THE MIXED DENTITION ANALYSIS

Practice Potential

Most orthodontic problems begin during the period of time when the development of the entire masticatory apparatus, including the dental arch and occlusion, proceeds from the primary to the permanent dentition.¹

Unfortunately, many patients do not see the orthodontic specialist during this time. This occurs because the orthodontist usually has to depend upon a referral from the general dentist. Because the general dentist is the one who cares for the dental needs of the vast majority of growing children, it is imperative that they be able recognize growth problems as they occur. This will allow them to either actively intervene or immediately refer these patients to the orthodontist.

In any examination of the child’s developing occlusion, it is essential to analyze the relationship between tooth size and dental arch size. This is especially important during the transition from the deciduous arch to the permanent arch.

During this transition period, the adult cuspid and two premolars will erupt. Because the space available for their eruption and final position is limited by the position of the first permanent molar and the lateral incisor, a space analysis should be performed to determine if the dental arch contains enough room to accommodate these yet unerupted permanent teeth. This analysis is called The Mixed Dentition Analysis.

Description of Normal Growth

Although the dentition changes associated with growth and development are continuous, it is clinically very helpful to be able to classify these changes into several stages. Barnett classified the stages of occlusal development as follows:²

<table>
<thead>
<tr>
<th>Stages</th>
<th>Ages in Years</th>
<th>Characteristics</th>
</tr>
</thead>
<tbody>
<tr>
<td>First stage</td>
<td>3</td>
<td>Primary dentition</td>
</tr>
<tr>
<td>Second stage</td>
<td>6</td>
<td>Eruption of the first permanent molars</td>
</tr>
<tr>
<td>Third stage</td>
<td>6 - 9</td>
<td>Exchange of the incisors.</td>
</tr>
<tr>
<td>Fourth stage</td>
<td>9 - 12</td>
<td>Eruption of the cuspid and bicuspids</td>
</tr>
<tr>
<td>Fifth stage</td>
<td>12</td>
<td>Eruption of the second molars</td>
</tr>
</tbody>
</table>
For a smooth transition through these stages the following events must occur:

a. The eruption of the first permanent molar will be guided by the distal surface of the second primary molar. The location and arrangement of the permanent incisors will be guided by the mesial surface of the primary canine.³

b. Once the permanent first molar and incisors are in the arch, (The Mixed Dentition Stage) the canine and two premolars will then erupt into the limited space between the mesial surface of the first permanent molar and the distal surface of the lateral incisor. This exchange takes about one and a half years to complete.

c. The sum of the mesio-distal widths of the primary cuspid and first and second primary molars is generally larger than that of the permanent cuspid and premolars by about 1mm per quadrant in the maxilla and about 2mm per quadrant in the mandible. This difference is called the leeway space. The leeway or extra space is a fundamental factor in allowing for an easy exchange of these teeth.⁴

d. A normal eruption sequence of the succedaneous teeth must take place in both the mandible and maxilla. In the mandible, the most frequent eruption sequence is the cuspid, first bicuspid, and second bicuspid. In the maxilla, the sequence of eruption typically seen is either the first bicuspid, second bicuspid and cuspid or first bicuspid, cuspid and second bicuspid.²

e. When the second molars begin to erupt, the distal surface of the first permanent molar will guide them into the arch. In most cases, the eruptive force of the second molar will cause a reduction in the dental arch length using up the leeway space. In fact, the arch circumference of the permanent dentition may become shorter than that of the primary dental arch³

Indications for Performing the Mixed Dentition Analysis

When dental development occurs normally at every stage and these stages occur in the proper sequence, there is a good chance a normal, healthy, permanent dentition and occlusion will be established. Unfortunately, many factors can adversely effect normal occlusal development. Some of the more common problems seen are:

- Existing Crowding in the Primary Dentition - during the primary dentition stage, loss of primate spacing is often seen. This loss of space is indicative of underdeveloped arches and crowding.

- Crowding in the Mixed Dentition - in the early mixed dentition stage, malalignment of the anterior teeth is usually a sign of an existing lack of space.

- Crossbites in the Primary and Mixed Dentition - the presence of an anterior or posterior cross-bite is also an indication of lost arch space.'
• A Tooth/Arch Size Discrepancy - sometimes a patient’s permanent teeth may simply be too large for their arch. At the present time, it is impossible to predict precisely the size of the permanent dentition during the period of the primary dentition. However, during the mixed dentition stage, by measuring the adult lower incisors we can often predict the tooth size of the unerupted teeth.3,4,6

• The Early Extraction of the Second Primary Molar - because of the high prevalence of caries found in second primary molars, it is not unusual to lose this tooth. Normally the eruption of the first permanent molar is guided by the distal surface of the second primary molar. When premature loss occurs and the primary molar space is not well maintained, the first molar often moves mesially before the second bicuspid can erupt.2,4,6

• The Early Loss of a Primary Cuspid - normally the location and arrangement of the permanent incisors are guided by the mesial surface of the primary canine. When this tooth is prematurely lost, arch length can be reduced by both mesial drift of the posterior teeth and distal drifting of the incisal teeth. The midline can also shift and cause the development of an arch asymmetry.1,7

• An Abnormal Eruption Sequence - normally the greater mesiodistal width of the second primary molar will permit easy eruption of the second bicuspid and provide space anteriorly for the cuspid. Should the arch length become shortened due to an unfavorable sequence of eruption, the cuspid will have insufficient space for its final positioning and will be forced to erupt in labioversion with a decided mesial inclination.3 Also in most cases, the eruptive force of the second molar will cause a reduction in the dental arch length and use up this leeway space. If this occurs before the second bicuspid erupts there may be insufficient space for it in the arch.3

When any of these problems exist, you must have the ability to determine whether or not you will have enough space to allow normal growth to continue. To this end, we use the Mixed Dentition Analysis.

The Purposte of the Mixed Dentition Analysis

The purpose of the Mixed Dentition Analysis is to evaluate the amount of space available in the arch for the succeeding permanent teeth. Although many methods have been suggested, none of them are as precise as one might like. For example, radiographs have often been used to help estimate the size of the succedaneous teeth. However, distortions, enlargements, and rotations of the tooth germs make this method ineffective.

The method presented here is advocated for the following reasons: 1) it has minimal systemic error and the range of such error is known, 2) it can be done with equal reliability by the beginner and the expert, 3) it is not time consuming, 4) it requires no
special equipment or radiographic projections, 5) it is easily done in the mouth or on
dental casts, 6) it may be used for both dental arches. 3

Technique

1. Take accurate alginate impressions and pour up a set of study casts in dental
stone.

2. Find the patient’s skeletal midline. - Because dental and skeletal midlines are not
always the same, it is important to find the patient’s skeletal midline and
accurately mark them on the dental casts. To do this, look in the patient’s mouth
and find the midpalatine suture. This landmark represents the patient’s midline
and can easily be seen in the patient’s mouth and on the upper dental cast.

Follow the midline from the palate and clearly mark its position in the front of the
patient’s mouth. Then, with the patient’s teeth slightly out of occlusion, continue
the midline mark onto the lower arch as well. Now, transfer this information onto
your dental casts.

3. Measure the existing arch length (existing space) in each incisor region - In each
quadrant, measure the arch from the distal of the permanent lateral (or the mesial
of the primary cuspid whichever is most distal), to the skeletal midline. Enter all
four measurements on the chart.

4. Determine the arch length needed for the incisors in each quadrant. - In each
separate quadrant measure the mesiodistal width of the central and lateral at their
widest point and add them together. (e.g. lower right 5+6= 11; upper right
7+9=16) Enter these four measurements on the chart.

5. Calculate the difference between the existing space and the space needed, in the
anterior region of each quadrant. (Step 3 minus Step 4). A positive number means
that there is excess space and a negative number means that there is crowding in
the anterior region.

6. Transfer the measurement for the anterior arch length needed onto the casts - e.g.
Open a Boley gauge to the sum of the mesiodistal width of the lower left incisors.
(Step 4) Hold one point of a Boley gauge at the skeletal midline and with the
other point held along the arch circumference mark the cast. Repeat the same
procedure for all four posterior quadrants. These lines represent the corrected
positions of the incisors when properly aligned to the skeletal midline.

7. Measure the space existing for the unerupted permanent cuspid and premolar
teeth in each quadrant. - This is accomplished by measuring from the menial
surface of the permanent first molar to the distal aspect of the corrected
permanent lateral incisor (See Step 6). Enter this measurement on the chart for all
four quadrants.
8. Obtain the predicted arch length necessary that will allow room for the canine and premolars in each quadrant - Studies show that you can use the sizes of the permanent mandibular incisors to predict, within rather close limits, the amount of space required for the cuspids and premolars in both arches. We use the Tanaka and Johnson System to make this prediction. Simply take one-half the sum of the mesiodistal width of the four lower incisors and add 10.5 mm to it for the lower quadrants and 11.0 mm for the upper quadrants.

(e.g. lower - 6+5+5+6 = 22; 1/2 of 22 = 11; 11+10.5 = 21.5)

9. Is there enough space for the unerupted cuspid and premolars in each quadrant? - Compare the existing space for the unerupted permanent cuspid and premolar teeth (Step 7) to the predicted or needed space for the unerupted permanent cuspid and premolar teeth (Step 8).

10. Remember, the second primary molar usually has a greater mesio-distal width than the second bicuspid. This leeway space in the second bicuspid region averages about 1 mm in each maxillary quadrant and 2 mm in each mandibular quadrant. In most cases, this space is necessary to provide room anteriorly for the erupting cuspids, and to account for the mental eruptive force that the second molars have upon the first molars. Therefore, when determining if there is enough arch space for your cuspid and two bicuspids, you must take this movement and loss of arch length into account.

This means that when the predicted space is subtracted from the actual measured space (Step 9) there should be a surplus of 1 mm per quadrant for the upper and 2 mm per quadrant for the lower. If the actual measured space minus the predicted space results in a number lower than these values, or in a negative number, there will most likely be some crowding when the permanent teeth erupt.

Interceptive Treatment Techniques

Space Maintenance

The early extraction of the first or second primary molar is not unusual, due to the high prevalence of caries for these teeth. If after doing a mixed dentition analysis, you have determined that there is still adequate space and there will be more than a six month delay before the permanent premolar erupts, then space Maintenance is needed to facilitate the normal eruption of the succedaneous teeth into their proper sites.

The use of a simple space maintainer after the early loss of primary teeth, is one of the most common clinical procedures in interceptive orthodontics. Although space Maintenance can be done with either fixed or removable appliances, fixed appliances are preferred in most situations because they eliminate the factor of patient cooperation.
Numerous examples of space maintenance appliances can be found in the textbook, *The Manual of Appliance Therapy for Adults and Children.*

Space Regaining

Some of the more common causes of lost arch space are errors in the eruption pattern of the dentition, discrepancies between the size of the primary and permanent teeth, and the drifting of permanent incisors or molars after the premature loss of the primary canines and molars. The permanent first molar usually migrates mesially quite rapidly when the primary second molar has been lost, and in the extreme case may totally close the primary second molar extraction site.

By performing a mixed dentition analysis, such abnormalities can be detected and treated in their early stages to a good result. Active occlusal guidance with a space regaining appliance is essential to prevent the malalignment of the permanent teeth. Examples of these appliances can be found in the textbook, *The Manual of Appliance Therapy for Adults and Children.*

Contraindications and Concerns

Remember, crowding can occur at any stage of development. If a trend has already emerged in the primary dentition, you can be assured it will be accentuated in the next stage of dentitional development.

It is not necessary for teeth to be missing for there to be crowding. Therefore, a Mixed Dentition Analysis should be done even before the primary molars are lost.

When evaluating the anterior teeth, do not assume that because one incisor has a specific width its contralateral incisor will be the same. It is important to measure all of the anteriors separately.

Always use the patient’s skeletal midline when doing this analysis. When transferring the upper skeletal midline to the lower arch, it is essential to make sure that the patient’s teeth are not in contact. This is important because the patient could have an occlusal interference that directs them into a functional shift. If this is the case, transferring the skeletal midline to the lower arch while the patient is in occlusion will cause an improper midline transfer to the lower arch.

A common mistake often made when doing this analysis is to try and use the maxillary incisors to predict the arch length needed in the maxilla. Remember, when using the Tanaka/Johnson predictive system, the lower incisors should be used to predict the size of the upper as well as the lower posterior teeth. Maxillary teeth are never used in any predictive procedures because they show too much variability in size, and their correlations with other groups of teeth are too low to be of practical value.
Although one of the main purposes in doing a Mixed Dentition Analysis is to actively intervene with appliance therapy before a space discrepancy becomes a problem, common sense indicates that the larger the space discrepancy the greater the chance that extraction of some of the teeth will be necessary to align the remaining ones. As a general guideline, space discrepancies up to 2 mm per quadrant usually can be resolved without extraction. Discrepancies between 2.5 to 4.5 mm per quadrant are best treated without extraction, but frequently will require extraction of some teeth other than the third molars. Arch discrepancies of 5 mm per quadrant or greater almost always require premolar or second molar extractions.¹

Supply List

The supply list for this procedure is minimal. All you will need is:

- An excellent set of study casts
- Diagnostic calipers (Boley Gauge)*
- Pencil
- Mixed Dentition Analysis Worksheet Template*

(* Available through Success Essentials)

Customary Fees and Income Potential

For whatever reason, we are often hesitant to collect a fee for the time we spend analyzing and diagnosing our patients’ dental problems. I feel this is a mistake. At bare minimum, you should be collecting a fee for taking diagnostic casts. Of course it depends on your area, but an average fee for this diagnostic procedure is around $100.

Space management is often the key to preventing a serious malocclusion in the permanent dentition. The early loss of primary teeth can result in a reduction of arch length directly affecting the later eruption of the adult teeth. If the permanent teeth are not going to erupt in six months, appliance therapy is indicated.

Space Maintenance and space regaining are relatively simple procedures. Follow up appointments are generally only needed to keep an eye on the patient’s growth. The average fee for these procedures range between $150 to $400. Even if you only place one appliance a month, you can add up to $4,800 to your bottom line.

By Dr. Rob Veis, D.D.S.
Director – Practice Development
References


Early Diagnosis of potential malocclusion can be made by observing the relationship of the maxillary first primary molar to the mandibular first primary molar.

If the distance between a tangent to the mesial surface, parallel to the long axis of each of these teeth is defined as the "a" space, then the following axions hold:

- If the “a” space is between 3-5mm, the patient is developing an Angle Class I occlusion.
- If the “a” space is less than 2mm, the patient is developing an Angle Class II occlusion.
- If the “a” space is greater than 5mm, the patient is developing an Angle Class III occlusion.

Using this method, a fairly accurate assessment can be made, even as early as age 3-5, of the type of occlusion this patient will have as an adolescent or adult.
FLUSH TERMINAL PLANE

In most normally developing mixed dentitions, upper and lower first permanent molars align in an end-to-end horizontal relationship with their mesial surfaces tangent to a perpendicular line referred to as the "flush terminal plane". Note the combined widths of the deciduous cusp and first and second molars in the maxilla (A'-B') is greater than the combined widths of the corresponding permanent teeth (C'-D'). In the mandible, the difference is even greater, approximately 2.7mm on average. When deciduous mandibular cuspids and molars are exfoliated, a "leeway space" causes a gain in space for lower permanent teeth to be realized. This allows the lower first permanent molars to drift farther forward than the upper first permanent molars, resulting in the conversion from one-half Class II to a full Class I occlusal relationship.
ANTERIOR CROSS-BITES IN THE PRIMARY AND MIXED DENTITION

Practice Potential

During a child's development the permanent lateral incisors are usually overlapped by and located palatal to the permanent central incisors. When growth is normal, this overlapping becomes minimal and enough space will exist for the laterals to move labially into the arch as they erupt.¹

But when growth is not normal and there is insufficient space in the dental arch for the permanent lateral incisors to move labially before their emergence, these teeth will change their path of eruption and become palatally positioned in cross-bite.¹

Anterior cross-bites are one of the most common orthodontic problems that we see in growing children. They usually occur in the primary and mixed dentition as a result of disharmony in either the skeletal, functional, or dental components of the orthognathic system of the child.²

Some of the more common etiologic factors are: trauma to the primary incisors with displacement of the permanent tooth bud; delayed exfoliation of a primary incisor with palatal deflection of the erupting permanent incisor; supernumerary anterior teeth; odontomas; congenitally abnormal eruption patterns, and as in our example, arch perimeter deficiencies. When this happens the pediatric specialist, orthodontist, or general dentist is often called upon to recognize and provide the appropriate treatment to eliminate its potentially far reaching negative effects.¹

Indications

The anterior cross-bite must be treated in the primary and mixed dentition. Allowing this malocclusion to continue into the permanent dentition without correction will result in a reduction of treatment options and provide a less than ideal environment for growth to proceed in an orderly fashion.

Specifically, an anterior cross-bite can lead to the following problems which when left untreated will require more extensive orthodontic therapy at a later time: labial displacement of the opposing mandibular incisor; gingival inflammation and recession of the investing tissues surrounding the mal-opposed teeth; occlusal trauma, enamel abrasion or fractures of the anterior teeth; the development of abnormal chewing and swallowing problems; abnormal growth of the maxilla and the mandible; the development of a permanent Class III dentofacial abnormality, and temporomandibular joint dysfunction.¹,³,⁴
Description

There are three types of anterior cross-bites found in children. They are the simple dental cross-bite, the functional or pseudo cross-bite, and the skeletal cross-bite. Each category is unique and has specific diagnostic criteria.

1. The Simple Dental Anterior Cross-bite

Simple anterior cross-bites are generally the result of an abnormal eruption of the permanent incisors. Various etiologic factors can be involved including: trauma to the primary incisors with displacement of the permanent tooth bud; delayed exfoliation of a primary incisor with palatal deflection of the erupting permanent incisor; supernumerary anterior teeth; odontomas; congenitally abnormal eruption patterns, and a arch perimeter deficiency.¹

Patients who have a simple anterior dental cross-bite exhibit the following characteristics:

   a. The cross-bite usually involves only one or two teeth.⁵

   b. The facial profile is normal in centric relation and centric occlusion.¹

   c. The anterior posterior skeletal relationship is normal.¹

   d. The mandible has a smooth arc of closure into an Angle Class I molar and cuspid relationship, with a coincident centric relation and centric occlusion.²,⁶

   e. A disharmony in the dental components results from an abnormal axial inclination of either the maxillary or mandibular anterior teeth as they erupt. This can be cephalometrically verified by looking at the upper incisor to NA angle and the lower incisor to NB angle. The rest of the teeth are usually in a normal occlusal scheme.⁵

2. The Functional Anterior Cross-bite (pseudo Class III)¹

Patients who have a functional anterior cross-bite exhibit the following characteristics:

   a. In centric relation or in a relaxed postural position, the patient presents with a normal facial profile convexity.

   b. In centric relation the opposing incisors generally contact edge to edge with the molars separated but in an Angle Class I relation.
c. During closing an early occlusal interference causes an anterior shift of the mandible.

d. As the mandible shifts forward into centric occlusion, the incisors are placed into cross-bite and the molars into a Class III relationship.

e. Depending on the severity of the anterior shift when the patient closes into centric occlusion they will either maintain a straight profile or exhibit a concave facial profile.

f. The maxillary incisors are generally retroclined and the mandibular incisors may be proclined.

g. In a pseudo Class III, the gonial angle is more nearly a right angle with the average near 120 degrees. In addition, a false normal ANB angle may be manifested in a pseudo Class III.

3. The Skeletal Anterior Crossbite

Patients who have a true skeletal Class III or mesiocclusion have a problem of skeletal dysplasia involving mandibular hypertrophy, a marked shortening of the cranial base or maxilla, or a combination of both. Some of the characteristics they will exhibit are:

a. In centric relation their facial profile will be straight or concave.

b. In centric relation there will be a Class III molar relationship and an anterior cross-bite.

c. In centric occlusion there will be a Class III molar relationship and an anterior cross-bite.

d. The arc of mandibular closure remains smooth without any occlusal interferences.

e. In an attempt to compensate for the skeletal discrepancy during growth the maxillary incisors usually become proclined and the mandibular incisors become retroclined.

f. Cephalometrically, a reduced or negative value for the ANB angle indicates that either the maxilla is relatively retracted or the mandible is positioned anteriorly. If the SNA angle value decreases beyond the standard deviation for the age and sex of the child, and the SNB angle is normal, the dentist should consider fault in the maxillary dental component. If the SNB angle value increases over the standard deviation
for the age and sex of the child, then the dentist should consider fault in the mandibular skeletal component.3

g. Another cephalometric characteristic found in a skeletal Class III is that the gonial angle is more often obtuse with a range between 130 and 140 degrees (this gives a long facial appearance). It should also be noted that a high SN to Mandibular Plane Angle can mask a developing Class III malocclusion. An in depth cephalometric analysis is a must before treating these cases.3 Note - Space Maintainers has a service that can provide a complete cephalometric analysis.

