan. 1994; 2^a ed. 897 p.

GUNDÜZ, E.; ZACHRISSON, B. U.; HÖNIGL, K.D.; CRISMANI, A.G., BANTLEON, H.P. *An improved transpalatal bar design. Part I. Comparison of moments and forces delivered by two bar designs for symmetrical molar derotation.* **Angle Orthodontist.** 73(3): 239-243, 2003.

GUNDÜZ, E.; CRISMANI, A. G., BANTLEON, H.P.; HÖNIGL, K.D.; ZACHRISSON, B. U. *An improved transpalatal bar design. Part II*. **Clinical upper molar derotation.** 73(3): 244-248, 2003.

HANDELMAN, C.S. - *The anterior alveolus: its importance in limiting orthodontic treatment and its Influence on the occurrence of iatrogenic sequelae.* **The Angle Orthod.,** 66(2): 95-110, 1996.

HART, A.; TAFT,L.; GREEENBERG, S. N. *The effectiveness of differential moments in establishing and maintaining anchorage.* **Am. J. Orthod. Dentofac. Orthop.** 102(5): 434-442, 1992.

HASKELL. B. S.; SPENCER, W. A.; DAY, M. *Auxiliary springs in continuous arch treatment: Part 2. Appliance use and case reports.* **Am. J. Orthod. Dentofac. Orthop.** 98(5): 488-498, 1990.

HASKELL. B. S.; SPENCER, W. A.; DAY, M. *Auxiliary springs in continuous arch treatment: Part 1. An analytical study employing the finite-element method.* **Am. J. Orthod. Dentofac. Orthop.** 98(8):387-397, 1992.

HASLER, R.; SCHIMIDT,G.; INGERVALL, B.; GEBAUER, U. *A clinical comparison of the rate of maxillary canine retraction into healed and recent extraction sites - a pilot study.* **Eur. J. Orthod.**, **Dec.** 19(6):711-719, 1997.

HIGLEY, L.B. *Anchorage in orthodontics*. **American Journal of Orthodontics.** 55(6):791-794, 1969.

HIXON, E. H.; ATIKIAN, H.; CALLOW, G. E.; MCDONALD, H. W.; TACY, R. J. *Optimal force, differential force, and anchorage*. **American Journal of Orthodontics.** 73(1): 437-457, 1969.

HIXON, E. H.; AASEN, T.O;ARANGO, J.; CLARCK, R.A.; KLOSTERMAN, R.; MILLER, S.S.; ODON, W.M. *On force a tooth movement.* **American Journal of Orthodontics.** 74(4): 476-489, 1970.

HOCEVAR, R.A. *Understanding, planning, and managing tooth movement: Orthodontic force system theory.* **American Journal of Orthodontics. Nov**. 457-477, 1981.

HOLLENDER, L. et al. *Root resoption, marginal bane support and clinical crown length in orthodontic ally treated patientes.* **Europ. J. Orthodont.**, 24(4): 197-205, l980.

HONG, R.K.; HEO, J.M.; HA, Y.K. *Lever-arm and mini-implant system for anterior torque control during retraction in lingual orthodontic treatment.* **Angle Orthodontist.** 75(1):129-141, 2004.

JOHNSON, W. D.: *Treatment of palatably canine teeth* **Am. J. Orthod.,** 56:589,1961

LEWIS, P.D. – *The deviated midline*. **AJO**, 70(6): 601-16, 1976.

LINCE, B. O. & LINGE, L. *Apical root resoption in upper anterior teeth.* **Europ. J. Orthodont.**, 5(3): 173-83, 1983.

LIOU, E.J.; HUANG, C.S. *Rapid canine retraction through distraction of the periodontal ligament.* **Am. J. Orthod. Dentofacial Orthop.** 114(4): 372-382, 1998.

LIOU, E.J.W.; PAI, B.C.J.; LIN, J.C.Y. *Do minis crews remain stationary under orthodontic forces ?* **Am. J. Orthod. Dentofac. Orthop.** 126(1): 42-47, 2004.

LOTZOF, L. P.; FINE, H. A.; CISNEROS, G. J. *Canine retraction: A comparison of two preadjusted bracket systems.* **Am. J. Orthod. Dentofac. Orthop.**110(2):191-196, 1996.

LUTHER, F. - *An unerupted canine - An unusual diagnostic problem?* - **British J. of Orthod.,** 20(2): 149-50, 1993.

MARCOTTE, M.R. - *Prediction of orthodontic tooth movement*. **AJO**. 69(5): 511-23, 1976.

