

The Use of the Straight Wire Appliance

General explanation of “Extraction therapy” using the fixed orthodontic appliance

I consider the Straight Wire Appliance (SWA) to be a “**fixed functional appliance**” when used to treat our young growing patients using *non-extraction orthodontic therapy*. It is used to create *growth modification* by unlocking a malocclusion so as to allow correction of CLII and CLIII malocclusions into a CLI position. It is important to have early correction of the patient into a CLI skeletal and dental relationship and to create ideal arch forms/shapes because as this is accomplished, it is easier for the patient to deprogram muscular/soft tissue dysfunctions (which contribute greatly to severe malocclusion) so as to create normal soft tissue versus hard tissue equilibriums (important for long-term stability).

We can “change the face” so as to improve the esthetics, sometimes dramatically, of our young growing patient during this phase of development.

Sometimes we must use “*extraction therapy*” in order to accomplish or goal of :

- An optimal CLI occlusion**
- An aesthetic harmony of the face, lips, jaws and teeth**
- A beautiful, pleasing smile to last a lifetime**

Orthodontic extraction therapy involves different treatment strategies as compared to **non-extraction** therapy. However, we can also “change the faces” of our patients for a better facial esthetic result when desired while using extraction treatment. Certain patients have excessive dento-alveolar protrusion and convex facial profiles (with or without crowding) and most often require extraction treatment to straighten the teeth while at the same time reducing the profile of the lips so as to have a more esthetically harmonious, CLI profile.

Which teeth to extract and what are the consequences

In most extraction cases we extract the 1st premolars. However, sometimes we must extract other teeth because of a specific clinical situation. “Premolar extraction” provides about 8 mm of space per quadrant and is the accepted way to provide space in order to: *Relieve crowding; Retract incisors that are too protruded; Move the molars mesially.*

One problem with extraction therapy is that often there is often too much space (premolar extractions provide about 8 mm of space per quadrant) so that controlling the amount on incisor retraction during space closure is important. Often we must avoid retracting the anterior teeth too far distally, because if the incisors are retracted too far and/or the incisor buccal crown torque is lost, then the result will be unacceptable esthetically as the mouth will become concave, the lips flatten too much and the nose and chin appear longer than they should.

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Premolar extractions provide space for alignment of crowded anterior teeth where, without the extractions, the treatment would create excessive anterior protrusion. And it allows us to be able to “camouflage” moderate CLII or CLIII jaw relationships when “Growth Modification” is no longer available (late adolescent and adult cases).

The important thing is deciding which teeth to extract and then how the spaces are to be closed. Will the incisor teeth be retracted, the posterior teeth be moved mesially or a combination of these?

Management of space closure

Let us assume that extraction therapy has been decided upon. We will now discuss the mechanics involved in retraction of anterior teeth and final space closure of “premolar extraction cases”, using “sliding mechanics” in the level slot line-up of the SWA.

The teeth are aligned and leveled using a series of Heat Activated Nitium wires (HA NiTi), starting with light flexible round wires and continuing to larger rectangular ones that apply a coupling force to the teeth. This can take a few months or several months depending on the amount of initial crowding and the age of the patient. Eventually we place the “working wire”, the 19X25 steel wire with brass wire hooks that are soldered on them in the spaces between the lateral and cuspid brackets. These hooks act as attachments for the “**en mass**” **space closure** using CLI, CLII or CLIII type forces.

When using the SWA, all movement of teeth to close spaces, with or without the extraction of teeth, is accomplished using the relatively simple idea of “**sliding mechanics**”. These sliding mechanics are accomplished only on the “working wire” (19x25 steel wire) which acts like the rail of a train track. The bracket or brackets (with the teeth attached of course) can “slide along” the wire or the wire can slide through the brackets (“**sliding mechanics**”) by the use of forces, which are applied with elastics and springs.

The heavy 19x25 steel wire helps resist unwanted tooth movements such as rotation, tipping, and torsional side effects and helps maintain the *desired tip and torque forces* to the brackets and thus to the teeth. These wires can also be re-shaped and lightly curved.

Controlled force = “Optimal force”

We have used various forces over the years, trying to avoid the unwanted side effects of too high a level of space closure force. Today, for CLI space closure (intra-arch) we have available the “**optimal force**” of the “Heat Activated” (HA) Nickel-Titanium (NiTi) closing springs”. These provide a low-level, measured force (in grams) that remains constant and at the same level even if stretched over a distance. Now we know what amount of force we are applying. These force systems can provide gentle, controlled space closure with “*translational tooth movement*” of about 1 – 1,5 mm per month. We can now minimize unwanted anchorage loss, tipping, rotation, and loss of torque during *CL I space closure*.

