Treatment of Class II Malocclusions
MODULE ONE: TREATMENT OF CLASS II MALOCCLUSIONS
APPLICATION OF MODERN TREATMENT MODALITIES TO AVOID OLD COMPLICATIONS

Pablo Echarri, DDS

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**Hands-on:**

- Proper microimplant insertion to achieve distalization in extraction cases
- How to adapt and use the Twin Force Bite Corrector® device, crimpable-hooks and bite guides
- How to activate Pendulum springs
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<td>Mesofacial or dolichofacial patient with upper protrusion</td>
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Clase II

DENTAL DEFINITION

- Molar Class II malocclusion is a relation between the upper and lower first bicuspids when the mesio-labial vertex of the upper first molar cusp occludes mesially from the mesio-labial groove of the lower first molar.

- Orthodontic problem.

CLASSIFICATION

- Class II – uni or bilateral (subdivisions).

- Class II-1\textsuperscript{st} division (overjet).

- Class II-2\textsuperscript{nd} division (overbite).

- Class II-2\textsuperscript{nd} division, “deck-biss” type (overbite and crowding).

- Class II camouflaged in Class I (advanced position of mandible).

Molar Class II malocclusion very rarely occurs due to spontaneous distalizing of lower molar. Usually it is a result of a mesializing, mesial version or mesial rotation of the upper molar.
CLASS II-1<sup>ST</sup> DIVISION

- Proinclination of upper incisors.
- Increased overjet.
- Incisal Class II.

CLASS II-2<sup>ND</sup> DIVISION

- Retroinclination of upper incisors.
- Normal overjet.
- Increased overbite.

CLASS II-2<sup>ND</sup> “DECK-BISS”

- Retroinclination of 11 and 21 with proinclination of 12 and 22.
- Anterior deep bite.
CLASS II-1\textsuperscript{st} Division Left Subdivision

CLASS II

- 2\textsuperscript{nd} division is always accompanied by anterior deep bite.
- 1\textsuperscript{st} division can have:
  - Normal overbite
  - Anterior open bite.
  - Anterior deep bite.
  - ***Both 1\textsuperscript{st} and 2\textsuperscript{nd} divisions can have posterior uni or bilateral cross bite.
- According to dento-alveolar discrepancies, it can be:
  - Normal.
  - With crowding.
  - With spacing.

SKELETAL CLASS II

- The main characteristic of this malocclusion is increased convexity (Ricketts) or increased ANB angle (Steiner).
- Orthopaedic problem (during the growth period) or surgical (after the growth period is finished).
- In mild cases, a compensation or “camouflage” is possible.
SKELETAL CLASS II TYPES

- Due to maxillary prognatia (increased maxillary depth, angle between Francfort plane and N-A).
- Due to mandibular retrognatia (decreased facial depth, angle between Francfort plane and Facial plane).
- Combination of the previous two.
- Biretrognathia, usually in dolychofacial patients.
- Biprognathia (more frequent in Asiatic patients).

SKELETAL CLASS II TYPES
CLASSIFICATION

- Skeletal Class II (only sagittal plane is affected – mesofacial and symmetric patient).
- Skeletal Class II, in which a vertical plane is affected: braquifacial or dolychofacial Class II.
- Skeletal Class II, in which transverse plane is affected: asymmetrical Class II.
- Class II with all three planes affected.
- Class II “camouflaged” in Class I:
  - The A point can be retruded due to the increased incisal torque.
  - Due to a symphysis shape with advanced Pogonion.
  - Due to an advanced position of mandible in respect to CR (for example, cases with cross bite of lateral incisors).
CAUSES OF CLASS II

- Heritage.
- Symptom of general syndromes.
- Soft food – without dental abrasion in mandibular advance in temporary dentition.
- Mouth breathing (specialists in Pediatry, ORL or allegologist should be consulted).
- Child swallowing (re-education of tongue interposition).
- Prolonged use of a pacifier and a feeding bottle (older than the age of 2).
- Lip or finger suction, etc.
- Incompetent or short upper lip.

CLASS II PROGNOSIS

- Persistence of etiological factors (the more abnormal habits and functions, the less favourable the prognosis is).
- Molar Class II seriousness (if there is more than one cusp, the prognosis is less favourable).
- Incisal Class II seriousness (a 4 mm OJ is not the same as a 12 mm OJ).
- Dento-alveolar discrepancy (The more crowding, the less favourable prognosis).
- Anterior overbite (The greater OB, the less favourable prognosis. The Class II mechanics tends to increase overbite).
- Posterior cross bite (less favourable prognosis because another problem is added).
- Skeletal Class II seriousness.
- Skeletal Class II due to mandibular retrognathia has less favourable prognosis than if it is due to maxillary prognathia.
- If there are more than one affected plane: vertical and transverse have less favourable prognosis.

- The more anchorage requirements, the less favourable prognosis (unless microimplants are used).

**CLASS II AND MOUTH BREATHING (Dr. Durán)**

**MOUTH BREATHING CAUSES**

- Nasal causes.

- Oral causes.

- Pharyngeal causes.

**NASAL CAUSES**

- Hypertrophy of cornets.

- Septum deviation.

- Polyposis and nasal allergy.

**ORAL CAUSES**

- Amigdalar hypertrophy.

- Increased tongue size.

**PHARYNGEAL CAUSES:**

- Adenoidal hypertrophy.
MOUTH BREATHING CONSEQUENCES

- Posterior mandibular rotation.
- Lip incompetence.
- Tongue descent.
- Hypertonic elevating muscles.
- Free space between jaws.
- Inhibition of mandibular growth.
- All above mentioned will provoke a series of dental and orthopaedic effects, which will get worse if the habit persists.

IMMEDIATE EFFECTS

- Lip incompetence generates labial version of upper incisors and lingual version of lower incisors.
- Free space between jaws favours upper molar extrusion. Lower molar does not extrude because the low position of the tongue leans on the lower incisors. Occlusal plane rotates in counter-clock-wise direction.
- Mandibular clock-wise rotation descends and retrudes the chin.
- Muscular hypotonia inhibits the growth of the condyle and the mandibular ramus.
MEDIUM-TERM EFFECTS

- Anterior overbite increases.

- Lower lip interposition is produced, usually followed by atypical deglutition. (one habit more is added).

- Molar Class II is more evident due to the persistency of upper lateral sector extrusion and the blockage of the lower teeth eruption.

- There is an alveolar remodelling which stabilizes postrotation and mandibular retrusion.

- There is already skeletal (orthopaedic) Class II (convexity is increased and facial depth descent in Ricketts’ cephalometric).

LONG-TERM EFFECTS

- Overbite increase due to the lower incisors extrusion and the blockage of the upper incisors eruption, which is a result of a lower lip interposition.

- Stabilizing of the Angle molar Class II.

- Low tongue position favours the appearance of maxillary contraction (unilateral or bilateral cross bite).

- Hypertonic lower lip. Short and hypotonic upper lip.

- All previously mentioned results in Angle Class II-1st division.

- The sooner the cause of mouth breathing is resolved, the less dental and orthopaedic effects should be dealt with.

- If orthodontic treatment is carried out in a patient-mouth breather, relapse is inevitable.
Treatment

SKELETAL CLASS II TREATMENT

- Dental Class II with skeletal Class I malocclusion treatment is exclusively an orthodontic treatment.

- Dental Class II with skeletal Class II malocclusion treatment requires a treatment that includes basal bones.

- Depending on the age, an orthopaedic treatment or surgical treatment will be carried out.

TREATMENT OF SKELETAL CLASS II DUE TO MAXILLARY CAUSE (1)

- Class II due to a maxillary prognathia malocclusion is easier to treat.

- Orthopaedic appliances or surgery are not usually used for maxilla retraction. It will be treated with extractions and upper anterior group retraction.

TREATMENT OF SKELETAL CLASS II DUE TO MAXILLARY CAUSE (2)

- Class II due to a vertical maxillary hyperplasia malocclusion is more difficult to treat.

- Orthopaedic appliances (high pull headgear) or surgery are usually used to impact maxilla, to rotate mandible in a counter-clock-wise direction, with or without mandibular surgery.

TREATMENT OF SKELETAL CLASS II DUE TO MAXILLARY CAUSE (3)
- In many cases, Class II is accompanied by a transverse maxillary hypoplasia.
- This contraction of maxilla keeps the mandible in a retrusive position ("moccasin-like" effect by McNamara).

**TREATMENT OF SKELETAL CLASS II DUE TO MANDIBULAR CAUSE (1)**

- More difficult to treat.
- The mandible is more susceptible because its growth is stimulated (due to the condylar and temporal cartilage (glenoid fossa)).
- Good results are achieved only if the treatment is carried out in the period of patient’s growth pitch.

**TREATMENT IN MIXED DENTITION (1)**

- Vertical maxillary hyperplasia: growth control using high pull headgear.
- If dento-alveolar discrepancy is very negative, serial extractions or expansion should be carried out.
- Overbite control using Functional C-plate.
- Anchorage control: especially in extraction cases.
- Transverse expansion: especially in cases in which is detected that maxilla contraction inhibits mandibular advance ("moccasin-like” effect by McNamara).

**CLASS II-1ST DIVISION MALOCCLUSION TREATMENT WITH EXTRACTIONS IN MAXILLA**
- The most frequently extracted teeth are upper first molars.
- 1<sup>st</sup> arch: .016” NiTi (ALR)
- 2<sup>nd</sup> arch: .016” x .022” SS with distolateral “T” loop and sagittal and transverse compensation curves. This arch is used for torque establishing, canine distalizing, anterior group retrusion and closure of the remnant spaces (STIR)
- 3<sup>rd</sup> arch: .017” x .025” SS with antemolar omega and a stop, and sagittal and transverse compensation curves (MID).

**CLASS II-1<sup>ST</sup> DIVISION MALOCCLUSION TREATMENT WITHOUT EXTRCTIONS IN MAXILLA**

- It appears only in few cases.
- 1<sup>st</sup> arch: .016” NiTi with distal bend, to align and to protrude.
- 2<sup>nd</sup> arch: .016” x .022” SS with antecanine “T” loop and compensation curves. (or with antemolar omegas, if there are no spaces).
- 3<sup>rd</sup> arch: .018” x .025” SS with antemolar omega and sagittal and transverse compensation curves.

