Feature

Herbst Appliance

Fixed-Functional Appliance
Class II Skeletal Malocclusion

By Brock Rondeau, DDS, IBO

The Herbst Appliance is designed specifically for treating patients with Class II skeletal malocclusions when patients present with normally positioned maxillas and retrognathic mandibles. This is the most common form of skeletal Class II malocclusion as 80% of patients have this problem. The diagnosis of a retrognathic mandible dictates some type of functional jaw orthopedic appliance be utilized to move the lower jaw forward. The Herbst Appliance is gaining in popularity due to the fact that it is a fixed-functional appliance where patient cooperation is not a problem. With the newer designs, the upper and lower parts of the Herbst are cemented on the upper and lower first molars via stainless steel crowns and the mandible is held in a protrusive position for a seven month period utilizing a special rod and tube assembly.

History of Herbst Appliance

Emil Herbst developed his appliance in the early 1900's and presented it for the first time at the International Dental Congress in Berlin in 1909. He wrote three articles about his appliance in 1934 but the appliance was not widely used until Dr. Hans Pancherz from the University of Giessen in Germany began writing about the appliance in 1979.[1] Since then, Dr. Pancherz has written many articles about the various designs for the Herbst Appliance and many orthodontists, including Dr. James McNamara and Dr. Terry Dischinger, have embraced the technique since they prefer a fixed-functional appliance over the removable functional appliance, which is so dependent on patient cooperation for its success.

THE NEWEST CANTILEVER HERBST APPLIANCE can be described as follows:

1. Upper Part
   a. Stainless steel crowns attached to the maxillary first molars
   b. Occlusal rests on maxillary first bicuspids
   c. Hyrax screw for transverse development
   d. Axle soldered to the buccal of maxillary first molars
   e. Tube attached to the axles on the buccal of the maxillary first molars
   f. Occlusal rests on maxillary second molars

It should be noted that the forces generated by the Herbst are too great for ordinary molar bands to withstand. Either special custom-made bands that are thicker than normal or stainless steel crowns must be utilized to avoid fracture when the axles are soldered to the buccal surfaces.[2]

2. Lower Part
   a. Stainless steel crowns attached to the mandibular first molars
   b. Cantilever arm soldered to the buccal of the mandibular first molars, extending to the mandibular first bicuspids
   c. Axle soldered to the cantilever arm in the area of the first bicuspids
   d. Rod attached to the axle in the area of the first bicuspids
   e. Occlusal rests on mandibular first bicuspids
   f. Optional midline screw for transverse development. The ideal time to use the midline screw is in mixed dentition prior to the eruption of the permanent mandibular cuspids.
   g. Optional occlusal rests on mandibular second molars

The rod on the lower part of the Herbst Appliance fits into the tubes of the upper part on both sides, which acts to position the lower jaw forward and helps to correct the Class II skeletal and Class II dental malocclusion.

Indications for Herbst Appliance

1. Class II Div 1 Malocclusion

The Herbst Appliance is an ideal appliance for the treatment of a Class II skeletal problem in patients with moderate to severe overjet (5 mm. or more) when compliance is an issue. In 80% of the Class II skeletal malocclusions, the maxilla is positioned correctly in the sagittal plane and the mandible is retrusive.[3] The Herbst is a fixed functional appliance which is extremely efficient at orthopedically repositioning the mandible to its correct Class I skeletal position.

2. Proper Arch Width

One important key for successful treatment with the Herbst or any functional appliance is the proper preparation of the maxillary arch. Advise the patient to posture the lower

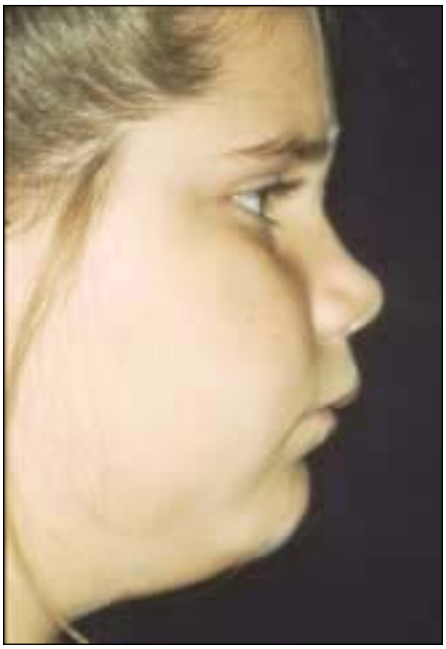

Figure 1: Pre-Treatment
Prognathic Maxilla — Retrognathic Profile

Figure 2: Pre-Treatment
Overjet 10 mm. — Anterior Open Bite 5 mm.

Figure 3: Midline Hyrax Screw
Thumbsucking Crib

Figure 4: Herbst Appliance
Advance Mandible 6mm.

Figure 5: Lower Cantilever
Crowns Lower First Molars
Occlusal Rests First Bicuspid

Figure 6: Add 3 mm. Shim
Lower Rod
Advance Mandible 3 mm.

Figure 7: Start Treatment
Advance Mandible 6mm.