Spaces can also be closed using CLI, CLII and CLIII intra-oral elastics. These elastics are most often worn full-time and must be changed every day. These elastic forces can be measured when applied to the teeth, but in the case of CLII and CLIII elastic forces, the vertical as well as the horizontal vectors of force are increased as the mouth is opened during eating and speaking. Thus, elastics can be somewhat variable and intermittent, *but are generally reliable and give predictable forces and results if worn full time.*

Other systems (steel springs, elastomeric chains) tend to place heavy initial forces (that will create unwanted, damaging results) that rapidly decline towards zero in two to three weeks. These are **not recommended** for use when there are large spaces to be closed.

Different Anchorage situations

Anchorage: To obtain the desired result within the arch, we must control the amount of **anterior segment retraction** against **molar-bicuspid protraction**. After extractions and once the teeth are leveled and aligned, there is usually still some space to close. In some cases, we are closing the space 50%/50% with “reciprocal force” – that is a force that passes across a space and is “felt equally” by the 2 segments on each side of the space and thus the anterior teeth move distally the same distance and during the same amount of time as the posterior teeth move forward.

Mostly however, we must choose a system that provides some kind of “anchorage” (the word anchorage refers to the stability of the posterior teeth).

In orthodontics, we speak of 3 types of anchorage situations; these are:

- Moderate Anchorage
- Maximum Anchorage
- Minimum Anchorage

Moderate Anchorage is the most common situation. Once the anterior and posterior teeth are leveled using the extraction spaces for room to align them, the remaining space must be closed. CLI (intra-maxillary force) NiTi springs or CLI elastics can be used to close this remaining space “reciprocally”.

Maximum Anchorage: A case may appear to be similar to the situation as above, but the dentist can visualize on the study models that all the available extraction space will be used up during the alignment phase of the anterior teeth and/or of the distalisation of the anterior segment. In these situations, the anchorage force must be 100% so that the posterior segment does not come forward during the distalization of the anterior segment (usually the cuspids and the incisors).

Minimum Anchorage: - No anterior segment retraction while the space is closed purely by posterior tooth protraction. In these situations, the final closing of the space after the alignment phase is accomplished by bringing the posterior teeth forward so as to take up 100% of the space. Thus **100% “anterior anchorage”** is needed.

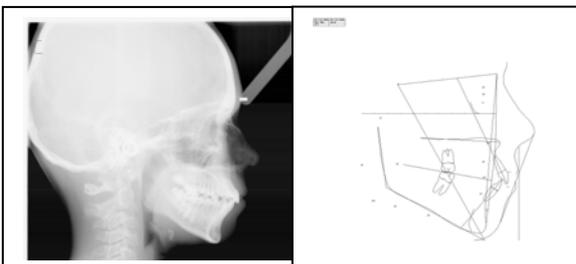
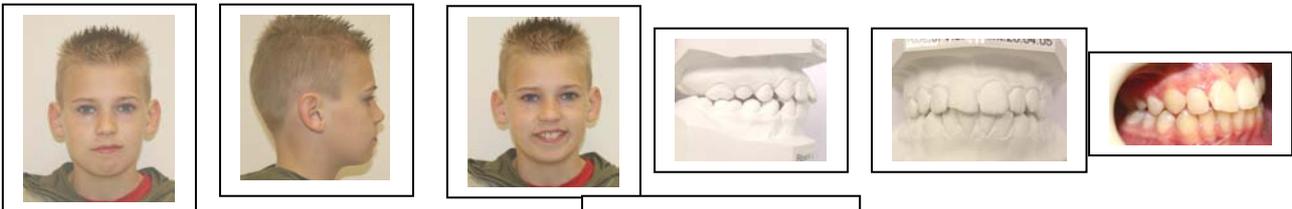
Conclusions

Using the SWA, all space closure is accomplished by using “**sliding mechanics**” and **proper anchorage**. The biomechanics of these must be understood, but with the SWA, they are very logical and not technically difficult to learn or to use. Most important is that when using this system properly, what we see as a result at the end of treatment are the following:

- An aesthetic harmony of the lips, jaws and teeth
- A beautiful, pleasing smile and facial appearance
- An optimal occlusion

The following is a case of an adolescent boy in which extractions were needed, not because of crowded teeth, but to improve the facial esthetics. In fact the patient has a skeletal and dental CLI occlusion with only slight crowding. As you will see in the photos, the patient has **Bimaxillary dento-alveolar protrusion (“BiPro”)** that needs to be reduced to obtain a nicer esthetic result.