MARKOSTAMOS, K.; AKLI, K. *The ideal forces for canine retraction.* **Orthod Epitheorese**.1(4):191-201, 1989.

MARTINS, D.R. *Contribuição ao estudo da "força ótima", "força diferencial", e preparo de ancoragem na movimentação ortodôntica***. 1972, Tese – Faculdade de Odontologia de Bauru, USP**

MCCOLLUM, A. E. H.; PRESTON, C. B. *Maxillary canine retraction, periodontal surgery, and relapse.* **American Journal of Orthodontics.** 78(6): 610-622, 1980.

MEINKLE, M.C. - *The effect of a class II intermaxillary force and dent facial : complex in the adult macaca mulatta monkey.* **AJO**, 54(4): 323-40, 1970.

MELSEN, B., KLEMT, B. - Adjunctive *orthodontic as part of interdisciplinary treatment : a case report. Int.* **J. Adult. Orthod. Orthognath. Surg.** 12(3): 233-42, 1997.

MELSEN, B.; BOSCH, *A. Different approaches to anchorage: a survey and an avaliation.* **The Angle Orthodontist.** 67(1): 23-30, 1997.

MOSS, M.; SALENTIJN, L. - *Differences between functional matrix in anterior open bite and deep bite.* **AJO**. 60(3):264-79, 1971.

NAHOUM, H.I. - *Vertical proportions and the palatal plane in anterior open bite*. **AJO**. 59(3):273-82, 1971.

NAHOUM, H.I.; HOROWITZ, S.L.; BENEDICTO, E.A. - *Varieties of anterior open bite*. **AJO**. 61 (5):486-92, 1972.

NAHOUM, H.I. - *Anterior open bite: A cephalometric analysis and suggested treatment procedures*. **AJO.** 67(5):513-21, 1975.

NAHOUM, H.I. - *Vertical proportions: A guide for prognosis and treatment in anterior open bite*. **AJO**. 68(1): 15-41, 1975.

NATRASS, C.; at al - *The effect of environment an elastomeric chain and nickel titanium coil springs.* **Eur. J. Orthod.** 20(2): 169, 176, 1998.

NEY, T.; G0Z, G. *Force-moment measurements on the passive palatal arch under the influence of the tongue.* **Fortschr Kieferorthop.** 54(6): 249-254, 1993.

NIELSEN, L - *Vertical malocclusions: etiology, development, diagnosis and some aspects of treatment.* **The Angle Orthod.** 61(4):247-60, 1991.

NIKOLAI, R. J. *On optimum orthodontic force theory as applied to canine retraction*. **American Journal of Orthodontics.** 68(3): 290-302.

NOGUEIRA, A. S. at al.; - *Principais transtornos ocasionados por dentes inclusos*. **Rev. da APCD,** 51 (3): 247-49, 1997.

NOGUEIRA, A.S. at al.; - *Condutas cirúrgico-ortodônticas relacionadas aos caninos superiores inclusos.* **Ortodontia.** 30(1): 84-91, 1997.

NOROOZI, H. *A formula to determine the amount of retraction of mandibular canines*. **Angle Orthodontist.** 70(2): 154-156, 2000.

ONG, H.B.; WOODS, M.G. *An occlusal and a cephalometric analysis of maxillary first and a second premolar extraction effects.* **Angle Orthodontist.** 71(2): 90-102, 2001.

OPPENHEIM, A.*A possibility for physiologic orthodontic movement*. **Amer. J. Orthodont.,** 30: 345-68, 1944. Apud: FREITAS, M. R. et. al..

ORTON, H. S.; GARVEY, M. T.; PEARSON, M. H. - *Extrusion of the ectopic maxillary canine using a lower removable appliance.* **Am. J. Orthod. and Dentofac. Orthop.,** 107(4): 349-59, 1995.

PARK, H.S.; KWON, T.G. *Sliding mechanics with micro screw implant anchorage*. **Angle Orthodontist.** 74 (5): 703-710, 2004.

PAULSON, R.C.; SPEIDEL, T.M.; ISAACSON, R.J. *A laminographic study of cuspid retraction versus molar anchorage loss*. **Angle Orthodontist.** 40(1): 20-27, 1970.

PAYNE, G.S. – *The effect of intermaxillary elastics force a temporomandibular,-articulation in the growing macaque monkey*. **AJO**, 60(5): 491-504, 1971.

PEARSON, L.E. - *Vertical contral in fully-banded orthodontic treatment*. **The Angle Orthod.** July:205-24, 1986.