*** To retrude the whole maxilla, but without extractions or spaces, “en masse” retrusion of all upper teeth, or a mandibular advance should be done.

**- UPPER RETRUSION CAN BE CARRIED OUT WITH:**

  o Headgear.
  o Distal microimplant (inserted in the tuberosity).
  o Distalizing treatment (using Pendulum appliance and wisdom-teeth extraction).

***It has an effect in mesofacial and braquifacial patients.

  o Class II elastics (upper retrusion and lower advance).
- **MANDIBULAR ADVANCE CAN BE CARRIED OUT WITH:**
  
  - Class II elastics.
  

**The movements are always bimaxillary, maxilla is a little bit retruded.**

**If there is no remnant growth, the movement will be of 2-3 mm in dento-alveolar direction, or it will provoke a double occlusion (maximal occlusion, advanced intercupation in respect to the centric relation).**

**NON-EXTRACTION TREATMENT IN MANDIBLE**

- **With correct maxilla:** Ideal lingual arch for consolidation, and Class II elastics as anchorage.

- **With only incisors crowding:** Utility arch for alignment and protrusion.

- **With extrusion of lower anterior group:** Utility arch for intrusion.

***These above mentioned cases are exceptional.***

- **With general crowding:** Sequence of arches for alignment: .016” NiTi, .016” x .022” NiTi or SS, and .018” x .025” SS with omegas.

**EXTRACTION TREATMENT IN MANDIBLE**

- The most common extractions are the extractions of the first and second bicuspid.

- **1\textsuperscript{st} arch:** .016” NiTi.

- **2\textsuperscript{nd} arch:** .016” x .022” SS with distolateral T loops and compensation curves (to close spaces).

- **3\textsuperscript{rd} arch:** .0172 x .025” SS with antemolar omegas and compensation curves.
CLASS II-2\textsuperscript{ND} DIVISION MALOCCLUSION TREATMENT

- Class II-2\textsuperscript{nd} should become Class II-1\textsuperscript{st} before it is corrected.

- It is convenient the use of a .016” NiTi, to proincline the incisors forwards. A utility arch for proinclination can be used, too.

- A patient should be informed that the treatment time will be longer because Class II-1\textsuperscript{st} division must be achieved. He should be also warned of aesthetic changes that will take place due to the upper protrusion.

SIDE EFFECTS OF EXTRACTION TREATMENT

Distal canine movement tends to:

A- Distal inclination of the crown, which is compensated by distoradicular bonding of the brackets for 6\degree.

B- Distal rotation, which is compensated by using a lingual button and tractioning on both labial and lingual sides.

The retraction movement of incisors tends to:

A- Torque loss, which is compensated by increasing the arch torque, or indirect bonding with mayor prescription of the torque or using incisors brackets with extratorque.

B- Increase the overbite, which is compensated with a sagittal compensation curve.

C- More intrusion and positive torque can be activated by activating a horizontal arm of T loop using Tweed omega pliers.

Mesial bicuspsids and molars movement tends to:

A- Mesial version – which is compensated by a sagittal curve.

B- Mesial rotation – which is compensated by a horizontal curve.
Class II. Early treatment in mixed dentition

C Plate active

**Indications:**
- Increased overjet with molar Class I or Class II
- Increased overjet with normal or increased overbite
- Increased overjet with or without posterior crossbite
- Increased overjet with diastemas or crowding in the upper arch
- Skeletal class I in mesofacial, mild braquifacial or mild dolicofacial patients
- Skeletal class II con prognatism of maxilla
- Skeletal class II with mild retrognatism of mandible
The C Plate active includes:

- 2 Adams retainers with circular loops
- XC metallic plane
- Retainer spring
- Sliding labial archwire
- Acrilic palatal resin
- Elastics 3,5 oz, 3/16”
The expansion C Plate active includes:

Planas expansion screw
The C Plate-Hawley changes:

The sliding labial archwire by a Hawley labial archwire
Fig. A

Extraction of temporary upper right and left cuspids

Fig. B

Use the C Plate 10-12 hs/day and change the elastics every 4-5 weeks
Fig. C
Extraction of temporary upper right and left first molars

Fig. D
Extraction of upper right and left first bicuspid. Change the sliding labial archwire by a Hawley labial archwire
Fig. E

Finishing with fixed appliances.
Duyzings Plate Active

Indications:
- Increased overjet with molar Class I or Class II
- Increased overjet with normal or reduced overbite
- Increased overjet with or without posterior crossbite
- Increased overjet with diastemas or crowding in the upper arch
- Skeletal class I in mesofacial, mild braquifacial or mild dolico facial patients
- Skeletal class II con prognatism of maxilla
- Skeletal class II with mild retrognatism of mandible
The Duyzings Plate active includes:

- Palatal acrylic resin with or without expansion screw
- Labial acrylic shields
- Conexion springs between the labial shields and the palatal resin
- Lingual reference
- Loops for the sliding labial archwire
- Stainless steel tubes for the sliding labial archwire
- Sliding labial archwire with coil-springs
Fig. A
Extraction of temporary upper right and left cuspids

Fig. B
Use the Duyzings Plate 10-12 hs/day and activate the loops for the sliding labial archwire every 4-5 weeks
Fig. C
Extraction of temporary upper right and left first molars

Fig. D
Extraction of upper right and left first bicuspid. Change the sliding labial archwire by a Hawley labial archwire
Fig. E

Finishing with fixed appliances.
Twin Block

**Indications** Skeletal class II:
- Mandibular retrognatia
- Mesofacial or Braquifacial
- Dental Class II, 1; Dental class II, 2
- Deep bite, open bite
- Growing patient
Deep bite Twin Block

Figs. A-B-C-D
Figs. E-F-G-H

Open bite Twin Block
Figs. I-J-K-L

Twin Block modified with lingual buttons and labial shields
Fig. M
Deep bite Twin Block

Fig. N:
Class II, 1 with deep bite
Fig. O
Deep bite Twin Block

Fig. P
Extrusion of first molars

Fig. Q
Twin Block – 2\textsuperscript{nd} appliance
Fig. R
Trimming the acrylic as a eruption guidance appliance

Fig. S
Trimming the acrylic as a eruption guidance appliance

Fig. T
Trimming the acrylic as a eruption guidance appliance
Fig. V

Ready for fixed appliances if necessary
Treatment of Class II Malocclusion

Fig. W
Class II, 1 with open bite

Fig. X
Open bite Twin Block

Fig. Y
Open bite Twin Block
**High Pull Headgear (Orthopedics)**

**Indications:**

- Skeletal Class II
- Vertical maxillary excess
- Mandibular retrognathia (Post rotation)
- Dental Class II

![Headgear with loops](image1)

*Figs. A-B*  
**Headgear with loops and Headgear without loops**

![Headgear without loops](image2)

![Headgear with C plane](image3)

*Figs. C-D*  
**Headgear with C plane (Dr. Cervera)**
Treatment of Class II Malocclusion

Figs. E-F
Cervical Pull

Figs. G-H
High Pull

Figs. I-J
Combination Pull
Fig. K

Dinamometer
### ADJUSTMENT CHART OF HEADGEAR

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<th>Braquifacial</th>
<th>Mesofacial</th>
<th>Dolicofacial</th>
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<td>Cervical Pull</td>
<td>Combination</td>
<td>Pull</td>
<td>High Pull</td>
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#### Adjustment of intraoral arch
- "U" loop
- Center
- Tip-back

#### Activation of intraoral arch
- Expansion
- Contraction
- Rotation

#### Activation of extraoral arch
- Extrusion
- No vertical movement
- Intrusion

#### Activation of asymmetrical distalization
- Expansion + short

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<th>Orthopedics</th>
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<td>180g - 350g</td>
<td>600g - 1000g</td>
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<td>12-14 hs per day</td>
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Double Transfer Trays for Indirect Bonding

PABLO ECHEVARRI, DDS
TAE-MEON KIM, DDS, MS, PhD

Indirect bonding has a number of advantages over direct bonding, including greater accuracy of bracket positioning and the ability to customize bracket prescriptions according to individual case requirements. Lingual orthodontics requires an indirect bonding technique because of the difficulty of attaching brackets directly to the lingual surfaces of the teeth.

Transfer trays for indirect bonding can be divided into full arch and single tooth categories. The following represent:

- Opaque silicone trays (Zentaperm*, Optoris®)
- Transparent silicone trays (Merrifield®)
- Thermoplastic trays (Herculite®, Bioplast®)
- Single-tooth trays (Zinc Oxide Ear Syringe, ZOE Syringe, Herculite Ear Syringe)

Single-tooth systems include:
- The Hico System
- Kyohe’s Individual Indirect Bonding Trays
- Kim’s Convertible Resin Core (CRC) Ready-Made Transfer Trays

Using full arch trays reduces chairtime compared with single-tooth trays, but the silicone full-arch trays are difficult to remove after bonding. The opaque trays cannot be light-cured. Both the opaque and transparent silicone trays can be used for repositioning by curing individual teeth out of the full trays, but these would units are cumbersome and inaccurate.

The single-tooth trays prevent more accurate positioning and can easily be stored for future repositioning. They also allow access adhesive to be removed from the gingival area before curing.

A new double-tray system introduced in this article has the advantages of both categories.

Fig. 1 Single-tooth trays: labial indirect bonding:

Fig. 2 Occlusal tie wing blocked out with wax.
Treatment of Class II Malocclusion

It permits the clinician to transfer the bracket positions to the patient's teeth quickly and without distortion, to remove the transfer tray after bonding without dislodging brackets, and to respace brackets accurately at any time during treatment.

Procedure for Labial Orthodontics

Brackets are bonded to the setup cast in the desired positions, using either the Jet Machinetm or the CLASSer technique. An elastomeric ligature is stretched through each bracket slot and over the occlusal tie wings to block out the slot during transfer tray fabrication (Fig. 1). The occlusal tie wings are then blocked out occlusally with wax (Fig. 2).