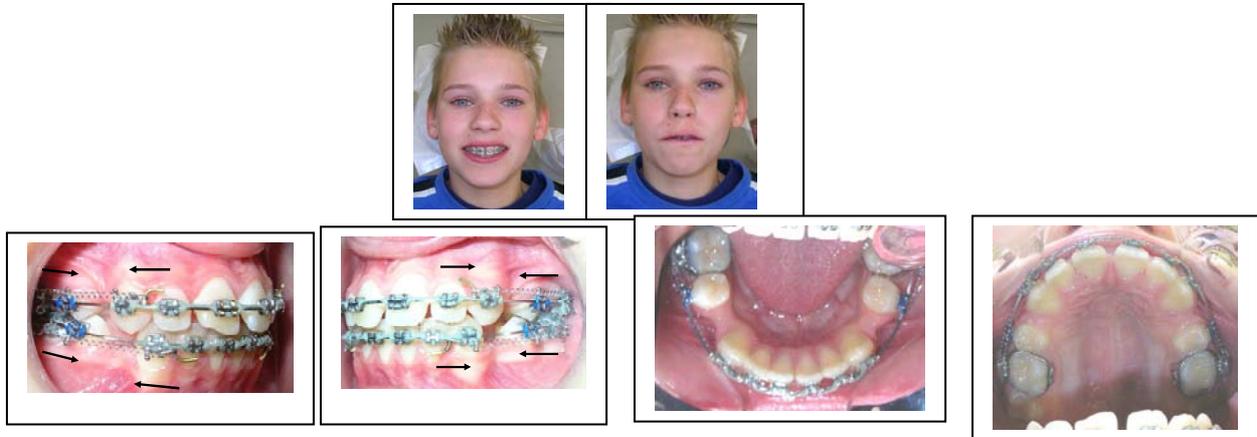
Case: Boy, Age 13 CLI dental and skeletal, Bimaxillary Dento-alveolar protrusion (BiPro), Extraction therapy to reduce lip protrusion of about 3 to 4 mm.



SNA 82.5
 SNB 78.7
 ANB 3.8
 Mx 1 - NA 10.7
 Mx 1 - NA Angle 26.2
 Md 1 - NB 11.9
 Md 1 - NB Angle 35.1
 Interincisor Angle 114.9
 PO - NB 1.7
 GO-GN - SN 35.0
 Md1 - APg 7.7
 AO - BO Wits -0.3
 Y axis 67.4

This cephalometric analysis indicates that the incisor positions are anteriorly-posteriorly too far in front of the “esthetic lines” to be considered esthetically ideal. This confirms the esthetic diagnosis that indicates extraction therapy.

6th month of treatment, the teeth are aligned. The esthetic evaluation was used to determine that the anterior segments should be retracted 3 mm (patient has to force his lips closed). Teeth 14, 24, 34 and 44 were extracted. *Moderate anchorage* mechanics will be used. The mechanics will be *reciprocal space closure* of the remaining 6 mm of extraction space per quadrant – the anterior segment will be retracted “en masse” 3mm while the posterior segments are equally and at the same time protracted 3mm using CLI, 200gram NiTi closed coil springs attached from the 1st molar hooks and stretched forward and attached to the arch wire posts (see photos).



8th month: progress photos – the anterior segment of 6 teeth, has approximately the same *root surface area* as the 2 posterior segments together of 4 teeth total. Thus the force, is “felt” equally on both sides of the extraction spaces, and the tooth segments move equally (reciprocally) towards each other the same distance in the same amount of time with a “translational type” movement of about 1 to 2 mm per month.



10th month : extraction spaces are closed



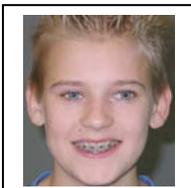
10th month



Before



Correction of the soft tissue dysfunctions – there is less tension of MAND lip and chin muscles

