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## MARA Appliance

*by Dr. Brock Rondeau*



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## INTRODUCTION

One of the most common malocclusions that occur with Caucasian patients is the skeletal Class II malocclusion where patients have normally positioned maxillas and retrognathic mandibles. Malocclusions may be classified as follows: 70% Class II, 25% Class I, and 5% Class III. If 70% of all malocclusions are Class II and according to McNamara and Moyers, in excess of 80% of these are Class II skeletal with constricted maxillary arches, deep overbites, normally positioned maxillas with retrognathic mandibles, clinicians must utilize some type of functional jaw orthopedic appliance in order to reposition the mandible anteriorly.

The most popular functional jaw repositioning appliance today is the Twin Block, developed over 20 years ago by Dr. William Clark, an orthodontist from Fife, Scotland. The Twin Block is still the appliance of choice for patients under age 11 who present with an underdeveloped lower jaw and

whose profile greatly improves when the lower jaw is repositioned forward. One of the disadvantages of the Twin Block is that it is a removable appliance and, therefore, treatment success depends to a large extent on patient cooperation. The trend today in treating orthodontic patients with orthopedic (skeletal) problems is definitely towards fixed-functional appliances.

## HISTORY OF MARA APPLIANCE

The MARA Appliance (Mandibular Advancement Repositioning Appliance) was created by Dr. Douglas Toll, an orthodontist from Germany. Dr. Jim Eckhart, an orthodontist from Manhattan Beach, California, started working with Dr. Toll in the 1990's to perfect some new designs for this fixed mandibular advancing appliance. Dr. Eckhart presented table clinics in 1996, 1997 and 1998 at the AAO meetings and Dr. Toll lectured at the AAO Annual Convention in 1997 and 1998 on this revolutionary new appliance.

## FUNCTIONS OF MARA APPLIANCE

The MARA Appliance is a fixed-functional repositioning appliance which virtually guarantees success because the appliances are worn 24 hours per day and are not dependent on patient cooperation. Staff, clinicians, parents and patients are enthusiastic because the appliance eliminates the need to constantly encourage, motivate and even badger patients into wearing removable functional appliances or the unsightly and most unpopular cervical facebow headgear. Cervical facebow headgear is still being widely used by clinicians who practice with a retractive philosophy (bicuspid extraction, cervical headgear and retraction of the maxillary anterior teeth). Clinicians who practice with a functional philosophy which stresses relating the mandible to the maxilla correctly in three dimensions; transversely, antero-posteriorly and vertically, absolutely do not use cervical facebow headgear and treat the majority of their cases non-extraction and non-surgically.

All functional jaw orthopedic appliances, including the MARA Appliance, function to improve the profile when the mandible is repositioned forward.

The MARA basically consists of four stainless steel crowns on the first molars. Attached to the upper crowns is a large square tube into which a large wire called an "elbow" fits. A large round wire, attached to the lower crown, projects buccally towards the cheek from the mesial part of the stainless steel crown. The buccal projection is called the "arm". The upper elbow is designed so that the patient can only close their mouth if they move their lower jaw forward so that the arm is in front of the elbow. If the patient, who is a Class II skeletal with a retrognathic mandible, tries to bite into their original centric occlu-

sion, the upper buccal elbow will hit the lower buccal arm and the patient will not only not be able to close their mouth and they will have a 10 mm. anterior open bite. Stainless steel crowns are needed to help withstand the tremendous leverage forces generated by the two attachments. The upper elbow and the lower arm mutually shield each other when the patient moves the lower jaw forward so that the buccal projection of the lower arm does not irritate the cheek.

## PARTS OF UPPER MARA APPLIANCE

### 1. Two stainless steel crowns on upper first molars

Stainless steel crowns are usually fitted by the lab and are micro etched to increase retention. Remove the occlusal surfaces of stainless steel crowns to help prevent a posterior open bite, intrusion of the molars and possible TMJ problems due to traumatic occlusion. The removal of the occlusal surfaces also makes it easier to remove the stainless steel crowns at the end of treatment.

### 2. Square tubes

Square tubes (.062") are soldered to the buccal of the upper stainless steel crowns.