Triad™ light-cured acrylic is used to make the single-unit transfer trays (Fig. 2). The acrylic should be extended as far as the gingival tie wings of each bracket, but not underneath the gingival wings. A groove is made in the occlusal surface of each tray which is marked with the tooth number. The bracket is then fixed to the tray with an elastomeric ligature stretched from the gingival tie wings to the occlusal groove in the acrylic (Fig. 4).

Once all the single-tooth trays have been made (Fig. 5), a silicone tray is fabricated from

Fig. 3. Single-tooth tray formed by covering labial and occlusal surfaces of bracket with Triad light-cured acrylic.

Fig. 4. Elastomeric ligature stretched from gingival tie wings to occlusal groove in acrylic tray.

Fig. 5. Cast with finished single-unit transfer trays.
Double Transfer Trays for Indirect Bonding

...green Xantopren and OptoSil to cover all the single-unit trays and transfer them to the mouth (Fig. 6). After bonding, the silicone tray is removed first, and the single-tooth trays can then be removed one by one without dislodging any of the brackets.

Fig. 6. Finished double transfer tray made from green Xantopren and OptoSil silicone.

Fig. 7. A. Occlusal plane of cast checked on glass plate with level. B. Tip and torque measured with HIS Model Checker.
Procedure for Lingual Orthodontics

For bracket setup, we use the KIS Model Checker*** developed by the Korean Society of Lingual Orthodontics. We verify the occlusal plane of the cast on a glass plate with a level and measure the initial tip and torque of each tooth with the Model Checker (Fig. 7).

The brackets can be positioned directly on the casts using the Slot Machine, as designed by Escot for vertical bracket slots and modified by Echarri for horizontal slots (Fig. 8). An

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Fig. 8 A. Slot Machine used for lingual bracket positioning. B. Brackets set up on original cast with Slot Machine.

Fig. 9 A. Individual tooth positions corrected on model using CLASS technique. B. KIS bracket positioner.

Fig. 10 A. CRC Ready-Made Transfer Trays. B. CRC single-tooth trays placed over brackets on original cast. C. Brackets tightened over CRC trays with elastomeric ligatures.
Double Transfer Trays for Indirect Bonding

An alternative is to correct individual teeth on the setup models under the CLASS procedure and then bond the brackets to the models with the KIS bracket positioning (Fig. 9).

If the Slot Machine is used, individual CRC Ready-Made Transfer Trays are placed over the lingual brackets on the original casts and held in place with elastomeric ligatures (Fig. 10). The trays are adapted to the occlusal and lingual surfaces of the teeth with Trial light-cured acrylic and marked with the tooth number (Fig. 11). Mechanical retention can be improved with a handlepiece if necessary. With the CLASS technique, the single-tooth trays are transferred individually to the corrected setup models (Fig. 12).

As in the labial procedure, the single-unit trays are then covered with green Xantopren, and the entire arch is covered with Optosil for transferring the brackets to the mouth (Fig. 13).

Advantages of the Double-Tray System

- This method can be used with the Slot Machine, CLASS, or KIS system.
- It reduces chair time compared with conventional single-tooth trays by allowing simultaneous bonding of all brackets in the arch.
- The trays are easy to remove without dislodging the brackets.
- Excess adhesive can be removed from the gingival areas before curing.
- Progressive bonding can be used if indicated by crowding or rotations.
- The single-unit trays can be used for precise rebonding at any time during treatment, with no fear of tray distortion.

Fig. 11: Trays adapted to occlusal and lingual surfaces with Trial acrylic.

Fig. 12: Single-tooth trays transferred individually to corrected setup model.

Fig. 13: A. Single-tooth trays covered with green Xantopren. B. Entire arch covered with Optosil. C. Double-tray system after removal from cast.
The indirect bonding technique offers numerous advantages over direct bonding, especially in bracket positioning and the possibility of customizing the prescription. In lingual orthodontics, indirect bonding is usually necessary, due to the difficulty of precise positioning of the bracket on the lingual surface of the tooth (irregular anatomy), the difficult access to the working field, and the impossibility of direct vision without the error of parallax.

However, the lingual bonding technique also has drawbacks, including: (1) the use of flexible materials for transfer trays fabrication allows the possibility of deformation; (2) traditional transfer trays do not allow flash paste cleansing (removal of adhesive excess). The flash paste can provoke gingivitis, due to mechanical and chemical irritation, and it facilitates bacterial plaque formation. Flash paste is difficult to remove after the adhesive is cured; (3) it is difficult to take out the transfer tray after bonding, and this frequently results in debonding of 1 or more brackets; (4) the re-bonding of a bracket by cutting out the single tooth tray from the original transfer tray is imprecise, because the single tooth tray that is cut is unstable and the dimensional stability of silicon does not provide sufficient precision during the procedure.

The use of rigid single tooth trays eliminates these problems, but the clinical bonding time is longer. On the other hand, non-reusable rigid single tooth trays force the clinician to fabricate a new single-tooth tray when the patient loses a bracket.

The author uses the double transfer tray system\(^1\)(Figs 1 and 2), which combines all advantages of the rigid reusable single tooth trays with the advantages of the whole arch trays.

The double transfer tray technique by Echarri and Kim consists of adapting the single-tooth trays to each bracket after the bracket positioning on the cast, according to the method of the Korean Society of Lingual Orthodontics: CRC ready-made core system.\(^2\) The trays are then joined together by means of a complete arch silicon transfer tray.\(^3\)

The advantages of double transfer trays are:

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**LINGUAL TECHNIQUE. INDIRECT BONDING: DOUBLE TRANSFER TRAY TECHNIQUE**

In this article, the author analyzes the problems that can occur with the traditional technique of indirect bonding with the complete arch transfer tray, and describes step-by-step the technique of a double tray bonding technique and its advantages. World J Orthod 2006;7:xx–xx.
Pablo Echarri, DDS

Fig 1 Patient with crowding who will undergo lingual bonding.
Fig 2 Double transfer tray system.
Fig 3 Checking the adjustment of a double tray in the mouth.
Fig 4 (left) Prophylaxis with the rubber cup and fluor-free and oil-free paste.
Fig 5 (right) The NOLA appliance is positioned.

- All teeth can be bonded simultaneously, which decreases the bonding time.
- Progressive bonding can be done, if indicated.
- Light-cure adhesives can be used.
- Flash paste cleansing is possible.
- Removal of the tray after bonding is easy (thus avoiding bracket debonding during this process).
- Re-bonding of the brackets is easier.

**CLINICAL PROCEDURE OF AN INDIRECT DOUBLE TRANSFER TRAY BONDING**

Indirect bonding technique requires a detailed procedure, to avoid possible debonding or undesirable positioning of the brackets. The author has published the indirect bonding technique using the complete arch silicon tray, but due to advantages offered by double transfer trays, an adaptation and an update of the technique is presented in this article.

1. **Tray checking.** The transfer tray must be checked before proceeding with bonding, to be sure of a perfect adjustment (Fig 3).

2. **Prophylaxis.** The prophylaxis must be done with rubber cups and a fluor-free and oil-free prophylaxis paste (Fig 4), such as Restore or Reliance Orthodontic Products, Itasca, USA.

3. **Field isolation.** It is important to keep all the teeth surfaces dry, especially the lingual surfaces. When the saliva flow is abundant, Sal-Trepene (0.4 mg) (Hope Pharmaceuticals, Scottsdale, USA) can be administered, 1 tablet 30 minutes before bonding. The clinician should check for allergies or contraindications before proceeding with the prescription. Maximum field isolation measures must be taken to avoid its contamination by saliva, since this would reduce the bonding strength.

The NOLA appliance (Great Lakes Orthodontics, Tonawanda, USA) is recommended for use in field isolation. This appliance has two simultaneous functions—it separates lips, cheeks, and tongue, and provides various respiration tubes (Fig 5). The complete isolation is accomplished with cotton rolls.

**Lingual surfaces preparation.** Considering that the majority of lingual orthodontics patients are adults, the clinician can encounter various surfaces for
Enamel:
- The lingual surfaces of the teeth should be sandblasted. Be careful to sandblast only the bonding area and avoid soft tissues. The enamel sandblasting is done with 50 µm aluminum oxide particles during 3 seconds at each surface (Microetcher; Danville Engineering, San Ramon, USA). It is advisable to use sandtraps (Microetcher; Danville Engineering) to avoid their ingestion or aspiration by the patient (Fig 6a).
- The lingual surfaces are then acid-etched with 40% orthophosphoric acid for 30 seconds (Onyx L/G; Centrix, Shelton, USA) (Fig 6b).
- All gel is removed; the area is then rinsed abundantly and dried.
- A 50% solution of ether-acetone (Fig 6c) is applied. The ether-acetone is hydrophilic and volatile and it decreases superficial tension, facilitating the drying and the primer application. It should be used carefully since it is flammable.
- All surfaces are dried with oil-free and humidity-free warm air (Fig 6d).

Precious and non-precious metals:
- Acid-etching has no effect on these type of surfaces. Therefore these surfaces should be sandblasted with the microetcher, using the 50 µm aluminum oxide particles, for 15 to 20 seconds at a distance of 5 to 10 mm.
- Surfaces are then rinsed and dried.
- The sandblasted surfaces are painted with Metal Primer (Ormco).
- Allow surfaces to dry and do not rinse.

If restorations or crowns are to be changed at the end of orthodontic treatment, the clinician can carry out mechanical retention via an inverted cone-shaped bur.

Porcelain:
- Acid etching has no effect on porcelain crowns. Therefore, these surfaces should be sandblasted using the 50 µm aluminum oxide particles, for 15 to 20 seconds at a distance of 5 to 10 mm.
- Surfaces are then rinsed and dried.
- Surfaces are painted with 2 to 3 layers of Porcelain Primer (Ormco) to silanization.
- Allow surfaces to dry and do not rinse again.