Treatment

1. Treatment of an Anterior Cross-bite

The first step in treating an anterior crossbite is to determine whether the crossbite is skeletal, functional, or dental in nature. To do this will require a precise clinical and radiographic examination of the patient. This determination is important because correction and retention is generally thought to be better in an anterior cross-bite resulting from a functional or dental problem.

Anterior cross-bites resulting from a skeletal dysplasia have a greater chance of growing out of a corrected normal relationship due to the inherent growth patterns of bone.

The following steps should be included in a clinical examination:

a. Evaluate the number of teeth involved in the cross-bite and their inclination - In a dental cross-bite usually only one or two teeth are involved. In a functional Class III, all the maxillary incisors are generally retroclined and the mandibular incisors are proclined. In a true skeletal Class III, an attempt to compensate for the skeletal discrepancy occurs and during growth, the maxillary incisors usually become proclined and the mandibular incisors become retroclined.

b. Examine the profile - Direct your patient to close their mouth into a rest position with their lips together but with their teeth out of contact. This will allow you to evaluate their soft tissues, facial musculature, and overall facial profile for any signs of a skeletal mandibular prognathism.

c. Examine the arc of closure - When a patient opens and closes into full occlusion, their arc of closure will either be smooth and uninterrupted or exhibit an anterior shift to avoid an abnormal incisal interference. A true skeletal Class III patient will close in a smooth uninterrupted arc. A patient with a functional cross-bite will experience an anterior shift and a patient with a dental crossbite may or may not shift forward.
d. Note the relative positions of the primary and permanent molars in both centric occlusion and centric relation - In a skeletal Class III a mesiocclusion is maintained in both positions. In a simple dental cross-bite, flush terminal plane of the molars will be maintained in both centric relation and centric occlusion. In a functional pseudo-Class III, there may be a shift from a flush terminal plane to a Class III relationship as the mandible closes from centric relation to centric occlusion.6

e. Attempt to manipulate the mandible posteriorly to obtain a more favorable relationship with the maxilla - If the incisors can be brought to an edge-to-edge position or nearly so, it indicates that the cross-bite is more likely due to a functional rather than a skeletal or dental component.3

2. Treatment of a simple dental cross-bite

The best treatment of a simple dental cross-bite is to prevent the condition from ever happening. This can be accomplished by taking routine radiographic images of the maxillary incisor region to look for abnormalities like an odontoma, the delayed exfoliation of a primary incisor, or the presence of a supernumerary tooth. Observing and managing severe arch perimeter deficiency is also essential to prevent a cross-bite from occurring.

Once a dental anterior crossbites exists many methods have been used to correct it. These range from the use of an acrylic incline plane to a reverse stainless steel crown. Even tongue blades have been used to try to jump a cross-bite.3,4 The key to success is to use an appliance that is both comfortable and predictable. The appliances shown in this lecture are two of the most common.

a. The first appliance is a simple Hawley retainer with recurve springs. Activation of the spring in a labial-gingival direction will put a direct pressure on the tooth in cross-bite. The typical design has a passive labial bow which is utilized to diminish any lip pressure during active therapy. It also acts as a limitation for anterior tooth movement.

Adams clasps or C clasps are typically used for retention. Additional retention can be obtained by placing ball clasps between the first and second primary molars. Posterior occlusal bite planes are often used to open the bite and allow the incisor to advance without any occlusal interference.

b. The second design is a fixed labial-lingual appliance. It includes a vertical removable lingual arch for ease of adjustment with a recurve spring to jump the cross-bite. As in the removable appliance, the passive labial bow is utilized to diminish any lip pressure during active therapy.
This appliance is particularly useful when you are dealing with a patient that is a little less cooperative.

Both of these appliances work by tipping the maxillary teeth forward so that they are in a normal dental relationship to the mandibular teeth. Once this is accomplished it will allow future coordinated growth to occur between the maxilla and the mandible.\(^1\)

Activation of these appliances should be done every four weeks by opening the springs so that approximately 2.0 mm of compression is required to seat the appliance.\(^1\)

3. Treatment of a functional anterior crossbite

Treatment of a functional anterior cross-bite should be undertaken as soon as possible to eliminate the mandibular shift that takes place. This is important because this shift subjects the incisors to abnormal occlusal interferences and over time, the forward positioning of the mandible may alter the patient’s growth resulting in a skeletal Class III pattern.\(^1\)

Similar to the treatment of a dental anterior cross-bite, the best way to treat a functional anterior cross-bite is to correct its cause before it becomes a problem. To do this, simply identify the early occlusal interference responsible for the anterior shift of the mandible and eliminate it. For example, mandibular primary cuspid are often the most common area of interference causing a functional shift. A simple adjustment of the cusp tips with a rotary diamond is often all that is needed to correct the problem.

Once a functional cross-bite exists, a predictable correction can be obtained with the Upper Anterior Cross-bite appliance #1073 as seen below. Here the entire anterior segment can be moved labially with an expansion screw placed 90 degrees to the maxillary incisors. The labial arch wire moves with the segment as a unit while using the posterior teeth for anchorage and retention.

A posterior bite plane is necessary if the anterior teeth are lingually locked behind the lower incisors. Activation is achieved by opening the expansion screw one quarter turn per week. This will advance the incisor segment 1.0 mm per month. Retention of the cross-bite correction is usually only required if there is not a positive overbite after the cross-bite has been jumped.\(^1\)

4. Treatment of a Skeletal Anterior Cross-bite

There is no simple orthodontic correction for a skeletal anterior cross-bite. In the hands of an orthodontist, the first step in treating a skeletal anterior cross-bite is to do a differential diagnosis of the location of the skeletal problem. A careful
clinical assessment along with a cephalometric analysis is commonly used to differentiate between a maxillary retrusion and a mandibular protrusion.

For example, while looking at a patient’s profile if there is a straight or concave tissue contour extending from the inferior border of the orbit down to the corner of the mouth, that patient may be suffering from a mid-face maxillary deficiency. A cephalometric analysis indicating a smaller than normal SNA angle would also support this conclusion. On the other hand, if the chin appears to be in front of a line extending down from soft tissue nasion, it is an indication that the mandible is the causative factor. A larger than normal SNB angle would support this conclusion.¹

Early treatment of the Class III involving mandibular excess is generally avoided. The treatment of choice for this skeletal problem is comprehensive orthodontics and/or orthognathic surgery when growth is complete.

Early orthopedic treatment using a fixed rapid palatal expansion appliance with a protraction headgear is the treatment of choice for patients presenting with a retruded maxilla. Turning the screw in this appliance one quarter turn daily will give you 1.0 mm of expansion every four days.

This expansion should be started at least one week before starting a protraction force as it initiates a cellular response in the sutures of the midface and will allow a more positive reaction to the protraction force. This treatment has been shown to be most effective in early mixed dentition.

**Appliance Adjustment Tips**

1. Retention of a removable appliance is often difficult in the primary dentition. To overcome this problem, simply bond a composite button on the buccal surface of the tooth being used for retention to create an undercut for the clasp.

2. Once an auxiliary spring has been adjusted they often tend to ride up the lingual surface of the tooth you are trying to move. One method to prevent this from happening and keep a constant force on the tooth is to bond a small button on the lingual surface. This will allow you to engage the spring under the button preventing it from riding away from the tooth.

3. Once a positive overbite and overjet have been established the occlusal relationship will usually retain the corrected tooth position. If the tooth is not fully erupted the bite planes should be removed off of the appliance and the appliance should be worn as a retainer until a positive overbite is established.

4. To remove an occlusal bite plane, use an extra stiff Robinson brush to cut across the occlusal surface of the acrylic without damaging the wires. Then use an
acrylic bur to shape the appliance to follow the lingual contours of the teeth. This will allow you to remove the acrylic without damaging any of the clasps needed for retention.

Contra-indications and concerns

The correction and retention of an anterior crossbite which is caused by a skeletal dysplasia is much more difficult to accomplish. This is because the inherent growth patterns of bone in a true skeletal Class III give it a greater potential to grow out of a corrected normal relationship.

In such cases, labial tipping of the maxillary teeth would be inappropriate. For the beginner or for the dentist who is only interested in treating minor tooth movement, I strongly recommend referring these cases to the orthodontist.

One of the most common mistakes a beginner makes when trying to correct a cross-bite is to try to move a tooth into position when there is inadequate space. So, before initiating the cross-bite correction, always make sure there is adequate space. This may involve slenderizing primary cuspids, extraction of the primary cuspids, and expansion of the arches.

Appliances can only be effective when they are properly designed to adhere to the principles of retention, force application and anchorage. Because spring pressure is applied to an inclined plane, the reaction tends to dislodge the appliance. Therefore, it is very important that some form of retention be placed near the spring. To accomplish this, circumferential clasps can be placed on the deciduous canines or first permanent molars.

The dentist should always try to anticipate whether other anterior teeth will erupt into crossbite. If this is likely, treatment should be postponed to allow correction of the additional teeth at the same time with one appliance.

The position of an unerupted cuspid should be determined prior to proclining a lateral incisor which is in cross-bite. This is to ensure that the root of the incisor will not be forced against the crown of the canine and possibly be damaged.

Retention therapy following correction of an anterior cross-bite is dependent not only upon which component is involved but also on the degree of overbite. If a patient presents with a deep overbite, retention therapy may not be necessary, as the mandibular incisors will naturally retain the maxillary anterior teeth in the corrected axial position.

If however, the patient presents with an end-to-end occlusion, an open bite, or a persistent neuromuscular habit, it is necessary to leave a retention appliance in the corrected position until new bone is formed and the teeth are stable. In the primary dentition, retention may be needed for several months.
Income potential

The average fee for this treatment around the country seems to range between $300 and $800. Anterior cross-bites are relatively common. By treating just two patients a month you can conservatively add 12,000 dollars a year to your bottom line.

By Dr. Rob Vei, D.D.S.
Director – Practice Development

References


CROSSBITES

Introduction

There are four basic types of crossbite:

1. Simple dental crossbite.
2. Functional crossbite: Unilaterally presenting crossbite with deflective guidance of the mandible towards the side of crossbite.
3. Bilateral crossbite: usually due to skeletal maxillary insufficiency, with no functional shift of mandible.
4. Brodie bite/scissor bite: where the mandible telescopes inside the maxilla either unilaterally or bilaterally.

In addition to this, some skeletal malocclusions (severe Class II and Class III malocclusions) have a relative crossbite. In centric occlusion there does not appear to be a crossbite, but when the models are manipulated to a Class I relationship, a relative maxillary insufficiency exists necessitating management of the transverse dimension in conjunction with the antero posterior discrepancy.

Possible Etiology of Posterior Crossbites

1. Simple dental crossbite. Teeth can be deflected out of line as a result of over retention of primary teeth, arch length deficiency, or an aberrant (ectopic) eruption pattern.

2. The etiology of a constricted maxilla which relate to functional unilaterally presenting crossbites and bilateral skeletal bites, include the following:

   A. Hereditary/Familial
   B. Intubation during infancy. Twenty-two percent of previously intubated neonates presented with future crossbites versus a 5% presentation in unintubated infants. It is thought that the tube pushes the central portion of the maxilla superiorly and constricts the lateral dimension.
   C. Airway problems. Research is not conclusive that airway problems do lead to constricted maxillae, although there appears to be an association between mouth breathers and an increased frequency of crossbites.
   D. Habits. There is a definitive association between prolonged digit and soother sucking habit beyond age 4 and the presentation of both an anterior openbite and posterior crossbite. This is especially true in the Swedish studies referenced.

3. Brodie bites are usually caused by a narrow mandible and an overly wide maxilla.
Rationale for Treating Posterior Crossbites

A. Usually posterior crossbites are not self correcting. The greatest chance of self correction occurs when selective grinding of primary canines is done in the primary dentition to eliminate functional shifting of the mandible associated with a unilaterally presenting functional crossbite. Simple dental crossbites, bilateral skeletal insufficiency with bilateral posterior crossbites, and Brodie bites do not self correct.

B. Cross sectional studies done in Sweden indicate that there is a high association between the presence of a posterior crossbite and TMJ signs and symptoms in the third decade of life. Tooth wear is frequently increased in adult crossbite cases.

C. Adults with unilaterally presenting crossbites often show skeletal adaptation and a higher frequency of Class II subdivision presentation with asymmetry in the craniofacial complex. This can take the form of either adaptation in the condyle fossa region, mandibular. skeletal asymmetry, mandibular dental midline and chin asymmetry, and antero posterior positional change in lower molars. Furthermore, there can be dental compensation with tipping of adjacent teeth. Also, correction of maxillary transverse insufficiency in an adult frequently requires surgically assisted maxillary expansion.

Simple Dental Crossbites

1. Clinical presentation:

A. Usually one tooth is affected.
B. One tooth is deflected to the buccal and the opposite tooth in the other arch is deflected to the palatal.
C. There is no centric relation (point of initial contact) to centric occlusion (maximal intercusption) shift of the mandible.
D. The arches are usually well coordinated except for the area of crossbite.
E. Midlines are usually coincident.
F. The teeth in crossbite demonstrate buccal or lingual deflection of the contact area with marginal ridge displacement.

2. Treatment:

Hooks- or cleats are placed on the buccal and lingual aspects of the appropriate teeth. These can be attached by direct bonding or applied on cemented bands. Then 3/16" "heavy" 4 oz. elastics are used in a cross elastic mode. Elastic packages are given in duplicate, one for school wear and one for home wear. Usual treatment time is 4-6 months. Once the tooth moves into a cusp-to-cusp position, the patient often experiences a desire to chew on the elastics with increased frequency of breakage. After full correction, the attachments are left on the teeth and elastic wear is reduced to nights only.
for one month. If there is no relapse, then elastics are discontinued with the patient checked in 1-2 months to again monitor relapse. If none has occurred by this time, then appliances are removed and retention is not necessary. Occasionally, selective occlusal equilibration is helpful. In older patients, where the crossbite has been more long standing, retention is necessary. Adams clasps on the treated teeth on upper and lower Hawley appliances provides excellent retention.

An alternative treatment would be upper and lower removable retainers with appropriately placed springs. Monthly appliance activation can correct the crossbite in 4-6 months with the same appliance used as a passive retainer, post treatment.

Treatment complications often occur when lingual and buccal movement of the crossbite teeth is attempted without adequate space being available for their movement. This is especially important in crowded cases. Lack of compliance with elastic or removable appliance wear can also delay treatment results.

**Functional Crossbites: Unilateral Presenting with Lateral Deflection of the Mandible Towards the Side of the Crossbite**

1. Clinical Presentation

   A. Skeletal symmetry with maxillary dental midline coincident with the maxillary skeletal midline.
   B. Mandibular dental midline and mandibular skeletal midline deflected towards the side of the crossbite (chin is to the side of the crossbite).
   C. Functional shift of the mandible from centric relation (point of initial contact) to centric occlusion (maximal intercuspation). This deflective guidance of the mandible is towards the side of the crossbite.
   D. The crossbite side often shows a week to a full cusp Class II relationship with the non crossbite side showing a Class I relationship due to rotational closure of the mandible.
   E. Asymmetric condyle position on tomograms and/or transcranial radiographs.
   F. Constricted maxilla with marginal ridges in line and absence of simple dental crossbite.
   G. Frequently the maxilla demonstrates relatively more crowding than the mandible because of the transverse maxillary insufficiency.

**Treatment**

Maxillary expansion should be directed towards opening of the midline suture, since this reduces the likelihood of dental relapse and reduces adverse dental side effects resulting from tooth tipping. Sutural expansion is more stable than dental tipping. Therefore, all efforts should be directed towards maximal sutural opening and minimal dental tipping. Since all appliances are supported on the teeth, one can never totally eliminate dental tipping. However, force levels should be correlated to the biologic age of the patient to obtain maximum sutural opening and minimal dental tipping. Biology of the suture
indicates that low forces can be used in the primary and early mixed dentition (under 8 years of age) to obtain sutural expansion, evidenced by a midline diastema during expansion and/or by radiographic opening of the suture. In the primary and early mixed dentition, sutural expansion can be accomplished with a Quad Helix, W arch, Porter appliance, and even with a removable retainer with a midline screw. The Quad Helix can also rotate permanent molars and assist in mild Class II correction, if needed.

By contrast, older patients in the early permanent dentition (12 years and up) require a higher force level and speed of expansion must be age related compared to the anticipated suture biology. In these older patients, rapid expansion should be used with a rigid type of appliance previously described. In older teenagers (over 14 in a female and over 17 in a male) one may be unable to orthopedically open the midpalatal suture. Irrespective of age and the appliance used, you always get a combination of skeletal and dental movement, unless the suture is fused where only dental tipping will occur.

Treatment Timing

Treatment in the late mixed dentition is inappropriate because of mobile exfoliating primary teeth. In the late permanent dentition, one may not be able to open the suture orthopedically because of sutural maturity. Therefore, the most appropriate time is in the primary or early mixed dentition (under 8 years of age) or in the early permanent dentition (ages 12 to 14). The advantage of early treatment (primary or very early mixed dentition) is that in cases of maxillary arch length deficiency, secondary to maxillary constriction, the permanent incisors are afforded more space prior to and/or during eruption than if the crossbite were to be treated at a later age. Also, any asymmetry in the condyle position and the presence of subdivision malocclusions may be reduced by centering the condyles secondary to elimination of the centric relation to centric occlusion shift. The work of Hesse indicates a return to concentricity of the condyles post elimination of the functional shift and a reduction of the Class II subdivision aspects of the malocclusion from pretreatment to immediate post treatment. Long term stability of early unilateral posterior crossbite correction is excellent and this is a further benefit of early intervention as well as the fact that sutural maturity is incomplete and, therefore, one can use lower force levels than in the early teens.

Appliance Fabrication

For fixed maxillary expansion appliances the sequence of appointments is as follows:

Visit 1 (10 minutes). Separate the teeth for one week. Use radio opaque separators and record the number of separators used.

Visit 2 (30-45 minutes). Separators are removed and accounted for. Band fit the teeth selected for banding. In the primary and early mixed dentition, usually second primary molars are banded. In the early permanent dentition first or second premolars and the first permanent molars are selected. When attempts are made to deliberately rotate permanent molars with a Quad Helix appliance, first permanent molars are selected for banding.
When two teeth (one on each side of the arch) are banded, the bands should be tightly fitted. By contrast when four teeth are banded, such as in the Hyrax or Haas appliance, the bands should not be tightly fitting because it makes insertion much more difficult due to the rigidity of the appliance. After band fitting, an impression is taken and the bands transferred to the impression for lab work. The teeth that have been banded are reseparated, again record the number of separators used.

Visit 3 (30 minutes). Separators are removed and accounted for. Teeth are cleaned and fluoridated. The appliance is trial fit. The appliance is checked to ensure that the turn screw mechanism opens and has been correctly placed (sometimes it is placed back to front. You need to find this out before, not after, the appliance has been cemented!!). The appliance is cemented using a glass ionomer cement and the parent instructed on the turning mechanism (how to do it and frequency of turns).

Slow Versus Rapid Maxillary Expansion

A. Slow maxillary expansion.

This is best used in the primary or early mixed dentition. It can be accomplished with a Quad Helix, Porter, W arch, or a removable as well as a Haas, Hyrax, or mini expander. The frequency of turns is 1/4 revolution of the screw every second to third day. The estimated time to correct the crossbite is 6-12 weeks. Overexpansion is appropriate to take the lingual cusps of the upper molars to contact the buccal cusps of the lower molars. Then the appliance can be left in place passively for an additional 6-12 weeks (use the same time that that it took to correct the crossbite). Some clinicians like to prevent possible slippage of the screw from turning back. This can be done with either a wire ligature or curing composite in the screw mechanism. If a removable appliance is used the frequency of turns is to every 5th to 7th day since activation tends to displace the appliance. This slower approach is also used for "fan expanders" to prevent the expanding portion of the appliance from riding occlusally. It is imperative that the appliance is made with well fitting Adams clasps to prevent sucy displacement.