### 3. Elbows

The elbows are inserted from the mesial into the square tubes, adjusted for correct mandibular position and patient comfort and then tied into place. The elbow is located distal to a buccal arm which is soldered to the buccal of the lower stainless steel crowns on the lower first molars and functions to help reposition the mandible forward.

### 4. Archwire tube located closest to the gingiva

Straight wire appliance can be used to align the teeth and erupt the bicuspids while the MARA Appliance is repositioning the



Figure 1. MARA Appliance  
Mandible Advanced  
Upper Elbow  
Lower Arm



Figure 2. Upper Elbow  
Lower Arm  
Retrognathic Mandible



Figure 3. Upper Part MARA  
Hyrax Screw  
Stainless Steel Crowns 1st Molars  
Mesial Rests 1st Bicuspid



Figure 4. Lower Part MARA  
Lingual Arch  
Stainless Steel Crowns 1st Molars  
Mesial Rests 1st Bicuspid



Figure 5. Buccal Arm  
Lower 1st Molars



Figure 6. Buccal Arm  
Upper Elbow



Figure 7. Pre Treatment  
Centric Occlusion  
Class II Molar



Figure 8. Construction Bite  
Advance Mandible  
Class I Molar  
Mark Working Models

mandible forward and expanding the maxillary arch.

#### 5. Hyrax screw

Most Class II skeletal cases with normally positioned maxillas and retrognathic mandibles have constricted maxillary arches. Therefore, a Hyrax screw is used almost routinely to help develop the narrow maxillary arch to normal. Clinically, the patient is asked to move the lower jaw forward to Class I cuspid and Class I molar relationship. If the maxillary arch is constricted, this will result in a buccal crossbite which is completely unstable. To avoid this situation, the maxilla must be developed with the Hyrax screw to its proper transverse width. The Hyrax screw is attached to the lingual of the upper molar crowns and mesial occlusal rests on the first bicuspid. For added retention these occlusal rests are bonded with composite. The mesial occlusal rests on the first bicuspid prevent the anterior part of the appliance from impinging on the gingival tissue.

If the maxillary arch is severely constricted, resulting in a buccal crossbite when the mandible is advanced, the buccal elbow will not be able to be placed in the square tubes. In order for the buccal elbow to function properly behind the buccal arm when the patient opens and closes, the maxilla must be properly expanded. Therefore, if the buccal elbow is not buccal to the lower arm when the mandible is repositioned forward, it is not recommended to cement the lower part of the MARA Appliance or attach the upper elbows until after the maxillary arch has been properly developed with the Hyrax expansion screw.

#### 6. Transpalatal (TP) Arch

If the maxillary arch has a normal width, then a transpalatal

arch can be placed to help distribute the forces of the elbows on the upper molars and buccal arms on the lower molars more evenly on the entire dentition. Otherwise, there will be excessive forces on the upper first molars.

#### 7. Shims

Shims can be added to the horizontal leg of the upper elbows in an effort to advance the mandible. The shims come in different sizes, 1 mm, 2 mm, 3 mm, and 4 mm. Once the shims have been added, the elbows are attached to the square tubes with stainless steel ligature ties.

### PARTS OF LOWER MARA APPLIANCE

#### 1. Two stainless steel crowns on the lower first molars

Remove the occlusal surfaces of stainless steel crowns to help prevent a posterior open bite, intrusion of the molars and possible TMJ problems due to traumatic occlusion.

#### 2. Buccal arms (.059") soldered to the buccal of the two stainless steel crowns

The buccal arm is located mesial to the buccal elbow inserted into the square tubes on the upper stainless steel crowns and functions with the elbow to reposition the mandible forward.

#### 3. Archwire tube located closest to the gingiva

This can be utilized to help prevent mesial rotation of the lower first molars. The archwire of choice would be a special utility arch (2 x 6), involving the six lower anteriors as well as the lower first molars. If this utility arch is used, frequently the lower lingual arch is not necessary. The advantage of using this utility arch is that the lower bicuspid will be able to erupt in the case of a posterior open bite or when the patient presents with a deep overbite. The eruption of the lower posterior teeth



Figure 9. Remove Occlusal Surface Stainless Steel Crowns



Figure 10. Lower Part MARA Lingual Arch Remove Occlusal Surface Stainless Steel Crowns



Figure 12. Patient Amber Pre Treatment Overjet 9 mm.



