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 therapy. It is used to create growth modification by unlocking a malocclusion 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 stop muscular/soft tissue dysfunctions (which contribute greatly to severe malocclusion) and create normal soft tissue - hard tissue equilibrium (important for long-term stability).

We can change the face, 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 when necessary while using extraction therapy. Certain patients have dento-alveolar protrusion and convex facial profiles (with or without crowding) and most often require extraction treatment to straighten the teeth and to reduce the “too full look” of the lips and the profile into a more esthetically harmonious, CLI profile.

In most extraction cases we extract the 1st premolars. However, often we must compromise on this idea because of a specific clinical situation. “Premolar extraction” provides about 7-8 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 7 to 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 incisors too far to the distal, 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 as the lips flatten too much and the nose and chin appear longer.

Preliminary extractions provide space for crowded incisor alignment where, without the extractions, the treatment would create excessive anterior protrusion. And it allows us to be able to “camouflage” moderate CL II or CL III 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?

Let us assume that extraction therapy has been decided upon. We will now discuss the mechanics involved in over-jet reduction and 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 Titanium wires (HA NiTi), starting with light flexible round wires and continuing to larger rectangular ones. This can take a few months or many months depending on the amount of initial crowding. Eventually we place the “working wire”, the 19x25 steel wire with soldered brass wire hooks 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 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) are “slid along” or “slide along” the wire (“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 proper posterior buccal-root torque. These wires also apply the desired tip and torque forces to the brackets and thus to the teeth. These wires can also be re-shaped and lightly curved.

We have used various forces over the years, trying to avoid the unwanted side effects of too much “closing force”. Today, we have available the nearly constant, light, optimal force of the Heat Activated (HA) Nickel-Titanium (NiTi) closing springs. These provide a measured force (in grams) even if stretched over a distance. We know what amount of force we are applying. These forces system 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 forces if used intermittently if patient compliance is not good. These elastics are most often worn full-time and must be changed every day. These elastic forces can be measured, but in the case of CLII and CLIII elastic forces, the vertical vector of force is increased as the mouth is opened during eating and speaking.

Thus, elastics can be 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 results) that rapidly decline in two to three weeks. These are not recommended for use when there are large spaces to be closed.

Anchorages: To obtain the desired result within the arch, we must control the amount of anterior segment retraction against molar-bicuspid protrusion. After extractions and once the teeth are leveled and aligned, there is usually still some space to close. In most cases, we are not closing the space 50%/50% with exactly equal “reciprocal forces”, so we must choose a system that provides some kind of “anchorages” (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
- Minimum Anchorage
- Maximum Anchorage

Moderate Anchorage is the most common situation. Once the anterior and posterior teeth are aligned using the extraction spaces, the remaining space must be closed. CLI (intra-maxillary force) NiTi springs or CLI elastics can be used to close this remaining space “reciprocally” – that is the anterior teeth move distally about the same as the posterior teeth move forward.

- Maximum Anchorage: - No incisor 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.

Maximum Anchorage: A case may appear to be similar to the situation as above, but the dentist can visualize on the models that all the available extraction space will be used up during the aligning of the anterior teeth. In these situations, the anchorage force must be 100% so that the posterior segment does not come forward during the distalization of the cuspids and the incisors.
Using the SWA, all space closure is accomplished by using “sliding mechanics” and proper “anchorage set-ups. 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, 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

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 very little crowding. As you will see in the photos, the patient has excessive Bi Maxillary Dento-alveolar Protrusion (“BiPro”) that needs to be reduced.

**Case: Boy, Age 13, dental age 12, CLI dental and skeletal, Bimaxillary Dento-alveolar protrusion (BiPro), Extraction therapy to reduce lip protrusion of about 3 to 4 mm.**

These cephalometric “numbers” indicate that the incisor positions are anteriorly-posterioy 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. It is determined that the anterior segments must be retracted 3 mm (patient has to force his lips closed). 14, 24, 34 and 44 were extracted. Moderate anchorage mechanics will be used. Reciprocal space closure of the remaining 6 mm of extraction space – the anterior segment will be retracted “en masse” 3mm while the posterior segments are equally protracted 3mm using CLI, 200gram NiTi closed coil springs attached from the 1 st molar hooks to the wire posts.

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, about 1 to 2 mm per month.
The following adolescent female patient was also treated with extraction therapy for several reasons: 1. to gain space to align the crooked-crowded teeth 2. to correct the CLIII dental malocclusion (skeletally the patient is about 4mm CLIII) 3. A high mandibular-plane angle is also a contributing reason (“long-face look”) 4. finally because of the excessive “BiPro/CLIII look”. The “too full” appearance is one of the chief complaints of the patient.

**Female, age 13 years, CLIII skeletal, high mandibular plane angle**

Problems to solve: CLIII dental - full canine and molar CLIII; camouflage the CLIII skeletal; posterior and anterior cross-bites; convex/BiPro/CLIII “Look”, “Peg-laterals”

**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.**

**10th month - extraction spaces are closed**

10th month  
Before

**10th month**  
**Before**
6th month: MAX & MAND: 19x25 posted steel wires; CLIII elastics, 8mm, 24/24 were used to distalize “en masse” the MAND anterior segment into a CLI position. At the same time this “reciprocal force” would mesialize the MAX posterior teeth towards a CLI position. Thus, the MAX space that was left over after aligning the crowded anteriors would be mostly taken up by mesializing the posteriors into CLI molar. The MAND space would mostly be used by distalizing the MAND anteriors from CLIII into CLI.

15th month – final finishing; Wires are “sectioned” (cut) distal to the cuspids; Start 4 mm delta elastics to settle in the occlusion; Control in 2 weeks

6th month – remove braces; fixed and removable retention appliances are made.

Before and after photos