Figure 8: 7 Months Later
Mandible Advanced

jaw forward from Class II molar to Class I molar relationship. If the posterior teeth are in buccal crossbite, the case will not be stable so the maxilla must be developed transversely with the hyrax screw in the upper part of the Herbst prior to mandibular advancement.[4] However, if both upper and lower arches need transverse development, hyrax screws can be added to both upper and lower parts of the Herbst Appliance and arch development and mandibular advancement can occur simultaneously with no binding of the rods in the tubes.

3. Proper Arch Length

Prior to the advancement of the mandible, the maxilla must be properly developed sagittally. Arch lengthening appliances that are sometimes utilized prior to the Herbst Appliance include:

a. Anterior Sagittal
A removable orthopedic appliance utilized mainly in mixed dentition Class II Div 2 malocclusions to torque lingually displaced maxillary central incisors.

b. Posterior Sagittal
A removable orthopedic appliance utilized mainly in mixed dentition to distalize maxillary first molars.

c. Maxillary SAG 2000 (Series 2000 Appliance, Dr. Michael Williams)
A fixed functional appliance utilized in late mixed or permanent dentition to torque vertical maxillary incisors.

d. Maxillary DMJ 2000
A fixed functional appliance utilized in mixed dentition or permanent dentition to distalize maxillary first molars.

4. Proper Torque Maxillary Incisors

a. If the maxillary incisors are flared, they must be torqued either with a removable appliance such as a Schwarz Appliance with a labial bow prior to treatment or with the straight wire appliance during treatment. If the maxillary incisors are flared excessively and the mandible was advanced to an end to end incisal position, this could result in a Class III malocclusion due to excessive mandibular advancement. After the maxillary incisors are detorqued with the straight wire

appliance, the patient could have an anterior crossbite, which is totally unacceptable. Therefore, it is imperative that the maxillary incisors be torqued correctly prior to the advancement of the mandible.[5]

b. If the maxillary incisors are too vertical, they must be torqued properly with an Anterior Sagittal or Maxillary SAG 2000 Appliance prior to the Herbst Appliance or during treatment with the straight wire appliance. If the maxillary incisors are too vertical, it will be impossible to advance the mandible adequately to correct the overjet and to obtain Class I molar and Class I cuspid relationship.

5. Proper Torque Mandibular Incisors

One of the main problems with all functional appliances, including the Herbst, that encourages advancement of the mandible, is their tendency to cause flaring of the lower incisors. Therefore, in order to help prevent excessive flaring and gingival recession, the lower incisors must be detorqued prior to the Herbst either with removable appliances with labial bows or with straight wire.

6. Improved Profile When Mandible Advanced

Patients are motivated to wear the Herbst Appliance due to the fact that their profile and appearance are significantly improved when the mandible is repositioned forward.

7. TM Dysfunction

Most Class II skeletal malocclusions have constricted maxillary arches, retrognathic mandibles and deep overbites. A large percentage of these patients have numerous signs and symptoms of TM dysfunction. The majority of these patients have condyles which are posteriorly or superiorly displaced with resultant compression of the nerves and blood vessels in the bilaminar zone distal to the condyles. The sooner treatment is initiated with the Herbst Appliance to move the condyles down and forward, the faster the patient's symptoms will subside.[6]

8. Normal Airways

Herbst Appliance treatment is most effective in patients who are nasal breathers and have normal airways. If the patient is a mouth breather resulting from airway obstruction, then the problem must be corrected. Possible causes include swollen adenoids and tonsils and nasal obstruction due to a deviated septum, enlarged turbinates, polyps or allergies. These patients must be referred to an ear, nose and throat specialist prior to treatment to correct some of these problems. It should be noted that the Herbst Appliance can help improve nasal breathing by developing the upper arch and advancing the mandible, but clinicians must also consider and treat the above mentioned problems to minimize the tendency for relapse.[7]

9. Requires no patient compliance to attain the desired treatment results.
10. The objective in mixed dentition is to correct all Class II skeletal malocclusions to Class I skeletal prior to the eruption of the permanent teeth and the placement of fixed braces.
11. The Herbst encourages condylar growth in growing individuals, which helps Class II skeletal patients with retruded mandibles to reach their true genetic potential.
12. The advancement of mandibular incisors is an advantage in Class II Div 2 cases. It is estimated that the mandibular alveolar processes can advance between 1.5 to 3.5 mm.[8]
13. The Herbst is good for vertical growers as the maxillary first molars are subject to distalizing and intrusive forces that help control the vertical.[9]
14. Patients prefer the 24-hour constant forces of the Herbst Appliance as compared to the intermittent forces generated by cervical facebow headgear, Class II elastics or removable functional appliances.
15. Does not interfere with speech.
16. The Herbst encourages anchorage in the maxillary arch as maxillary molars do not extrude and do not move mesially.
17. The Herbst is a strong appliance which is cemented to the maxillary and mandibular first molars and therefore cannot be lost.
18. While the Herbst Appliance is ideal for growing individuals, since 50% of the changes are dento-alveolar, it can also be used for adults with mild to moderate Class II skeletal malocclusions.

