

Orthodontic Treatment of CLIII Malocclusions using the Straight Wire Appliance

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In order to be able to provide high quality dental care, a dental practitioner must possess the knowledge of appropriate modern fixed orthodontic treatment available for his patients of various age groups. He should as well be aware of the treatment results that can be obtained using orthodontics. It is even more useful if the practitioner possesses the ability, in his own office, to use a fixed orthodontic appliance such as the Straight Wire Appliance (SWA).

To begin with, fixed appliances such as the Straight Wire Appliance (SWA), work at a different biomechanical level in comparison to removable appliances. This is because once the teeth in the arch are aligned and leveled (lined-up) using light and flexible round heat-activated (HA) Nickel-titanium (NiTi) wires, relatively large steel rectangular wires are placed in the brackets. This is the significant difference, because a rectangular wire in the rectangular slot of the bracket produces a "coupling force" in the bracket that is attached to the tooth, and of course this "coupling force" is transferred to the crown as well as the tooth root. Because of this, the root can be moved through the bone in all directions. Bodily movement or "tooth translation" (crown and root move the same distance at approximately the same time) is possible. This is important because in order to obtain a stable result, the crown must be aligned below (or above) the root apex at the end of treatment. But also with the coupling effect, the tooth can be properly angulated mesio-distally, torqued bucco-lingually (a very important esthetic consideration as well), rotated "bodily" around its center and even intruded or extruded in a controlled manner. Thus, "Three Dimensional" movement is possible. Without this ability of this type of tooth movement/control, the practitioner can not obtain a "super CLI occlusion". If tooth movement is continuous, and the very lightest forces ("optimal forces") needed to move the teeth are used, then the teeth move optimally in the bone without damage to the periodontal ligament.

The SWA is an *orthodontic* appliance used to position the teeth in an ideal position. It can also be considered as a "Fixed Functional Appliance" that can be used to orthopedically correct CLII and CLIII jaw discrepancies in growing patients.

If the treatment of a child is started early, one can work with nature so as to have as a result an esthetic harmony of the lips, jaws and teeth along with a beautiful, pleasing smile and facial appearance. If started too late in the growth and development period of the patient, then often the only other solution for an acceptable result would be extraction therapy or maxilo-facial surgery.

Today, it is imperative to incorporate an "esthetic based diagnosis and mechanical treatment planning". This is combined with the traditional diagnostic tools such as study models of the teeth, the cephalometric x-ray and the cephalometric analysis.

The most common malocclusions (about 90%) are CLI and CLII. This article will address **CLIII malocclusions** as patients with these classifications of malocclusions seem to cause the most anxiety for many practitioners. However, an understanding of what is possible and what are the limitations of the treatment of these types of cases will hopefully relieve these anxieties.

CLIII "Skeletal malocclusions" require specific strategies. Most often these types of malocclusions are exacerbated by soft tissue "functional problems" or "dysfunctions". These dysfunctions mostly originate in early childhood with finger sucking habits. Those sucking habits incorporate hyper-actions of the soft tissue (the lips, cheeks, and tongue), during swallowing and breathing. A pattern of actions develops which breaks the *normal equilibrium between the soft tissue and the alveolar bone and teeth*. Also, the position of the fingers directly against the teeth during these actions, physically push the teeth and the underlying alveolar bone out of a normal position. We see this in CLIII cases and especially CLIII open bite cases. If these bad habits continue long term into the "mixed-dentition period", then the vicious cycle of soft tissue dysfunctions and the loss of equilibrium remain, even after the sucking habit has stopped.

Every time the child swallows with these soft tissue patterns that are now established, there is an effect on the teeth and the alveolar arches. We often see as a result: a narrow, hypo-developed maxillary arch with the maxillary molars rotated mesio-lingually and the anterior and posterior teeth tipped lingually. Because of this, the maxillary arch form is too narrow to contain the mandibular arch in a CLI position and there is usually cross-bite posteriorly and anteriorly. The lower jaw is habitually locked in a forward position. If "habitual mouth breathing" is also part of this pattern, we often see a change for the worse in the maxillary posterior teeth. They are forced downward by the cheek pressure and hyper-develop vertically downward. This is commonly known as "vertical maxillary excess". This contributes to a "long face look" and a vertical growth pattern of the mandible. Obviously there are many variations, but this is the basic concept.