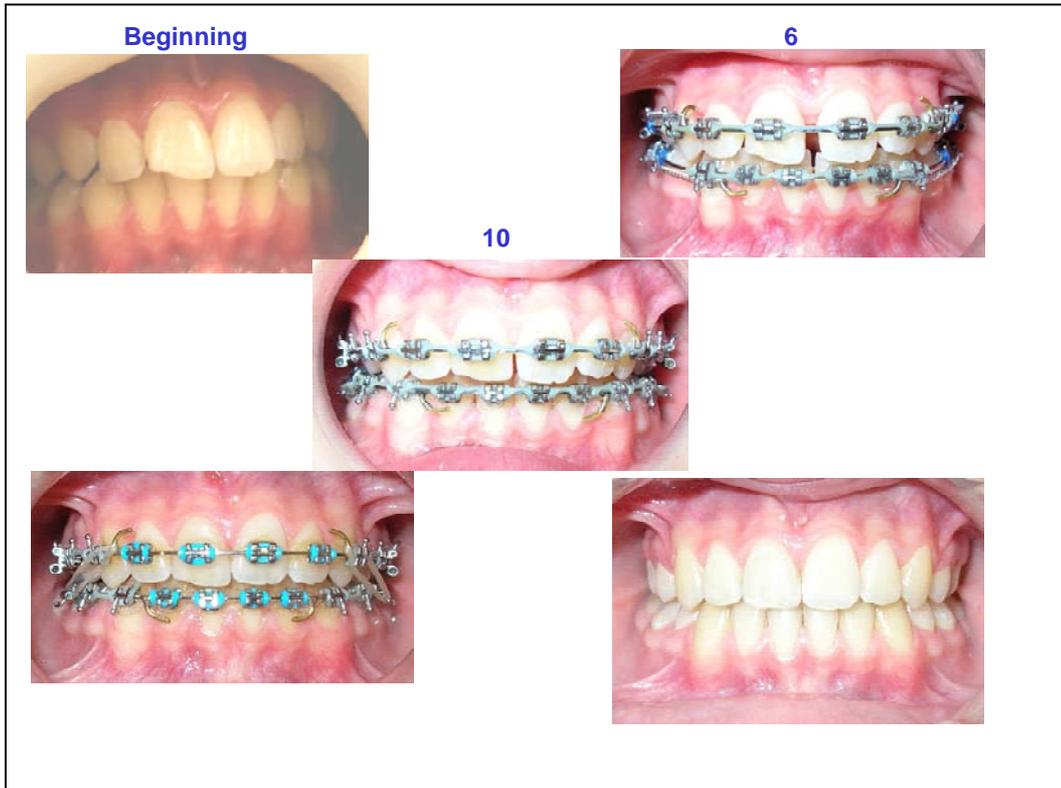


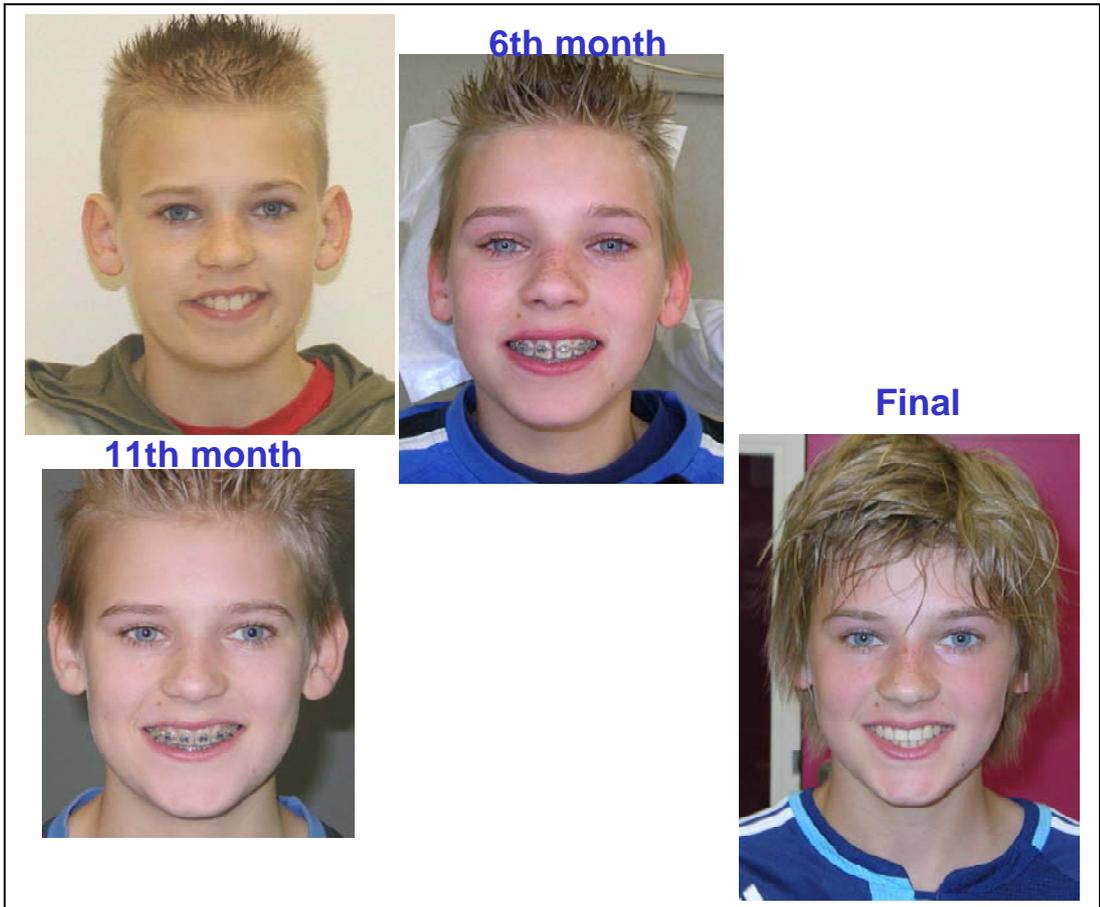
There is less of a “too full, too toothy” look.