B. Rapid maxillary expansion.

This can be used in the primary, early mixed, or early permanent dentition with either a Haas, Hyrax, or mini expander. The frequency of turns is either one 1/4 revolution of the screw or two 1/4 revolutions per day. The estimated time to treat the crossbite is 2-4 weeks if unilateral and longer if bilateral. The selected expansion screw should allow for more expansion in bilateral posterior crossbite cases. The patient should be warned that there will be a diastema created initially. During the retention stages of care this will gradually close, often by dental tipping as transeptal fibres approximate the central incisors. Deliberate over expansion is done to help counteract relapse. It is necessary to retain for a minimum of 12 weeks, but preferably longer. This can be done either with moving to a removable night time retainer or by keeping the appliance in place. Rapid maxillary expansion is best used in the early permanent dentition in cases of bilateral posterior crossbite.
Clinical Tips

1. Always separate before banding.
2. Always check that the turn screw mechanism works before the appliance is cemented.
3. If a screw key is used, ensure that floss is secured to this and then secure it around the parent's wrist to prevent the potential for swallowing. The super screw mechanism eliminates the difficulty of finding the hole in the screw mechanism.
4. Always ensure that the parent sees the next hole appear before the key is removed.
5. If the crossbite correction is going slowly, check that the parent is not forgetting the turns. The alternative is the rare likelihood of the screw thread being stripped.
6. For some parents with eye problems or lack of manual dexterity, you need to appoint the patient to do the turning himself. This is eliminated with the use of the super screw appliance because the wrench action is very "user friendly".
7. When cementing a Quad Helix in place, automatically expand the appliance 4mm both anteriorly and posteriorly since this is the average amount of expansion needed to correct a unilaterally presenting crossbite. The 4mm activation can be done by sighting the appliance over a model or by tracing the outline of the unactivated appliance against a subsequently activated appliance.

Potential Side Effects of Treatment

1. Mandibular intercanine width increase: There is some spontaneous mandibular intercanine width increase in rapid maxillary expansion in the permanent dentition. This also occurs to a minimal degree with slow maxillary expansion in the early mixed dentition.
2. Bite opening: As the lingual cusps of the upper posterior teeth engage against the lowers during the crossbite correction, there can be some significant bite opening. This is especially true if you are correcting a crossbite when all second permanent molars are present. This bite opening may be desirable or undesirable. In patients with a steep mandibular plane and an anterior open bite tendency, one should consider the use of occipitally directed headgear and occlusal coverage on either the upper or the lower posterior dentition to control molar eruption and actually apply an intrusive force. This can be done with a bonded maxillary expansion appliance or the use of a removable lower posterior bite block appliance.
3. Maxillary protraction: Maxillary protraction can occur secondary to the mandibular auto rotation caused by the bite opening. Furthermore, the mere act of sutural expansion can cause forward movement of the maxilla. This can be useful in Class III cases which require subsequent maxillary protraction with reverse forward pulling headgear appliances.
4. Maxillary perimeter increase. In the short term, one can expect a 4mm increase in arch perimeter in the primary or early mixed dentition stage of development. Long term maintenance of this perimeter increase remains to be documented.
5. Root resorption: Root resorption occurs on the support teeth when rapid maxillary expansion is used. When cases require a combination of rapid maxillary expansion and subsequent first premolar removal, histologic root resorption was observed on the anchored teeth. Therefore, when early maxillary expansion is needed in the mixed dentition second primary molars should be banded if possible.

6. Periodontal status of the maxillary first permanent molar when maxillary expansion is used. Short term results reveal that there is no compromise in the periodontal status. It would be prudent to set up the mechanics to ensure maximal skeletal opening and minimal dental tipping to further enhance the periodontal status. When there is limited skeletal improvement but significant tipping (as may be seen in an older patient) the maxillary molars are pushed buccally. If during retention you get dental relapse with the molars held in their expanded position, you may have their roots perforate the buccal alveolus.

Bilateral Posterior Crossbite Due to Skeletal Maxillary Insufficiency

In these cases, significant maxillary expansion is needed, well beyond the average 4mm for unilateral cases. For this reason rapid maxillary expansion is often selected and the key element is to ensure that the expansion appliance has a screw in it which allows maximal opening. When the maxilla is sufficiently constricted that a large screw can not be placed, then one has to use either a "Super Screw" or accept the fact that two separate appliances will be needed to accomplish the necessary maxillary expansion. Because of the large amount of expansion necessary, it is imperative that first of all, over-expansion is accomplished, and secondly that there is adequate retention. Personal experience of doing these cases in the primary or early mixed dentition reveal a subsequent need to re-expand in the early permanent dentition. I have attributed this to the fact that retention during the late mixed dentition is very difficult because of exfoliating teeth. Therefore, I tend to postpone treatment of bilateral posterior crossbites until the early permanent dentition.

Brodie Bite/Scissor Bite/Mandibular Arch Telescope Within the Maxillary Arch

The rationale for treating such cases which are extremely rare is that failure to treat them results in lack of occlusal stops on the affected side. Then there is nothing to prevent the vertical eruption of upper and lower posterior teeth resulting in canting of the occlusal plane if the condition is unilateral and/or problems with chewing due to this vertical supra eruption. If this progresses unimpeded, the patient can only be treated with a surgical correction. Therefore, such cases should be treated in the early mixed dentition stage of development. It may be that treatment would be directed solely towards establishing appropriate transverse occlusal contact to prevent subsequent supra-eruption on the previously affected side(s).

Early treatment often takes the form of expandable lower lingual arches and cross elastics. Because of the diverse nature of these Brodie bites, no generalized guidelines can be given, rather each case has to have individual treatment objectives established.
References

Relative Crossbite


Etiology

A. Intubation

B. Habits


C. Airway


Self Correction and Rationale for Treatment:

A. Disking

B. Treatment Success


C. TMJ and Symmetry


D. Airway

E. Suture

Treatment
A. Early Treatment


B. Late Treatment


Effects of Treatment

A. Airway

B. Relapse


C. TMJ


D. General


E. Perio


F. Resorption


Brodie Bite


**ORAL HABITS**

**Oral Habits**

Oral habits can be classified into three catatories: (1) Pressure habits (thumbsucking, lip habits, tongue habits and postural habits); (2) Mouthbreathing habits (open-mouth habit) and (3) Biting habits (fingernail biting, pencil biting, lip biting, gum chewing etc.).

**Bibliography**

Hogeboom F.E.: Practical Pedontia, C.V. Mosby Co. 1953

**Thumbsucking**

The significance of thumbsucking and its effects on the dentition differs with age, state of eruption of teeth and most important, with the intensity and duration of the action. If performed at an early age (3 months to 1 year) at low intensity and short duration, the act is considered to be normal and the effects on the dentition are nil. If performed at later ages (4-6 years) at high intensity and prolonged duration, the action is probably symptomatic of a regression to an infantile level and the effects on the dentition may be severe. When performed during the eruption of the permanent incisors the effects are almost always severe.

The primary effect of thumbsucking is to push the upper incisors labially. If there is also pressure from the thumb on the lower teeth, these are inclined lingually. The result is an overjet and a distinct anterior open bite. The open bite frequently leads to tongue thrusting habits and lisping.

Pediatricians, psychiatrists and pediatric dentists generally agree that thumbsucking is a normal action during the first 2 years of life and should not be interfered with. From 2-5 years of age, occasional thumbsucking at certain times (falling asleep, etc.) is still regarded as normal. However, if the intensity and duration of the action is excessive it may cause damage to the occlusion. Sillman has shown that the thumbsucking malocclusion tends to correct itself if the thumbsucking is discontinued before the fifth year and if the labial and lingual musculature are in normal tone and balance. After 6 years of age the action should be regarded as infantile. Since damage to the erupting incisors in almost inevitable, treatment is usually indicated.

The types of treatment for thumbsucking are: (1) Punitive methods (tied sleeves, bitter substances, etc.) are generally unsuccessful and ten to fix the habit rather than to transfer it; (2) A fixed palatal wire or crib (intraoral) seems to be the most effective appliance to displace the thumb. However, appliances will not succeed unless the child is ready to accept them, and (3) A simple finger bandage or nail polish may act successfully as a reminder. Whatever the treatment modalities are, the education of the parents and their cooperation is essential to successful therapy.

**Bibliography**

Lip Habits

Lip habits often are transfers from displaced thumbsucking habits. The most destructive type of lip habit is the passive or active thrusting of the lip between the upper and lower incisors. The active lip thrust is generally termed a "mentalis habit" since the contracture of the mentalis muscle ("button chin") is typical and diagnostic. This type of habit is most damaging if practiced during the active eruption of the permanent incisor teeth.

The greatest frequency of this habit appears to be between 6 to 12 years. Especially if the permanent incisors are erupting. The decision to treat is best predicted upon the presence or absence of incisor protrusion. Self-correction is the most common type of treatment and varies with the age of the child and it consists of bringing the lower lip up and over the upper incisors. In many cases this consists of various lip exercises (paper held between the lips, etc.). In severe cases, sharp spurs attached to bands or to a palatal wire have been used to discourage the lip sucker.

Bibliography

Tongue Habits

Tongue thrusting is the most pernicious of the tongue habits since it produces the most severe effects. These consist of a labial protrusion of the upper permanent incisors with spacing, depression of the lower permanent incisors and an anterior open bite accompanied by lisping. The question as to what causes this condition is equivocal. Does the tongue thrust cause the anterior open bite or does the anterior open bite result in the tongue thrust? It is generally stated that abnormal swallowing habits result in a tongue thrust. Large inflamed tonsils and "sore throat" have been sited as etiologic in abnormal swallowing habits and in abnormal tongue thrusting. What can be said is that lisping is frequently associated with anterior open bite and tongue thrusting. Treatment should be predicated upon the presence of an upper anterior protrusion and anterior open bite. Under 6 years of age myofunctional exercises or conscious repetition of the correct method of swallowing are generally infective since tongue movements, unlike lip movements, are much more difficult for the young child to control. Conscious re-education is more successful in the adolescent especially if presented as a speech corrective exercise when a lisp is present. The most effective methods of preventing the tongue from thrusting itself between the incisors is to construct a vertical wire "basket" or "crib" attached to a lingual or palatal arch using bands on the molars for anchorage. Cooperation by the parents, plus their sympathetic understanding of the problem is essential to successful therapy.

Bibliography
Postural Habits

Postural habits (leaning habits) can cause deformities of the arches and the jaws. The force to do this must be excessive in amount and very long in duration. Discontinuance of the pressure habit must be achieved before any appliance may be used in order for the appliance to be effective.

Bibliography

Mouthbreathing

Mouthbreathing is very prevalent in children between 5 and 15 years of age. It is estimated that 85% suffer from some degree of nasal obstruction while 20% are habitual mouthbreathers. Diagnosis is simple because the type and character of the mouthbreathing determines the mode of treatment. Mouthbreathing is either total or partial; continuous or intermittent. The direct cause is some form of obstruction in the nasopharyngeal airway (tonsill hypertrophy, deviation of the nasal septum, etc.). Removal of the obstruction does not ensure return to nasal breathing. Most children continue to mouth breathe until adolescence (habitual mouthbreathing). Testing for nasal or pharyngeal obstruction is easily done by holding a wisp of cotton over each nostril. Snoring during sleep is indicative of obstruction. Treatment of obstructive mouthbreathing lies in the domain of the rhinologist. Habitual mouthbreathing should be corrected by the trained pediatric dentist or general dentist. Oral screens fitted inside the anterior vestibule, and/or myofunctional therapy (lip exercises, breathing exercises, etc.). Devices such as taping the mouth at night are not indicated.

Bibliography

Biting Habits

Biting habits have their inception at about 4 to 5 years of age, the most common being fingernail biting. These habits persist throughout life in the original form or as transfers to other more socially acceptable forms (pencil biting, toothpick chewing, lip biting, gum chewing, smoking, etc.). In general, biting habits are not destructive to the occlusion
unless practiced in a perverted or unduly stressful manner. This is due to the fact that, unlike sucking habits which exert pressure against the long axis of the tooth, biting habits produce pressures along the long axis of the tooth. Fingernail biting begins at 4-5 years of age and almost every child bites his nails to some degree at some time during his life. During adolescence nail biting is usually displaced or transferred by other biting habits because of social pressure. Nail biting is a tension-releasing mechanism and is probably a direct transfer from thumbsucking. Treatment of fingernail biting is not indicated nor desirable. Punitive measures such as application of bitter substances, restraints, nagging, and threats are condemned by the psychologist and pediatrician. Perhaps the most important aspect of this problem is the education of the parent to accept fingernail biting as a normal action during childhood which serves as a tension-releasing mechanism.

Bibliography
SCHWARZ ANALYSIS CORRECTIONS BY FACIAL TYPE

In developing an analysis system for the determination of ideal arch width for a given case, it was determined that a given fixed constant could not be used in one formula that would be applicable to all facial types. With this in mind the Schwarz analysis has modifiers to allow for correction of the original constant depending on which of the three basic facial-type categories the patient might fall into. These three basic facial types as viewed frontally are as follows:

Leptoprosopic: This type of individual, when viewed frontally, exhibits a long narrow facial outline with greater predominance of vertical dimension with less influence seen in the lateral dimensions. Correspondingly, the dental arches tend to be longer anteroposteriorly and more narrow.

Mesoprosopic: This is the average type of individual whose facial outline follows a generally paraboloid pattern. The dental arches tend to develop to a nicely shaped geometric Roman arch form.

Euryprosopic: This type of facial pattern is more dominant in the lateral dimensions than in the vertical dimensions and appears as a more square and stocky facial outline. The dental arches tend to be shorter anteroposteriorly but more square or widened out laterally.

The modifications used to accommodate such variance in facial type are simple. The constants used in the formula are 6mm, 7mm, and 8mm as indicated:

- Leptoprosopic: \( SI + 6 = \) bicuspid width
  \( SI + 12 = \) molar width
- Mesoprosopic: \( SI + 7 = \) bicuspid width
  \( SI + 14 = \) molar width
- Euryprosopic: \( SI + 8 = \) bicuspid width
  \( SI + 16 = \) molar width

Using this facial-type modifier in selecting an arch width standard that is more individualized for a given patient, the Clinician can be assured of a greater chance for long-term stability and success.
The completed Schwarz Analysis will assist the Clinician in determining the approach to take in correcting the discrepancies that exist in the patient’s arches. For example, if the discrepancy in the bicuspid area is equal to the discrepancy in the molar area, simple uniform lateral development with an appropriate appliance will bring the case to correct width. If the discrepancy is greater in the bicuspid region, more development will be needed in that area than the molar region, or vice versa. The appropriate appliance design for these situations will then be easy to determine.

It is important to remember that all arch analysis techniques are only guides in assisting treatment planning. Remember to treat to harmony, beauty, and function; not to the dictates of theoretical formulas. Treat to the patient's needs; not to the numbers.
**SCHRÁWZ MODEL ANALYSIS FOR ARCH WIDTH**

The Schwarz Analysis is commonly used to determine the amount of discrepancy in millimeters of actual measured arch width versus ideal arch width in the upper and lower dentition. It is a simple formula to follow and offers a good guideline as to how wide the arches for a given patient should be.

The 8 easy steps to complete the Schwarz Analysis are as follows:

<table>
<thead>
<tr>
<th>STEP</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Measure the mesiodistal widths of the upper centrals and laterals, 21</td>
</tr>
<tr>
<td>2</td>
<td>Determine the <em>ideal</em> 4</td>
</tr>
<tr>
<td>3</td>
<td>Measure the patients <em>actual</em> 4</td>
</tr>
<tr>
<td>4</td>
<td>Determine the <em>ideal</em> 6</td>
</tr>
<tr>
<td>5</td>
<td>Measure the patients <em>actual</em> 6</td>
</tr>
<tr>
<td>6</td>
<td>Measure the patients <em>actual</em> 4</td>
</tr>
<tr>
<td>7</td>
<td>Measure the patients <em>actual</em> 6</td>
</tr>
<tr>
<td>8</td>
<td>Complete the chart by calculating the differences between ideal and the actual values for the arch widths at the upper and lower bicuspids and molars.</td>
</tr>
</tbody>
</table>
The completed Schwarz Analysis will assist the Clinician in determining the approach to take in correcting the discrepancies that exist in the patient’s arches. For example, if the discrepancy in the bicuspid area is equal to the discrepancy in the molar area, simple uniform lateral development with an appropriate appliance will bring the case to correct width. If the discrepancy is greater in the bicuspid region, more development will be needed in that area than the molar region, or vice versa. The appropriate appliance design for these situations will then be easy to determine.

It is important to remember that all arch analysis techniques are only guides in assisting treatment planning. Remember to treat to harmony, beauty, and function; not to the dictates of theoretical formulas. Treat to the patient's needs; not to the numbers.
Measurement points for the Schwarz Analysis

S.I. = _______ mm 21 | 12

<table>
<thead>
<tr>
<th>Patient's S.I. = _______ mm</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patient's</td>
</tr>
<tr>
<td>-----------</td>
</tr>
<tr>
<td>4</td>
</tr>
<tr>
<td>6</td>
</tr>
<tr>
<td>4</td>
</tr>
<tr>
<td>6</td>
</tr>
</tbody>
</table>
Patient Name __________________________________________  Date ____________

Last                       First               Middle Initial

Measurement points for the  Schwarz Analysis

S.I.  =  ____31.2___mm  21 | 12

Patient's S.I. = ______31.2______mm

<table>
<thead>
<tr>
<th>Patient's</th>
<th>Ideal</th>
<th>Actual</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>4 or U.B.</td>
<td>39.2</td>
<td>33</td>
</tr>
<tr>
<td>6</td>
<td>6 or U.M.</td>
<td>47.2</td>
<td>43</td>
</tr>
<tr>
<td>4</td>
<td>4 same as 4</td>
<td>39.2</td>
<td>33.7</td>
</tr>
<tr>
<td>6</td>
<td>6 same as 6</td>
<td>47.2</td>
<td>43.5</td>
</tr>
</tbody>
</table>
Measurement points for the Schwarz Analysis

S.I. = ______ mm 21 | 12

<table>
<thead>
<tr>
<th>Patient's</th>
<th>Ideal</th>
<th>Actual</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>4 or U.B.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>6 or U.M.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>4 same as 4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>6 same as 6</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Measurement points for the Schwarz Analysis

S.I. = 31.2 mm 21 12

<table>
<thead>
<tr>
<th>Patient's</th>
<th>Ideal</th>
<th>Actual</th>
<th>Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 4 or U.B.</td>
<td>39.2</td>
<td>35.8</td>
<td>-3.4</td>
</tr>
<tr>
<td>6 6 or U.M.</td>
<td>47.2</td>
<td>46.5</td>
<td>-0.7</td>
</tr>
<tr>
<td>4 4 same as 4 4</td>
<td>39.2</td>
<td>37.5</td>
<td>-1.7</td>
</tr>
<tr>
<td>6 6 same as 6 6</td>
<td>47.2</td>
<td>46.9</td>
<td>-0.3</td>
</tr>
</tbody>
</table>
The Practice Building Bulletin

THE TWIN BLOCK APPLIANCE
Helping to grow beautiful faces

Today as dentists, our duty is to recognize and treat all forms of oral disease. Thankfully the days of only drilling and filling are over. As part of this new opportunity, we are beginning to recognize our role in the growth and development of our patients.

In the past, we have had to stand helplessly and watch our younger patients mature with all types of malocclusion. Now, there is much we can and should do to intervene in this process. We recognize that crooked teeth are rarely, if ever, the result of a single factor. Our goal therefore is just to realign teeth, but to achieve a proper balance between teeth, bone, and muscle.