The overall strategy in these **CLIII cases** is to start early enough so that we can *work with nature* to try to solve these problems. The more severe the problems, the earlier the case should be started. Often we start cases at dental age 8 to 10 and do a 2-phase treatment.

Using the SWA, we can alter or "modify the existing growth pattern". If we position the teeth (along with their alveolar ridges) and the jaws into ideal positions at an early enough age in a child's development, then the surrounding soft tissue dysfunctional patterns can be disrupted and hopefully functionally re-educated. We try to obtain *proper "lip closure"* early.

In orthodontic cases in which treatment is started at an earlier age, most **CLIII cases** are "pseudo CLIII". We most often see a maxilla which is "under-developed" sagittally as well as transversely, and a prognathic mandible. The truth is that the "CLIII Look" is often caused partly by a retruded, underdeveloped maxilla and partly by a protruded mandible. The prognathic mandible is very often the result of a "forward mandibular slide" due to teeth

interferences. These interferences occur during the eruption of the anterior teeth (baby or permanent) and result in an anterior cross-bite position. Every time the mandible functions, it is forced into this anterior and often a lateral CLIII position. We often see the mandible in a CLIII position with a unilateral cross bite and the lower midline displaced towards that side. The cross-bite can as well be bilateral posterior as well as anterior. Because the tongue also tends to rest and to function in a lower position (not in the palate), the mandibular arch is well shaped, flat and with little or no crowding, and the maxillary arch is smaller and “under-developed” sagittally and transversely, and has crowding. One of the main reasons that the maxilla is underdeveloped sagittally is because the maxillary incisors erupt lingually to the mandibular incisors, the natural forward growth of the maxilla is thus held back/slowed down by the mandibular anterior teeth and so tends to be hypo-developed sagittally. The transverse/horizontal deficiency is often caused by soft tissue hyper-functions of the cheeks and mouth breathing habits that narrow the palatal width. Often we see an **anterior open bite** with an out of position tongue that thrusts forward into the open bite when speaking, eating and swallowing. Usually there is dysfunctional lip closure.

The strategy here is to stop the mandible from being forced forward into a CLIII position. This is accomplished by enlarging/expanding the arch form of the maxilla so that eventually the teeth in the maxillary arch can contain the mandibular teeth in a CLI position. We must “unlock” this forward positioned mandibular CLIII occlusion to allow a natural growth pattern. Often once the occlusion is unlocked because the maxillary arch form is widened and ideally reshaped, the patient automatically moves and re-centers the mandible towards a **CLI position**. This allows as well an early, ideal positioning of the condyles so that they can grow in harmony with the rest of the bony structures and the face.

We start by enlarging the maxillary alveolar ridge and teeth both sagittally and transversely by using the SWA and wires (wires are the forces that move the teeth). Usually, after a few weeks of palatal expansion and widening with wires and/or a Heat Activated Nickel Titanium transpalatal expander, the cross bites are corrected, thus the interferences that cause the dysfunction of the mandible are removed. Now the mandible re-centers naturally and can be contained within the perimeter of the maxilla also resulting in the line-up of the midlines. CLIII elastics are sometimes needed for a short time in order to obtain a Super CLI occlusion by moving the maxillary arch slightly anteriorly and the mandibular arch slightly distally. Other combinations of inter-arch elastics, such as “vertical bite-closing elastics”, may be needed in these cases to obtain a properly interdigitated occlusion.

In all cases, once we have corrected our initial problems and the patient is in a CLI occlusion, we hold this corrected position with “finishing wires” for 3 to 4 months. These finishing wires (21.5x27 HA NiTi wires), by their coupling force that is applied in the slot of the brackets, automatically “read or express” what is pre-programmed in the SWA – that is, the final ideal angulations and torque of the crowns and roots as well as the final upper and lower arch forms. If we take the time for this treatment phase, we will have improved esthetics and a better long-term stability. Any repositioning and detailing of the brackets needs to be done now.

If all looks good after this period, the case is then finished over the next month or 2 by dropping back to smaller HA NiTi wires. If needed, further “settling-in” the bite can be accomplished by re-positioning any poorly positioned bracket(s) and/or by using “bite settling elastics” (“delta”, “box”) to obtain a good inter-cuspidation. Light “stripping” is used during this period in the lower incisor area to enhance retention.