PECK, S.; PECK, L. ; KATAJA, M. - *The palatably displaced canine as a dental anomaly of genetic origin*. **Am. J. Orthod. and Dentofac. Orthop.,** 110(4): 441-3, 1996

PEREIRA, J. F. & MONTEIRO, J. L. *Reabsorção radicular externa em dentes submetidos a movimentos ortodônticos; contribuição ao estudo.* **Rev. Gaúcha Odont.**, 29(3): 159-6 l, 198 l.

PEREZ, C. A.; ALBA, J. A.; CAPUTO, A. A.; CHACONAS, S. J. *Canine retraction with J hooks headgear.* **American Journal of Orthodontics.** 78(5): 538-547, 1980.

PINTO, A.S. et al.; - *Comparação entre duas técnicas cirúrgicas de tracionamento dentário*. **Rev. da APCD,** 50(5): 415-17, 1996.

PINTO, F.M.; SILVA, F.R.A; SILVA, S.C.; MACIEL, S.M.L. - *Doença Periodontal :Uma orientação preventiva para o clinico geral-* **Revista APCD**,48(1): 1127.30, 1994.

PONCE, A. L Q.; JUNQUEIRA, A. L. F. *Comparação entre a mola fechada de nitinol e a mola de retração de Ricketts na retração de canino.* **JBO Jornal Brasileiro de Ortodontia & Ortopedia Facial.** 3(15):35-39, 1998.

PONCE, A. L. Q. *Sistema de retração de canino com força baixa.* **JBO Jornal Brasileiro de Ortodontia & Ortopedia Facial.** 5(2): 80-87, 2000.

PROFFIT, W.R.; FIELDS, H.W. *Ortodontia Contemporânea.* 3ª ed. **Guanábana-Koogan**, 2002, 675 p.

PROSTERMAN, B.; PROSTERMAN, L.; FISCHER, R.; MERVYN, G. - *O uso de implantes para*

a correção ortodôntica de uma mordida aberta. **AJO**. 107(3): 245-50, 1995.

RAIJIC; MURETIC; PERCAC - *Impacted canine in a prehistoric skull*. **The Angle Orthod.,** 66(6): 477-80, 1996

RAJCICH, M. M.; SADOWSKY, C. *Eficácia de las mecánicas intra-arco usando momentos diferenciales para alcanzar el control de anclaje en casos de extracción.* **Journal of Orthopedics-Orthodontics and Pediatric Dentistry.** 4(2):53-64, 1999.

RAMOS, A.L, ; at al - *Considerações sobre análise da discrepância dentária de. Bolton e a finalização ortodôntica.* **Rev. Dental Press Ortodontia e Ortopedia Maxilar** 1(2): 86-106, 1996.

RAMOS, A. L.; SAKIMA, M. T.; PINTO, A. S.; MARTINS, L. P.; RAVELI, D. B. *Barra Palatina*. **Rev. Dental Press Ortodon. Ortop. Facial.** 5(1): 75-100 – jan./fev. 2000.

REITAN, K. *Effects of force magnitude and direction of tooth movement and alveolar bones types*. **Angle Orthodont.**, 34:244-55, 1964.

REN, Y.; MALTHA, J. C.; KUIJPERS-JAGTMAN, A.M. *Optimum force magnitude for orthodontic tooth movement: A systematic literature review.* 73 (1): 86-92, 2003.

RICHARDSON, A. *An investigation into the reprodubility of some points, planes, and lines used in cephalometric analysis.* **American Journal of Orthodontics.** 52(9):637-651, 1966.

RICHARDSON, A.R., - *Dento-alveolar factors in anterior open bite and deep bite*. **Dent. Pract. Rest. Rec.** 21 :53-7,1970.

RICKETTS, R.M. *A foundation for cephalometric communication*. **American Journal of Orthodontics.** 46 (5): 330-357, 1960.

RISINGER, R.J.; GIANELLY, A.A. - *Effects of vertical forces a mandible and total face height.* **AJO**, 58(2): 151-5, 1970.

ROBERTS-HARRY, D.P.; HARRADINE, N.W.T. - *A sectional approach to the alignment of ectopic maxillary canines.* **British J. of Orthod.,** 22(1): 67–70, 1195.

RODRIGUES, C.B.F.; TAVANO, O. - *Tracionamento de caninos não irrompidos : uma controvérsia*. **Rev. da APCD,** 45(4): 529-34, 1991.

ROSSATO, C.; MARTINS, D. R.; ALVES, M. E. A. F. *Distalização do canino pelos métodos convencional e com "power arm" – Estudo fotoelástico das áreas de pressão.* **Ortodontia**.; 16 (2): 5-11. 1983

ROWLEY, R.; HILL, F.J.; ORTH, D.; WINTERS, G.B. - *An investigation of the association between anterior open bite and amelogenesis imperfect.* **Am. J. Orthod. and Dentofac. Orthop.** 88(1): 229-33,1982.