The use of functional jaw orthopedics, at the correct time during growth, can ultimately result in the patient achieving a broad beautiful smile, an excellent functional occlusion, a full face with a beautiful jaw line and lateral profile, and maybe most important of all, a stable and healthy temporomandibular joint.¹

In recent years, a wide variety of appliances have been successfully used to achieve a proper functional occlusion. Many of the appliances utilized for this purpose, however, shared one major disadvantage. The upper and lower components were joined together, thus making it difficult for the patients to speak and function normally. Eating with the appliance in place was out of the question. The end result was poor patient compliance... until NOW! The Twin Block Appliance, as featured in this bulletin, has addressed all of the above concerns and is thus described as the "most comfortable and the most esthetic of all the functional appliances." ²

Practice Potential

How many adult patients do you see in your practice who have open bites with flared anteriors, deep bites with ground down lower teeth, crowded arches which are hard to keep clean, weak-looking retruded chins, or who exhibit painful TMJ dysfunction?

Many of these conditions could have been prevented, or at least improved if the patient's general dentist had been able to intercede with a functional therapy during some stage of their development.

The Twin Block technique now gives you the tool you need to provide this service as part of your comprehensive patient care. It is designed to correct these problems in a controlled and comfortable manner. With little help and experience, it is a technique that is simple and easy to use.

You will get good patient acceptance and cooperation allowing you to direct their dental development.
As you continue to read this bulletin you will see that the possibilities for the use of this appliance in your practice are enormous. But don't be overwhelmed. Start out by treating a simple uncrowded, Class II div 1 malocclusion in a growing child and, with experience, you will soon be able to get predictable results for a wide variety of treatment procedures.

**Indications**

The Twin Block is the most versatile of all the functional appliances as it can be used to effectively treat the following situations:

- Class II division 1
- Class II division 2
- Class I open bite
- Class I closed bite
- Class III
- Lateral arch constriction
- Anterior/posterior arch length discrepancies
- TMJ dysfunction

Early intervention with this technique will allow normal eruption patterns to occur and provide the correct environment for proper physiological balance between the jaws and soft tissues. Not treating these problems on an interceptive level can subject the patient to the possibility of needing complicated orthodontic treatment, maxillofacial surgery, or extensive TMJ rehabilitation. The author can see a time, in the not to distant future, when not offering this level of care will be considered malpractice.

**Description**

The standard Twin Block is for the treatment of an uncrowded Class II division 1 malocclusion. Twin Block treatment has two phases. The phase 1 appliance has an upper and lower bite block and is actually two separate appliances which function together as one. In function, these two appliances interlock at the 70 degree angle set into the bite blocks and posture the mandible forward into an ideal Class I position preset by your wax bite registration.

The Phase 1 Twin Block can:
1. Correct a skeletal Class II to a normal Class I relationship.
2. Reduce the overjet and overbite of the incisors.
3. Increase the arch length in an anterior/posterior direction.
4. Expand the upper arch into a normal buccal/lingual relationship with the lower.
5. Expand the lower arch if it is indicated.

The Twin Block has unique design advantages:
1. It can be worn 24 hours a day - even while eating. This allows you to take advantage of all the functional forces applied to the dentition during mastication.
2. The mandible is free to move normally in anterior and lateral excursions without being restricted by a bulky one-piece appliance.
3. Control of upper and lower arch width and length can be done independently.
4. Patient’s speech is normal as tongue movement is not restricted.
5. Appearance of the patient is noticeably improved immediately. This is an excellent patient motivator.

Once the Active Phase is completed with the standard appliance, the Stage 2 - Support Phase is begun. During this phase, an anterior incline plane is used to retain the corrected incisor relationship until the posterior occlusion is fully integrated.

The Twin Block system is also designed to be utilized with fixed appliance therapy in order to expedite treatment while at the same time increasing control through better mechanics. For example, this system can be added to fixed Quad Helix appliances for the young patients, and used in conjunction with full arch fixed cases for patients of all ages when vertical or AP (anterior/posterior) problems need to be corrected in a timely manner.

**Treatment Procedures**

1. As always, proper appliance selection and application requires good diagnosis and treatment planning. It is recommended that the following records be taken:
   
   a. Complete medical and dental history
   b. Periodontal records
   c. X-Rays (full series)
   d. Cephalometric X-Ray and Analysis
   e. Models
   f. Photographs

   Taking the time to obtain these records will also alert you to possible additional treatment that may be needed to assure that your patients receive the comprehensive care they deserve.

2. Upon delivery of the appliance, the clasps should be adjusted to hold the appliance securely. It should be explained to the patient that Twin Blocks are a 24-hour a day appliance. They are even to eat with them in place.

3. Adjustment of the occlusal planes:
   
   a. In cases with a deep overbite the upper block should be slightly trimmed occluso-distally to leave the lower molars 1 mm clear of the occlusion so as to allow for eruption. This is usually done at the first visit, with subsequent reductions performed as needed until the proper vertical relationship is established.
b. In cases with reduced overbite (or open bites) it is very important that NO trimming is done on the blocks. In these cases, all posterior teeth must then remain in contact with the blocks to PREVENT eruption of the posterior teeth.

4. Appointment Scheduling:
   a. 1st Appointment - delivery of the appliances and patient instruction. Adjustment of occlusal planes above.
   b. One week later - adjust the bite blocks if the lower molars have erupted into contact. Arch development - have patient begin expansion screw activation at one turn per week.
   c. One month intervals - check adjustments. Watch for proper vertical, lateral, and AP (anterior/posterior) development. (treatment cont)

5. Once the first phase of treatment is completed, i.e. the case is at the desired vertical and AP position, it is necessary to place a Phase 2 or “Support Appliance”. The aim of this phase of treatment is to retain the corrected incisor relationship until the posterior occlusion is fully established. An upper removable appliance with a steep anterior inclined guide plane is used. The lower appliance is left out at this stage.

6. The support phase appliance is worn until the posterior segments are in full occlusion (usually 4 to 6 months) and is continued for an additional 3 to 6 months to allow for functional re-orientation of the muscular complex.

7. Once you have corrected the patients orthopedic (functional) problem, it can be determined whether they will need to continue with further treatment using a fixed appliance for final leveling, rotation, or alignment of individual teeth.

Lab Requirements

1. Accurate models with good lingual extensions on the lower model. Occlusal surfaces should be bubble-free.

2. An accurate construction bite:
   a. The bite should register a 2 mm vertical clearance between the upper and lower incisors and the midlines should be aligned.
   b. The anterior positioning of the mandible should bring the incisors edge to edge, assuming that there is not excessive upper anterior flaring and that this position is comfortable for the patient.
c. IT IS IMPORTANT TO CHECK THE COMPLETED CONSTRUCTION BITE BY PLACING IT BACK ON THE WORKING MODFLS. Check the bite for proper midline, AP, and vertical correction and then carefully wrap the bite separately for shipment.

3. A complete prescription. The Twin Block is a very versatile appliance. It can be designed with many different clasps, springs, and expansion screws. So it is very important to give the lab your exact specifications.

Adjustment Tips

1. Prior to delivery of the appliance, we recommend the placement of elastic separators between the lower first molars and its adjacent teeth. This will break the contacts and allow for rapid eruption of the lower molars.\(^5\)

2. Once the appliance has been checked for a comfortable fit, it is important to relieve the lower appliance slightly lingual to the lower incisors. This will avoid gingival irritation as the appliance settles in during the first few days.

3. Arch development in Class II constricted arches: The upper appliance should be expanded 1 turn weekly as the mandible advances so that a proper buccal/lingual posterior relationship will be achieved at the end of treatment. Care too should be taken not to over expand the maxilla in these cases.

4. An overjet of up to 10 mm can typically be corrected without reactivating the twin blocks, but overjets greater than 10 mms normally require increased activation by the addition of cold cure acrylic to the anterior incline of the upper block during the course of treatment.

Care for the Appliance

Twin Blocks should only be taken out for cleaning. Cleaning them after every meal is essential as food will collect under the appliances. They should be scrubbed thoroughly with a tooth brush and tooth paste, then rinsed with cool water.

The patient must be shown how to remove and insert the Twin Blocks by using the acrylic not the wires to dislodge the appliance. Instructions should also be given on how and when to adjust any expansion screws.
Contra-indications and concerns

1. As with all functional therapy, proper diagnosis is the key to successful treatment with the Twin Block technique. We highly recommend that complete records be taken prior to initiating appliance therapy (see "Treatment Procedures" section).

2. Prior to treatment, all caries should be removed. The use of sealants and fluoride therapy will reduce the possibility of caries occurring during treatment.

3. In mixed dentition cases where the patient is actively exfoliating primary molars, appliance retention and comfort may become a problem.

4. In cases that exhibit severe crowding in the posterior segments, the Twin Block technique may not be suitable due to the close fit of the occlusal bite blocks. The crowding should be corrected before Twin Blocks are placed.\(^6\)

Customary Fee-Range

$1,800.00 to $3,800.00 per case depending on the complexity and whether or not finishing will require full arch bracketing.

Income Potential

Starting just one twin block patient per month can add over $33,000 in gross production to your practice.

A recent study in the May '91 issue of The Journal of Clinical Orthodontics, pages 295-297, indicated that practices using functional appliances usually had a substantially higher gross income when compared to practices that do not offer this service to their patients.

Keep in mind the possibility of using Twin Blocks in conjunction with TMJ therapy for your adult patients. This may prove to be the most exciting development yet in TMJ treatment. We are just beginning to realize the potential of this dynamic appliance.

References


ATHLETIC MOUTHGUARDS

An update on the state of the art in mouthguard protection.

Practice Potential

Picture falling off your bike or receiving a blow while playing basketball. Now imagine taking in a deep breath of cold air or a having a sip of water. Even if you have never personally experienced the pain that comes from an accident like this, just seeing the results of this type of trauma can send chills down your spine.

It is estimated by the National Youth Sports Foundation that more than 5 million teeth will be knocked out in sporting activities this year. In fact, dental injuries are the most common type of oral facial injury sustained during participation in sports.

Fortunately, many of these injuries can be prevented. The American Dental Association has reported that faceguards and mouthguards prevent more than 200,000 oral/facial injuries in football alone annually.

While it clearly makes good sense to wear a mouthguard when playing a sport, the most recent research indicates that not all mouthguards are equal. In 1993 at the First International Symposium on Dental Biomaterial, Dr. J. Park stated that dentists should not recommend the store bought boil and bite mouthguards as they are inadequate and provide the athlete with a false sense of protection. So, if you are still advising your patients to purchase boil and bite, and stock mouthguards, it is time to re-evaluate your position.

Every patient in your practice who is involved in any athletic activity where contact can be made or a fall can occur should be using a dentist prescribed, heat/pressure laminated intraoral mouthguard. Wearing this type of custom mouthguard not only protects the teeth and soft tissues but will also reduce the potentially dangerous forces that may cause head concussions, neck injuries, and jaw fractures.

Description

The functions of a mouthguard according to Andreasen and Stevens in their 1981 study are as follows. A properly made mouthguard must:

1. Hold the soft tissues of the lips and cheeks away from the teeth, so that lacerations and contusions of the soft tissue during impact can be avoided.
2. Cushion the anterior teeth and redistribute the forces from a direct frontal blow.
3. Fill the space of missing teeth.
4. Help prevent neurological injury by separating the condyles from the base of the skull during impact, reducing intracranial pressure and bone deformation.
5. Help prevent neck injury.
6. Prevent opposing teeth from coming in violent contact, reducing the risk of tooth fracture and supporting structures.
7. Provide support to the mandible by absorbing the forces of impact.
8. Provide the athlete with the confidence that they are less likely to sustain injuries, thus giving them the competitive edge for aggressive competition.

There are four basic types of Mouthguards:

Type I - Stock Mouthguards: These are an over-the-counter product that can usually be purchased at sporting goods stores. These mouthguards require no alterations. Just open the package and place the guard directly in your mouth. This type offers the least amount of protection as there is no retention and can only be held in place by constantly biting into it. At impact it usually becomes dislodged because of its poor fit. Speaking is also difficult because of the lack of retention and bulkiness. This Type I Stock "mouthguard" should not be recommended by the health professional.

Type II - Boil and Bite Mouthguards: These are the most prevalent mouthguards used today. This "mouthguard" is also purchased over the counter at sporting goods stores. The manufacturers have designed these "mouthguards" to be thermoplastic at a low temperature so they can be molded directly in the athlete's mouth. To do this, the wearer must first place the appliance in boiling water and then allow it to reach a temperature that can be tolerated in the mouth. Then it is molded using fingers, tongue and biting pressure. Unfortunately, this lower temperature also allows the boil and bite "mouthguard" to distort at normal body temperatures.

According to a study by Park, since the athlete is asked to bite down during the forming procedure, the thickness of the material between the teeth can decrease from 70% to 99% of its original thickness. This makes it inadequate to protect the athlete against an impact to the mandible. The athlete is usually unaware of the decrease in the occlusal thickness as he continues to wear the "mouthguard" during competition thus providing the athlete with a false sense of protection. "Unless dramatic improvements are made in these products, they should not be promoted to the customers as they are now".4

As recently as July 1995, the Currier Mail, the national newspaper of Brisbane, Australia, highlighted a life threatening incident where a 17 year old had his boil and bite "mouthguard" lodged in his oropharynx due to the poor fit and retention. The athlete collapsed and had to be taken to the hospital.

Just like the Type I stock "mouthguard", the Type II boil and bite "mouthguard" should not be recommended by the health professional.

Type III - Vacuum Custom Built Mouthguard: This mouthguard has in the past, been promoted by the literature and accepted by the health profession as the best available
mouthguard. Using a single sheet of polyvinylacetate-polyethylene copolymer material and the same type of vacuum forming machine that is used to make bleaching trays, a mouthguard can be formed to fit either the upper or the lower arch. This procedure is done under low heat and one atmosphere of pressure. Unfortunately, vacuum processing can pull the mouthguard material away from the incisal edges of the upper front teeth, which is just the area where athletes are most often injured. In the same 1993 study by Park, he noted that vacuum custom-made mouthguards also decreased in thickness during forming as much as 25% occlusally (much less than the 70%-99% noted with the boil and bite) and 50% buccally and lingually. Because of this thinning, there appears to be no way to ensure a proper occlusal, palatal, or labial thickness.4

It has also been shown that although these mouthguards fit well at their initial insertion, after several weeks of use in an athlete's mouth, they become loose. This is believed to occur because the material used to make these vacuum-machined mouthguards retains some memory of its original shape.7

Therefore, before diagnosing and promoting this type of mouthguard, the health professional must be aware of its inherent decrease in thickness and the fact that in time, the mouthguard may not maintain a proper fit. Any Type III Vacuum Mouthguard, provided by the dentist, must be closely monitored for fit, occlusal thickness, and retention as they will not provide proper protection for prolonged periods of time.8

Type IV.- Heat/Pressure Laminated Thermoformed Mouthguards: This type of mouthguard is constructed from upper and lower casts of the patient’s teeth. The material used is an ethylvinyl acetate that has a Shore Hardness of 80 with minimal shrinkage or water absorption after its fabrication. The Mouthguards are laminated with a special machine, under high heat and high pressure.9

Some of the benefits of making a mouthguard with this type of a technique are:

1. the Mouthguards will have excellent tooth and tissue adaption.
2. there will be negligible deformation of the guard even after it has been worn for prolonged periods of time.
3. an area can be thickened as needed because of the laminating ability of the high heat \ high pressure machine.
4. the ability to customize the mouthguard for each sport, age, and level of competition, orthodontics, mixed dentition, clefts, missing teeth, and anatomical and occlusal variations.
5. the ability to insert a hard polycarbonate layer between soft ethyl vinyl acetate materials for additional protection for high velocity impact sports such as hockey, boxing, martial arts.
6. achieving a constant occlusal separation while maintaining the proper occlusal balance necessary for concussion prevention.

7. there are no interferences with breathing or speech.

8. the ability to individually design the guards to meet the specifications of the treating dentist.

Recent published studies and papers are showing that the type IV Mouthguards are now considered the mouthguard of choice for the ultimate in oral/facial athletic protection.

By acknowledging that there are substantial differences in mouthguard types and designs, we as health professionals can seriously look at providing a much higher level of protection and standard of care for athletes.

**Appliance Designs**

The key to successful mouthguard therapy is to make one that will be worn! Therefore it must fit the athlete’s mouth and teeth accurately, stay in place comfortably and allow the wearer to breathe and talk normally.

Tear strength, tensile strength, modules of elasticity and drop ball impact tests are just some of the material tests that researchers have been doing to find the ideal mouthguard material. Based on these tests the ideal material should:

1. be subject to high compressive strength.
2. be thick enough to absorb the energy of an impact.
3. be able to dissipate the energy of a blow throughout the material rather than allowing it to transfer to the underlying teeth.
4. be durable enough to eliminate any physical changes that might occur under normal use.

The actual performance of the mouthguard in vivo not only depends on the material properties, but also on design parameters such as the number and type of layers and its final thickness after fabrication. Selecting the proper design for your patient will depend on:

1. The type of sport being played.
2. The type of sporting equipment used.
3. The experience and level of play of the participant.
4. The age of the athlete.
5. The athlete’s dental health (i.e. tooth mobility, caries, orthodontic treatment )
6. The patient’s dental anatomy (i.e. Skeletal relationship, stage of dentition)
Space Maintainers Intact All Sports Mouthguards have four different designs which are based on the parameters specified above.*

1. The Intact Youth Mouthguard: Recommended for athletes who are in primary and mixed dentition. Given all the pertinent information (i.e. sequence of exfoliation, type of orthodontic movement being accomplished) the mouthguard can be modified to allow for these changes. But because children’s arches continue to change, it is necessary to have a guard that will provide an adequate amount of retention and protection yet be inexpensive enough to be replaced throughout growth. This guard is usually 3-4 mm in thickness.

2. The Intact Adult Mouthguard: Recommended for the majority of athletes with an adult dentition involved in recreational sports. This mouthguard is made to last. It is composed of 2-3 laminated sheets making it thicker (approx. 5 mm) and stronger.

3. The Intact Professional Mouthguard: This guard is recommended for professional athletes, and for anyone involved in a sport where strong and hard impacts to the face and jaw are to be expected. Some examples are hockey, karate, boxing and rugby. These guards are multi-layered with a thin polycarbonate insert on the labial and buccal surfaces of the teeth. This extra protection is also needed for anyone who has a history of trauma.

4. The Intact Martial Arts Mouthguard: This guard is recommended for anyone involved in any of the martial arts or boxing. Because these athletes often receive strong impacts to the face and jaw a mouthguard must protect not only their teeth but also their Temporomandibular joint. With that purpose in mind, the Martial Arts guard is composed of three laminated layers to give the athletes the added protection they need.

* All of these guards are made to a balanced occlusion creating the best protection for the joint and dentition.

Indications

A 1984 study by Davis and Knott in Australia, showed that over 80% of all dental injuries from sports occurred to the front four maxillary teeth. It has been estimated that the total rehabilitation costs for a single knocked out tooth are more than 20 times the preventative cost for a custom laminated professional-grade mouthguard.11

The National Youth Sports Foundation for Safety reported that dental injuries are the most common type of oral facial injury sustained during participation in sports.1 In a 1995, Flanders and Mohandas stated in the Journal of the American Dental Association that the oral facial injury rate was only .07% in football where faceguards and mouthguards are worn. However, in basketball, where mouthguards are not normally worn there was a oral facial injury rate of 34%.2
A report in Pediatric Dentistry magazine clearly indicated the importance of wearing mouthguards. Interviews involving 2,470 junior and senior high school athletes receiving injury during sports revealed the following: Nine per cent of all players suffered from some form or oral injury while another 3% reported loss of consciousness. Seventy-five per cent of the injuries occurred while not wearing mouthguards, and of this total 40% occurred during baseball and basketball. Fifty-six per cent of all concussions were suffered while not wearing mouthguards.\(^2\)

Mouthguards may help prevent concussions, cerebral hemorrhage, and possibly death, by separating the jaws, thus preventing the condyles from being displaced upward and backward against the wall of the glenoid fossa.\(^13\) Due to the diversity of sports that can produce oral trauma, it is recommended that mouthguards be worn by all participants. Some examples are baseball, basketball, boxing, rugby, hockey, squash, soccer, racquetball, tennis, lacrosse, karate, judo, volleyball, touch and contact football, bicycling, and skating.