Profile looks improved due to the **changes in the relationship** between the position of the incisors, the chin and the lips. Chin looks "stronger", face less convex.

Final – After finishing with finishing wires and "settling-in" of the occlusion, the braces are removed. Fixed lingual wires and removable retainers are placed.





Case: Adolescent female: CLI dental/skeletal, Bimaxillary dento-alveolar protrusion; Extraction of 14, 24, 34, 44; Space closure by maximum anchorage.

Beginning



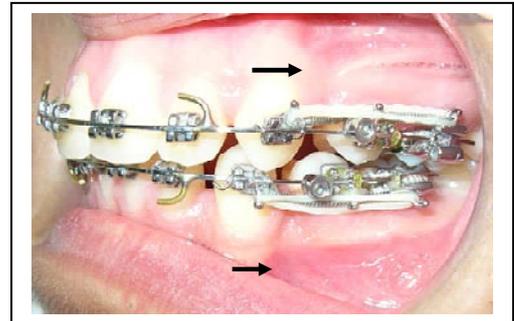
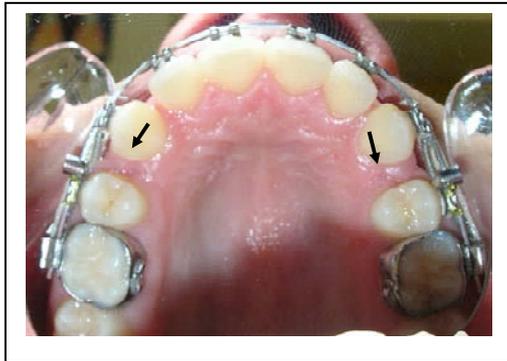
4th month: after 4 months of leveling, it is apparent that the patient has a "Too full" profile requiring virtually maximum anchorage. Appointment for the extraction of 14, 24, 34, 44.



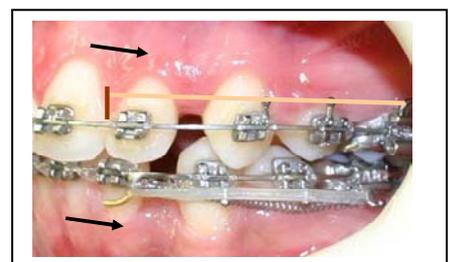
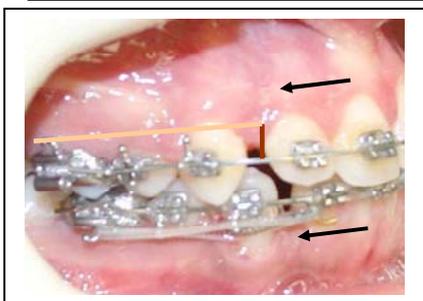
5th month: 19x25 posted steel wires. Posterior segment is stopped with lock-stops and the cuspids are “distalized first” to protect the anchorage. 200gram NiTi closing springs are in place 24/24. The patient adds 6mm CLI elastics 12/24.



6th month: Continue the same: posterior segment is stopped with lock-stops and the cuspids are “distalized first” to protect the anchorage. 200gram NiTi closing springs from the molar hooks to the cuspid hooks are in place 24/24. The patient adds 6mm CLI elastics 12/24.



8th month: Cuspids are now distalized. The lock-stops are removed. The incisors are now distalized “en masse” using the same CLI forces from the molars hooks to the wire posts.



13th month: Spaces are closed; final finishings.



Final month: Remove appliance, place retention.



Final : Facial esthetics

5th month



13th month



Final



Beginning



5th month



13th month



Final



Recall 12 months after the braces were removed. The patient is 18 years old