Resin and composite:
- These surfaces should be sandblasted using the 50 µm aluminum oxide particles, for 5 seconds at a distance of 5 to 10 mm.
- Surfaces are then rinsed and dried.
- Apply Plastic Primer (Ormco).
- Allow surfaces to dry and do not rinse.
Resin and composite:
• These surfaces should be sandblasted using the 50 μm aluminum oxide particles, for 5 seconds at a distance of 5 to 10 mm.
• Surfaces are then rinsed and dried.
• Apply Plastic Primer (Ormco).
• Allow surfaces to dry and do not rinse.

The application of Metal, Porcelain, or Plastic Primer should be done at the end of lingual surface preparation, when all teeth surfaces are etched, rinsed, and dried. No rinsing or drying should be done after the primer application.

5. Drying. After the sandblasting, the working field should be isolated, avoiding contamination with saliva. Drying is an important step: cotton rolls should be changed according to patient needs.

6. Bonding
Tray preparation:
After tray adjustment has been checked, preparation can proceed.

• Carefully sandblast the composite surfaces with the microetcher and 50 μm of aluminum oxide (Fig 7a).
• Rinse and dry.
• Plastic Primer application (Ormco) (Fig 7b): Apply the liquid bracket-side adhesive (Sondhi Indirect Bonding, 3M Unitek) (Fig 7c). This is an adhesive especially designed for indirect bonding. It consists of two liquids that are used without mixing, applying one to the tooth and the other one to the bracket. The liquids are activated when they contact.
• After this, the tray is ready to be placed into the mouth. This procedure should be done simultaneously with the mouth preparation.

Lingual surfaces preparation:
After sandblasting, acid-etching, and ether-acetone application, the clinician can proceed with painting the lingual surfaces of the teeth with Orthosol (Ormco) to increase the bonding strength (Fig 8a). Use of an antihumidity primer is recommended, to increase bond strength, since no matter how well the drying is done, there will always be some water condensation, due to patient breathing.

• The tooth-side liquid adhesive is painted onto the tooth (Sondhi Indirect Bonding) (Fig 8b).
• The tray is then placed in the mouth, pressing against the lingual surfaces for 5 minutes and letting dry for 5 minutes more (Fig 8c).
• While the tray is under pressure, the cement excess (flash paste) is removed using an adhesive remover instrument (Fig 8d).
• When the necessary time has passed (8s), the silicon tray is removed, leaving the single tooth mini-trays uncovered (Fig 8f).
• The elastic ligatures are removed with the help of an elastic remover or with a heated instrument, avoiding excessive pressure on the single tooth mini-trays (Fig 8g).
• One by one, the single tooth mini-trays are removed. The final result is the complete bonding of the whole arch with the double transfer tray technique for lingual bonding (Fig 8h).
Fig 8  Lingual surfaces preparation. (a) Application of Orthocelo to increase bonding strength. (b) Application of the tooth-side adhesive. (c) Placement of the double tray in the mouth. (d) Flash paste removal with an adhesive remover instrument. (e) Tray is held in a position under pressure. (f) Remove the silicon tray carefully, leaving the single tooth mini-trays exposed. (g) Elastic ligatures are cut to remove the single tooth mini-trays. (h) Lingual brackets in the mouth after bonding.

With this bonding technique it is easy to take out the tray with minimized risk of brackets debonding during this procedure. The single tooth mini-trays should be categorized and stored according to the numbers that are engraved for easier identification. In case of debonding, the tray can be used again with the same bracket, if the patient still has it, or with a new bracket. The bracket will be ligated to the corresponding mini-tray and the previously mentioned steps will be repeated. If the clinician is sure that the composite base of the bracket is intact, the Sonhi adhesive can again be used. If the composite base of the bracket is not complete or if a new bracket is used, bond should be done with Enlight (Ormco).

REFERENCES
REFERENCES

Self Ligating Brackets & Smart Mechanics

1 Brackets and Buccal Tubes

Carriere LX® Self Ligating Bracket:
- Roth prescription in non-extraction cases.
- McLaughlin, Bennett and Trevisi in extraction cases.

Carriere LX® Self Ligating Bracket details.
Solstice Self Ligating 1\textsuperscript{st} molar buccal tubes or
Elite\textsuperscript{®} 1\textsuperscript{st} convertible molar tubes - Roth prescription

Elite\textsuperscript{®} 2\textsuperscript{nd} Mini molar buccal tubes. Roth prescription.
## 2- Archwires Sequence

### .022"

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<tr>
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<tr>
<td>.014 Dimpled Bio-Kinetix™ Thermally Activated Niti® Archwire</td>
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<td>.016 x .025 CNA™ Archwire for loops mechanics</td>
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<td>.018 x .025 Bio-Kinetix™ Plus™ D-LX Archwire</td>
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<td>.017 x .025 CNA™ Beta III D-LX Archwire</td>
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3- Accessories

1- Action Ligature Rotator

2- MIM Crimp Stops

3- Archwire Stop Lock (.018” or .022”)

4- Archwire Stop Lock with Hook (right and left)

5- Double-Sided Archwire Stop Lock Wrench

6- Crimplable Ball Hooks
7- Crimpable Archwire Power Hooks (right and left)

8- Hook Crimping Plier

9- Twin Force® Bite Corrector

10- Nitanium® Palatal Expander 2™

11- Ancor Pro® Microimplants
4- Smart Mechanics SLB & SM

- Rolling effect control
  - Dimpled archwires
  - Stops (upper-2; lower-1)
- Sliding and Rolling effects control
  - 2 hooks mesial-to molar - ligated
- Space maintainer
  - 2 stops
- Expansion
  - D-LX Archwires
  - Nitinum * Palatal Expander - NPE
- Extraction
  - Crimpable power hooks - Microimplants
  - Twin-Force * Bite Corrector - TFBC
  - Low force intermaxillary elastics
- Class II / Class III
  - 2 stops
  - Mesial-to-bicuspids hooks ligated to bicuspids brackets
  - Mesial-to-bicuspids stops
  - Molar stops
  - Nance appliances or microimplants
  - Double arches with stops

Hooks & Stops

Passive

Active

Space regainer

Stripping

Prolusions

Distalization

Ectopic teeth
PASIVES

5- Rolling Effect Control

The Rolling Effect is the tendency of the archwires to a lateral sliding, especially in low friction systems. To prevent this undesirable effect we can use dimpled archwires or crimpable stops between the brackets of the central incisors (2 stops in the upper arch and 1 stop in the lower arch). Depending on the crowding and rotations of the central incisors we cannot use dimpled archwires, but we could use crimpable stops in between the brackets of other teeth. This mechanics do not prevent the Sliding Effect.

6- Sliding Effect Control

The Sliding Effect in the tendency of the archwires to a forward sliding, especially in low friction systems. This effect provokes both protrusion and torque increasing of the incisors. To prevent this effect, when it is not indicated, we can use mesial to molar
crimpable hooks ligated to the molar tubes. This mechanics also prevents the Rolling Effect.

7- Space Maintainer

To maintain the space of a non erupted or a missing tooth we can use 2 crimpable stops. This mechanics also prevents the Rolling Effect.

8- Expansion Cases

To achieve the transverse expansion of the arches we can use the D-LX expansion archwires (see the archwires sequence on page 3). To get more expansion, we can use also the Nitanium® Palatal Expander 2™ and to get a Rapid Palatal Expansion, we can use a Bonded Hyrax Appliance.
9- Extraction Cases

In the extraction cases, we can use Stainless Steel rectangular wires with crimpable power hooks and Ancor Pro® TADs for sliding mechanics or CNA™ archwires for loops mechanics (see the archwire sequence on page 3).

10- Class II / Class III Cases

After alignment, levelling and torque control, we can use the Twin Force® Bite Corrector to correct Class II and Class III cases with better results than Class II and Class III elastics (see the Twin Force Therapy by Dr. Echarri).
ACTIVES

11- Space Regainer

To regain a space we can use a Superelastic Nitanium®, or Bio-Kinetix™ or Bio-Kinetix™ Plus™ or Black-Ti Round Archwires with 2 crimpable stops instead of a coil spring. The distance between the 2 stops should be 2 mm larger than the distance between the brackets.

12- Stripping Cases

In Stripping Cases, we can use a Superelastic Nitanium®, or Bio-Kinetix™ or Bio-Kinetix™ Plus™ or Black-Ti Round Archwires with 2 mesial to first bicuspid brackets crimpable hooks ligated to the bicuspid brackets. This mechanics will prevent both the protrusion and the torque increasing of the incisors during the stripping and alignement procedure.
13- Protrusion Cases

In Protrusion Cases, we can use a Superelastic Nitanium®, or Bio-Kinetix™ or Bio-Kinetix™ Plus™ or Black-Ti Round Archwires with 2 mesial to first bicuspid brackets crimpable stops with a larger distance than the distance between the first bicuspid brackets. This mechanics will protrude and increase the torque of the incisors.

14- Distalization Cases

In cases indicating a minor distalization of the molars we can use 2 crimpable stops: one crimpable stop distal to the first bicuspid and the other crimpable stop mesial to the first molar tube. The distance between the two crimpable stops should be larger than the distance between the bracket and the tube. To prevent the mesial movement of the anterior teeth a Nance Palatal Arch bonded or welded (bands) to the first bicuspid is a must. We can use other mechanics to obtain a major distalization of the molars.
15- Cases with Ectopic Teeth

We can use a double arch system with the .022 brackets. The anchorage archwire is a .012 Superelastic Nitanium® Archwire with 2 crimpable stops to maintain the space. The ectopic tooth archwire is a section of .012 Bio-Kinetix™ archwire ligated with wire ligature to the brackets of the mesial and distal teeth to the ectopic one. This archwire should have 2 crimpable stops to avoid the lateral sliding.

16 Tips

1- Open the cap for bonding using the Bracket Height Gauge

2- Open easily with a scaler, a wire director or an opening instrument and apply a light occlusal/incisal pressure.
   Close easily with the finger.
3- The Carriere LX® brackets also have wings for a traditional wire ligature in cases with teeth in extreme positions.

4- Use the ligature rotator to help for the correction of rotated teeth.

5- To prevent the friction increasing the “8-figure-ligatures” or the elastic chain must be used under the archwires.