Treatment Procedures

1. Ask your patient if he or she is involved in any sports.
2. Discuss the need for using a mouthguard.
3. There is a tape available which patients can watch if they need a little extra incentive (call for details).
4. Take alginate impressions of the upper and lower arch making sure to record the vestibular and palatal extensions completely.
5. Pour the impressions in a hard stone, and check them for accuracy.
6. Take an accurate bite registration at the desired horizontal and vertical relationship. The mouthguard will be made to reproduce this relationship allowing you to achieve a constant occlusal separation while maintaining the proper occlusal balance necessary for concussion prevention.
7. Carefully wrap up the models and bite relationship separately and send them along with your specific design instructions to the laboratory.
8. Based on your instructions the laboratory can customize the mouthguard for each sport, the age of the athlete, and the level of the competition.
9. The laboratory can also modify the mouthguard to take into consideration active orthodontic treatment, a changing mixed dentition, existing clefts, missing teeth, and any anatomical and occlusal variations.
10. Mouthguards should be monitored and replaced when necessary. Extra care should be taken during the mixed dentition stage. During this time the mouthguards should be replaced every six months. During orthodontic therapy, close communication should be kept with the orthodontist to establish a time sequence for mouthguard replacement.
11. Upon delivery discuss: how to wear, clean, and store the appliance.
Lab Requirements

1. A set of accurate working models with full buccal vestibular extensions and palate poured in dental stone along with an accurate bite registration.
2. A prescription including type of mouthguard desired. Indicate color(s), sport to be played, level of competition, age of athlete, and any special instructions. (For example, the patient has a history of concussion; maintain occlusal thickness of 4mm.)

Supply List:
   Alginate*
   Mixing bowl and spatula
   Water
   Dental stone
   Impression Trays*
   Tray Tree*
   Bite registration material
   Video tape on the and spatula material
   Use of mouthguards (Call for details).

* Available from Success Essentials

Adjustment Tips

During the seat and adjustment appointment, make sure the occlusion is balanced, and all teeth are hitting simultaneously. Check that the proper occlusal thickness is present and the athlete is comfortable with the fit. The mouthguard should be difficult to remove once it is seated properly. Check the patient’s speech while the mouthguard is in place. If it is necessary, reduce the palate to allow for proper speech.

Care for the Appliance

The patient should be instructed in the proper care of the mouthguard. If it is exposed to heat or pressure it may permanently deform. This may occur if the mouthguard is squashed in the bottom of a player’s sports bag, left in a hot car, or out in direct sunlight.

The mouthguard should be kept moist allowing it to maintain its flexibility and resilience. After use, the mouthguard should be scrubbed with a tooth brush, then placed in its container.
Contra-Indications and Concerns:

1. Mouthguards are most commonly made for the maxillary arch.

2. For the athlete with a prognathic mandible it is recommended that a custom mouthguard be made to cover the mandibular arch.

3. Prior to receiving a mouthguard, a complete oral exam should be completed to ensure that the patient is in good health.

4. All new or recurrent caries should be treated prior to the fabrication of a mouthguard. The decay process could be accelerated if the mouthguard is worn over carious lesions.

5. New restorations placed after the mouthguard is placed could effect the fit of the guard.

6. It may be necessary to block out any undercuts in an area where there is a fixed prosthesis (posterior bridge).

7. Removable prosthodontic devices (appliances) should be removed prior to taking impressions for the mouthguard. The patient must be instructed to remove these appliances while wearing the mouthguard.

8. Special care needs to be taken when designing mouthguards for the edentulous patient. Please consult with the lab for further information.

9. Third molars - the most frequent site of mandibular fracture is in the area of unerupted third molars. Each athlete should have his or her third molars evaluated for possible extraction.

10. Erupting teeth - the area of tooth eruption should be blocked out on the dental model to allow a guard to be made which will allow for its normal eruption.

11. Orthodontics - mouthguards should be modified to allow for the anticipated changes over a 3-month period. Patients in fixed appliances should be wearing either separate mouthguards on both the upper and the lower arches, or a bimaxillary mouthguard to prevent the possibility of severe soft tissue trauma.

12. At this point it is impossible to properly increase the thickness of the mouthguard through lamination or thermo-forming with a simple "in office" vacuum machine.
Income potential

Many Doctors make mouthguards for their patients at or below cost because of their effectiveness as a marketing tool. Promoting mouthguard care is one of the best ways to attract new patients and build your practice. Some effective marketing ideas I have heard about while lecturing around the country are:

1. Offer this service to local gyms and sports clubs.
2. Become a school dentist.
3. Give talks to community service clubs i.e. P.T.A., Rotary.
4. Make the service available to the neighborhood sports teams i.e. soccer, Little League, Pop Warner Football.
5. Contact businesses such as martial arts studios, gymnastic schools, sporting goods stores and bike shops. Cooperative coupons and flyers can be used to promote your mouthguard service and the local business.
6. You might want to supply a personalized tooth brush (with practice name and phone number) and a small carrying bag with each mouthguard.

Offering mouth protection to your patients will open up many treatment opportunities for you. Every patient who needs a mouthguards should have:

- A comprehensive dental examination.
- Their periodontal status evaluated for pericoronitis, periodontitis or gingivitis.
- All caries and restorative work completed.
- An orthodontic evaluation which can provide you with the opportunity to do minor treatment i.e. retract protruding upper anteriors.
- His or her third molars evaluated for possible extraction, since the most frequent site of mandibular fracture is in the area of the unerupted or impacted third molars.

Remember, it has been estimated that the total rehabilitation costs for a single knocked out tooth are more than 20 times the preventative cost for a custom laminated professional grade mouthguard!

References


8. Padilla R, Balikov S, Sports Dentistry Coming of Age in the 90’s, California Dental Association Journal, April 1993, pp 27-34.


THE TALON™ SPLINT
Comfortable - Retentive - Adjustable

Splints come in a variety of designs. Traditionally, they have been made from a hard acrylic or a soft, polyvinyl material. The hard acrylic splints provide the patient with an adjustable occlusal surface but usually require substantial chair time to make the appliance fit comfortably. The soft splints, although more comfortable for the patient, do not lend themselves to adjustment and repair. The new Talon™ splint offers the best features of a hard splint and a soft splint while eliminating these disadvantages.

Practice Potential

Splints are being used in the general practice to achieve a variety of objectives:

1. Bruxism Splints are used to prevent excessive tooth wear, tooth mobility, and loss of tissue attachment.¹

2. After periodontal surgery, splints are used to distribute forces, decrease trauma, and aid in the healing process.¹

3. In orthodontics, they are used as a form of final stabilization.¹

4. Splints are used to treat patients with TMJ dysfunction, i.e. patients who suffer from local neck, shoulder or sinus pain; clicking in the joints; pronounced malocclusion; impaired excursion in opening of the mouth or deviant motions of the jaw.

Description

The term “Talon™” refers to the material used for the retentive portion of the splint. Talon™ is a soft, thermoplastic, resilient polymer. Unlike other thermoplastics currently available, it maintains its original flexibility for years. This material is very retentive and eliminates the need for any other form of mechanical retention.

Once the Talon™ material is processed, hard acrylic is then chemically bonded to the Talon™ material to form the occlusal surface of the splint.²

Precise occlusal adjustments can easily be accomplished due to the hard occlusal surface. This allows you to maintain a proper proprioceptive response with the opposing dentition.

* Shore Hardness Tests performed by Braun Intertec Northwest, Inc.
Indications

The Talon™ splint will benefit every patient in your practice needing a splint for bruxism, periodontal splinting, orthodontic stabilization, or TMJ dysfunction.

The Talon™ splint should be used when you need:

1. A splint with a superior fit - the soft nature of the retentive portion of the appliance completely eliminates pressure points and thus the patient adapts immediately. No longer will you have to spend time trying to find "tight spots" on the appliance due to possible slight model imperfections. You will find that your delivery appointments will be reduced greatly over conventional hard splints.

2. Positive retention without the use of metal clasps.

3. The ultimate in comfort - a Talon™ splint has the best features of a soft splint yet it allows for excursive movements free of the friction inherent in polyvinyl splint designs.³

4. An appliance that can be made in a manner that will not interfere with your patient’s ability to speak normally. Because retention is superior, this appliance can be designed without speech inhibiting lingual extensions. This is greatly appreciated by your adult patients.

Treatment Procedures

1. Every patient who needs a splint should have a comprehensive dental examination.⁴ This should include:
   a. A complete medical and dental history.
   b. A thorough dental exam.
   c. A periodontal evaluation.
   d. An occlusal analysis.
   e. An orthodontic survey.
   f. A TMJ screening.

2. All caries and necessary restorative work should be completed before impressions for a splint are taken.

3. TMJ patients should have a complete TMJ work up. Radiographic techniques such as a transcranial or a tomogram should be used for the purpose of confirming your clinical diagnosis.

4. Upon delivery of the appliance, do any needed occlusal adjustments.

5. Discuss with the patient how to insert, remove, and care for the appliance.
Lab Requirements

1. Accurate casts poured in stone. Air bubbles or holes on tooth surfaces are unacceptable as they can negatively affect the fit of the appliance.

2. Provide a carefully taken construction bite that represents the exact vertical and AP position that you desire in the finished appliance. This is the single most important step to successful treatment after making the correct diagnosis.\(^5\)

3. Detailed instructions as to how you would like the occlusal surfaces finished, i.e. flat plane, occlusal indexing, cuspid and/or anterior rise, etc.

Lab Fee

The slightly higher cost, per arch, is more than offset by savings in chair time for adjustment and in patient compliance due to the increased comfort and stability.

Adjustment Tips

The self adjusting nature of the thermoplastic Talon™ material all but eliminates the need for a long and tedious adjustment session. My experience is that it easily saves 15 to 20 minutes of grinding during the initial seating of the appliance.

Adjustments for opposing arch contact with the splint should be minimal provided that an accurate construction bite is sent to the lab with the working models.

Patients should be checked after the first week of wearing the splint. Any remaining occlusal and lateral interferences can be quickly removed at this time.

Care for the Appliance

It is essential that the patient is properly instructed in the proper care of the Talon™ splint. This includes the following guidelines:

1. It is VERY IMPORTANT to have the patient soften the appliance under warm tap water prior to its placement.

2. Never allow the appliance near high temperatures or allow it to dehydrate for more than 24 hours.
3. The appliance should be kept moist when not in use. A retainer case works nicely. The patient should simply place the appliance in the case with a small piece of wet paper towel.

4. The appliance should be hardened under cold tap water prior to cleaning. A soft brush and toothpaste, or soaking in denture cleaner, is all that is needed.

5. Removal of the appliance is best accomplished by using equal pressure on both sides of the mouth. This will minimize the chance of damage to the resilient portion of the appliance.

Contra-Indications and Concerns

All new or recurrent caries should be treated prior to the fabrication of the Talon™ splint. The decay process could be accelerated if the splint is worn over carious lesions.

As with all appliances, patients should be checked on a regular basis to be sure your treatment objectives are being met.

When treating TMJ dysfunction, it is essential to take proper records which should include a pre-treatment image of the TMJ (a transcranial or tomogram).

By Rob Veis, D.D.S.
Director – Practice Development

References


2. Talon™ Laboratory Technique Manual: Thermoplastic Resilient Polymer for Interocclusal Dental Appliances.


“The reasonable man adapts himself to the world: the unreasonable one persists in trying to adapt the world to himself. Therefore all progress depends on the unreasonable man.”
“Maxims for Revolutionists” George Bernard Shaw

The author has heard many doctors comment that they were afraid to treat TMJ because they would be married to the patient. This is true if you are treating with guesswork and using generic splints. However, the fact is that TMJ disorders are chronic and degenerative. There is no cure for TMJ problems and there should be no guilt for the treating doctor if the natural progression of degeneration reoccurs after he has done everything reasonable to treat the patient.

If the patient is educated to accept this basic fact, and they then go out of remission with a flare-up, they will understand that it is part of the process and view the dental physician as the health care provider of choice to turn to for help with their affliction.

We are going to approach this problem with this perspective and arm ourselves with the knowledge and attitude of our medical colleagues who have been educated to treat the chronic pain patient. They manage chronic pain, deterioration, debilitation and, of course, death, every day. We will manage TMJ problems non-invasively. I would rather be a physician of the mouth treating TMJ.

Chronic cranio cervical pain is unique because of the large number of structures with so many different functions, vascularity, and innervation. The psychogenic aspects of facial pain can influence self mage and esteem further complicating the situation. The goal must be to view the victim of this process as a complete human being and not as a package of confusing symptoms. There is a lack of organization and consensus in the treatment of TMJ disorders because there is no unifying clinical concept. This confusion is fed by economic factors, politics, third parties, etc.
It is not unusual for an individual patient to be seeing a surgeon for TMJ intracapsular injections, a physical therapist for jaw exercises, a chiropractor for TMJ manipulation, a medical physician for pharmacotherapeutic management, a psychotherapist for help with feelings, and a dentist for equilibration and generic splint therapy.

Most of this treatment is based on guesswork that adds tremendous cost but very little value to the treatment because it focuses on management of symptoms, not the proximate cause of the disorder, intrinsic derangement and degenerative disease of the temporomandibular joints.

Doctors who treat with guesswork, who have poor records, and who fail to educate and inform their patients can get into big trouble with risk management.

In the March 1988 Journal of the New York State Dental Association, Dr. Larry Weinberg wrote that “...any dentist is legally at risk if he/she does not establish beforehand the relative health or state of dysfunction of the temporomandibular joint and its musculature.”

Note the degree of motion of the disc in the normal TMJ in the wide opening maneuver. The thicker posterior band of the disc acts as a wedge to prevent the Lateral Pterygoid muscle from pulling the disc through the anterior joint space. The posterior ligament acts to some extent to limit the forward motion of the disc also. Elongation of the posterior ligament and flattening of the posterior band of the disc leads to internal derangement.
Screening for TMJ Problems

The new standard of care in New York state requires that TMJ transcranial films be used on all new patients and to screen patients of record. In Dr. Weinberg’s opinion, TMJ imaging is as important as diagnostic bitewing radiographs for screening for cavities.

Absolutely any patient who will undergo occlusal treatment of any kind (and that can include just an MOD amalgam), full mouth reconstruction, dentures, or even periodontal treatment, should be carefully screened radiographically for TMJ and submitted to a muscle evaluation for trigger points. This is rapidly becoming the standard of care throughout North America.

The Submental Vertex Radiographic view is interesting. In the patient with TMJ problems, it is very common to find that the polar axes of the condyles are asymmetrical. Likewise the the polaraxis is usually not at a right angle to the plane of mandibular ramus.
The Medical History

The dental physician who examines a patient complaining of signs and symptoms of a “presumed TMJ disorder” may make the classic clinical mistake of carefully recording the signs and symptoms that would confirm the TMJ problem at the exclusion of other entities. The author always makes a conscious effort to arrive at an impression of the patient’s problem by exclusion. That is, I assume that everything except a TMJ disorder is causing the problem and when everything else is ruled out, I am left with the unmistakable impression of a TMJ problem.

The general dental health history forms provided by dental schools are excellent for recording background information. The examination form devised by Dr. Rob Veis and available through Space Maintainers Dental Laboratory is excellent. There are, however, other vital areas of information that must be obtained from the cranio cervical pain patient to help you arrive at an impression of a TMJ disorder. In this document you will find copies of the forms that the author uses in his practice. Please be advised that these forms are supplemented by entries into the clinical progress records of information that arises out of patient screening. The author’s office TMJ history forms are not meant to be the only information taken from a TMJ patient. The average dental physician will likely adjust his paperwork to reflect his philosophies and the focus of his or her individual practice.

The Two Minute TMJ Screening

The dental physician may not be interested in treating TMJ but the responsibility to examine and screen for the problem cannot be ignored. This at least establishes a baseline in the event that the patient develops a TMJ problem in the future or sustains a craniocervical injury.

All new patients should get TMJ imaging and the two minute screen for TMJ problems. All current patients, including children, should be screened and rescreened annually. All patients with positive screens should be submitted for an extended history, transcranial TMJ imaging, and tomograms and MRI studies if they are readily available. There are medical diagnostic codes for these procedures which should become as routine as soft tissue analysis and probing for periodontal disease.

The two minute screening is designed to identify the patient who is predisposed to a problem as a result of trauma or cranio cervical factors that contribute to TMJ disorders. The first question to ask is: “Does your jaw ever feel tired?” A sensation of jaw fatigue with chewing or normal jaw activity is almost always a definitive finding for TMJ problems.
Next, screen for the following:

1. History of trauma
2. History of orthodontics
3. History of difficult extractions
4. History of oral reconstruction
5. Patient wears a denture
6. History of tonsillectomy
7. History of "migraines"
8. More than one headache per month, dose family history of TMJ or "migraine" problems
9. Decreased range of jaw motion
10. Jaw noises, auscultate the joints
11. History of myringotomy
12. Retro orbital, occipital and bitemporal cephalgia
13. History of photophobia
14. History of prior splint treatment
15. Palpate the TMJs
16. Check range of motion
17. Order baseline TMJ imaging
18. Carefully palpate the following.
   a. The anterior, mid, and posterior
   b. fibers of the temporalis in the open
   c. dosed position.
   d. The superficial and deep masseters
   e. in the open and intercuspal position
   f. The Lateral Pterygoids
   g. The Medial Pterygoids
The most common cause of TMJ disorders by far is cranio cervical trauma. The trauma may be minor and not even involve direct impact with the jaw or skull, but the soft tissue injuries can occur and become a chronic problem from which the patient never recovers. Ask the patient carefully about any head injuries, sports injuries, motor vehicle injuries, etc. If the patient can’t recall, talk to the parents and especially grandparents about childhood trauma that may be the proximate cause of TMJ problems many years after the occurrence of an injury.

This rapid screening procedure will allow you to spot the majority of patients with TMJ problems. Baseline studies are done on all patients new or in recall as this program is introduced into your practice.

Any positive findings are explored further and if significant history is elicited, the patient is rescheduled for further studies and workup.

All of the steps up until #15 of this two minute screening can be performed by your hygienist for even greater office efficiency. Except for the baseline TMJ imaging, this two minute screening is performed verbally at each recall visit and recorded in the chart. A written entry in the progress records by your staff is a most excellent record.

The Extended History

The first phase of history taking is a general information gathering about the past medical, social, surgical and other factors that can contribute to the present health status. This will lead to questioning that will reveal the events and proximate cause of the TMJ complaint.
Patient evaluation begins with the initial contact. General observations about gait, head neck posture, and quality and duration of craniocervical pain is noted.

A careful history and logical examination of the patient with TMJ disorders will usually reveal the primary etiologic factor in the TMJ headache patient, i.e., compression of posterior neurovascular structures and disc displacement.

An excellent dental medical history form is the one provided by Space Maintainers Dental Laboratory. If you carefully record the history of trauma in your progress records, this should be adequate in most cases. It is especially important for the doctor to review the past history of present symptoms as this will give valuable clues to the patient’s present status.

What to Record

A complete and concise history helps:

1. elucidate the patient's perceptions and expectations,
2. define the onset, clinical course, and character of symptoms, and
3. determine the efficacy of previous efforts at treatment, especially surgery.

This is vital information to record in the progress records.

Important Questions to Ask

Several other facts are very important to record. The first would be, in the case of a trauma patient, to record if there was any pretrauma TMJ problem and if so, what kind of treatment was rendered, who the health care providers were, and what was the efficacy of the treatment. If there was pre-existing TMJ problems, was the patient free of symptoms at the time of the trauma.? Is the patient currently considered to be under treatment for a pre-existing condition?

If there was no pre-existing TMJ or headache problem, then it is valuable to record this and to specifically record that the patient has never been treated for a TMJ problem, has never been under the care of a dental or medical physician for headaches, and that the patient doesn’t take medications for headache more than every 10 to 15 weeks for men and more than one or two days per month for women. Our society has conditioned people to treat headaches as a common everyday occurrence. The author is continually amazed at the high levels of over the counter medication that patients take to control headaches related to TMJ problems of which they are unaware.

Another important observation is to have the patient explain their chief complaint and then list in order the most significant symptoms they are suffering and have them actually point to the areas of pain with the finger. Recording this on video or slides can be a very is valuable part of your complete record taking. It is very important to record the chief complaint and secondary complaints and the patient’s perception of the symptoms.
Subjective symptoms are problems that the patient complains of. Objective signs are the observations of the doctor that will play the major role in developing an impression of the case.