Contra-Indications for Herbst Appliance

1. Not to be used for Class I or Class III skeletal malocclusions
2. In the case of a prognathic maxilla and a normally positioned mandible, the use of a Herbst Appliance would result in the creation of a bi-maxillary protrusion with a prognathic maxilla and a prognathic mandible.
3. Patients cannot sleep on their sides as the lower axle on the cantilever arm digs into their cheek. Patients must be able to sleep on their backs in order to eliminate this irritation.
4. Lower incisors that are flared or proclined. During Herbst Appliance treatment, as with all functional jaw repositioning appliances, fixed or removable, there is a tendency to flare the lower incisors. This is due to a loss of anchorage on the lower arch because of the forces exerted on the lower incisors by the Herbst Appliance. A possible solution for cases where the proclination is slight would be to place straight wire brackets on the lower arch from the lower left second bicuspid to the lower right second bicuspid. I would recommend a special Class III prescription for the lower anteriors -5º torque rather than the standard -1º torque for lower incisors. These Class III straight wire brackets would, in combination with power chain placed from cuspid to cuspid, help to detorque the lower incisors and help to minimize their proclination during Herbst treatment.

Construction Bite

a. When using the Cantilever Herbst with the stainless steel crowns, no construction bite is necessary since there is no vertical component to the appliance. This is due to the fact that the molars cannot erupt because of the four stainless steel crowns. The lab will fabricate the Herbst by advancing the mandible up to 6 mm. depending on the overjet. If the overjet is more than 6 mm., after 3 months the clinician will have to unscrew the rod from the lower part, and add a 2 mm., 3 mm., or 4 mm. shim to the lower rod to advance the mandible the desired amount. The vertical correction will have to take place when the Cantilever Herbst is removed and a Twin Block II Appliance or Rick-A-Nator is utilized to allow for the eruption of the molars and bicuspids.

b. When using the lower removable acrylic part with the Herbst Appliance, a construction bite is necessary. A baseplate wax construction bite must be taken to advance the mandible 6 mm. and provide an interincisal opening of 3 mm. This will allow for adequate thickness for an anterior acrylic cap.[10] The lower removable acrylic part may be removed for cleaning and covers the lower primary molars or lower bicuspids. There is no acrylic covering the lower first permanent molars which are then encouraged to erupt and correct the deep overbite.[11]

Insertion of Herbst Appliance

Most Class II skeletal malocclusions have a constricted maxillary arch and a normal mandibular arch. The maxillary arch must be expanded utilizing the hyrax screw on the upper part of the Herbst Appliance. If the upper part is expanded with the rods and tubes connected, resulting in a binding in the tubes, this could cause the patient some difficulty when opening and closing during talking and chewing. I would suggest the following sequence when inserting the Herbst Appliance:

1. Place separators mesial and distal to the maxillary and mandibular first molars one week before the insertion of the appliance. Must have maximum separation since the stainless steel crowns are much thicker than ordinary molar bands.
2. Unscrew maxillary tubes from the axles on the maxillary first molars. The hex head screws are removed with a special screwdriver.
3. Insert upper part of the Herbst with the hyrax screw cementing the stainless steel crowns on the maxillary first molars with glass ionomer cement (Ideal Band Cement, GAC). Place wax around the axles prior to cementation.
4. Turn the midline (hyrax) screw twice per week until adequate development of the maxilla has been achieved. To confirm that proper expansion has been achieved, advance the mandible to Class I molar relationship and ensure that the buccal crossbite has been corrected.
5. Screw the tubes into the axles on the maxillary first molars using the hex head screwdriver. To help ensure that the screws will not become loose, it is advisable to first add some Ceka Bond to the screws beforehand.
6. Tie in the lower part to make sure that the rods on the lower part fit properly with the tubes on the upper part. The rods must be long enough so that when the patient opens wide the rods will not come out of the tubes. Check to see that the rods do not protrude more than a few millimeters past the axle on the upper or you will have impingement on the cheek when the patient occludes in centric occlusion. If you have to cut off part of the rod to obtain the correct length, smooth it off so the rod has no restriction and slides freely in the tube when the patient opens and closes.
7. Before attaching the rods to the lower axles, the clinician must consider how much mandibular advancement will be required with the Herbst Appliance. If the overjet is 6 mm. then the appliance can be constructed to advance the mandible 6 mm. and Ceka Bond could be used to secure the screws in the axles. The use of Ceka Bond makes it very difficult to remove the screws. In cases where the overjet is excessive such as 10 mm. the mandible will have to be advanced in two stages. The appliance would initially be made to advance the mandible 6 mm. Then after 2 to 3 months, the rod would be removed from the lower part and a 4 mm. shim added to advance the mandible. After the 4 mm. shim was added, then Ceka Bond could be used to secure the screws.
8. Place the lower rods into the upper tubes and cement the stainless steel crowns on the lower appliance with glass ionomer cement. Prior to cementation of the stainless steel crowns on the lower first molars, place wax around the screws to prevent cement from getting into the screws.