Figure 14. Upper Part MARA Hyrax Screw Stainless Steel Crown 1st Molars Mesial Rests 1st Bicuspid



Figure 24. Tie Upper Elbow To 1st Molar Hook Stainless Steel Ligature Tie



Figure 11. Upper Part MARA Hyrax Screw Mesial Rests 1st Bicuspid Stainless Steel Crowns Remove Occlusal Surface



Figure 13. Pre Treatment Retrognathic Profile



Figure 15. Lower Part MARA Lingual Arch Stainless Steel Crowns 1st Molars Mesial Rests 1st Bicuspid

is often the treatment of choice for patients who are skeletally overclosed with a deep overbite. This orthopedic correction frequently helps reduce TMJ signs and symptoms by moving the condyle down and forward and helps to relieve muscle spasms and trigger points.

#### 4. Lingual arch

This is necessary on the lower to help prevent the mesial and lingual movement of the lower first molars as a result of the forces applied to the lower buccal arm by the upper elbow when the patient opens and closes. The lingual arch is soldered to the lingual of the stainless steel crowns on the lower first molars and to the mesial occlusal rests which are placed on the lower first bicuspids. For added retention, these mesial rests can be bonded with composite. The mesial rests prevent the lingual arch from going lingually in the anterior region and irritating the gingival tissue.

#### 5. Hyrax Screw

If the mandibular arch is constricted, a mini Hyrax screw could be added to the lower part of the MARA Appliance.

#### CONSTRUCTION BITE

It is not necessary to take a construction bite with either wax or silicone when fabricating a MARA appliance. Normally, the appliance is made by advancing the mandible 5 mm. If the patient has an overjet of 5 mm. with Class II molar relationship, then the mandible is advanced to a Class I molar relationship. If the patient has an overjet of 10 mm. only advance halfway (5 mm.). If the appliance was fabricated at 10 mm. initial advancement, this would cause breakage of the lower buccal arm since the patient would not easily be able to move the lower jaw far enough forward to get the lower buccal arm in front of the

upper elbow. To get some relief, the patient may even retrude the lower jaw to a point where the buccal arm goes distal to the elbow's sweepback leg which could cause the buccal arm to get locked. This could be extremely uncomfortable for the patient and necessitate an emergency visit to the office which should be avoided. To prevent this occurrence, only advance the mandible 5 mm initially. After 3 months, when the patient is comfortable with the appliance, 3 mm. shims can be added to the elbows on both sides to advance the mandible a further 3 mm. Then after 2 months, a 2 mm. shim can be added on both sides to advance the mandible the remaining 2 mm. to correct the 10 mm. overjet.

### PLACING SEPARATORS

Separators must be placed mesial and distal to the upper and lower first molars before the placement of stainless steel crowns, two weeks before the appointment. Stainless steel crowns are thicker than stainless steel bands so there must be adequate separation.

If the laboratory is going to fit your stainless steel crowns on your working model, it is not necessary to separate the molars before the impressions are taken. The lab will disc the model mesial and distal to the first molars when fitting the stainless steel crowns.

### TREATMENT PHILOSOPHY

The treatment of Class II skeletal malocclusions with functional jaw orthopedic appliances is essentially to first properly prepare the maxillary arch in terms of proper width, adequate arch length and correct inclination of the maxillary incisors. Then when an ideal maxillary arch is achieved, the mandible must be repositioned to the maxilla in order for it to be properly related in three dimensions: transversely, antero-posteriorly and vertically.

## INDICATIONS FOR MARA APPLIANCE

### 1. *Class II Div 1 Malocclusion*

The MARA Appliance is an ideal 'new' appliance for the correction of Class II Div 1 skeletal malocclusion to Class I skeletal in patients over age eleven. The appliance is used when the overjet is moderate to severe (5 mm. or more) when patient cooperation is anticipated to be a problem. This fixed-functional appliance has an extremely high success rate in repositioning the retrognathic mandible forward to its proper position.

### 2. *Proper Arch Width*

The key for successful treatment with the MARA Appliance is the maxillary arch must be wider than the mandibular arch when the patient positions the lower jaw forward. Ask the patient to move the lower jaw forward to Class I cuspid and Class I molar relationship and normal overjet. If there is a buccal crossbite, this must be corrected with the addition of a Hyrax screw to the upper part of the MARA Appliance.