In all cases, proper retention is needed. Before removing the braces, a “dead soft wire” is bonded to the lingual surface of the 6 or 8 front teeth of the mandibular and maxillary arches. It is in this area where teeth would start to crowd-up first if the teeth are not retained. Then the braces are removed and impressions are made for “Wrap-around” Hawley retainers for both the upper and lower arches. These are to be worn full-time for 6 months, then at night for 18 more months. If these types of removable retention plates are not used, and only lingual wires are placed, then there is a possibility that the new arch forms will be lost. Those retainers plates also help to keep open bite cases closed. After 24 months of retention, the fixed wires are removed and the Hawley plates are continued to be worn at night until the end of the adolescent growth period. I advise the patients to wear them, as needed, indefinitely if they want to keep their teeth optimally straight.

Treatment of CLIII Cases using the Straight Wire Appliance
 Treatment of Young People and Adults
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In habitual centric occlusion, the *Wits cephalometric analysis* could indicate a significant CLIII skeletal disparity. However, to determine if this is a "pseudo CLIII Skeletal" situation and to determine if non-extraction treatment is possible, the examining doctor should position the mandible in centric relation and observe if an "end-to-end" (or almost) incisor position is possible. If so and if there is little mandibular crowding and/or the mandibular anterior teeth are normally positioned (not too lingually inclined), then non-extraction treatment is highly possible.

Case 1: Boy aged 11 years ; CLIII dental and skeletal – "a functional problem"



SNA 76° SNB 78° ANB -2°
 +1/NA 20°; +1/NA 4mm
 -1/NB 22°; -1/NB 4mm
 Mandibular Plane Angle = 30°
 Wits analysis = -6.5

The mandible is sliding/functioning forward into a CLIII position due to dental interferences. The maxilla is too small to contain the mandible inside its perimeter.

Treatment Plan: 1. The maxillary arch will be "expanded" so as to remove the dental interferences causing the mandibular forward slide, and permitting the maxillary arch to contain the mandibular arch in a CLI position. Once the mandible is freed-up by eliminating the cross-bite, there occurs an ideal positioning of the condyles so that they can grow in harmony with the rest of the bony structures and the face.

2. Create ideal arch forms and then maintain the space until all the permanent teeth erupt.

Beginning: the bite is opened using composite built-up on the molars; "2x4" with a 16 HA NiTi wire that simply tips the incisors forward.



3rd week: a 16X16 Steel Utility Arch Wire that is adjusted so as to advance the 4 incisors about 1.5mm. The cross-bite is already corrected and the mandible can now close in a neutral position



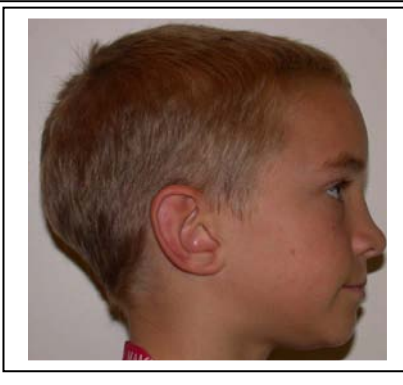
4th week: same 16X16 Steel Utility Arch



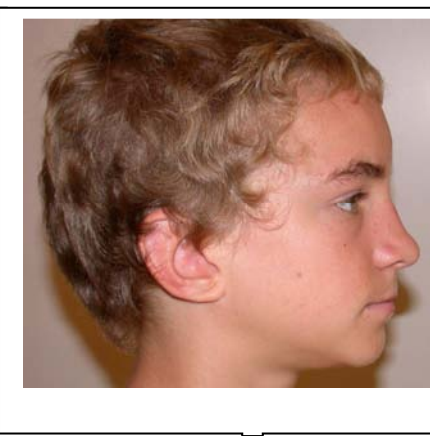
4th month: Start treatment on mandibular arch — 2X4 with 16x16 Utility Arch Wire



8th month: 19x25 steel wires. This is the end of the **1st phase of treatment**. The "pseudo CLIII growth pattern" has been corrected to a CLI occlusion. Waiting for the permanent teeth to erupt. End of the First Phase of treatment.



24th month: CLI occlusion is firmly established. No CLIII elastics were needed in this case.