Disadvantages of Herbst Appliance

1. The cantilever arm on the lower part must be fabricated in close proximity to the buccal surfaces of the posterior teeth. The main disadvantage of the Herbst Appliance is that the axles and screws which attach the rods to the lower part stick out into the cheek in the area of the lower first bicuspids. This is extremely irritating and patients must be encouraged to sleep on their backs to minimize the discomfort. To help prevent any problems in the cheek area, an elastic is placed on the rod before it is attached to the lower part with the hex head screw. Then a cotton roll is attached to the rod using the elastic and is worn for approximately one week at night to help protect the patient's cheek from the cantilever arm. The patient is given several cotton

rolls and is instructed to change the elastics every night before bedtime. A special elastic could also be placed around the hex head screw to help reduce the irritation.

2. The removal of the Herbst Appliance is another situation that can be time consuming. Prior to the cementation of the stainless steel crowns, I recommend the following:
   a. Place Vaseline on the occlusal surface of the molars.
   b. Place a hole in the occlusal surface of the crown approximately 4 mm. in diameter.

There is a special instrument for the removal of the stainless steel crowns at the end of treatment. Otherwise, the crowns will have to be cut off with carbide burs which is an extremely time consuming procedure.

Class II Div 2 Mixed Dentition

The Herbst Appliance is a very effective appliance in the treatment of Class II Div 2 malocclusions. Maxillary and mandibular incisors are usually retroclined and, therefore, the fact that the Herbst Appliance causes the lower anteriors to procline can be used advantageously to help create a stable anterior occlusion. The proclination of the upper and lower anteriors must be a treatment objective in the treatment of all Class II Div 2 malocclusions in order to create a normal interincisal angle so that this will help prevent the recurrence of a deep overbite.

Prior to the utilization of the Herbst Appliance, consideration must be given to the alignment of the maxillary incisors. For patients in mixed dentition, the utilization of a three-screw Anterior Sagittal Appliance is sometimes indicated. The midline screw is important to help develop the upper arch to its proper width in order to help make room for all the permanent teeth, improve nasal breathing, ensure adequate room for the tongue, and allow the mandible to come forward to its normal Class I skeletal position. The cut for the side screws is distal to the central incisors and, after the arch has been adequately developed, the side screws are activated to torque the maxillary central incisors forward.

The objective in orthodontics is to convert all Class II Div 2 malocclusions into Class II Div 1 malocclusions and then to treat the case with a jaw repositioning or functional jaw orthopedic appliance such as a Twin Block or Herbst Appliance. In permanent dentition, if the Herbst Appliance is the treatment of choice, then a midline (hyrax) screw must be built into the upper part of the appliance to ensure adequate expansion of the upper arch. Most Class II malocclusions have an underdeveloped maxillary arch that needs some arch development prior to the advancement of the mandible. Otherwise, the mandible will be advanced into a posterior crossbite situation and the case will be unstable.

Figure 9: Start Treatment
Anterior Open Bite — Thumbsucking Habit

Figure 10: 7 Months Later
End to End Bite — No Thumbsucking Habit

Figure 11: Pre-Treatment
Constricted Maxillary Arch

Figure 12: 7 Months Later
Maxillary Arch Normal

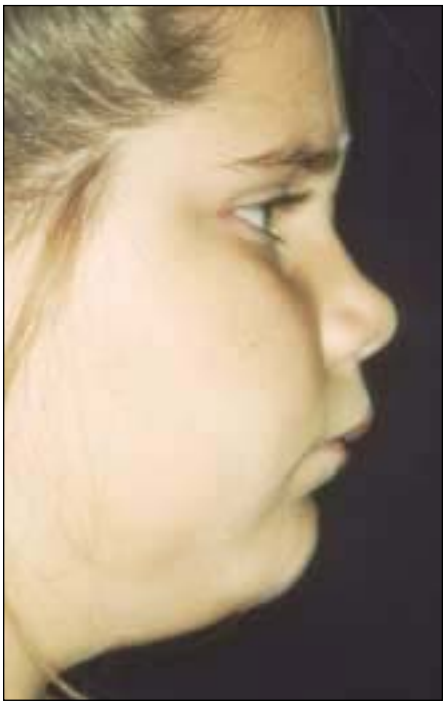

Figure 13: Pre-Treatment
Prognathic Maxilla — Retrognathic Mandible

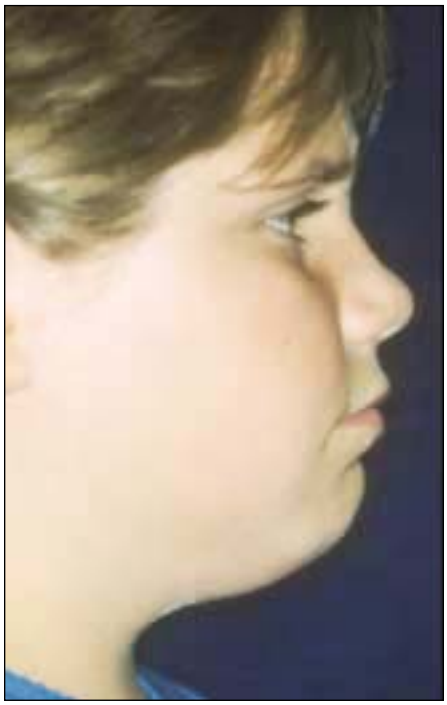

Figure 14: 7 Months Later
Normal Maxilla — Normal Mandible

To ensure stability there must be a definite occlusion established following the use of the functional appliance. The ideal width between the maxillary first molars on the lingual at the gum line would be 34 to 39 mm. in permanent dentition. Clinically, to check to see if the patient's maxillary arch is adequately developed, ask the patient to move the lower jaw forward to Class I cuspid and Class I molar relationship to ensure that there are no posterior crossbites. The presence of a posterior crossbite when the mandible is advanced in the area of the bicuspids and molars is an indication that the maxillary arch needs more expansion.