### 3. *Proper Arch Length*

The maxillary arch must be the proper length antero-posteriorly to allow for the eruption of all the permanent teeth prior to the fabrication of the MARA Appliance. Arch lengthening appliances that are sometimes utilized include:

- a) The Anterior Sagittal is a removable orthopedic appliance which is ideal in Class II Div 2 malocclusions in mixed dentition to torque lingually displaced maxillary central incisors to help increase arch length and to align the maxillary incisors.
- b) The Posterior Sagittal is a removable orthopedic appliance used mainly in mixed dentition to distalize the maxillary first molars.



Figure 16. Pre Treatment Retrognathic Profile



Figure 17. Seven Months Later Straight Profile



Figure 18. Square Tube Maxillary 1st Molars Archwire Tube



Figure 19. Insert Elbow Into Square Tube

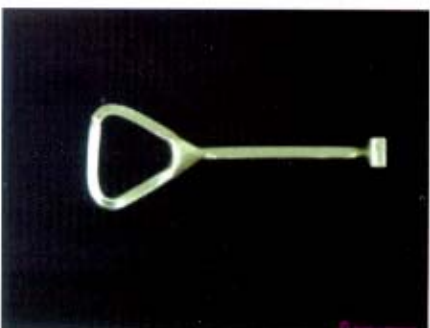


Figure 20. Torquing Tool Upper Elbow



Figure 21. Torquing Upper Elbow

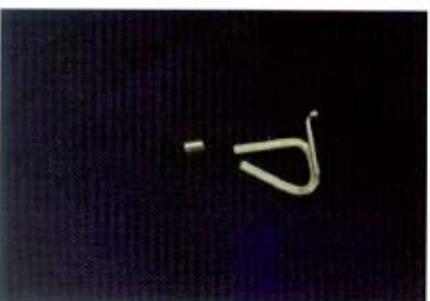


Figure 22. Buccal Elbow 2mm Shim



Figure 23. Buccal Elbow Insert Square Tube

c) Dr. Michael Williams, Orthodontist, Gulfport, Mississippi, has developed three excellent fixed appliances suitable for mixed or permanent dentition where cooperation problems are anticipated.

- i) Maxillary SAG 2000 is ideal for torquing vertical or lingually inclined central and lateral incisors.
- ii) Maxillary DMJ 2000 is used to distalize maxillary first or second molars that are vertical or tipped mesially.
- iii) Maxillary DMAX 2000 is used to expand the maxillary arch and to distalize the first and second molars.

#### 4. Proper Torque Maxillary Incisors

- a) If the maxillary incisors are flared excessively, it will be difficult to know how far forward to reposition the mandible. If the mandible was positioned to an end to end incisor 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 would have an anterior crossbite which is clinically unacceptable. Therefore, it is imperative that the maxillary incisors be detorqued with either a labial bow on a removable appliance or power chain with straight wire prior to mandibular advancement with the MARA Appliance.
- b) If the maxillary incisors are too vertical, it will be impossible to reposition the mandible far enough forward with the MARA Appliance to correct the Class II skeletal, Class II molar or Class II cuspid relationship. Therefore, these maxillary incisors must

be torqued properly with either an Anterior Sagittal or a SAG 2000 Appliance prior to the placement of the MARA Appliance.

#### **5. Proper Torque Mandibular Incisors**

One of the side effects of all functional appliances, fixed or removable, is the tendency to flare the lower incisors. To help prevent excessive flaring of the lower incisors, these teeth must be detorqued with a labial bow on a removable appliance or power chain with straight wire prior to treatment with the MARA Appliance.

#### **6. Improved Profile When Mandible Advanced**

The MARA Appliance is only utilized if the patient's profile is improved when the lower jaw is repositioned forward.

#### **7. TM Dysfunction**

Most Class II skeletal malocclusions have constricted maxillary arches, retrognathic mandibles, deep overbites, and several 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. When the condyles are posteriorly displaced, the discs are frequently anteriorly or antero-medially displaced. The objective with the MARA Appliance is to reposition the lower jaw as well as the condyle down and forward in an effort to recapture the disc. Research has shown that when the disc has been successfully recaptured utilizing an anterior repositioning appliance, such as the MARA Appliance, this significantly reduces the signs and symptoms of TM dysfunction.