6- After the action of the rectangular wires, it is necessary to take a panoramic X-ray to check the roots parallelism, and if necessary re-bond some brackets.
7- The intermaxillary elastics to improve the intercuspidation can be fixed to the hooks of the brackets or to crimpable ball hooks in the archwire.
Straight Wire Treatment with Extractions

Introduction

There are some 40-50% of cases treated in my office where extractions due to orthodontics are indicated.

Extractions due to orthodontics are usually indicated in cases with a space lack, negative dental-occlusal discrepancy. Nevertheless, sometimes the extractions are carried out in order to compensate the mild skeletal Classes I or II, when a patient refuses to undergo an orthodontic treatment combined with orthognathic surgery in order to re-establish skeletal normality.

The most frequent extractions (without taking into account the included molars extractions) are:
- First bicuspids
- Second bicuspids
- Lower incisors
- Exceptionally, first and second molars, usually because it is the case where the extraction of these teeth is indicated due to therapeutic reasons.

To decide between the first or the second bicuspid extraction, we have to pay attention to:
- Therapeutic stage of the bicuspid.
- Periodontal and gingival state of the bicuspid.
- Position of the bicuspid in the arch (aligning, rotation, included bicuspids).
- Minimal orthodontic treatment plan (extraction of the bicuspid which implicates less orthodontic movement in order to achieve the treatment objectives: for example, in cases where the intrusion of the anterior group (incisors and cuspids) is necessary, the first bicuspid extraction is more indicated.

To decide if the lower incisor should be extracted, we have to pay attention to:
- Anterior negative dental-occlusal discrepancy of the lower anterior group, with normal occlusion of bicuspids and molars.
- Anterior crossbite or anterior buccal posture.
- Bolton discrepancy after with mandibular excess.
- Aligned or fractured border of a lower incisor.
- Compromised periodontal or gingival state of a lower incisor.

Extractions treatment

This article will describe the protocol we use for bicuspids extraction cases. The most important problems during the extraction treatment are:

- Anchorage control
- Decision on mechanics type
- Anchorage side-effects control

Figure 01: Anchorage with cuspid "T" loop.

Due to the extension limitations of this article, all these topics cannot be developed in detail. On the other hand they can be opened up for discussion because of its importance.

Anchorage control

Figure 02A: Distalization of a cuspid with elastic chain.

The cuspid tips towards distal, flexing the archwire.

Traditionally, Nance appliance and headgears have been used in the upper arch, and lingual archwires and a lip-bumper in the lower arch. Currently, headgears and lip-bumper are not used anymore, but the Nance appliance and the lingual archwire are still used in cases with a good archtype, and mini-screws in cases where the anchorage requirements are more important. The mini-screws offer not only an absolute anchorage, but also the possibility of new traction directions which are not possible with the traditional mechanics.

Decision on a mechanics type

The loops mechanics or the sliding mechanics can be used for space closure.

The sliding mechanics has the following characteristics:

- It is easier for the orthodontist.
- Its activation is easier.
- It offers more comfort for the patient.
- It has less vertical control and occlusal torque control.

The loops mechanics has the following characteristics:
Treatment of Class II Malocclusion

- It is more difficult for the orthodontist
- Its activation is more difficult
- It offers less comfort for the patient
- It has more vertical control and incisal torque control

We should always try to treat cases with sliding mechanics, but in order to be able to use it, it is necessary to prepare the cases in such a way so the vertical control and torque control are not necessary in this stage.

**Figure 04:** Activation of a horizontal arm of a “T” loop using the three jaw plier.

This can be achieved if we:

- Overcorrect incisal torque using the super-torque brackets (−4°) in four incisors or with direct bonding and customized prescription.
- Correct the overbite and carry out the complete Curve of Spee leveling before starting the space closure.

**Figure 05:** Closed helicoidal “L” loop with the “A” type ligature.

To check if the Curve of Spee is well leveled, we must be sure that the patient does not present increased overbite and that the patient shows an occlusal contact of the whole bicuspid and molar area with their antagonists.

The friction has a fundamental role in sliding mechanics. The friction depends on the contact between the archwire and the slot:

- If the leveling, aligning and rotations (AAR phase) and torque are not completely corrected, the slots are not perfectly aligned and therefore the friction is increased.
- If the brackets with badly polished slots are used (reached or because they are recycled) the friction is increased.
- Metallic brackets have less friction than plastic or porcelain brackets.
- Steel or chrome-cobalt arches have less friction than TMA arches or arches with a teflon-coat. There are also low friction TMA arches which are colored in purple, blue or honey color.

- Not too tightened metallic ligature has less friction than elastic ligature.
- Convertible tubes present less friction than conventional brackets.
- Self-ligating brackets present less friction than conventional brackets.
- “Notches” in the arch increase the friction, too.

If we want to decrease the friction, besides the above mentioned points, we should also take into account:

- To use self-ligating brackets Damon (DIAMCO), Speed (SPEED), etc.
- To use bi-dimensional technique where the .018 brackets are used in cuspids and incisors and .022 brackets are used in bicuspid and molars. This technique has also some disadvantages:
  - It is necessary to have a larger stock of brackets
  - Less tip, rotation and vertical control in bicuspid and molars has been noted
  - Molar and bicuspid brackets should be changed after the space closure
- To use bi-dimensional arches such as Combination arches (BAH), which present a rectangular section at the anterior area, and a circular section at the bicuspid-molar areas.

**Figure 06:** Activation of a horizontal arm of a closed helicoidal “L” loop using the three jaw plier.

These wires can be:

- 0.018 x 0.022 con. 0.018
- 0.017 x 0.025 con. 0.017 (**the use**)
- 0.019 x 0.022 con. 0.018

Using these arches, we can observe:

- Significant torque control in incisors and cuspids and decreased friction in the posterior area
- Less tip, rotation and vertical control in bicuspid and molars but on the other hand, there is no need to change brackets in molars and bicuspid after the space closure.

**Archwire side-effects control**

The archwire side-effects are:

1. Vertical and horizontal bowing effect
2. Sliding effect
3. Rolling effect
the upper arch and reverse Spee curve in the lower arch) and by horizontal compensation curve (too incurve).

**Space closure technique**

**Figure 07A**: Intracural photo of the closed helicoidal "L" loop. Frontal view.

There are two options, as far as the technique is concerned:

1. First, to carry out the cuspsids distalization and then 4 incisors "en masse" retraction.
2. "En masse" retraction of the whole anterior area (6 teeth): incisors and cuspsids (4 loops are used).

The only advantage of the "En masse" retraction of the anterior area is less treatment time, but it requires the repetition of leveling and a special control of cuspsids tip, which, on the other hand, makes the treatment time longer.

We prefer to distalize cuspsids first, and then to carry out the retraction of the anterior area because:

- it requires less anchorage in molars
- the movements of cuspids and incisors are different:
  > Cuspsids move mesio-distally and require tip and rotation control.
  > Incisors move labio-lingually and require vertical and torque control.

Cuspsids distalization results in:

- elastic chains and a lingual button in the cuspids.

During the cuspsids distalization, it might happen that the movement is not effective due to the following reasons:

- There may be some interferences with antagonist teeth or brackets.
- The cuspids may have too positive torque and therefore it inhibits itself with labial cortical bone.
- Occlusal expansion had been carried out earlier and the border is contracted which provokes the inhibition of the cuspsids movement with both labial and lingual cortical bones. Dental movement is always inhibited at the level of cortical bone due to less irritation of this area of the bone and less influence of osteoblasts and osteoclasts.

Anyway, giving the positive torque to a cuspids in the mesial area of the archwire provokes a movement which takes the cuspids crown towards labial avoiding the interferences, and brings the cuspids root to the spongy bone avoiding the cortical bones. Therefore, the positive torque of the cuspids on the mesial side favors this movement. The positive mesial torque of the cuspids should not be compensated with a negative anti-torque activation on the distal of the cuspids bracket because the bend would inhibit the movement and because the wire length of this activation space minimizes the negative torque effect over the second cuspids.

The incisal group intrusion has the following consequences:

- Torque test which should be compensated with the use of the larger torque brackets with the indirect bonding and customized prescription or with the activation of the archwire.
- Overbite increase, which should be compensated with the sagittal compensation curve (increased Spee curve in the upper arch and reverse Spee curve in the lower arch).

"A" type ligature usage to rotate the anterior group can also be helpful in compensation of these side-effects: "A" type ligature consists of the following: a sliding knot should be made in the distal end of the "T" loop, and then ligated to the molar tube hook. The activation of the "T" hook is carried out backwards and downwards provoking an elastic recuperation of the mesial arm of the "T" hook backwards and upwards.

The activation of the "T" or "L" hook horizontal arm with three-jaw or cinchback plier also provokes mayer anterior intrusion and torque increase.

The asymmetric "T" hook with the distal arm directed towards gingival also compensates these effects with the activation of the "A" type ligature.

Elastic chain ligature placed in the arch behind the hook also compensates these effects and helps to avoid ulcers due to decubitus over the gingival tissues.

**Anchorage control**

These are the following types of anchorage:

- **Reciprocal anchorage**: It depends on the size and shape of the root, state of the crown or restorations, as well as on the state of the periodontal support.
- **Cortical anchorage (Ricketts)**: Currently not in use due to possible root resorption.
- **Tip-back & Toe-in anchorage**: Preparing the Tweed anchorage.
- **Muscular anchorage**:
  > Masticatory muscles (facial type)
  > Lip muscles (for protrusion)
Treatment of Class II Malocclusion

Figure 8: Ligature splinting anchorage auxiliary appliances anchorage:

- Goshgarian bar: It provides good transverse and vertical anchorage but not the sagittal one.
- Nance appliance
- Lip-bumper
- Headgear anchorage:
  - Facebow
  - Interceptive overjet
  - Facemask
- Absolute anchorage: Mini-implants
  The anchorage can be also divided by planes:
- Sagittal: mesiodistal: It depends on:
  - The quantity of posterior teeth
  - The crowns and restorations state
  - Periodontal support
  - The third and second molars pressure
  - Occlusion anchorage (masticatory muscles, facial type, integrity of cusps and presence of antagonist teeth)
  - Mesial tip of molars
  - Mesial rotation of molars
- Vertical: It depends on:
  - Periodontal support
  - Antagonist teeth presence

> Lip, cheek, tongue trust or objects interposition
> Mouth breathing (open mouth)

Anterior: It depends on:
- Lip musculature
- Tongue trust
- Previous protrusion (bony lack of the protruded teeth root on lingual or on palate site)
- Overjet
- Overbite

Absolute anchorage with mini-implants offers:
- Absolute anchorage (there is no reciprocal dental movement)
- New force directions, which are difficult to achieve with the conventional orthodontics.