SANDER, C.; GEIGER, M.; SANDER, F.G. *Contact less measurement of canine retraction by digital macrophotogrammetry during hybrid retractor application*. **J. Ortofac. Orthop.** 63(6): 472-82, 2002.

SANDER, F.G. *Biomechanical investigation of the hybrid retraction spring.* **J. Ortofac. Orthop.** 61(5): 341-351, 2000.

SAYIN, S.; BENGI, A.O.; GÜRTON, U.; ORTAKOGLU, K. *Rapid canine distalization using distraction of the periodontal ligament: A preliminary clinical validation of the original technique*. **Angle Orthodontist.** 74(3): 304-315.

SCHUDY - *Vertical growth vs. antero-posterior growth as related to function and treatment.* **The Angle Orthod.** 34: 75-93, 1964.

SCHUMACHER, H.A.; BOURAEL, C.; DRESCHER, D. *Arch-guided tooth movement--its dynamics, efficacy and side effects.* **Fortschr Kieferorthop.** 52(3): 141-152, 1991.

SHIMIZU, R.H. *Fechamento de espaços após as exodontias de primeiros pré-molares***.** 1995. 99f. Dissertação (Mestrado em Odontologia) – Faculdade de Odontologia, Universidade Estadual Paulista, São Paulo.

SHIMIZU, R.H.; SAKIMA, T.; SANTOS-PINTO, A.; SHIMIZU; I.S. *Desempenho biomecânico da alça "T", construída com fio de aço inoxidável, durante o fechamento de espaços no tratamento ortodôntico.* **Rev. Dental Press. Ortodon. Ortop. Facial.** 7:(6): 49-61, 2002.

SHIMIZU, R.H.; STASZAK, K.R.; SHIMIZU, I.A.; AMBROSIO, A.R. *Retração dos dentes caninos com alças: Aspectos biomecânicos indispensáveis para o sucesso deste procedimento*. **J. Bras. Ortodon. Ortop. Facial.** 9(50): 178-186, 2004.

SHROFF, B.; YOON, W.M.; LINDAUER, S.J.; BURSTONE, C.J. *Simultaneous intrusion and retraction using a three-piece base arch.* **The Angle Orthodontist** 67(6): 455-461, 1997.

SILVA FILHO at al - *Irrupção ectópica dos caninos permanentes superiores: soluções terapêuticas*. **Ortodontia,** 27(3): 50-66, 1994.

SILVA FILHO, O. G. et al. *Estimativa da reabsorção radicular em 50 casos ortodônticos bem finalizados*. **Ortodontia**, 26(1): 24-37, 1993.

SJOLIEN, T. & REITAN, K. *Tissue changes following rotation of tooth length in orthodontic ally treated and untreated persons.* **Amer. J. Orthodont.**, 64: 28-37, 1973.

SKILLEN, W.G. & REITAN, K. *Tissue changes following rotation of teeth in the dog.* ***Angle Orthodont*.**, 10: 140-7, 1940. Apud: FREITAS, M. R. et al.

SODRE, A.S.; PRANCO, K.A.; MONTEIRO, D.F. - *Mordida Aberta Anterior*. **JBO**, 3(17): 50-94. 1998

STEINHAUSER, E.W.; LINES, P.A. - *Correction of severe open bite associated with disease*. **Oral Surg.** 39:509-26, 1975.

TANNE, K.; MATSUBARA, S.; SHIBAGUCHI, T.; SAKUDA; M. *Wire friction from ceramic brackets during simulated canine retraction.* **Angle Orthod.** 61(4): 285-290, 1991.

TEN HOEVE, A & MULIE, M. R. *The effect of anteroposterior incisor repositioning on the palatal cortex as studied with laminography.* **J. Clín. Orthodont**., 10: 804-22, 1976.

THOMPSON, W. J. *Combination anchorage technique: An update of current mechanics*. **Am. J. Orthod. Dentofac. Orthop.,** 93(6): 363-379, 1988.

TOUTOUNTZAKIS, N.E.; HARALABAKIS, N.B. - *A postero-anterior cephalometric evaluation of adults open bite subjects as related to normals.* **European J, Orthod.** 13:410-15, 1991.

TROUTEN, J.C.; ENLOW, D.H.; RABINE, M.; PHELPS, A.E.; SWELDON, D. - *Morphologic factors in open bite and deep bite.* **The Angle Orthod.** 53(3): 192-211, 1983.