#### **8. Non Compliant Patients**

Non compliant patients who will not wear removable appliances.

#### **9. Condylar Growth**

The MARA Appliance, like all functional jaw orthopedic appliances when utilized in growing individuals, encourages condylar growth which helps Class II skeletal patients with retrognathic mandibles reach their true genetic potential.

### **CONTRA-INDICATIONS FOR MARA APPLIANCE**

1. It is not recommended for deciduous molars due to the excessive forces caused by the lower buccal arms and upper elbows which may cause resorption of the roots of the deciduous molars.
2. Patients in early mixed dentition frequently present with a very small vestibule and not enough room in the back cheek area to accommodate the lower buccal arm and the upper elbow on the upper and lower first molars. It is not advisable to use the MARA on patients until after age 11, when there is adequate area in the posterior part of the mouth for the protruding and potentially irritating buccal arms and elbows.
3. First molars must be fully erupted with no gingival tissue (operculum) covering the distal of the lower first permanent molars. After age 11, the roots of the first molars are completely formed and therefore able to resist the forces applied without the potential side effect of root resorption.
4. Dolichocephalic facial patterns with excess lower face heights. The eruption of the molars and bicuspids are not recommended in these cases as this would worsen the vertical problem that already exists.
5. Patients with short rami may not hope to achieve an ideal clinical result with the MARA Appliance.
6. If the maxillary arch is severely constricted, this will not allow the placement of the upper elbows in the square tubes without restricting the patients' ability to open and close their mouth. In these cases, it is recommended to place the upper part of the MARA Appliance only without the buccal elbows with the Hyrax screw to properly develop the maxillary arch. After the maxillary arch has been expanded to the point where there is no buccal crossbite when the mandible is repositioned forward, then the rest of the components of the MARA can be placed including the upper elbows and the lower part of the appliance.
7. The MARA Appliance is contraindicated in patients who have Class II malocclusions with a prognathic maxilla and a normally positioned mandible. Repositioning of the mandible forward would result in a bimaxillary protrusion with a prognathic maxilla and prognathic mandible, which is unacceptable.
8. During MARA Appliance treatment, as with all functional jaw repositioning appliances, there is a tendency to flare the lower incisors. The MARA Appliance has a tendency to move the lower molars forward which results in a loss of anchorage and causes the lower incisors to flare. In an effort to detorque the lower incisors, it is recommended that clinicians place Class III prescription brackets with  $-5^\circ$  torque rather than the standard  $-1^\circ$  torque. These Class III straight wire brackets, in combination with power chain placed on the lower anteriors, would help to detorque the lower incisors and help to minimize their proclination during treatment with the MARA Appliance.





Figure 25. Patient Nick  
Pre Treatment  
Overjet 11 mm.



Figure 26. Pre Treatment  
Retrognathic Profile



Figure 27. Upper Part MARA  
Hyrax Screw  
Stainless Steel Crowns 1st Molars  
Remove Occlusal Surface  
Mesial Rests 1st Bicuspids



Figure 28. Lower Part MARA  
Lingual Arch  
Stainless Steel Crowns 1st Molars  
Remove Occlusal Surface  
Mesial Rests 1st Bicuspids

## ADJUSTMENTS OF THE MARA APPLIANCE

### 1. Fitting Stainless Steel Crowns

Due to the fact that the stainless steel crowns are thicker than the bands, it will be necessary to separate the teeth for two weeks prior to the cementing of the crowns. When the MARA Appliance comes back from the lab, check the fit of the crowns.

- If the crown is too large, it will hurt the gingiva when inserted.
- If the crown is too small, it will not seat properly.
- Try and not trim the stainless steel crown too short as this will make the crown fit too loose and retention of the appliance could be a problem. To help increase retention, crimp the mesial and distal margins using your Tweed arch-bending pliers.

### 2. Adequate Size Maxillary Arch

If the maxillary arch is not wide enough to accommodate the mandible in the advanced position, the elbows will not be able to be added to the square tubes on the upper first molar crowns. Proper arch development will have to be obtained prior to the insertion of the MARA Appliance as discussed earlier.