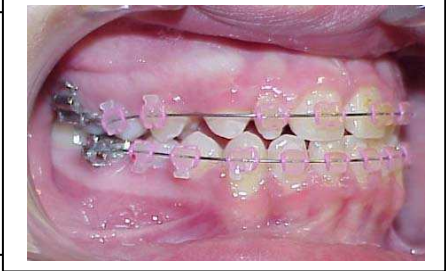
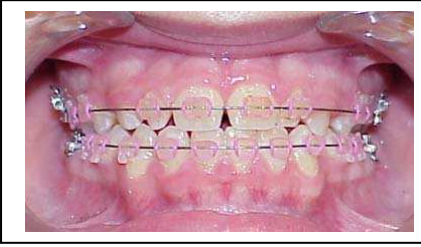


Case 2: Girl age 11.5 years; CLIII dental and skeletal



Skeletal CLIII: *Wits analysis = -4*

Situation at the end of the leveling phase : a "CLIII Look" with "CLIII molar relationship" relationship



19X25 steel wires in place; Beginning of 3 months of CLIII elastics, full time (24/24). CLIII elastics will move the maxillary arch forward a little and the mandibular arch distally a little so as to correct the CLIII into a CLI.



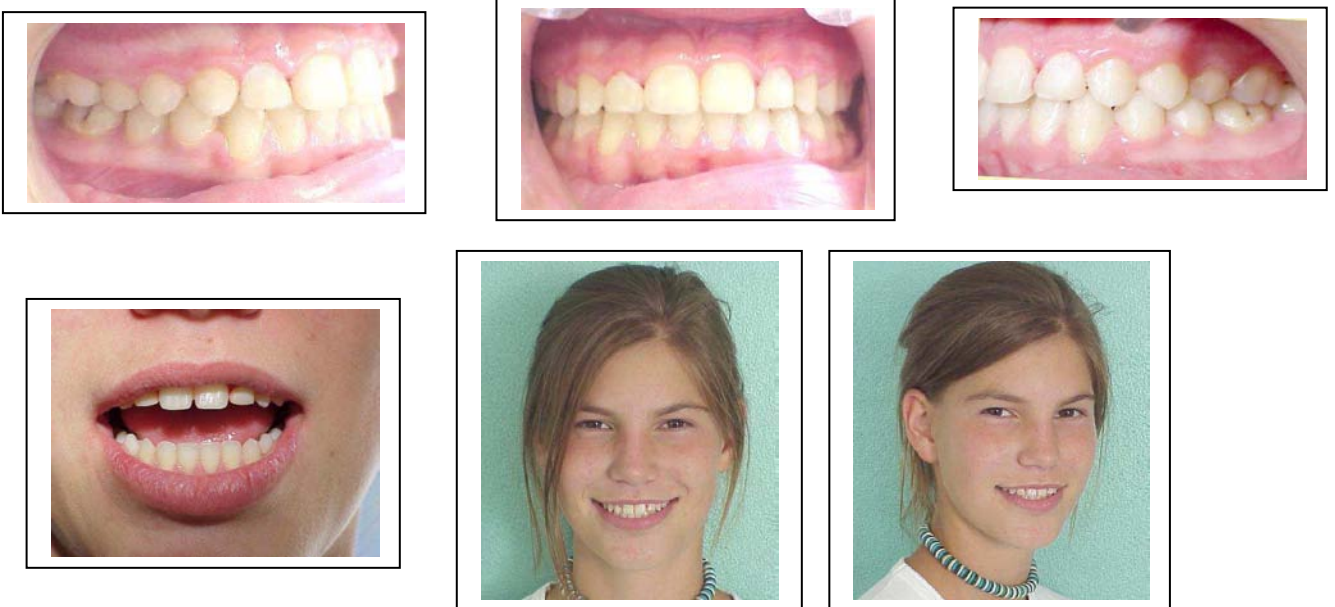
After 1 month of CLIII elastics



After 3 months of CLIII elastics: A CLI occlusion and improved facial esthetics with the "CLIII Look" corrected

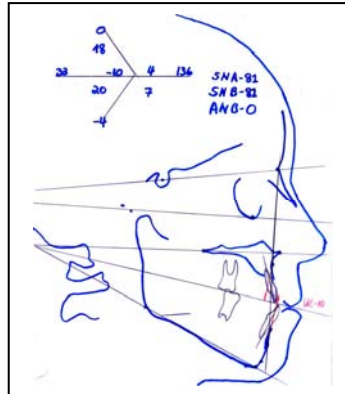
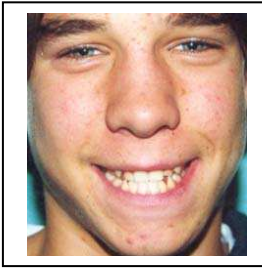