The character, location and severity of pain should be recorded by the patient on a drawing of the body by the patient and discussed with the dental physician. It is very important to record any precipitating factors in the pain and what the patient does at home to get control of the pain. Most TMJ patients are unsuccessful in getting control of their pain with common medications, but they take them anyway if just to take the edge off. If the patient is able to control pain in some manner, then this should be recorded. The history and onset of the pain is important because it will help you determine if you are dealing with acute or chronic pain and if it can be related to a specific event, may direct the treatment later on. The patient with recent acute pain will likely describe it as local or focused. The patient with chronic pain will often describe pain as diffuse and in several seemingly unrelated areas.

The Physical Exam

The physical examination process includes the appropriate dental clinical studies, radiologic studies, and medical and dental laboratory studies. It does not conclude with the consultation visit, constant re-evaluation must be performed which has the potential to alter your impression of the situation. An altered impression of the situation may materially change the direction of therapy.

A complete dental examination with a panoramic film and bitewings, an oral /cervical cancer check, periodontal probing recording status of the soft tissues, and prior dental history should, of course, be performed.

Included in the appendix at the back of this document is a dictionary of common signs or symptoms found in the typical TMJ patient. It is probably best to submit for treatment under the patient’s medical policy, the codes and terminology that have been provided for you.

Transcranial or tomographic imaging of the TMJs is next performed. If the transcranial suture projection used to image the joints is difficult to interpret or has significant superimposition of structures, then tomograms should be ordered. For cases with suspected adhesions or perforations, an arthrogram with dye injection is indicated. Adhesions are very frequent sequelae of surgical procedures and present as a limitation of motion often with very erratic jaw movement and intense pain. Perforations are very common in surgical cases and in trauma and are characterized by loud coarse crepitus.

If there is an adhesion, often the dye injection will relieve the fibrous tissue and the joint will resume normal range of motion. In the case of a perforation, the dye will spread into both joint spaces. For cases with complex disc dislocations or surface lesions of the condyles with a normal range of jaw motion, an MRI study could be performed.
It is very important to record the type of malocclusion, the overbite and overjet, crossbites, canine rise or group function, and any abnormal occlusal wear or buccal erosion. Nearly all TMJ patients are suffering from problems related to decreased posterior vertical dimension and or horizontal malposition of the mandible.

When you examine mounted casts that have been manipulated on the Levandoski Articulator, you will find that the back teeth do not touch. It is a good idea to record gross balancing contacts and other occlusal irritations but the great majority of TMJ patients will not have their back teeth touching with the condyles in the physiologic position. These occlusal discrepancies are not the cause of the TMJ problem, they are the result of intrusion or adaptation of the teeth to intrinsic TMJ problems due to growth or trauma problems.

Next, the range of joint motion is obtained by holding a plastic ruler over the dental midlines. The maximum wide opening with pain is recorded and the maximum wide opening without pain is recorded. The lateral protrusive and straight protrusive ranges of jaw motion are then recorded.

The motion of the lower jaw from the dental midlines during the wide open position is measured and drawn on the TMJ “T” graph and the velocity is noted as being fast, medium, or slow. The millimeters of deflection to the right or left at the end of range
is also recorded. If there is clicking upon opening and closing, this is indicated at the proper position by a “+” for the open click and a “#” sign for the closing click. If there are other joint noises such as crepitus, record that also.

The joint is carefully examined by placing the fingers 12 to 15 mm in front of the auditory meatus and pressing on the tissues at the lateral pole of the condyle as the patient bites down in the maximal intercuspal position of the back teeth.

At this point, you are palpating the lateral capsule of the joint and the lateral TMJ ligaments. The patient is then asked to open widely while the examiner palpates the posterior aspect of the condyles. Pain in this area indicates posterior capsulitis and can help detect edema secondary to inflammation and pain due to aggravation of sensory nerves in the posterior neurovascular ligament. Any joint noises should be recorded.

Next, palpate the internal aspect of the auditory meatus with the little fingers and ask the patient to open and close. This will help confirm lateral capsulitis and can often lead to exquisite pain referred to the areas of chronic or acute cephalgia that the patient originally complained about. This can confirm that the cephalgia is due to a posterior capsular joint space compression due to the condyles being too far back in the joint.

The range of jaw motion is drawn on the above diagram with a pen. "+" is used to denote an opening click and a “#” is used for the closing click. The wide open maneuver is a solid line and the closing maneuver is interrupted.
A normal wide open range of jaw motion is usually 45 to 55mm. The motion is linear, pain free, and of normal velocity. The normal range for lateral protrusive movement is 10 to 15 mm. The straight protursive is usually around 10mm These moves do not have deflection or deviation, are deliberate and well coordinated. The patient has good jaw proprioception.

The posterior aspect of the condyles are next palpated while the patient goes through slightly open and wide open lateral protrusive maneuvers. This again is giving the doctor a sort of 3-D trip around the lateral and posterior neurovascular tissues, and can disclose unusual mandibular translation movements and joint noises not normally observed otherwise. Palpating in this manner actually discloses pain by provocation that may be noticeable to the patient only during long clenching activity or after eating hard foods. This procedure will focus the patient. Often at the next visit the patient will comment that now he knows what is causing his pain.

The rest of the oral facial musculature is palpated and note is made of any trigger points in muscles that cause pain in specific teeth. If the doctor is performing the “Two Minute TMJ Screening Exam”, then the following muscles are examined: 1) The anterior, mid, and posterior temporalis in the open and intercuspal position, 2) The superficial and deep masseters in the open and intercuspal position, 3) The lateral pterygoids, and 4) The medial pterygoids. This short exam will probably spot 95% of the patients with myalgic trigger points due to intrinsic TMJ problems. If you get a highly positive response, then this is an indication to schedule the patient for a complete comprehensive history and workup.

The Joint
After dental pain, cephalgia or headache as a result of referred TMJ pain is the most common painful affliction of the head. Chronic cranio cervical pain is the chief complaint of over 50% of the patients who visit a medical physician’s office. There is almost incalculable lost time and productivity as a result of this common malady. The most frequently encountered TMJ afflictions include various degrees of internal derangement, degenerative osteoarthritis, capsular inflammation and fibrotic changes which are directly related to internal derange

In this range of jaw motion study, there is an opening click on the left (+) at around 18mm and a closing click (#) on the left at 8mm. The jaw will always deviate to the side with the unilateral click. This type of jaw motion is very common after disc dislocations due to trauma such as difficult left third molar extractions, or blows to the right chin.
In the acute unilateral closed lock the mandible deflects sharply to the right in the wide open maneuver, there is limited range of opening, usually around 18mm. The left lateral protrusive maneuver is restricted and the straight protrusive is deflected to the right and limited also. The Right lateral protrusive may be nearly normal.
The Practice Building Bulletin

Snoring and Obstructive Sleep Apnea

» PRACTICE POTENTIAL:

Have you wondered why, all of a sudden, your dental patients are asking if there is something you can do to help them with their snoring? It’s because in today’s information age, they can’t read a paper, listen to the radio or watch television without learning something about the latest electronic device, herbal medicine, nasal strip, surgical technique or dental appliance being used to treat snoring.

If you snore loudly and often, you may be accustomed to middle of the night elbow thrusts and lots of bad jokes. But snoring is no laughing matter. That log-sawing noise that keeps everyone awake comes from efforts to force air through an airway that is not fully open.

Perhaps ten percent of adults snore and although for most people snoring has no serious medical consequences, for an estimated one percent of snorers habitual snoring is the first indication of a potentially life threatening disorder called “Obstructive Sleep Apnea.”

It has been estimated that the indirect costs of sleep disorders are over 41 billion dollars a year from lost productivity, 17 to 27 billion dollars a year from motor vehicle accidents, seven billion dollars a year in work-related accidents and 2 to 4 billion dollars a year in home and public accidents. Clearly this is a major national problem that needs to be dealt with in an appropriate fashion.

Unfortunately, most physicians have not been trained to deal with these common problems. It has been estimated that on average during the four years of medical school only two hours are spent teaching medical students anything about sleep. This has created a significant deficit in our current medical system.

Dentists can provide a role in recognition and treatment of Snoring and Obstructive Sleep Apnea. To provide optimal care, the dentist must have an overview of the complex process of sleep and sleep disorders.

» DEFINITIONS:
What is Sleep Apnea?

Steadman’s Medical Dictionary defines “apnea” as the absence of breathing or the want of breath. When there is a cessation of airflow at the mouth and nose for more than 10 seconds an apnea episode has occurred. If a person experiences 30 or more apnea episodes during a seven-hour sleep period, then they are believed to be suffering from Sleep Apnea.2,3

Apnea severity is usually categorized by the frequency of apnea episodes.2 5-15 episodes per hour is mild, 15-25 episodes per hour is moderate, and more than 30 episodes per hour is considered severe.

These episodes can last anywhere between 10 to 20 seconds each, terminating with at least a partial wakening. Typically, a patient may have as many as 300 apneic episodes per night.

There are three basic classifications of sleep apnea: central, obstructive, and mixed.

Central apnea- air flow stops because inspiratory efforts temporarily cease. Although the airway remains open, the chest wall muscles make no effort to create airflow. The etiology frequently is encephalitis, brainstem neoplasm, brainstem infarction, poliomyelitis, spinal cord injury, and cervical cordotomy.4

Obstructive apnea- is the cessation of airflow due to a total airway collapse, despite a persistent effort to breathe. An obstruction in the upper airway can occur in three areas. They are the nasopharyngeal, oropharyngeal and hypopharyngeal regions.

Regardless of the level, an obstruction causes the breathing to become labored and noisy. As pressure to breathe builds, muscles of the diaphragm and chest work harder. The effort is akin to sipping a drink through a floppy straw, the greater the effort the more the collapse. Collapse of the airway walls eventually blocks breathing entirely. When breathing stops, a listener hears the snoring broken by a pause until the sleeper gasps for air and awakens but so briefly and incompletely that he/she usually does not remember doing so in the morning.1

Mixed Apnea- is a combination of central and obstructive apnea usually beginning with a central episode being immediately followed by an obstructive one.2

What is Snoring?
Many people think that snoring and apnea are the same thing. This is not true. Snoring, which is caused by a change in airflow through the nasal and pharyngeal tissues, is only a sign that a patient may be suffering from apnea. It’s basically like water running through a pipe. If the water runs abnormally through the pipe it will vibrate. The same thing happens with airflow when it is partially obstructed.

Snoring can be categorized by its severity. On one side of the spectrum, you have the benign snorer, who snores but experiences no physical problems. On the other side of the spectrum, you have the snorer who suffers from apnea, and in the middle you have the snorer who suffers from what we call **Upper Airway Resistance Syndrome**. In these people, though they may not actually experience apnea episodes, their snoring is so loud and their breathing is so labored, that it still wakes them up numerous times throughout the night. This leaves them unrefreshed and tired in the morning.

★★ THE ROLE OF THE DENTIST:

Because the etiology of obstructive sleep apnea is multifactorial and the treatment options are varied, proper diagnosis and treatment are best handled by a team approach. Members of this team may include a sleep specialist, an ENT, an internist, an orthodontist, an oral surgeon, and a general dentist. As a general dentist, you should play an active role in:

a) screening your patients

b) treating them in conjunction with other sleep specialists

c) providing them with follow up treatment.

**Screening:**

**Adults**

To properly screen your patients, you must evaluate them for the presence of any physiologic and behavioral predisposing factors.

A complete evaluation will reveal some of the possible physiologic factors.

It should include the following:

a) Complete medical / dental histories.

b) Soft tissue / intraoral assessment.

c) Periodontal evaluation.
d) Orthopedic/TMJ/occlusal examination
e) Intraoral habit assessment.
f) Examination of teeth and restorations
g) Initial dental radiographic survey (panoramic, full mouth x-rays and a base line lateral cephalometric survey).
h) Diagnostic models.  

While doing the soft tissue/intraoral assessment part of the exam, you should evaluate all three regions of the upper airway.

An obstruction in the naso-pharyngeal area is usually caused by turbinate hypertrophy, a deviated septum, or an abnormal growth like a polyp. Although documenting a problem in this region is the job of an ENT, you can at least check your patients to see if they have a patent nasal airway.

When evaluating the oropharyngeal region, first check for hypertrophy in the tonsils. Then check the size and position of the tongue as it relates to the soft palate. Finally, look at the size and drape of the soft palate and the uvula. When the soft palate is excessive or drops down immediately, there is a good chance that this patient will suffer from an oropharyngeal blockage.

An obstruction in a hypopharyngeal airway space is a lot harder to detect through observation alone. We do know that when motor nerve activity stops during REM sleep, the tongue can drop back against the posterior pharyngeal wall and block the airway. Cephalometric films can give us some information on whether an airway is blocked. Although it is a two dimensional view of a three dimensional space we can get an idea of the relative size of the airway, the posterior airway space, the length of the soft palate and the position of the mandible, maxilla and the hyoid bone. But to truly be meaningful they should be taken in the supine position with the patient asleep and this is very difficult to accomplish.

One of the more exciting developments in the past few years has been the incorporation of the Eccovision System by Health Technology Limited as a diagnostic tool to thoroughly and accurately assess the patient’s airway. Completely painless and non-invasive, the Eccovision emits sound waves through a self-contained central processing unit comprised of two tools: the rhinometer and pharyngometer. They map the patient’s nasal passages and pharyngeal airway, respectively, via a technique called ‘acoustic reflection’. The results are on-screen graphs directly correlating to the physicality of the
patient’s nasal passages and pharyngeal airway. When used properly these tools do two things:

1. They will identify the area of obstruction

2. Graphically display the changes in the oral airway with lower jaw advancement and vertical changes so you can see the effect an oral appliance has on oral airway size.

A new component of the physical exam has also been developed which is called the Chin Press/Tongue Curl Maneuver. This maneuver is based on the changes that occur in the mandible’s position during sleep. During sleep the lower jaw in most patients drops back into the most retruded position. The Chin Press attempts to put the chin in the most retruded position while the patient is supine or reclined in the exam chair. MRI studies clearly show that when an obstruction occurs with the Chin Press/Tongue Curl Maneuver, there is a strong correlation with the degree of severity of apnea as seen in a polysomnogram. It is important to recognize though that a negative Chin Press/Tongue Curl does not rule out a diagnosis of Sleep Apnea.

**Signs & Symptoms:**

The following are some of the signs and symptoms that are indicative of a person who is suffering from apnea:

**Adults**

- Heavy snoring
- Gasping or choking during the night
- Excessive daytime sleepiness
- Frequent arousals during sleep (fragmented sleep)
- Non-refreshed sleep
- Restless sleep
- Morning headaches
- Nausea
- Personality changes such as becoming irritable or temperamental
- Severe anxiety or depression
- Poor job performance
- Clouded memory
- Intellectual deterioration
- Occupational accidents
- Impotence
• Decreased sex drive
• Bruxing
• Dry mouth when you awaken
• Scratchy throat

**Children**

Children can suffer from sleep apnea as well. Typically these children suffer from growth and development problems. A lot of them have under-developed maxillas, narrow upper arches, and retruded mandibles. Often they are highly allergic with their airway completely blocked due to tonsillar hypertrophy. If they are already having snoring and breathing problems, do not ignore them. Here are some of the signs and symptoms seen in children:

• Hyperactivity
• Poor concentration
• Developmental delay
• Hyponasal quality to their voice
• Noisy breathers
• Obesity
• Frequent upper airway infections
• Earaches
• Bedwetting
• Nocturnal mouth breathing
• Snoring
• Restless sleep
• Nightmares
• Night terrors
• Headaches
• Chronic nose running

**DIAGNOSIS:**

If you do suspect that a patient may be experiencing apnea episodes, then refer them to a physician immediately. Either an ENT, a sleep specialist, an internist or an oral surgeon can work with you to make sure your patient gets a complete medical work-up and a sleep test.

A proper medical work-up by a physician can detect physiologic changes as well. Typically these patients will exhibit a fragmented sleep pattern, experience excessive
daytime sleepiness, and have a change in their CO2/02 ratio, causing acidosis. You will also find that these patients tend to have hypertension. Some will show signs of altered heart function like cardiac dysrhythmias and premature ventricular contractions. Someone suffering from apnea episodes can also end up having anoxic seizures, cardiopulmonary arrest and even experience sudden death.

Even after a thorough evaluation by the dentist and the physician, a definitive diagnosis of OSA can only be accomplished by a sleep test called a polysomnogram. During sleep, a polysomnogram measures ventilation, gas exchange, cardiac rhythm, the number and length of apneic episodes, assesses oxygen saturation, determines sleep stages, and detects arousals. In the past, this test could only be done in a hospital sleep clinic. Today, we have mobile sleep technology that allows you to take this test in the comfort of your own home.

Most major medical insurers will require patients to undergo a full blown PSG (Polysomnography) study in a sleep lab for primary diagnosis prior to paying for any treatment. However, in recent years ambulatory sleep study devices have entered the dental market and are beginning to play an important role in proper treatment protocol. Patients with a high insurance deductible, or no medical insurance, may prefer the low cost of diagnosis with an ambulatory study as opposed to the relatively high cost of a PSG. An ambulatory study, with a physician’s signature, is a legal diagnosis that a dentist can use to justify treatment.

Currently there are three major ambulatory sleep study devices available to dentists, the Remmer’s Sleep Recorder (Sagatech), the SNAP and the Watch-PAT 100. The Remmer’s and the SNAP both use traditional methods for determining presence of obstructive sleep apnea; nasal/oral airflow, snoring, chest effort, position, pulse, oxygen saturation. The Watch-PAT 100 uses a proprietary system to monitor the sympathetic nervous system. All three units have studies showing a relatively high correlation with a PSG test and the respective device. Dentists are cautioned to avoid using simple overnight pulse oximeter studies as means to verify appliance efficacy or diagnose OSA. Oxygen saturation is one component of proper diagnosis, but in many mild/moderate cases oxygen saturation statistics alone will not show a significant problem even though apnea exists.

**TREATMENT PROCEDURES:**

Once you understand some of the basics in sleep medicine, it becomes clear that the dentist can play a role in both the prevention and treatment of snoring and OSA.
Early detection of structural abnormalities in the developing child affords us the opportunity to intervene with functional therapy possibly preventing another eventual OSA casualty. For example, after a thorough orthopedic evaluation, the dentist may then decide to use orthopedic appliances to direct and control a child’s growth. Arch development, mandibular repositioning, and controlling vertical dimension can create the intraoral volume needed to accommodate the tongue and prevent its compaction into the hypopharynx.

Many treatment methods have been tried over the years to treat snoring and obstructive sleep apnea. To date, three approaches seem to be the most effective. They are Continuous Positive Airway Pressure (CPAP), surgical techniques, and the use of intra-oral appliances. Regardless of the technique used, most people benefit by following a few general measures.

**General Measures:**

1. Lose weight- People with severe sleep apnea are almost always over weight. Losing weight will reduce redundant tissue volume in the upper airway, decrease the load on the chest wall and abdomen, and improve respiratory muscular efficiency. In mild cases, weight reduction alone may result in a cure. In other cases it enhances the effects of additional therapy.

2. Sleep on your side- Many studies have shown that patients who sleep on their back have a significantly higher level of sleep disturbance. It is believed that sleeping in the supine position causes a gravitational pull on the tongue forcing it to come in contact with the posterior pharyngeal wall. Therefore any technique that keeps you sleeping on your side could be beneficial.

3. Avoid alcohol within two to three hours of bedtime. Alcohol is a central nervous system (CNS) depressant and changes motor activity to the muscles that control normal inspiration. These changes create unfavorable forces in the upper airway causing it to collapse.