### 3. Distal Rotation Maxillary First Molars

If the maxillary first molars are mesially rotated, the elbows will not function properly with the arms on the lower first molars. Therefore, it will be necessary to correct this problem with straight wire prior to the fabrication of the MARA Appliance.

### 4. Torquing Tool

A special torquing tool is available to help position the elbow properly in relation to the buccal surfaces of the lower teeth as well as the cheek. If the elbow is too lingual, it will interfere with the lower teeth when the patient opens and closes. If the elbow is

torqued too buccally, it will not function well with the lower arm to hold the mandible in a forward position. Also, if it is too far buccally, it will cause irritation of the cheek. The use of the torquing tool will help adjust the elbow without damaging its square corners.

### 5. Shims

Shims are added to the horizontal leg of the elbow to advance the mandible in further increments of 1 mm, 2 mm, 3 mm, or 4 mm. The MARA Appliance is indicated for patients with 5 mm. overjets or more. If the patient has a 5 mm. overjet, the mandible is advanced end to end when the MARA Appliance is constructed. No further advancement would be necessary. However, if the overjet was 8 mm, the mandible would be advanced 5 mm. when the MARA Appliance is constructed. Then after 3 months, when the patient is comfortable occluding in the forward position a 3 mm. shim would be added to each side to advance the incisors to an end to end position.

### 6. Avoid Allowing Buccal Arm from Biting Behind Elbows

Ask the patient to try and retrude the mandible to see if they can move their lower jaw back to where the buccal arm bites behind the elbow. This must not occur as the buccal arm could get caught behind the elbow and the patient's jaws could lock in that retrusive position. This would necessitate an emergency visit to the office to remove the elbow in order to disengage the elbow and arm. To avoid this problem:

- Ensure that the initial advancement when the MARA Appliance is being fabricated by the lab is no more than 5 mm. If the initial advancement is more than 5 mm. the above problem



Figure 29. Composite Bonding  
Mesial Rests 1st Bicuspids



Figure 30. MARA Appliance  
Advance Mandible  
Straight Wire  
Maxillary Anteriors



Figure 31. MARA Appliance  
Straight Wire  
Maxillary Anteriors



Figure 32. Pre Treatment  
Retrognathic Profile



Figure 33. Post Treatment  
10 Months Later  
Straight Profile



Figure 34. Acrylic Blocks  
Lower Part MARA  
Between Bicuspids



Figure 35. Acrylic Blocks  
Lower Part MARA  
Lingual Arch



Figure 36. MARA Appliance  
Posterior Open Bite  
Bicuspid Area



Figure 37. Composite Buildups  
Lower Bicuspids  
Blue Bisfil Composite

with the elbow and arm are more likely to occur.

- b) The sweepback arm which is the part of the elbow closest to the gingival must be long enough and bent up in such a way that the elbow cannot get behind the buccal arm.

**7. Insertion of Upper Elbow**

Prior to the insertion of the upper elbow and prior to the construction of the appliance, check to see how much distance there is between the mesial of the upper large square tube and the lower buccal arm. The distance between the square tube and buccal arm must be at least 4 mm. on each side in order to allow adequate room to insert the elbow into the square tube. This space cannot exceed 8 mm. as this would create excessive leverage forces and cause a breakage of either the elbow or the buccal arm. The distance can be adjusted minimally by bending the lower buccal arm either mesially or distally using the short beak, three-prong plier. Once the distance has been determined to be correct, insert the upper elbow into the large square tube.

The distal end of the horizontal leg of the elbow should extend 3 – 4 mm. distally out of the large square tube to allow for tying in the elbow with a stainless steel ligature tie and to provide room for more advancing

shims later on, if necessary. This horizontal leg must not extend more than 4 mm. distally out of the square tube or it will cause cheek sores, especially if the second molars have not erupted.