Advanced mechanics for extraction cases
The advanced mechanics for extraction cases should take into account:
- Incisors torque overcorrection and cusps and tip overcorrection (combining brackets with indirect bonding).
- Bi-dimensional archwires, .017x.025 in cuspid to cuspid area and .017 in bicuspids-molar areas
- Power-arm in front of and distally of the cuspid
- Anterior mini-implant

Advanced mechanics advantages:
- Absolute anchorage (eliminates the anchorage loss problem)
- Reduced friction in the posterior sector but not in the anterior one
- Practically "full-size" arch in the anterior area (major cuspid tip and rotation control and incisal torque control)
- Force vector direction from the power arm to mini-implant offers an excellent vertical control
- No cooperation of the patient is needed (there is no need to use facebow or intermaxillary elastics)
- The cost is similar to the Nance appliance cost or any other anchorage auxiliary appliance.

Closure force direction can be controlled using the height of the force arm in relation to the mini-implant height provoking more or less intrusion in the initial group during the retrusion.

Winston Churchill
Don't wait for extraordinary opportunities. Seize common occasions and make them great.
- Orison S. Marden

Ninety-nine percent of the failures come from people who have the habit of making excuses.
- George Washington Carver

Editorial Team:
Dr. V. Srinivas, Dr. Subramaniam J., Dr. Ashfaque Shetty and Dr. Vein R. Patil.

Visit our website: www.torq.in Email: contact@torq.in
Extraction Cases- Absolute Anchorage

1- Extraction of the right and left

2- Bond the brackets to all the teeth. first bicuspids.

3- Alignment and leveling with a NiTi Round Archwire.
4- Alignment and leveling completed.

5- Establishing torque with a NiTi Rectangular Archwire.
6- Torque established.
7- Stainless Steel rectangular archwire with hooks welded to the molar bands and figure “8” ligature between second molar and second bicuspid (on both sides).
8- Insert two microimplants (6-8mm) right on the distal of the cuspids, one on the left and the other on the right side.

9- Place a closing coil spring on each hook.
10- Activate each closing coil spring from the hook to the microimplant on the same side.

11- Space closure completed.
Extraction cases - Minimum Anchorage

1- Extraction on the right and left first bicuspids.
2- Bond the brackets to all the teeth.

3- Alignment and leveling with a NiTi Round Archwire.
4- Alignment and leveling completed.

5- Establishing torque with a NiTi Rectangular Archwire.
6- Torque established.
7- Stainless Steel rectangular archwire with hooks welded to the molar bands and figure “8” ligature between second molar and second bicuspide (on both sides).
8- Insert two microimplants (6-8mm) right on the distal of the cuspids, one on the left and the other on the right side.
9- Place a closing coil spring on each hook.
10- Activate each closing coil spring from the hook to the microimplant on the same side.
12- Space closure completed.
Unilateral Extraction Cases

1- Extraction of the right or left first bicuspid.
2- Bond the brackets to all the teeth.

3- Alignment and leveling with a NiTi Round Archwire.
4- Alignment and leveling completed.

5- Establishing the torque with a NiTi Rectangular Archwire.
6- Torque established.
7- Stainless Steel rectangular archwire with a hook welded to molar band (on extraction side) and figure “8” ligature between second molar and second bicuspid (on extraction side).

8- Insert a microimplant (6-8mm) right on the distal of cuspid on extraction side.

9- Space closing coil spring on the hook.

10- Activate the closing coil spring from the hook to the microimplant.

11- Space closure completed.
A Modified Pendulum Appliance for Anchorange Control

PABLO ECHARRI, DDS
GIUSEPPE SCIUZZO, DDS
NUNZIO CIRULLI, DDS

Some orthodontists have reported a loss of anterior anchorage with the Hilgen Pendulum® appliance—in other words, a protrusion or proclination of the incisors during molar distalization. Two cases will demonstrate how we counteract this tendency by using a modified version, the M-Pendulum,1,2 which has a mesially oriented loop and removable arms.

Case 1
A 15-year-old male presented with a Class II, division 2 right malocclusion and midline deviation (Fig. 1). The upper right cuspid was in crossbite, and the upper left cuspid in labial,

*Terex:* AC Company, 1717 W. Colfax Ave., Orange, CA 92867.

Fig. 1 Case 1. 15-year-old male patient with Class II, division 2 right malocclusion and midline deviation before treatment.
Dr. Echarri is in the private practice of orthodontics at Museu, 0.
101, 08912 Barcelona, Barcelona, Spain; email: echarri@
centrodent.com. Dr. Scuzzo is in the private practice of ortho-
dontics in Rome, Italy. Dr. Cinulli is a graduate student, Depart-
ment of Orthodontics, University of Milan, Varese, Italy, and
in the private practice of orthodontics.

Fig. 2 Case 1. Distalization with M-Pendulum appliance.

Fig. 3 Case 1. Patient after 24 months of treatment.
Treatment of Class II Malocclusion

A Modified Pendulum Appliance for Anterior Anchorage Control

 ectopic eruption.

The molars were distalized with an M-Pendulum appliance for six months (Fig. 2). Treatment was continued with maxillary lingual brackets, combined with an upper Nance button and transpalatal bar, and with lower labial brackets.

The maxillary archwire sequence was: .016” copper nickel titanium (adapted labial archwire), .016” Australian wire and coil spring for bicuspids distalization, .017” x .015” TMA, .0175” x .0175” with closing “I” loop, .016” TMA. Mandibular archwires were .016” copper nickel titanium and .017” x .017” TMA. Total treatment time was 24 months (Fig. 3).

Distalization with a Modified Pendulum

Normally, as in the case shown above, the first molars are distalized with the left and right TMA arms of the Pendulum. The same distal force that the arms exert against the molars is also exerted mesially against the Pendulum, which makes incisor protrusion likely. This protrusion can be increased further when the second bicuspids arms are cut to permit spontaneous distalization of those teeth.

Therefore, in cases of extreme overjet or where anchorage is critical, such as with reduced periodontal support or excessive lower facial height, we modify the M-Pendulum by using four removable arms, for both the first and second molars. The internal diameter of the four stainless steel tubes*** embedded in the acrylic corresponds to that of the removable TMA arms (Fig. 4).

The following case needed distalization only of the upper right first and second molars. The fixed left spring was made with stainless steel wire for anchorage. The two removable right springs were made with TMA wire. The bonding procedure is as follows:

1. Adjust and cement the molar bands using

*Registered trademark of Cerro A. Company, 1717 W. Collins Ave., Orlando, CA 32807.
**Dentalum, Inc., 15 Pleasant Run, Newtown, PA 18940.
Blue Ultra Band Lock†
2. Etch the occlusal surfaces of the four upper bicuspids for 30 seconds with Omnix Etch.†
3. Rinse the teeth for 10 seconds and dry.
4. Place the Pendulum appliance in the proper position, and bond it with Light Bond† (Fig. 5).
5. Light-cure the adhesive for 30 seconds.
6. Check the occlusion with articulating paper. The contact of the four upper bicuspids with their lower antagonists must be simultaneous. The surface of the adhesive should be flat and polished.
7. Insert the left stainless steel spring into the lingual sheath, and fix it in place with an elasticomerigature. Insert the TMA spring of the upper right second molar into the corresponding tube of the Pendulum appliance and into the lingual sheath, where it is also tied with an elasticomerigature for added security (Fig. 6). The pressure exerted by the Pendulum will be less, since the distalization force is used to move the second molars and first molars sequentially, rather than simultaneously.
A Modified Pendulum Appliance for Anterior Anchorage Control

Because they are removable, the arms can be adjusted more easily to control tooth inclination and intrusion and to compensate for molar extrusion. If vertical control is critical, the molar disclusion caused by bonding the Pendulum to the bicuspids can be counteracted with composite build-ups on the lower molars. The build-ups must have completely smooth occlusal surfaces.

Once the second molars have been distalized (Fig. 7), their arms are left passively in place for anchorage, and the first molar arms are activated for distalization and intrusion (Fig. 8). After the first molars have been distalized, the Pendulum is replaced with a Nance button (Fig. 9). A continuous .016" stainless steel archwire or a sectional .016" archwire can be used, with an omega bend mesial to the molars, to increase anchorage. A figure-8 ligation is added from the first to the second molar. The archwire will be passive in the anterior region, thus avoiding incisor protrusion. Elastic chain is used to distalize the second bicuspids and then the first bicuspids (Fig. 10).

If anterior anchorage is critical, we recommend that the palatal acrylic of the Pendulum be kept out of contact with the incisors. In addition, the second bicuspid arm should not be cut for spontaneous distalization, and the bicuspids
should not be moved with springs that can pro-
trude the incisors.

Finally, the cuspids are distalized with elas-
tic chain (Fig. 11), and the incisors are leveled
and aligned (Fig. 12).

Case 2

A 29-year-old female presented with a
Class II malocclusion and crowding (Fig. 13).
The maxillary molars were distalized in four
months with the modified Pendulum (Fig. 14).

Treatment was finished with a lingual multi-
bracketed appliance.