4. Avoid certain pharmacological agents- Benzodiazepines, narcotics, barbiturates, and testosterone have all been reported to affect the occurrence of apnea episodes. For example, Flurazepam has been shown to worsen apnea episodes in patients who already suffer from this disease and trigger apnea in patients who have no history of a problem.
**Specific Measures:**

**Continuous Positive Airway Pressure (CPAP):** This technique involves wearing a mask tightly over the nose during sleep. Pressure from an air compressor is used to force air through the nasal passages and into the airway. The forced air creates a pneumatic splint, keeping the airway open and allowing the person to sleep normally. When accepted by the patient, this treatment is highly effective and is considered the “Gold Standard” on which all other treatments are compared. To increase patient acceptance, many improvements have been made over the last few years. Some of these innovations include having the ability to vary the pressure rate during inspiration and expiration (BiPAP) to using a mask that doesn’t need straps to hold it in place (CPAP-Pro). Even with all the improvements that have been made, this treatment modality is still not for everybody. In fact, daily compliance by patients using CPAP is less than 50%. Besides being uncomfortable, the other negatives to this treatment are that it is inconvenient, it restricts a patient’s movement and it dries out the airway mucosa. There is also a real concern of having reduced cardiac output and renal function.26

**Surgical Approaches:**

Surgical treatment of OSA began with the tracheostomy, which enjoys a 100% success rate because it completely bypasses all the sites of upper airway obstruction. Even though a tracheostomy often results in immediate relief of symptoms, patients poorly accepted it as many cannot accept the idea of a permanent tracheostomy. A number of complications emerge with time. They are tracheal site infection, physiological problems, granuloma formation, chronic irritation, uncontrolled secretions, bronchial infections, and eventual stenosis.9

**Nasal reconstruction**

A nasal obstruction causes a patient to mouth breathe. When you open your mouth to breathe, the mandible rotates back and allows the base of the tongue to drift posteriorly and block the airway. A nasal obstruction also eliminates the use of CPAP as a choice of treatment. Surgical procedures to clear the nasal airway are done to correct turbinate hypertrophy, septal deformities, alar collapse and the removal of tumors or polyps.

Although nasal surgery in and of itself has not been shown to be an effective treatment for OSA, a clear and patent nasal airway is very important for normal respiratory function.
UPPP
Uvulopalatopharyngoplasty was first introduced by Ikematsu in 1964 and later by Fujita in 1981. This surgical procedure enlarges the air space by excising redundant soft tissue of the palate, uvula, tonsils, posterior and lateral pharyngeal walls. When the airway obstruction is at the oropharyngeal level, this procedure can be quite successful at stopping snoring. However, if the obstruction is below the oropharynx, this surgery is contraindicated. Most clinical investigations indicate that the success rate of this surgical approach to correct OSA is less than 50%. This is due to the level and cause of the obstruction often being misdiagnosed. Removing some of the vibrating tissues may resolve snoring, but it does not prevent an obstruction by the base of the tongue. This is a serious surgery that is not without its complications. Post-operative stenosis, significant post-operative pain, and infection are all possible complications of this approach.

LAUP
A laser Assisted Uvulectomy is a modification of UPPP surgery. It is accomplished using lasers and is considered a less invasive procedure. It is commonly being used to remove the redundant soft tissue of the palate believed to be causing snoring.

Somnoplasty
This procedure uses a radio frequency to heat the tissue to a very precise temperature creating a finely controlled lesion of coagulation within the tissue. Over a period of four to six weeks, the injured tissue heals and in the process the tissue shrinks and tightens. This technique can be used to reduce the excess tissue in the soft palate, the nasal turbinates and the tongue.

This procedure generally takes two to three treatments to shrink the tissue sufficiently to have a clinical effect. Patients seem to have minimal side effects making it one of the more promising procedures for treating snoring and sleep apnea.

Orthognathic Procedures:
The position of the hyoid complex, mandible, tongue and the size and position of the maxilla all play a role in an obstruction at the hypopharyngeal level. The goal of a surgical approach here would be to make more room for the tongue and/or take the base of the tongue away from the posterior pharyngeal wall.

In patients with a mandibular deficiency, surgical advancement to a normal occlusal relationship can bring the base of the tongue away from the posterior pharyngeal wall. When both a maxillary and mandibular deficiency exists, a bimaxillary surgery will provide more physical room for the tongue as well as increase anterior tension on the
tongue musculature. Waite et. al. have shown a 96 percent improvement when bimaxillary advancement surgery was the primary surgical procedure. In patients with a normal dental occlusion who need no additional tongue space, a procedure called an anterior inferior genial osteotomy can be done. This is the site of the attachment for the genioglossus muscle. In this procedure, only this part of the mandible is advanced anteriorly. Theoretically this should pull the tongue forward to improve the hypopharyngeal airway. Various procedures have also been designed to reposition the hyoid bone and thereby advance the base of the tongue.\textsuperscript{7}

**Dental Appliances**

Numerous appliances are available to treat snoring and obstructive sleep apnea. Research has shown that many appliances are quite effective and can now be considered an alternative when choosing a treatment modality. In fact, sleep appliances offer several advantages over other therapy choices. They are inexpensive, non-invasive, easy to fabricate, reversible, and quite well accepted by patients.

The basic indications for sleep appliances are to treat primary snoring and mild to moderate obstructive sleep apnea. Attempting to make an appliance is particularly appropriate for those patients who cannot handle CPAP. When surgery is contraindicated or your patient is unwilling to go through a surgical procedure, then appliance therapy may be the way to go.

The treatment objectives for appliance therapy are to reduce snoring to an acceptable level, resolve the patients’ OSA problems, get a higher amount of oxygen into their systems, and eliminate excessive daytime sleepiness; allowing them to function normally.

Sleep appliances seem to work in one or a combination of three ways. Appliances can reposition the soft palate, bring the tongue forward, or lift the hyoid bone. As they reposition, they also act to stabilize these tissues, preventing airway collapse. Lastly, appliances seem to increase muscle tone. Specifically, there seems to be an increase in pharyngeal and genioglossus muscle activity.

Variations in design range from the method of retention, the type of material being used, the method and ease of adjustability, the ability to control the vertical dimension, differences in mandibular movement and whether it is lab-fabricated or made in the office. The appliance design that you choose will be dependent upon our knowledge of these variations and the oral conditions of the patient. In selecting an appliance don’t
forget to evaluate the health of the TMJ, the periodontal structures and the number and health of the teeth.

**Palate Lifters**

**The Soft Palatal Lift Appliance**
Many patients have excessive or pendulous tissue in the oral pharyngeal region that obstructs the airway and causes snoring. The Palate Lift appliance has an adjustable acrylic button that extends distally to the midpoint of the soft palate and gently lifts this tissue, preventing it from vibrating as air passes during sleep. This appliance is hard for most patients to tolerate for any length of time, but when you suspect that the airway obstruction is due to an excessive palatal drape, this appliance might prove useful as a diagnostic tool. Simply have the patient wear it to sleep for an evening. If it clears the airway enough for them to breathe and their spouse tells you that they didn’t snore while wearing it, then this may indicate the need for a UPPP surgery. This appliance is rarely used and is shown here to give a historical perspective on the evolution of appliance design.

**Tongue Retainers**

**The Tongue Retaining Device**
In this appliance the tongue goes into the anterior bulb. Pushing the tongue forward and giving the bulb a little squeeze creates a suction that holds the tongue in a forward position. It is a lab-fabricated appliance and is made out of a flexible polyvinyl material. This appliance works, and it has excellent sleep studies to support its use but is not very comfortable.

Most of the other appliances that are used to clear the airway in the hypopharyngeal region work by bringing the mandible forward. But not everyone can bring his or her mandible forward. If your patient suffers from a TMJ problem, bringing the tongue forward with an appliance like this may be the best way to clear the airway. Patients who are edentulous or periodontally compromised may also benefit from this appliance.

**The Snor-X**
One of the latest appliances is called the Snor-X; it was developed by Dr. Alvarez in the San Francisco area. The Snor-X can be used as a test appliance or as a training device to see if the TRD can be worn. It can also be used as a treatment appliance. Just like the TRD, it holds the tongue forward so it can’t drop back. The Snor-X is not retained on the teeth in any manner and allows total freedom of movement of the mandible.
Non-adjustable Mandibular Repositioners

The Clasp Retained Mandibular Repositioner
CT scans taken with this device in place show that the tongue is more superiorly placed with a narrowing of the dorsal aspect. There is also an enlargement of the airway. This appliance uses multiple clasps to positively lock the mandible into the appliance and prevent it from retruding. Because it is a one-piece appliance, you can control the vertical dimension by changing the height of the appliance. There is also a larger airway cut into the acrylic in this design.

The position of the mandible must be pre-determined and accurately produced in a construction bite for proper appliance fabrication. Typically, the mandible must be advanced to only 75% of its maximum protrusion with the anterior vertical separation of 4mm. This prevents excessive strain on the TMJ and facial musculature.

An open airway is maintained with this appliance by directly holding the mandible in a forward position. An incline flange is used to direct the mandible forward and prevent it from dropping back upon opening. This flange is made out of a thermoplastic material that softens at body temperature making it more comfortable and greatly reducing the possibility of soreness to the anterior teeth and tissues.

The body of the appliances is fabricated from hard clear acrylic and snap fits to the maxillary arch. The lower dentition is deeply indexed into the occlusal surface of the appliance to hold the mandible in the forward position. A breathing hole is placed in the anterior portion of the appliance to allow for easy breathing throughout the night.

The position of the mandible must be pre-determined and accurately produced in a construction bite for proper appliance fabrication. Typically, the mandible must be advanced to only 75% of its maximum protrusion with the anterior vertical separation of 4mm. This prevents excessive strain on the TMJ and facial musculature.

The Dorsal Appliance
The Dorsal Appliance utilizes precision milled upper and lower occlusal splints to open the vertical relationship while holding the mandible in the desired forward position by the use of interlocking buccal inclines. The inclines are milled in such a way that they allow a degree of mandibular lateral movement alleviating the occurrence of any muscle trismus. The inclines also aid in keeping the mandible from dropping open during sleep.

The SnoreFree™ Appliance
The SnoreFree™ is a one-piece thermoplastic mandibular repositioning appliance that is made chair side. It comes in a kit that contains everything from complete instructions to
all the forms necessary to screen your patients for snoring and apnea. When treating obstructive sleep apnea with a dental appliance, the SnoreFree™ is often used as an initial or test appliance. This allows the dentist to inexpensively evaluate whether a mandibular repositioning appliance will work for that patient. If it does, the dentist may then want to choose one of the other appliances that are titratable.

**Adjustable/Titratable Appliances**

**The Clark (U.C.L.A.) Modified Herbst® Appliance**
This appliance consists of two occlusal splints held together by a bilateral Herbst® tube assembly. This setup allows the mandible to positively be postured forward. Posturing the mandible forward brings the tongue anteriorly to open up the airway. This unique design allows the patient to move the mandible freely in both a vertical and lateral direction while at the same time preventing the mandible from dropping back during sleep. Because the Herbst® tubes are placed buccally to the teeth, there is nothing to interfere with the patient’s tongue position and patients find this design extremely comfortable.

Users of this appliance typically provide a construction bite taken with the mandible positioned 75% of the way from maximum intercuspation to maximum protrusive with a 4mm vertical opening in the anteriors. This appliance can also be titrated forward from its initial position by adding shims in 1mm, 2mm, and 3mm increments.

The occlusal surfaces of the upper and lower portions of this appliance are carefully milled into full contact. Vertical elastics are used in the cuspid region to create a proprioceptive response that encourages a lip together posture. Maximum retention is achieved through multiple ball clasps on both the upper and lower portions of the appliance.

**The Adjustable Herbst® Sleep Appliance**
Having the ability to easily bring the mandible forward in small measurable increments is often the difference between success and failure when using a sleep appliance to treat apnea. Although this can be accomplished with the original U.C.L.A. design by adding shims to the Herbst assembly, this new Herbst® screw allows us to incrementally bring the mandible forward with greater ease and adjustability. As with its predecessor, the palate is clear of any obstruction that would encourage the posterior placement of the tongue. In all other aspects, this appliance is identical to the original design.
**The Klearway™ Appliance**
This appliance is a mandibular repositioning appliance. It is fabricated with a thermoactive acrylic giving it excellent retention and comfort for the patient. It has an expansion screw in the palate that allows you to adjust the mandibular position in 0.25mm increments. Lateral and vertical jaw movements are sufficient to allow the patient to yawn, swallow and drink water without dislodging the appliance. Its adjustability makes it a very good appliance. Data from a large clinical trial, funded by the Canadian government, indicated a 78% success rate for the treatment of sleep apnea.

**The EMA, Elastic Mandibular Advancement® Appliance**
This appliance consists of upper and lower custom pressure-molded clear trays that are joined together by flexible elastic bands. These elastic bands come in various lengths and degrees of flexibility allowing the dentist to regulate the precise amount of mandibular advancement and lateral movement desired. These parameters will be different for every patient. Because the bands are easily changed, you will be able to quickly find the right set of bands that provided your patient with optimal results.

**The Original TAP®**
This appliance incorporates two hard outer polycarbonate shells that are lined with a unique thermoplastic polymer blend, called ThermAcryl™. ThermAcryl™ has the right balance of flexibility and rigidity to give the TAP excellent retention without tooth movement. Although initial fabrication of the appliance is accomplished on stone casts of your patient’s arches, an even more precise fit is accomplished at delivery by heating ThermAcryl™ and molding it to the patient’s dentition.

Attached to the upper and lower dual laminate thermoplastic trays is a unique hook and screw device that is used to bring the jaw forward to maintain an open airway. This hook and screw provides 8mm of vertical adjustment, a minimum of 25mm of lateral freedom and is infinitely adjustable anterior-posteriorly.

Although the initial trial position of the appliance is set at delivery, the dentist is not limited to a range of predetermined positions with the TAP®. An adjustment knob is used to advance the mandible 0.25mm with each turn. The patient can vary the position precisely by counting the turns. This allows both the dentist and the patient to confidently maintain the proper treatment position and yet be able to vary it depending on the patient’s symptoms. This feature also allows titration of the appliance in the sleep lab by a technician or the adjustment at home by the bed partner if the patient’s symptoms return while that patient is asleep.
Once the ideal treatment position has been determined, the dentist or patient can elect to remove the adjustable device. In such a case, a locking nut is then applied to fix the hook in one location. If adjustment again becomes necessary, the change can easily be reversed.

Another unique feature of the TAP® is that it has a unique universal mount for a CPAP mask that bolts to the adjustment mechanism. For the severe apneic, the TAP® reduces the required pressure while providing a leak-free, stable, “strapless” mask system.

The information on this appliance has been provided for historical perspective as the other designs shown in this bulletin are far superior. The other appliances in the TAP series perform in the same manner, but provide great improvements over the original design.

**Clasp Retained Hard Acrylic TAP®**

Although the ThermAcryl™ material used in the original TAP® has the benefit of allowing you to improve the retention of the appliance chair-side regardless of the accuracy of the models, if the appliance is not meticulously maintained, it can delaminate and/or become difficult to keep clean.

To eliminate the possibility of delamination and provide a cleansable appliance, a hard acrylic clasp retained TAP® was designed. The clasps can be easily adjusted throughout treatment to maintain retention. In all other aspects this appliance is identical to the original design.

**The Multi-laminate TAP®**

Many patients prefer the comfort of a soft material against their teeth. To accomplish this, a layer of soft ethyl vinyl acetate has been incorporated into the design of the TAP®. This is accomplished by laminating three separate layers together under high heat and pressure. What is created is a clasp-free appliance that uses the buccal and lingual undercuts for retention.

**The TAP® T-TL**

The TAP® T-TL is the latest innovation in the TAP appliances. Its components are made of a nickel-free biocompatible titanium alloy that has been widely used for dental and medical implants. The TAP® T-TL hardware is much smaller than the other TAP designs allowing for lip closure and a more comfortable fit. As opposed to the original design this appliance does not protrude beyond the lips. This is a great improvement leading to greater patient acceptance. While the TAP® T-TL hardware is improved, its function is the same as the TAP® and the TAP® ll.
**The Snore-Aid®**

This appliance is designed to open the upper airway by mandibular repositioning and antero-superior reposturing of the tongue. It combines a single mandibular bite plate, which has a flat occlusal surface, with an external lip shield. The appliance is titrated by manually adjusting the shield in a rearward direction upon a calibrated anterior extension off of the dental plate. This action advances the lower plate relative to the lip shield, thus advancing the mandible. Titration of this appliance can be made immediately and it can be done even while it is being worn. The adjustment is also easily reversible.

Some of the benefits of this design are that it has no palatal structure to interfere with an ideal antero-superior tongue position. In fact, the mandibular plate is wide enough that it actually helps to elevate the tongue as the mandible is advanced. This supports the genioglossus muscle and prevents it from settling posteriorly and inferiorly into the pharynx. The occlusal surface of the appliance is designed so that the maxillary dentition contacts uniformly. This gives the mandible complete freedom to function laterally and vertically. The bite plate surface can also be customized to alter the vertical dimension. This makes this appliance ideal for nocturnal bruxers and for patients undergoing diurnal splint therapy for TMJ dysfunction. The appliance itself can be made out of hard acrylic with ball clasps for retention or with a thermoplastic material bi-laminate splint like our Talon® splints.

**The Adjustable PM Positioner®**

The Adjustable PM Positioner® designed by Dr. Jonathan Parker, is recognized as a very effective intraoral appliance that has proven 70% effective for patients with mild to moderate obstructive sleep apneas and 90% effective for managing patients’ snoring. The Adjustable PM Positioner® can be fabricated with standard clear acrylic or with thermoplastic material that softens in warm water. Bilateral expansion screws are attached on the buccal aspect of the appliance to offer ample space for the tongue and to allow a degree of freedom of jaw movement in a lateral or protrusive direction. This helps to increase jaw comfort. Mandibular position can be altered in an anterior/posterior direction by using an expansion screw key to turn the screw mechanisms on each side of the appliance.

Once you have decided that treatment with a PM Positioner® is appropriate, you must first take accurate impressions of the patient’s upper and lower arches and a construction bite. Both impressions should reveal clear detail of the teeth and gingival tissues and extend at least 2 mm beyond the most posterior teeth. The Construction Bite should be taken with the mandible positioned at approximately 60% of maximum protrusion.
When posturing the mandible forward be certain that the patient does not deviate to the right or the left. To aid in achieving these results we recommend the use of a PerfectBite or a George Gauge. When taking this bite make sure that the anterior teeth are separated by 3 to 5 mm.

Because of the design of this appliance there are very specific placement and removal procedures that need to be followed. For example, if you have ordered the PM Positioner® made in the thermoplastic material, you will want to place the appliance under warm/hot water to soften the material first. Then insert the upper portion of the appliance over the upper teeth and have the patient move the mandible forward and close slowly into the mandibular portion. When doing this, the patient should not have to use excessive force to place the mandible firmly into the lower portion of the appliance. Similar detailed instructions exist for the removal of the appliance.

**The Silencer®**
The Silencer designed by Dr. Wayne Halstrom is a laboratory fabricated fully adjustable oral appliance that features a titanium precision attachment (Halstrom Hinge) which controls the anatomical settings of the appliance. It is capable of anteroposterior adjustment as well as vertical adjustment through a range of 10mm, in both dimensions. The design of the precision attachment also allows lateral movement of the mandible, which respects and protects the TMJ. The adjustable component is made of implant grade titanium and carries a five-year warranty. The body of the appliance is constructed of an elastomeric pliable material that offers the patient a much greater degree of comfort than harder acrylic materials. For additional support to the dentition, as well as the temporomandibular joint, hard acrylic “bite pads” are placed in the molar regions. An implant grade pure titanium articulating component grants the appliance the many adjustment characteristics that make the Silencer unique - kind to the tissues, the teeth, and the temporomandibular joint. The Silencer® can also be used for the partially or completely edentulous patient. Fitting the Silencer® requires the following steps:

1. An impression is made of the patient’s teeth at a dental office.
2. Measurements of the forward and sideways maximum movements of the jaw are recorded using a GAT™ gothic arch tracer.
3. The impression is sent to the dental laboratory for manufacturing and assembly of the Silencer® Professional with the Halstrom Hinge.™
4. The patient returns to the sleep professional’s office for fitting.
5. The patient is required to return for follow-up appointments, which may include adjusting the Halstrom Hinge™ to achieve the optimum setting for airway dilation.

**The OASYS Oral Airway System™**

The OASYS Oral/Nasal Airway System™ is the first dental device to be reviewed by both the dental and ENT divisions of the FDA and to be approved as a dental device for treatment of snoring and sleep apnea through mandibular repositioning and also as a nasal dilator for reduction of nasal resistance and improved nasal breathing. The appliance acts as a nasal dilator by maintaining a stretch in the nasal labial tissue to dilate the internal nares. A greater volume of air is delivered to the oropharynx with less effort thus reducing the negative pressure in the throat. It also maintains the patency of the oropharyngeal airway by functioning as a mandibular repositioner.