### **HOW TO PLACE THE MARA APPLIANCE**

Prior to the placement of the MARA Appliance, the teeth must be separated for two weeks in order to give adequate separation for the stainless steel crowns which are thicker than bands. Ask the patient to move the lower jaw forward to see if they can easily have the upper elbow bite behind the lower arm. This will be easily accomplished as long as the initial advancement of the mandible is no more than 5 mm. Check to see if the buccal arms on the lower first molars do not stick out excessively which might irritate the cheeks. Ensure that the upper elbow is

torqued correctly so that it is outside of the buccal surface of the lower posterior teeth so there is no interference when the patient opens and closes. Use the torquing tool to adjust the upper elbow so that it is not interfering with the patient's ability to chew and talk and does not cause any irritation to the cheek from being positioned too far buccally. Check to see if the patient can retrude the mandible without biting behind the buccal elbow. The key is not to advance the mandible more than 5 mm. initially and to make sure that the sweep back arm is long enough and is bent up in such a way that the patient cannot bite behind it.

The lower part of the MARA Appliance, the stainless steel crowns of the lower first molars, are cemented first using a glass ionomer cement (Ideal Band Cement, GAC). Then composite is placed on the mesial rests of the

lower first primary molars or lower first bicuspids. The buccal elbows are removed and the stainless steel crowns of the upper first molars are cemented (upper part of MARA Appliance). Composite is also placed on the mesial rests of the upper first primary molars or upper first bicuspids.

Once the position of the elbow has been established and the appropriate shims have been added, the elbow is tied in as follows: twist the stainless steel ligature tie so that it is two strands thick which will make it less likely to break. Normal stainless steel ligature tie is .010 stainless steel. It is recommended that a slightly larger diameter .012 stainless steel ligature tie be utilized to try and minimize the breakage. Attach one end of the twisted ligature tie to the buccal hook on the molar and the other end to the distal end of the horizontal leg of the elbow which

is protruding 3 – 4 mm. distally from the large square tube. Sometimes an anterior ball hook has been added to the elbow and the .012 stainless steel ligature tie is tied from this anterior hook to the buccal hook on the molars.

### POSTERIOR OPEN BITE

Class II skeletal patients who have large overjets and deep overbites will frequently have posterior open bites in the area of the bicuspid when the lower jaw is repositioned forward with the MARA Appliance. Patients now will have difficulty in chewing their food properly. In these cases, I recommend two possible solutions:

1. If the space between the bicuspid is 4 mm. or more then an acrylic bite block could be added to either the upper or lower part of the MARA Appliance. The acrylic could be gradually reduced to allow for the eruption of the bicuspid utilizing vertical elastics.
2. If the space between the bicuspid is 3 mm. or less then composite could be added to the bicuspid to facilitate chewing. Gradually the composite could be removed to allow for the eruption of the bicuspid using vertical elastics.

### LENGTH OF TREATMENT

In patients with horizontal growth patterns in late mixed dentition or early permanent dentition, the MARA Appliance should be worn at least 7 months. In cases where the overjet is excessive, then treatment time may have to be extended to 10 months.

### SUPPORT PHASE

Following treatment with the MARA Appliance which lasts 7 to 10 months, there is usually a support phase which lasts 6 to 9 months. The two appliances of choice would be:

#### 1. *Rick-A-Nator Appliance*

A fixed functional appliance consisting of an anterior incisal ramp attached to two molar bands with .050 stainless steel wire.

#### 2. *Twin Block II Appliance*

This maxillary removable functional appliance has acrylic covering the palate with an anterior incisal ramp and two Adam's Clasps attached to the maxillary first molars.

**Incisal Ramp** – The purpose of the incisal ramp is to keep the mandible in a forward position following the advancement with the MARA Appliance. The patient is instructed to bite in front of the incisal ramp every time they swallow.

The support phase is an extremely critical phase in the success of all functional appliances including the Twin Block, Herbst and MARA Appliance.

### CONCLUSION

The MARA Appliance is destined to be one of the most significant appliances in the treatment of Class II skeletal malocclusions. It is an extremely easy appliance to use and is well liked by parents, clinicians and especially by the patients. Because the appliance is worn 24 hours per day, it is not dependent on patient cooperation for its success. This has many advantages over both the removable Twin Block and the fixed Herbst Appliance and I am certain that this appliance will prove to be a tremendous asset to any orthodontic clinician who wants to utilize a fixed functional appliance to correct Class II skeletal malocclusions successfully with a non-surgical technique. My clinical experience of utilizing functional appliances for the last 20 years has convinced me that parents and patients alike prefer fixed functional appliances and a non-extraction and non-surgical treatment approach. ■

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