The maxillary archwire sequence was:
0.016" stainless steel sectional archwires for
bicuspids distalization, 0.016" stainless steel con-
tinuous archwire for cuspids distalization, 0.017" ×
0.017" copper nickel titanium, 0.016" × 0.022" stain-
less steel, 0.016" stainless steel. Mandibular arch-
wires were 0.017" × 0.017" copper nickel titanium,
0.016" × 0.022" stainless steel, and 0.016" stainless
steel. Total treatment time was 16 months (Fig.
15).
A Modified Pendulum Appliance for Anterior Anchorage Control

Discussion

If an increase in overjet is seen after Pendulum therapy, it may not be caused by anterior anchorage loss, but by any of the following factors:

1. Improper diagnosis of a CO-CR discrepancy. If centric occlusion is produced in an advanced position with respect to centric relation, the mandible may reposition to centric relation after leveling and alignment, and the consequent increase in overjet could be interpreted as anterior anchorage loss.

2. Inadequate vertical control of the molars during treatment. This can lead to undesirable molar extrusion and thus to a backward rotation of the mandible and increased overjet. We recommend minimizing the use of intermaxillary elastics with light archwires, and using closing archwires with a built-in upper curve of Spee and reverse lower curve.

3. Molar distalization. As Ricketts established, for each 3mm of molar distalization, the mandible rotates 1° backward. The rotation can be greater if the molars are mesially inclined initially, so that distal uprighting causes an increase in the vertical dimension. It can also be exacerbated in patients with weak facial patterns.

4. Arch expansion. If a molar that is to be moved distally is also in a crossbite position, we can simultaneously expand the maxillary arch by activating the central Pendulum screw or the TMA arms. During the crossbite correction, the molars pass through a stage of edge-to-edge occlusal contact, and the mandible rotates 1.5-2° backward. From this position to normal occlusion, the mandible rotates only 1°-1.5° forward. Thus, a 1° backward rotation will remain when expansion is finished. Slower expansion can result in as much as a 2° backward rotation, and if the molar torque is simultaneously increased, the rotation can be even greater.

We have used the modified M-Pendulum appliance presented here in both labial and lingual treatment with excellent results and without losing anterior anchorage.
Fig. 15 Case 2. Patient after 16 months of treatment.

REFERENCES

Modified Pendulum with 4 removable arms

1. Fabrication of the Modified Pendulum with 4 removable arms: occlusal support in bicuspids, expansion screw and 4 Stainless Steel tubes to insert the removable arms.

2. Modified Pendulum with 4 removable arms, occlusal view.

4. Pendulum for unilateral distalizing of upper first and second right molar. Bonding technique 1: bonding of the bands and 30” acid etching of occlusal surfaces of bicuspid, and 10” rinsing.


7. Bonding technique 4: Checking of the occlusion using articulating paper.

8. Bonding technique 5: Balanced occlusion of all 4 composite surfaces should be achieved, which also should be smooth and without traces of antagonist cusps.
9. TMA arms for upper first and second right molar.

10. Insertion of the arm into the tube inside the resin and in the lingual sheath of the second molar band for distalization of the second molar.

11. Scheme of the second molar distalization.
12. Second molar distalization.

13. X-ray of second molar distalization.

14. Scheme of the first molar distalization.
15. First molar distalization.

16. X-ray of first molar distalization.

17. After the separate distalization of the second and first molar, Pendulum appliance is removed, Nance appliance is inserted, and the second molar is distalized using elastic chain, and the molar anchorage is increased with figure “8” ligature between the first and second molar.
18. In continuation, first molar is also distalized using elastic chain.

19. In continuation, canine is also distalized using elastic chain for the purpose of aligning and levelling.
20. Activation for distalization following the desired direction of the molar. Removable arms allow a very precise activation of the arms, as it is explained in continuation.

21.

22. Activation for expansion or contraction.

23. Activation for distal or mesial rotation.
24. Activation for distal or mesial inclination.

25. Activation for intrusion or extrusion.
Distalization with Pendulum-M using Microimplants after the Pendulum-M

1- Bond bands on first and second molar on both sides. Bond Pendulum-M appliance.
2- Insert the second molar springs in the pendulum tube

3- Insert second molar spring in the lingual sheaths of second molar bands to distalize second molars.
4- Insert the first molar springs to distalize the first molars.

5- Distalization of first and second molars completed.
6- Bond the brackets on first and second bicuspid on both sides. Remove Pendulum appliance. Place fig 8 ligature between first and second molar on both sides. Insert microimplant (6-8mm) mesially to first molar on both sides. Ligate a Stainless Steel sectional archwire on both sides.
7- Activate an elastic chain from second bicuspid to microimplant on both sides for distalization of second bicuspids.
8- Distalization of second bicuspids completed.

9- Ferulize from second molar to second bicuspid using figure 8.
10- Distalization of first bicuspids completed.

11- Alignment and leveling of anterior teeth (and retrusions if indicated) using microimplants if necessary, is completed.
12- Treatment is completed.
Distalization with Pendulum-M Increasing the Appliance Anchorage with Microimplants

1- Bond bands on the first and second molar on both sides. Bond the Pendulum-M appliance. The Pendulum-M used with microimplants can be smaller and it has two holes to insert microimplants.
2- Insert two microimplants (8mm) through acrylic plate of the pendulum.

3- Insertion of microimplants completed.
4- Insert the second molar springs for second molars distalization.

5- Second molars distalization completed.
6- Insert the first molar springs to distalize the first molars.
Treatment of Class II Malocclusion

7- Distalization of the first and second molars completed.
8- Distalize the second bicuspids with elastic chain.

9- Cut the first bicuspid spring of the Pendulum-M and distalize the first bicuspids with elastic chain.
10- Distalization of the first bicuspids completed.

11- Bond the lingual or labial brackets to all the teeth.
12- Alignment and leveling completed.
13- Retrude the anterior teeth with cuspid-to-cuspid figure “8” ligature and elastic chains from cuspids to the Pendulum-M springs.
14- Retrusion completed.

Distalization
Twin Force Therapy

Class II treatment

Class II malocclusion should be considered not only as a sagittal plane abnormality, but also as transverse and vertical plane abnormalities, too.

In sagittal plane, McNamara studies indicated that the majority of Class II malocclusions were characterized by mandibular retrusion and not maxillary protrusion, and therefore the most of the Class II malocclusion patients treated without extractions improve their profiles.

Apart from the sagittal plane, in majority of the cases a transverse plane is also affected by maxillary contraction. In cases treated with mandibular advancement the casts must be placed in Class I in order to evaluate the transverse molar occlusion in advanced position of the mandible. If posterior cross bite is observed, an upper expansion must be carried out.

In many Class II malocclusion cases, the vertical plane is also affected, and patients present a vertical pattern with mandibular clock-wise rotation that which worsens skeletal Class II malocclusion and profile.

In short, many patients with skeletal Class II beneficiate from a treatment including mandibular advancement, maxillary expansion and vertical control.
Class II Treatment Scheme using CSW Technique

<table>
<thead>
<tr>
<th>Diagnosis</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Upper protrusion patient</td>
<td>Active C plate, Duyzing’s appliance with a shield</td>
</tr>
<tr>
<td>Mesofacial or braquifacial patient with mandibular retraction</td>
<td>Twin Block</td>
</tr>
<tr>
<td>Dolicho facial patient with mandibular retraction</td>
<td>Headgear with high pull-up</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Diagnosis</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mesofacial or dolicho facial patient with upper protrusion</td>
<td>Extractions and anchorage using microimplants</td>
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<tr>
<td>Braquifacial patient with upper protrusion</td>
<td>Distalization using Pendulum and microimplants</td>
</tr>
<tr>
<td>Mesofacial, braquifacial or moderate dolicho facial patient with mandibular retraction</td>
<td>Mandibular advancement using Twin Force</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Diagnosis</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patient with maxillary normposition and mandibular retraction</td>
<td>Sagittal mandibular advancement osteotomy</td>
</tr>
<tr>
<td>Patient with mandibular and maxillary retraction</td>
<td>Lefort I for maxillary advance</td>
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<td></td>
<td>Lefort I for maxillary advance and impaction</td>
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<tr>
<td></td>
<td>Segmented Lefort I for maxillary advance and expansion</td>
</tr>
<tr>
<td></td>
<td>Sagittal mandibular advancement osteotomy</td>
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<tr>
<td></td>
<td>Sagittal mandibular advancement osteotomy and counter-clock wise rotation</td>
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<td></td>
<td>Possible mentoplasty</td>
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</tbody>
</table>

Description of the appliance:

**Twin Force Bite Corrector (TFBC) Double-Lock**

Twin Force Bite Corrector Double-Lock is an intraoral and intermaxillary appliance and it is used in Class II malocclusion treatment. It requires a minimal cooperation from the patient.

The insertion and removal of the appliance is easy and rapid and there is no necessity for laboratory fabrication. It is fixed to SS .0172 x .025” arch for the .018” slot and to SS .018” x .025” arch for the .022” slot, adjusting the screw with a Twin Force wrench. Its NiTi components offer a very safe adjustment system in the arch.
Ball and socket joint fasteners situated at its ends (next to the wire clamps) allow a wide range of jaw motion including the lateral jaw movements, which increase the comfort of the patient.

The plunger/tube telescopic assemblies on each side contain NiTi coil springs that deliver constant and light forces to position the mandible.

**Accessories:**
Spare Allen screws and Twin Force wrench

**Determination of the appropriate size of the Twin Force**
A Twin Force Bite Corrector Double-Check is used and it is fixed directly to the arch using its wire clamps.

After aligning and leveling, and with a patient in habitual maximal occlusion, take measures from the mesial edge of the upper molar tube to the distal edge of the lower

| If the distance is less than 27 mm – the Twin Force Small is used. |
| If the distance is equal or greater than 27 mm - the Twin Force Standard is used. |

Advantages:
- Improves the profile of the patient.
- A minimal cooperation of the patient is required.
- It produces continuous and light forces due to its NiTi coil springs
- It allows lateral jaw movement, due to which is more comfortable for the patient.
- Resistant.
- No laboratory work is required (time and costs reduction). It is inserted directly at the clinic using a simple procedure.
- It is easy to remove it at the clinic in order to check the position of the mandible and insert it again, if necessary.
- The patient can remove it in case of emergency.
- It can be used both in extraction and non-extraction cases.