Class II Div 2 Permanent Dentition

a. Expand maxillary arch with midline (hyrax) screw.
b. Place straight wire brackets (Canadian Micro Arch, GAC) from maxillary second bicuspid on the left to the maxillary second bicuspid on the right. This will help align the maxillary incisors which will allow the mandible to come forward to its proper position. In Class II Div 2 cases, with the maxillary central incisors lingually inclined, the mandible is held posteriorly and cannot assume its correct position which is downward and forward.

The advantage of the Canadian Micro Arch prescription (GAC) is that the central incisor has a 17º torque compared to the Roth prescription which has a 12º torque. Also, the cuspids have a 2º positive crown torque which allows the mandible to come forward to its proper position. The key to the success in Class II Div 2 malocclusions is to adequately expand the maxillary arch, properly align and torque the maxillary anteriors and then to allow the mandible to be repositioned forward to its correct position.

c. Activate the Herbst Appliance by adding the maxillary tubes to the axles on the maxillary first molars.
d. Insert the lower part of the Herbst Appliance with the rods attached to the cantilever arm in the area of the first bicuspid.
e. Insert the rods on the lower part into the tubes on the upper part and this will allow the Herbst to begin its primary function, that of mandibular advancement. If the patient cannot open wide enough, the clinician may have to insert the rods into the tubes before cementation of the lower part.

It must be noted that all Class II Div 2 malocclusions must be treated as early as possible due to the fact that many of these patients are suffering from TM dysfunction. The reason for this is due to the constricted maxillary arch as well as the lingually inclined maxillary central incisors which hold the mandible in a retrognathic position which causes the condyles to be posteriorly displaced. Upon clinical examination, most of these patients have numerous signs and symptoms of TM dysfunction including limited range of motion and several sensitive muscles and trigger points on palpation. Radiographic examination utilizing TMJ x-rays, such as transcranials or tomograms, frequently reveal condyles

Figure 15: Maxillary Twin Block II
Incisal Ramp — Hold Mandible Forward

Figure 16: Twin Block II — Incisal Ramp
Adam's Clasps First Bicuspids
Adam's Clasps First Molars

Figure 17: Pre-Treatment
Overjet 10 mm. — Anterior Open Bite 5mm.

Figure 18: 12 Months Later
Normal Overjet — Normal Overbite

Figure 19: Pre-Treatment — Lip Sucking Habit

Figure 20: 12 Months Later — Habit Corrected

posteriorly and superiorly displaced in the glenoid fossa. This causes compression of the nerves and blood vessels in the bilaminar zone with resultant pain and discomfort. Joint Vibration Analysis (JVA) equipment (BioResearch Inc.) which measures the vibrations within the temporomandibular joint often reveals Stage I or Stage II of internal derangement. Therefore, it is vitally important for the well-being and health of the patients that all Class II Div 2 malocclusions be treated as above as early as possible.

Figure 21: Occlusal View
Maxilla Hyrax Screw
Mandible Midline Screw

Figure 22: Lower Cantilever Herbst
Bar Soldered to Lower Molar Crown
Rod Attached to Cantilever Arm
Midline Screw

Figure 23: Right Lateral — Holds Mandible Forward

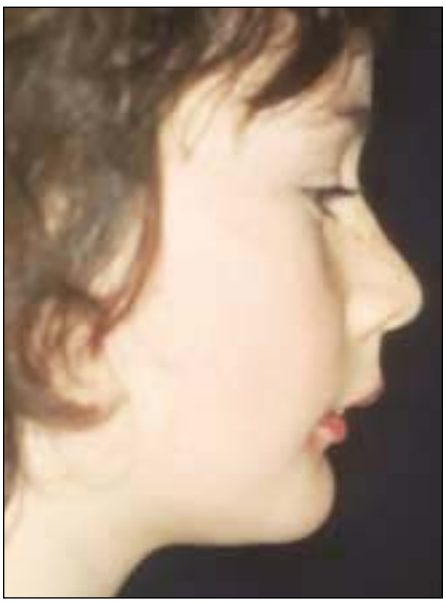

Figure 24: Pre-Treatment
Retrognathic Profile

Figure 25: Pre-Treatment
Overjet 12 mm. — Overbite 7 mm.