Final: CLI molar and cuspid



Case 3: Adolescent boy, 14 years old
cross-bite and midline discrepancy

CLIII skeletal and dental "Mandibular slide" to the right causing



Wits analysis = -10mm

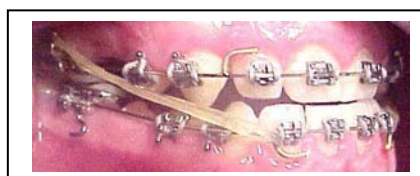
Beginning: bracketing of the teeth and a 16 HA NiTi wire is placed for 2 months to begin the aligning, leveling. During this phase the maxillary arch will be slowly expanded by the wires so as to free up the mandible allowing it to re-center in a condylar neutral position. The maxilla will contain the mandible within its perimeter.



4th month: the cross bite is corrected by expanding the maxillary arch using steel wires combined with a 6mm "cross-elastic" for 3 weeks.



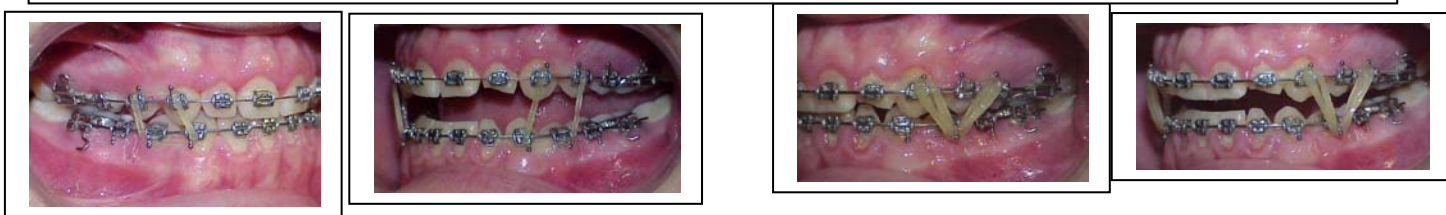
5th month: the cross bite is now corrected and the mandible has re-centered automatically on the skeletal midline and the maxilla can now contain the mandible in a final CLI position. 19X25 posted steel wires are in place; begin CLIII elastics, 2/24 for 3 months.



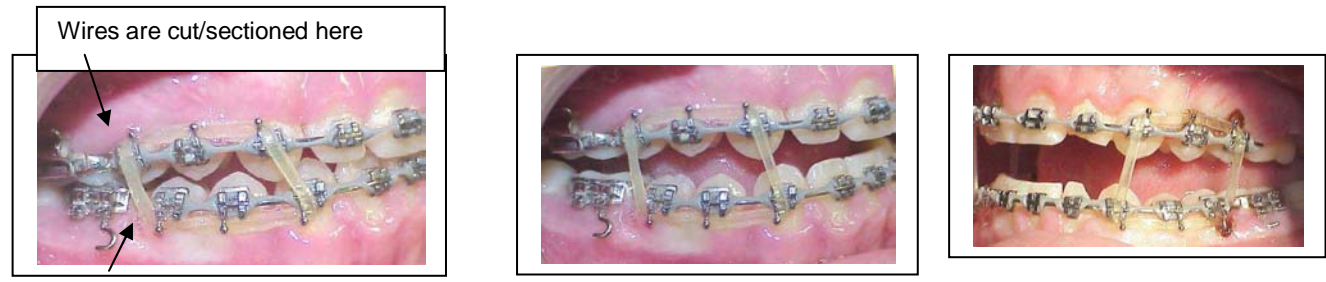
9th month: the CLIII dental bite is now corrected to a CLI, and the mandible is re-centered on the skeletal midline. 19X25 steel wires are in place; begin 10mm box elastic on the wire posts, 24/24 to start closing-down the anterior open bite and to start the settling in of the posterior teeth.



10th to 12th month: 21x25 HA NiTi wires in place. The anterior open bite is corrected; the posterior occlusal segments can be settled-in using various types of "bite settling" elastics, 24/24.



14th month: 21x25 HA NiTi wires are cut/sectioned mesially to the molars to allow settling of the premolars and canines using 10mm Box elastics, 24/24.



Patient at age 18 years – 2 years after the braces were removed