7 mechanisms of Twin Force action:
Growing patient or with finished growth:
1. Complete maxillary distalization from 1mm to 1,5 mm – Overjet and molar class correction.

2. Complete mandible protrusion from 1 mm to 1,5 mm – Overjet and molar class correction.

3. Remodelling of the glenoid cavity and condyle (approx. 1 mm) – Overjet and molar class correction.
4. Molar distal rotation – Molar class correction.

5. Intrusion of the upper molars and counter clockwise rotation of the mandible – Overjet, molar class and profile correction (in anterior open bite cases).

6. Lower molars extrusion to fix the jaw position – Overjet and molar class correction (anterior deep bite cases)

*** In adult patients a 3 mm to 5 mm profile reduction can be expected due to orthodontic effects.
Growing patient:

7. Condyle and glenoid cavity growth.

Indications:

1. Skeletal Class II malocclusion with mandibular retrognathia.
2. Facial type:
   a. Braquifacial,
   b. Mesofacial,
   c. Moderate dolychofacial.
3. Permanent dentition.

Limitations:

1. Skeletal Class II malocclusion with maxillary protrusion.
2. Severe or medium dolychofacial patient.

Class II div. 2 malocclusion patients should become in Class II div, 1 malocclusion patients in order to be able to carry out mandibular advancement.
Prevention of side effects:

1. To prevent solely the upper molars distalization – upper distal closure using ligated hook and ligated omega.
2. To prevent proinclination of lower incisors – lower distal closure using ligated hook and omega, plus lingual splinting from lower canine to lower canine.
3. To avoid excessive distal rotation of upper molars – transpalatal bar.

Insertion and removal of the appliance

Place archwire clamp of the Twin Force at 1 mm mesial to the upper first molar tube and tighten the Allen screw using a Twin Force wrench. Repeat the procedure on the opposite side.

When the left and right Twin Force Bite Correctors are fixed to upper arch, place the other archwire clamp 1 mm distal to the canine bracket on the lower arch and tighten Allen screw with the Twin Force wrench.

Check if the appliance is well fixed on both ends, and ask the patient to make mandibular movements in all directions.

Instructions for the patient:
1. Brush the Twin Force Bite Corrector at the same time when brushing teeth.
2. In case of de-bonding of a bracket or a band, or if Twin Force moves from its position, try to place it back using the wrench, or remove also the opposite end, place Class II elastics and contact the orthodontist as soon as possible.
3. Try to limit the excessive mouth opening movements, such as yawning.
4. If manipulating the Twin Force, do not remove completely the screws from wire clamps.

**Biomechanical sequence**

Before inserting the Twin Force appliance, dental occlusion should be brought into the position of mandibular advancement:

1. Diagnosis. Correct diagnosis and Twin Force use checking (Indications; Limitations page 5)

2. ELITE Opti-MiM Mini-Twin brackets bonding with Roth prescription. In CSW technique a .018” slot is used, but .022” slot can also be used. In case you use the .022” slot, arch size should be adapted to it. Carriere LX brackets can be used, too.
3. Align, level and correct rotations – ALR - .016” NiTi (Super elastic NITANIUM). Depending on the crowding level, a thermal .016” NiTi arch (BIO-KINETIX) or .016” Black Ti or .014” NiTi (Superelastic NITANIUM) can be used.
4. Torque correction - .016” x .022” NiTi (Superelastic NITANIUM) or thermal .016” x .022” NiTi (BIO KINETIX) or 016” x .022” Black Ti.

5. Level the curve of Spee - 016” x .022” NiTi (Superelastic NITANIUM RCS) or thermal NiTi (BioKinetix RCS) arch with reverse curve .

6. Transverse correction with plaster casts in Class I. Check it with the model casts positioned in Class I, expansion indication.

7. Correct rotations in upper molars.
8. .017” x .025” Stainless Steel arches with hooks and omegas ligated to molar band.

9. Indicate the use of Class II elastics 3/6” – 2.5 oz (TOUCAN) or 3/6” – 4.5 oz (ZEBRA) a month before insertion of Twin Force, so the patient get used to advanced mandible position.

10. Twin Force

Check list of the Twin Force use in cases of deep bite (see page 8).
Check list of the Twin Force use in cases of open bite (see page 9).
How long must I wear Twin Force?

It is recommended to use Twin Force during 1 month per each millimetre of the planned correction of overjet. As far as only orthodontics is concerned, it is used during 3 to 4 months.

Checking the effect of Twin Force

Remove the Twin Force and try to retract the mandible. If the mandible moves back, put the Twin Force back. If the mandible does not move, take the Twin force out and put the Class II elastics 3/6” – 2,5 oz (TOUCAN) or 3/6” – 4,5 oz (ZEBRA).

Case Finishing

Finish intercuspation and midline correction using intermaxillary elastics.
Twin Force in Class II malocclusion cases with anterior deep bite. Checklist.

1. ELITE Opti-MIM Mini-Twin or Carriere LX Roth .018" or .022" brackets
2. Stainless Steel arch with .018" slot or with .022" slot
3. Convertible molar tube
4. Crimpable hook or tube with hook
5. Lingual sheaths
6. Transepalatal bar (Palatal adapted to vault)
7. Twin Force
8. Lower lingual
9. Opti-MIM Bite Guide
10. Extraction of posterior teeth in order to give stability to mandibular position

- Vertical elastics
Twin Force in Class II malocclusion cases with anterior open bite. Checklist.

1. ELITE Opti-MIM Mini-Twin or Carriere UX Roth .018” or .022” brackets
2. Non Stainless Steel arches: either .018” slot and .017” x .025” arch with .022” slot .018” x .025” arch
3. Convertible molar tube
4. Crimpable hook x tube with hook
5. Lingual sheaths
6. Anspalatal (bar) splint (bar) separated from palatal vault
7. Twin Force
8. Lower lingual splinting
9. Opti-MIM Direct Bonding Button for tongue reeducation

Biomechanical sequence using .018” x .022” slots
### Treatment of Class II Malocclusion

#### Brackets

<table>
<thead>
<tr>
<th>Brackets</th>
<th>.018&quot;</th>
<th>.022&quot;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aligning and levelling</td>
<td>.016&quot; NiTi Superelastic NITANiUM Thermal NiTi (BIO-KINETIX) Black Ti</td>
<td>.016&quot;x .018&quot; NiTi Superelastic NITANiUM Thermal NiTi (BIO-KINETIX) Black Ti</td>
</tr>
<tr>
<td>Torque establishing</td>
<td>.016&quot;x .022&quot; NiTi Superelastic NITANiUM Thermal NiTi (BIO-KINETIX) Black Ti</td>
<td>.017&quot;x .025&quot; NiTi Superelastic NITANiUM Thermal NiTi (BIO-KINETIX) Black Ti</td>
</tr>
<tr>
<td>Curve of Spee leveling</td>
<td>.016&quot;x .022&quot; RCS NiTi Superelastic NITANiUM Thermal NiTi (BIO-KINETIX)</td>
<td>.017&quot;x .025&quot; RCS NiTi Superelastic NITANiUM Thermal NiTi (BIO-KINETIX)</td>
</tr>
<tr>
<td>Transverse correction</td>
<td>Transpalatal bar Nitanium Palatal Expander 2 Quad Helix</td>
<td></td>
</tr>
<tr>
<td>Molar rotation</td>
<td>Transpalatal bar Nitanium Palatal Rotator</td>
<td></td>
</tr>
<tr>
<td>Twin Force arches and finishing</td>
<td>.017&quot;x .025&quot; Stainless Steel</td>
<td>.018&quot;x .025&quot; Stainless Steel</td>
</tr>
</tbody>
</table>

#### Other uses:

- **NiTi Coil Spring**

- Distalization of upper molars
Inverse use in Class III malocclusion treatment

Anchorage reinforcement in extraction cases
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http://www.centroladent.com

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Quad Helix

Removable Quad Helix with elastic ligature
Assymetric Expansion

- TRANSPALATAL BAR
- MICROIMPLANT IN EXPANSION SIDE
- MICROIMPLANT LIGATURE LIGATED TO BAR ON THE NON-EXPANSION SIDE

- QUAD HELIX
- MICROIMPLANT IN EXPANSION SIDE
- MICROIMPLANT LIGATURE LIGATED TO QUAD HELIX ON THE NON-EXPANSION SIDE
Nitanium Palatal Expander™
Treatment of Class II Malocclusion
Treatment of Class II Malocclusion
Separation And Rapid Expansion

1. Hyrax appliance with 4 bands. To bond it, a paralelism of the first bicuspids and the first molars is needed.

2. Fan type Hyrax appliance. Indicated for the mayor anterior movement, or if welded backwards, for posterior movement.
3. McNamara appliance bonded with resin splints. Especially indicated to be used in mixed dentition and to be combined with anterior traction.

4. Separation appliance with a compact screw. The same movement, but much more comfortable for the patient.

5. Direct Bonding Separator used by author with sheaths welded in the first molar bands, and bonded on lingual surfaces of the bicusps.

7. Post-expansion and post-separation retention in extraction cases. Combination of transpalatal bar with anterior arms and Nance appliance.

8. Posterior cross bite case in an adult patient. Surgical separation will be carried out.
9. Bonding of the bands with lingual sheaths.


11. Acid etching of lingual surfaces of bicuspsids.
12. Rinsing to remove acid and drying.

13. Insertion of the Separator.

15. Light-curing using a light-curing lamp.

16. Separator bonded with Fermit on lingual sheaths to avoid tongue discomfort and to increase retention of the Separator.

17. Progress in separation process. Activation of the screw for 2/4 of turn per day during the first week, and ¼ of turn per day the rest of the weeks. For the rapid expansion, the screw should be activated every second day for ¼ of the turn.

18. Separation is finished in 30 days. Frontal view.
19. Occlusal X-ray of the separation.


21. The Separator is removed, but the bands are left bonded. A transpalatal bar for retention is inserted in the same sheaths.
22. Ligating of the transpalatal bar with elastics.

23. Ligating of the transpalatal bar with elastics.

24. Transpalatal bar is ligated.
Bibliography

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Pablo Echarri, DDS

echarri@centroladent.com

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