Other treatment options for the Class II skeletal malocclusion include:

1. Camouflage Orthodontics - Retraction of Maxilla
   a. Extraction of first bicuspids and retraction of the six maxillary anterior teeth posteriorly.
   b. Cervical facebow headgear or Wilson Distalizing Arch to distalize the maxillary molars followed by retraction of the maxillary anteriors.

This method, known as camouflage orthodontics, treats the maxillary arch by retracting the anterior teeth utilizing extraction of bicuspids or distalization of the first molars using cervical facebow headgear or the Wilson Distalizing Arch. If the maxilla is in normal position, which is the case in the majority of Class II skeletal malocclusions, the treatment of choice is not to retract the maxilla. If the problem is clearly a retruded mandible, then obviously a jaw repositioning appliance such as the removable Twin Block in mixed dentition or the fixed Herbst Appliance in permanent dentition would be the treatment of choice. The objective of treatment should be to treat the skeletal Class II malocclusion by advancing the mandible to Class I skeletal and not to camouflage the malocclusion by retracting the maxilla.[12]

2. Surgical Advancement of the Mandible

This is another method of correcting a Class II skeletal malocclusion. Some orthodontic clinicians who are not familiar with functional appliances refuse to treat patients in early permanent dentition with functional appliances but prefer to wait until the patient has completed most of their growth by age 17 or older. The patient is then subjected to a surgical procedure such as a mandibular split osteotomy or more recently the mandibular distraction osteogenesis procedure to advance the mandible surgically. Logically, most patients given the option between wearing a Herbst Appliance for 7 months or having a surgical operation and having their jaws wired shut for 6 weeks, prefer the non-surgical approach. The Herbst treatment also results in lower costs and lower risks for the patient without increasing treatment time. Therefore, the Herbst Appliance is the treatment of choice for most Class II skeletal malocclusion for non-compliant patients in late mixed dentition or early permanent dentition.

Condylar Position

Dr. Hans Pancherz did extensive work in Germany and took tomograms and MRI's of the patients before, during and after Herbst Appliance treatment. At the beginning of treatment, some condyles were posteriorly displaced as you would suspect in Class II Div 1 cases with large overjets and retrognathic mandibles. Some condyles were only slightly posteriorly displaced in cases that had relatively slight overjets prior to treatment.

The MRI's revealed that during treatment, the condyles were positioned anteriorly and downwards on the articular eminence but the disc stayed in the proper position at all times. The 2.5 mm. cartilaginous disc functions as a shock absorber between the head of the condyle and the temporal bone of the glenoid fossa during all opening and closing movements of the mandible. After Herbst Appliance treatment, which repositioned the mandible forward, the condyles returned to their original position in the glenoid fossa. This was accomplished by adaptive skeletal and dental changes including slight posterior movement of the maxillary dentition and anterior movement of the mandibular dentition (approximately 1.5 to 3.5 mm.).[13]

Pancherz also observed from the MRI's that the condyles increased in length and there was a remodeling of the glenoid fossa. He further noted that a normal disc-condyle relationship was maintained during and after Herbst Appliance treatment. This was confirmed by the research done by Metaxas and Woodside when they reported that not only did the condyles remodel in superior and posterior directions, but the entire glenoid fossa remodeled to accommodate the condyles' new anterior position.[14]

With regard to increasing the length of the mandibular condyle, most authorities agree that when functional appliances such as the Herbst Appliance are used in growing patients, there is an increase in mandibular length (condylion to gnathion). Some researchers think that the Herbst Appliance can accelerate condylar growth in adolescents but you cannot exceed the growth that was genetically preordained.

It must be remembered that most Class II skeletal patients never reach their genetic potential without treatment. The mandible is held in a retrognathic position due to mouth breathing, constricted maxillary arch and/or retroclined maxillary incisors. These patients need to have their airway problem addressed as well as their maxillary arches developed to normal and then a functional jaw orthopedic appliance, such as a Herbst Appliance, be utilized to reposition the mandible forward to its proper Class I skeletal position.

Figure 26: Herbst Appliance
Fixed Upper Banded Hyrax
Removable Acrylic Lower

Figure 27: Removable Acrylic Lower

Figure 28: Tongue Crib
Prevent Anterior Tongue Thrust

Figure 29: Banded Hyrax — Tongue Crib
Tubes Attached Upper First Molars

Figure 30: Acrylic Covers All Lower Teeth Except First Molars
Allow Lower Molars to Passively Erupt

Figure 31: Frontal View
Herbst Appliance
Acrylic Cap Prevents Flaring Lower Incisors

TM Dysfunction

In patients who suffer from the signs and symptoms of TM dysfunction as a result of internal derangements where the disc is anteriorly or antero-medially displaced, the utilization of the Herbst Appliance is the treatment of choice. A study done at the University of Lund in Sweden by Westesson, Eriksson, etc. entitled "Disc-Repositioning Onlays in the Treatment of Temporomandibular Joint Disk Displacement: Comparison with a Flat Occlusal Splint and with No Treatment" clearly demonstrated that patients in Stage I and II of internal derangement (disc displacement with reduction) clearly showed a consistent reduction in signs and symptoms of TM dysfunction when anterior repositioning silver onlays were placed on the lower posterior teeth. Using arthrograms where dye was injected into the joints before

and after the use of the silver onlays, which repositioned the mandible forward, the researchers were able to show that in all cases in Stage I and II, the disc was recaptured in the forward position (normal overjet, normal overbite). These patients stopped clicking, their range of motion improved, and they had less muscle pain, less joint pain, and a significant improvement in overall health. They also clearly demonstrated that when the silver onlays were removed within six months, all of the patients returned to their original malocclusions and their signs and symptoms of TM dysfunction returned.[15]

In conclusion, they stated that it seems imperative that a Stage II or finishing stage is necessary following Stage I anterior repositioning in order to help stabilize the occlusion and to accomplish permanent changes for the patient. In this regard, I should like to discuss the importance of the Support Phase in Herbst Appliance treatment.