TURPIN, D. L. - *New findings expose the palatably displaced canine*. **The Angle Orthod.,** 64(4): 243 e 246, 1994.

TURPIN, D.L.; Woloshyn, H. - *Two patients with severely displaced maxillary canines respond differently to treatment.* **The Angle Orthod.,** 65(1): 13-22, 1995.

VÁSQUEZ, M.; CALAO, E.; BECERRA, F.; OSSA, J.; ENRIQUEZ, C.; FRESNEDA, E. *Initial stress differences between sliding and sectional mechanics with an endogenous implant as anchorage: A 3-dimensional finite element analysis.* **Angle Orthodontist.** 71(4): 247-256, 2001.

VERMETTE, M.E.; KOKICH, V.G.; KENNEDY, D.B. - *Uncovering labially impacted teeth : apically positioned flap and closed-erption techniques.* **The Angle Orthod.,** 65(1): 23-34, 1995.

VIASIS, A. - *Cephalometric evaluation of skeletal open and deep bite tendencies*. **Journal of Clin. Orthod.,** 26(6), 1992.

WEINBACH, J.R.; SMITH, R.J. - *Cephalometric changes during treatment with the open bite bionator*, **Am. J. Ortho, and Dentofac. Orthop.,** 101(4):367-74, 1992.

WERNECK, E. C. S. - *Mordida aberta anterior: características morfológicas, tendência de crescimento, tipologia, alternativas de tratamento e normas de predição*. **Odontologia - Ensino e Pesquisa.,** 1(1) : 10-15, 1996. PARTE I.

WERNECK, E. C. S. - *Mordida aberta anterior: características morfológicas, tendência de crescimento, tipologia, alternativas de tratamento e normas de predição*. **Odontologia - Ensino e Pesquisa.,** 2 (1) : 22-3 l, 1997. PARTE II.

WERNECK, E.C.S. - *Mordida aberta anterior.: características morfológicas, tendência de crescimento, tipologia, alternativas de tratamento e normas de predição.* **Odontologia - Ensino e Pesquisa.** 2(2): 24-33, 1997. Parte III.

WERNECK, E.C.S.; CAVALIERI, I. – *Tracionamento cirúrgico–ortodôntico dos caninos inclusos impactados e deslocados por palatino – Alguns aspectos a serem considerados na execução dos mesmos..* **Odontologia - Ensino e Pesquisa.** 2 (3): 8-17, 1997.

WERNECK, E.C.S. – *Apinhamento dentário tardio antero-posterior: uma avaliação sobre os fatores causais .* **Odontologia - Ensino e Pesquisa.** 3 (1): 7-12, 1998.

WERNECK, E.C.S. – *Desvio da linha mediana: Possíveis causas e alternativas de tratamento. Relato de caso.* **Odontologia - Ensino e Pesquisa.** 3 (3): 13-20, 1998

WERNECK, E.C.S. – Avaliação cefalométrica do posicionamento dental superior após a distalização dos caninos, empregando a barra palatina fixa como elemento de ancoragem posterior. Tese. 2004. UNICID – SP, 100 p.

WILSON, A.N.; MIDDLETON, J.; McGUINESS, N.; JONES, M. *A finite element study of canine retraction with a palatal spring.* **Br. J. Orthod.,** 18(3): 211-218, 1991.

WOLFORD, L.M.; COTRELL, D. - *Diagnosis of macroglossia and indications fot. reduction glossectomy.* **Am. J. Orthod. Dentofac. Orthop.** 110(2): 170-TI 1996.

WOLOSHYN, H.; at al - *Pulpal and periodontal reactions to orthodontic alignment of palatably impacted canines*. **The Angle Orthod.,** 64(4): 257-64, 1994.

WOODS, M.G.; NANDA, R, - *Intrusion of posterior teeth with magnets: an experiment in no growing baboons*. **Am. J. Orthod. and Dentofac. Orthop.**, 100(5):393-400, 1991.

YOSHIDA, N.; KOGA, Y.; MIMAKI, N.; KOBAYASHI, K. *In vivo determination of the centers of resistance of maxillary anterior teeth subjected to retraction forces.* **Eur. J. Orthod.** 23(5):529-534, 2001.

ZIEGLER, P.; INGERVALL, B. *A clinical study maxillary canine retraction with a retraction spring and with sliding mechanics*. **American Journal of Orthodontics.,** 95(2): 99-106, 1989.

ZUCCATI, G. - *Bilaterally impacted maxillary canines : a case report in an adult*. **Eur. J. of Orthod.,** 16: 325-28, 1994