Support Phase

One of the first functional clinicians to stress the importance of the support phase in functional jaw orthopedic treatment was Dr. William Clark, Orthodontist, Fife, Scotland.[16] Most Class II skeletal malocclusions have three essential components: transverse, sagittal and vertical. The Herbst Appliance does an excellent job of developing the transverse dimension of both upper and lower arches utilizing expansion screws. The sagittal correction of the Class II skeletal malocclusion is also efficiently corrected utilizing the jaw repositioning capabilities of the Herbst Appliance. The problem arises when we try and solve the vertical problem. Most Class II skeletal malocclusions are skeletally closed with a short lower face height, deep overbite, and therefore require an orthopedic solution. In order to increase the lower face height to normal and to correct the deep overbite, the treatment of choice would be to erupt the lower posterior teeth with vertical elastics. This technique does not increase the length of the crowns on the lower posterior teeth, but actually results in the alveolar bone increasing in height on the lower arch. In most Class II malocclusions, the lower alveolar process is depressed in the posterior region due to mouth breathing which results in low tongue position causing intrusion of the lower alveolar processes that further enhances the problem of the deep overbite.

Figure 32: Pre-Treatment
Overjet 12 mm. — Overbite 7mm.

Figure 33: 8 Months Treatment — Herbst Appliance — Normal Overjet — Normal Overbite

Figure 34: Twin Block II
Prevent Relapse — Keep Mandible Forward

Figure 35: 8 Months treatment
Normal Overjet — Normal Overbite

Figure 36: Pre-Treatment — Retrognathic Profile

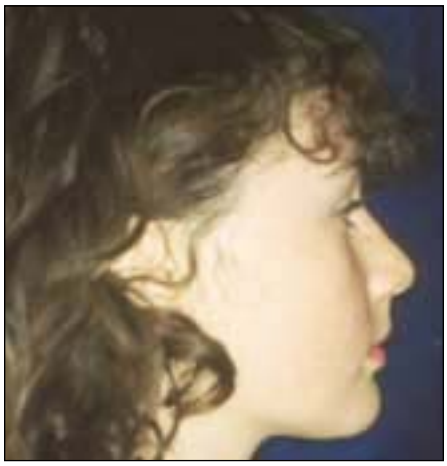

Figure 37: 8 Months Treatment — Straight Profile

Problem with the Cantilever Herbst

With the Cantilever Herbst Appliance, because the patient is occluding on the four stainless steel crowns as well as the occlusal rests on the bicuspids and second molars, there is no way to allow any eruption of posterior teeth in order to correct the deep overbite. The problem arises when the Cantilever Herbst Appliance is removed due to the presence of a posterior open bite. If there is not a stable posterior occlusion, then this increases the tendency for relapse back to the original Class II malocclusion. It is also difficult for the patient to chew their food due to the fact that there is no contact between the posterior teeth. The result is that the patient attempts to close his back teeth together so they can eat normally by occluding on their posterior teeth and this causes the mandible to go distally with a subsequent relapse.

The other problem that occurs with the posterior open bite is that there is no posterior support for the TMJ. Without support the mandible goes distally and the condyles seat posteriorly and superiorly. This frequently causes an internal derangement due to posteriorly displaced condyles and anteriorly displaced discs which increases the signs and symptoms of TM dysfunction. To avoid this problem, it is important to consider stabilizing the mandible in a favorable position during the support phase. I recommend a jaw stabilization appliance such as the removable Twin Block II Appliance or the fixed Rick-A-Nator Appliance.

Twin Block II Appliance

The Twin Block II Appliance is a removable orthopedic appliance to help reposition the lower jaw forward. This appliance consists of acrylic coverage on the palate, no occlusal coverage on the posterior teeth and two Adam's Clasps on the maxillary molars for retention. The lab is asked to fabricate the appliance with an anterior biteplate. The anterior biteplate is relined in the mouth using Triad to form an incisal ramp. The anterior biteplate is roughened up with an acrylic bar and a thin layer of Triad Activator is added and light cured (Dentsply, Activator #95765).

Then a piece of Triad Transheet (#89307) is shaped into an incisal ramp and placed on the anterior biteplate. The patient is instructed to close into the correct position, aligning the skeletal midlines (labial frenums) with a 1 mm. overjet and 1 mm. overbite. The patient is then instructed to move the tongue forward and push gently on the lingual of the Triad material to help shape the incisal ramp. When the clinician is satisfied with the position obtained by the Twin Block II Appliance, the Triad incisal ramp is light cured. The appliance is removed, trimmed and reinserted. The purpose of the incisal ramp is twofold:[17]

i) To help keep the lower jaw forward and prevent a relapse. Every time the patient swallows, they are instructed to close with their lower incisors anterior to the incisal ramp. Repeating this procedure 2,000 times per day helps to ensure that the lower jaw will stay forward and the sagittal correction of the Class II skeletal malocclusion has been successful. The Twin Block II Appliance can be worn in mixed or permanent dentition.

ii) In mixed dentition the appliance must be designed to hold the lower jaw forward while allowing for the exfoliation of the deciduous molars and the eruption of the permanent bicuspids. The Twin Block II Appliance with the incisal ramp allows for this to occur in the late mixed dentition stage.

The other important consideration for the Twin Block II Appliance is that, in an effort to support the TMJ, composite build ups must be done to ensure a healthy jaw joint.

Mixed Dentition

Composite buildups on the lower second primary molars will help the patient to chew properly as well as support the TMJ. When the lower primary molars are built up to the same occlusion as established by the incisal ramp (1 mm. overjet, 1 mm. overbite), this allows the lower first permanent molars to erupt to the proper occlusal plane and corrects the deep overbite. This also orthopedically increases the lower face height when the lower first permanent molars erupt and the alveolar processes are increased in height. If the patient is vertically deficient (short lower face height), usually the muscles of mastication, especially the masseters, are in a state of continual contraction so they will not go into spasm which translates into muscle soreness and sometimes the formation of painful trigger points. The eruption of the lower posterior teeth and alveolar processes which allows the muscles to attain their correct resting length, frequently eliminates these sore muscles.

One test that can be employed to ensure that you have "normal" muscles is muscle palpation prior to and after treatment to confirm the reduction in muscle soreness after the eruption of the lower posterior teeth. Another test which we now employ in our office is the EMG (electromyographic equipment) to evaluate normal and abnormal muscle contractions. The EMG (BioResearch Inc.) readings reveal excessive muscle contractions, especially the masseters, prior to treatment when the patient has a short lower face height as compared to more normal muscle contractions when the lower face height has been restored to normal.

The primary goal of any functional jaw orthopedic appliance is to properly relate the mandible to the maxilla in three dimensions; transversely, antero-posteriorly (sagittally) and vertically. When utilizing the Cantilever Herbst Appliance it must be remembered that the Herbst Appliance will help correct the transverse and antero-posterior problem but the utilization of a support appliance such as a Twin Block II Appliance is necessary to wear for six months after the Herbst Appliance to help prevent relapse and also to allow for the correction of the vertical problem as outlined previously.

Benefits of Herbst Appliance

1. Improved Profiles
   In cases where the mandible is deficient, the advancement of the mandible has a positive effect on the patient's profile and face.
2. Increased Facial Height
   In patients that have a short lower face height, the Twin Block II Appliance or acrylic lower Herbst can be used to increase the posterior vertical dimension by allowing the eruption of the lower first molars and bicuspids.
3. Broad Smiles
   When the hyrax screw is expanded in the upper part of the Herbst Appliance, this results in a broader, more pleasing smile.
4. Non-Surgical Treatment
   The Herbst Appliance can orthopedically, non-surgically

reposition the lower jaw forward. Patients and parents alike prefer the non-surgical approach.

5. Non-Extraction
   When the dental arches are developed to their proper shape and size using the Herbst Appliance, most malocclusions in mixed and permanent dentition can be corrected without extractions.
6. Improved Breathing
   The widening of the maxillary arch with the hyrax screw results in the palate dropping and increasing the size of the nasal cavity. This helps the patient to breathe more easily through the nose and decreases the tendency towards mouth breathing.
7. Prevents Snoring and Obstructive Sleep Apnea
   If the tongue falls back and partially obstructs the airway during sleep, it can cause the patient to snore. If the tongue blocks the airway for more than ten seconds, thirty or more times per night, this is obstructive sleep apnea. This can be a life-threatening condition that can lead to hypertension, heart attacks and strokes. Both snoring and sleep apnea can be prevented by advancing the mandible with the Herbst Appliance.[18]

Conclusion

Since 70% of all malocclusions are Class II and 80% of them have normal maxillas and retrognathic mandibles, clinicians must become proficient in the use of functional appliances. It seems completely illogical not to treat these problems with jaw repositioning appliances in mixed or early permanent dentition rather than wait until age seventeen and subject the patient to a surgical procedure with all its risks and limitations. Functional clinicians are appalled at the fact that most patients are still not given the orthopedic, non-surgical, non-extraction option for treatment. The most common methods of treating Class II skeletal problems regrettably are still extraction of first permanent bicuspids and surgery.

General dentists, pediatric dentists and orthodontists have to educate themselves in the area of functional jaw orthopedics. The use of the Herbst Appliance at the correct time during growth can ultimately result in the patients achieving a broad smile, an excellent functional occlusion, straight profile, and a healthy temporomandibular joint.

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Additional Resources

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