The OASYS consists of two parts: the device itself and an upper splint. When seating the appliance, begin by fitting the upper splint over the upper dental arch as you would for a periodontal splint or an orthodontic retainer. The lower appliance, however, is fabricated with thermal acrylic. It must be softened in warm tap water before placing it in the patient’s mouth. If this is not done properly you may find the appliance difficult to seat, or you may run the risk of fracturing the appliance. Be sure to make this instruction very clear to your patient.

Because of the unique design of this appliance, getting an upper impression that extends all the way up into the vestibule is important. An easy method for capturing the upper vestibule is to use a Monoject 35 CC syringe with catheter tips (#888-1) as an alginate syringe to inject alginate into the anterior vestibule and then taking the alginate impression of the upper arch. This will easily capture the upper vestibule region for the construction of the upper flange.

At the initial fabrication of the appliance the mandible is advanced 70% of maximal protrusion and the vertical has a 3 mm inter-incisal opening. To further adjust the mandibular position, the locks can be easily loosened just enough to slide along the wire up against the tube one side at a time. To adjust the Nasiolabial button position, the initial adjustment can be made before inserting it in the patient’s mouth. Further adjustments can be made by having the patient keep his mouth closed while opening the lips enough to introduce your index finger then bend the button in the desired direction. Next check the amount of stretch on the tissue and adjust to get a moderate stretch without discomfort. Have the patient breathe through the nose for a few minutes. This should become easier after a brief period of use. If you the have instrumentation to measure the nasal volume, such as an Acoustic Rhinometry, as mentioned in this PBB, the initial
readings should be made prior to fitting with the after treatment readings made after a few minutes of usage to appreciate the effect.

**The CPAP PRO®**

CPAP has a 50% failure rate because patients find most masks unbearable to wear. However, nightly CPAP doesn’t have to be torture. A new CPAP interface called the CPAP PRO® may be the answer to a better night’s sleep. Unlike all other masks and nasal devices that require straps and/or other headgear to keep them in place, the CPAP PRO® utilizes a simple customized dental mouthpiece that easily snaps onto the upper teeth. A small thin bracket is attached to the dental mouthpiece and extends outward through the lips, to support the fully adjustable CPAP PRO®. Two highly flexible tubes convey the CPAP air into the nostrils. Unique nasal inserts, which are foam filled and inflate slightly during use from the CPAP pressure, provide excellent nasal sealing with just feather-light pressure applied to the nostrils. Regardless of all the twisting and turning that occurs throughout the night, the CPAP PRO® stays in positive position with the nose.

》**CHOOSING AN APPLIANCE**

You can very effectively treat both snoring and sleep apnea with appliances if you remember that there are often multiple factors involved in causing the patient’s problem. In fact, it is possible for there to be an obstruction in the hypopharyngeal, oropharyngeal and nasopharyngeal regions at the same time. If you do not work in a team approach to properly identify the causes of the obstruction, appliances will work only 50% of the time regardless of the appliance chosen. Even under the best circumstances, you will often end up utilizing more than one appliance before finding the best one for the patient. The following simple guidelines may help you select the best appliances for your patient:

1. Choose an appliance based upon your team’s clinical assessment of the level of the obstruction, then evaluate its effectiveness.

2. Your first appliance often acts as a diagnostic tool or as a trial appliance. For example, if you suspect a hypopharyngeal block-age and the patient has a retruded mandible, a SnoreFree™ may be your appliance choice. It can be used to assess if a mandibular repositioning approach works to clear the airway. You can also use it to evaluate if your patient can tolerate a forward mandibular position. If it works, it may be your final treatment appliance or you may choose another mandibular repositioner. If it does not work, at least you haven’t spent $200 or more on a lab-made appliance. If your patient cannot tolerate it, perhaps a TRD would be more appropriate.
3. Your trial appliance can also be used to help determine whether a surgical approach could be effective. For example, if one of these appliances achieves some measurable level of success but the patient just can’t tolerate it on a daily basis, an orthognathic surgery, which repositions the chin or the mandible, may be an acceptable alternative.

4. The Academy of Dental Sleep Medicine has established an excellent protocol for the use of dental appliances. They can be reached at 708-273-9366. We highly recommend that you follow their guidelines.

» PROVIDING FOLLOW-UP THERAPY

When we work as a team, oral surgeons, internists, ENTs and sleep labs, all have their role. Ours is to be in charge of the appliance therapy. The attending dentist should do selecting, fitting, and monitoring of appliances.

Periodic evaluation of these appliances is a must. When they are kept clean and stored properly, we see them lasting a long time. However, patients will occasionally break them or wear through them. When someone is being successfully treated with an appliance they simply won’t go home without a replacement. Therefore, it is a good idea to keep a few “in office” appliances around like the SnoreFree™ so you can immediately replace a lost or broken appliance.

Some of the questions you should be asking during follow-up visits are:

• Are you able to sleep with the appliance?
• Is it comfortable?
• Are your teeth sore in the morning?
• If so, for how long?
• Is your bite different from normal in the morning?
• Does your jaw hurt?
• If so when and for how long?
• Did your partner hear you snore?
• Was it as loud as usual?
• Was any gasping or choking observed?
• Did you appear to stop breathing at any time?
• Was your breathing any different from prior to the appliance placement?
• Did you wake often?
• Did you feel more refreshed in the morning?
• How did you feel the rest of the day?
• Do you have any other comments or concerns?

If your patients are suffering from OSA and you are treating them with an appliance, they must have a follow-up polysomnogram to evaluate the effectiveness of the appliance. Once they are subjectively doing better, i.e. their excessive daytime sleepiness is gone, they are feeling great, their energy level is back, and they are not snoring at night, then it is time to go for the second sleep study.

Another valuable role ambulatory sleep studies such as the Watch-PAT 100, the Sagatech, or the SNAP test perform is to verify efficacy of the appliance. Once an appliance is delivered it is important to have another sleep study done on the patient in order to have objective data showing the appliance has effectively treated the OSA. Patients widely prefer an in-home study option as opposed to having to return to the sleep lab for another test.

» CONTRA INDICATIONS AND CONCERNS

As a dentist, it is essential that you work as part of a team of health care professionals. This is particularly important because many other medical conditions can be associated with OSA.\(^2\) Some of these are:
• Increased hypertension.
• Elevated protein levels (Proteinuria).
• Angina pectoris – more likely to develop.
• Initiation of a gastroesophageal reflex.
• Frequent nocturnal voiding.
• Hypoxema.
• Hypercapnia (high blood level of CO\(^2\)).
• Cardiac changes – bradycardia, tachycardia, & right heart failure, possibly leading to sudden death.
• Susceptibility to atherosclerosis.
• Hypothyroidism- causing polythycemia and bicarbonate retention.
Make sure that your patient gets a proper sleep test. Taking a polysomnogram is the only way to make the distinction between someone who snores and someone who is actually suffering from apnea. For those who have patients who are a little hesitant to go and take a sleep study, as an initial step, you may give them a pulse oximeter to take home. This will at least allow you to measure their oxygenation level during sleep. Showing them that they have a decreased oxygenation level is often the extra push they need to have a complete sleep test done.

Treatment of Snoring and OSA with dental appliances without first having a definitive diagnosis confirmed by your medical team could cause the patient to become worse, not better. For example, some appliances may alleviate snoring giving the patient and doctor the false impression that the appliance is working, when in fact it is possible that the patient’s apnea episodes could be getting worse even though their snoring has decreased.

Sometimes you may go through a series of appliances trying to find one that works and still not be successful. Appliances simply do not work all the time. Therefore treating an unmotivated patient is clearly a contraindication to Appliance Therapy. If you can’t find an appliance that works, then CPAP or even a surgical approach may be appropriate.

As with any other mandibular repositioning appliance, you will need to make sure that the patient’s occlusion stays stable. Even though most appliances cap the teeth, you can still get flaring and other occlusal changes.

Some of the common side effects that you see with the use of sleep appliances are excessive salivation, discomfort in the teeth, a dry mouth, tissue irritation from mouth breathing, temporary disharmonies in the bite and some pain in the joints. It is essential to respect the TMJ when considering the use of a repositioning appliance. A proper TMJ exam is recommended and if a patient is found to suffer from TMJ dysfunction or their muscles are sore and painful while wearing a repositioning appliance, you may need to use the Tongue Retaining Device (TRD). Appliance use is contraindicated for patients diagnosed with Central apnea.
SUPPLY LIST:

SnoreFree Appliance*
Snor.X Appliance*
Transparent Acrylic Kit*
Acrylic Curing Unit*
Acrylic Burs*
Brush Mounted Mandrills*
Retainer Polishers*
Herbst Spacers*
T.A.P. Parts*
Hot Water Bath*
Per-Fect Bites*
Passports to a Healthy Smile*
Appliance Cleaning System*
Appliance Care C.D.*
Retainer Brite*
Appliance Bath*
Brace Relief Kit*
Appliance Case*

*Available from Success Essentials, call 800-423-3270

LAB FEES:

The range of fees for an appliance to treat snoring and apnea is between $70 for an in-office fabricated appliance to $700+ for a lab fabricated appliance using titanium parts. All the appliances presented in this bulletin have been used successfully. There are many variables which determine whether an appliance will be successful in treating OSA. Since appliances do not always work, it makes sense to try an appliance that is less expensive first.

Customary Fees & Getting Paid:
Fees for treating obstructive sleep apnea with appliance therapy average between $300 and $2500. This variation in fees is dependent upon the number of appliances and appointments needed to accomplish a positive result. This fee should include your examination, clinical work-up and all the appliances. Out-of-office services such as sleep
studies, tomograms/ceph x-rays, and any medical consultations or procedures are not included.

Payment may be obtained from medical insurance plans for the treatment of snoring and sleep apnea with appliances, but benefits differ dramatically from plan to plan. So payment through insurance is not always guaranteed.

When filing a claim, most insurance companies will request a referral from a physician. This should not pose a problem as you should already be working closely with a physician. As with any insurance claim, the more documentation you provide the more likely you will receive payment. So be prepared to send them a copy of the patient’s sleep study and any other records they may request. Remember some insurance organizations require pre-authorization.

Dental insurance may also be billed, but at present there are no set codes. The Academy of Dental Sleep Medicine is working very hard to obtain new dental codes for this treatment. They can be reached at 708-273-9366.

**INCOME POTENTIAL:**

Statistics show that one out of every ten people in your practice snore. But, if you don’t find a way of telling your patients that you can help them, how are they going to know? Here are a few simple marketing ideas to help you reach your existing patients and bring new ones into the practice.

1. Place brochures on Snoring and OSA in your waiting room. We have created an excellent patient pamphlet called “Stop Snoring Before it Stops You.” By reading this pamphlet, your patients will learn that you can help them with their sleep problem.

2. Revise your medical and dental questionnaires. Asking your patients the right questions can trigger a discussion on snoring and apnea. A few questions that you may want to add to your forms are: Do you snore? Do you wake up tired in the morning? Do you dream? Do you become extremely tired or fall asleep during the day? Are you overweight? Can you breathe through your nose? Do you drink before bedtime?

3. Re-evaluate your intraoral examination. If you are not spending the time to look at the oropharyngeal airway space, the hypopharyngeal airway space, the size of the tongue,
the position of the mandible, the vault of the palate, and the nasal airway, then you are missing an opportunity to treat your patients for snoring and apnea.

4. Send out a newsletter. Newsletters are an excellent tool to keep your patients informed on what’s new in your practice. Please feel free to use the information in this Practice Building Bulletin to make your letter.

5. Work closely with other medical professionals in a team approach. Referring patients to a physician or a sleep diagnostic center indicates your desire to make sure that your patients get the best care possible. It is this level of knowledge and expertise that will have sleep specialists willingly referring patients back to you for Appliance Therapy.

Do you remember the old movie, Field of Dreams? The famous line in that movie was, “If you build it, they will come.” When it comes to treating Snoring and Apnea, if you treat one, they will come. Stop one person from snoring, and you will have patients knocking down your door. Treating just one patient per month can add up to $30,000 a year to your gross income.

By Rob Veis D.D.S.
Director-Practice Development

REFERENCES:

2. Garry, J.; The role of the Dentist in Sleep Apnea. Dr. James Garry, 1321 N. Harbor Blvd. #201, Fullerton, Ca. 92635
5. Weaver, Millman; Broken Sleep. Am J Nurse 88: 146-150, 1986
8. Clinical Protocol for Dental Appliance Therapy for Snoring and Obstructive Sleep Apnea. The Academy of Dental Sleep Medicine, One Westbrook Corporate Center, Suite 920, Westchester, IL 60154, Phone: 708-273-9366


16. Bonnet MH; *Effect of sleep disruption on sleep, performance and mood*. Sleep 8: 11-19, 1985


The Practice Building Bulletin is a special service of Space Maintainers Laboratory produced solely for the private use of our clients. It is designed to help expand and enhance your ability to provide comprehensive patient care. Information included is the opinion of the author and may not be reproduced in any form without written consent.

Appliance Therapy Group Headquarters:
Space Maintainers Laboratory
P.O. Box 4184, Van Nuys, CA 91409-4184
Copyright © 2006
www.appliancetherapy.com

Regional Labs:
Southwest  800-423-3270
Northwest:  800-423-6509
Northeast  866-310-5800
Southeast  800-289-0118
Midwest:   800-325-8921
Canada     800-661-1169
Australia  03-9521-0299
Malaysia   03-6251-8599
Taiwan     886-7-235-5612
MOLAR UPRIGHTING
The most neglected treatment in dentistry

Practice Potential

When performing a routine clinical examination, rarely, if ever, do we record any abnormality in tooth position. This is unfortunate because the position of each tooth plays an important role in the health and maintenance of the dentition.

Tooth position affects esthetics, phonetics, occlusion, muscular activity, and temporomandibular joint function. Malposition of any tooth can also create a change in the local environment encouraging the onset of caries and periodontal disease.¹

Specifically, the mesially inclined 2nd molar is one of the most common dental maladies in the adult population. This occurs because the first permanent molar is often extracted in childhood due to decay. In the adult, the first molar is often lost because of endodontic failures, multiple restorative attempts, decay in the buccal and lingual furcation, and advanced periodontal disease. Without timely replacement or provisions for space maintenance, the second molars drift mesially and tip. When this occurs, arch integrity is lost and teeth begin to shift.

The typical clinical picture consists of extrusion and migration of teeth, accelerated mesial drift, uneven marginal ridges, angular bony crests, altered coronal to gingival form, food impaction, caries, periodontal disease, and ultimately posterior bite collapse with loss of the occlusal vertical dimension.²

All of us see mesially tipped molars on a daily basis. Why then is treatment so often ignored? Worse yet, why are we tempted to place a bridge before returning this tipped tooth to its normal occlusal position?

Typical concerns may be:

1. Many of us feel uncomfortable with the orthodontic mechanics needed to upright a molar.

2. If we refer the patient to the orthodontist, it may be months before the patient returns to us for active treatment.

3. Most patients don’t want to leave the office to see another dentist.

4. It is more expedient to place a bridge now. Referring this out is just dollars out of our pocket.
Given the fact that most orthodontists prefer not to do these adult limited treatment cases and that they usually do them only as a courtesy to you, perhaps it is time for you to reconsider learning how to upright a molar. It is the proper thing to do for your patient’s dental health, it will enhance the final results of your restorative procedures, and it can be very financially rewarding.

Indications

1. Perhaps the most common use of orthodontics to aid in restorative work is the uprighting of a second molar. A tipped molar can have a profound effect on prosthetic therapy.3

Restorative problems associated with a tipped molar include:
• inadequate parallelism.
• poor occlusal plane.
• lack of interproximal space.
• adverse root proximity.
• faulty occlusal landmarks.
• excessive tooth preparation with potential pulpal involvement.
• inadequate pontic space.
• hard and soft tissue deformities of the periodontal structures.
• teeth are more difficult to clean.1,2

2. Bruxism and clenching habits may also be initiated by abnormal tooth position. Any alteration in the occlusal pattern such as the location of cusps, fossa, proximal contacts, and marginal ridges, may cause acentric occlusal contacts during function.1

3. The patients most likely to benefit from molar uprighting are those with active periodontal disease. One of the primary characteristics of chronic destructive periodontal disease is loss of supporting bone. Teeth with abnormal axial inclination do not properly distribute occlusal forces. Functional or parafunctional forces, which would not move a tooth with adequate support, may cause movement of teeth with reduced bony support. Furthermore, if the malpositioned tooth has a poor clinical crown to root ratio, it will be more susceptible to trauma from occlusion, since there is less alveolar bone to resist the misdirected forces.1

4. Tipped teeth are more difficult to clean than teeth that are properly aligned in the dental arch. When prosthetic work is done without first uprighting a molar, oral maintenance becomes even more difficult.
Treatment Procedure

As always proper appliance selection and application requires a well-thought out and thorough diagnosis and treatment plan. To accomplish this the following procedures should be done:

1. A complete medical and dental history.

2. A thorough clinical exam. This should include:
   a. an oral cancer screening.
   b. documentation of any abnormalities in the oral mucosa and gingiva.
   c. radiographic evaluation of all necessary films (FMX, PAN, CEPH).
   d. charting of all existing restorations and carious lesions.
   e. a periodontal evaluation.

3. An orthopedic evaluation of the patient’s skeletal pattern should be completed.²,⁴

4. A clinical assessment of the muscles of mastication should also be done to determine whether the patient muscles are strong and tight or weak and flaccid.²

5. An analysis of the dental arches, tooth position, and occlusal plane should be completed. Modifications to the occlusal plane are sometimes necessary. For example, it is often appropriate to adjust an extruded maxillary molar before reducing the lower molar being uprighted.¹
   Note - The above analysis (3, 4, and 5) will be helpful in choosing the appropriate uprighting appliance.

6. Remove all caries. Whenever possible, all caries should be removed before placing appliances.

7. Before beginning orthodontic treatment, any tissue inflammation must be eliminated. A thorough root planning and curettage as well as surgery may be necessary.

8. Take alginate impressions and pour up both working and study models.

9. The clinician can now select an appliance to accomplish his objectives (see Description).

10. Whether you are using a fixed or removable appliance, the patient should be seen for adjustments once every 3 to 4 weeks (see Adjustment Tips).

11. During tooth movement, the clinician must accept responsibility for keeping this area free of inflammation. This will require regular maintenance throughout treatment. In fact, the frequency of visits during tooth movement will not be determined by orthodontic adjustments but by the necessity to keep the soft tissue
free of all inflammation and to prevent crestal bone loss during appliance therapy. To achieve this weekly appointments may be necessary.

12. After uprighting is completed, some form of stabilization must be provided immediately to prevent relapse. If an implant can be integrated to replace the missing molar, an interim partial or a banded space maintainer bridge would be appropriate methods of stabilization. If a fixed bridge is the treatment of choice, it will act as its own final retainer.

Description of Appliances

Molar uprighting can be accomplished using either a fixed or a removable orthodontic approach. Both have their advantages and disadvantages.

Fixed Appliances

A variety of fixed appliances have been proposed to upright tipped molars. Although the design and application may vary slightly, the principles are the same.

This appliance can be separated into an active and stabilizing or anchor unit. To provide appropriate anchorage, all teeth as far forward as the canine in the treatment quadrant should be included. The canine on the contralateral side should also be linked to the anchor teeth by use of a heavy stabilizing lingual arch. This canine to canine stabilizing arch not only increases the anterior anchorage but also resists buccal displacement of the anchor teeth.

Although direct bonded brackets are suitable for all the teeth it may sometimes be advisable to band the molar. In the simplest of cases where the premolars and cuspid are only being used for anchorage, the brackets can be placed in the position of maximum convenience where minimum wire bending will be required to engage a passive archwire. A rigid stabilizing wire, .019 x .025 stainless steel, is then placed in the premolars and canine only.

The molar uprighting is done with a helical uprighting auxiliary spring of .017 x .025 stainless steel wire placed in the auxiliary tube of the molar. The mesial arm of the helical spring should be adjusted to lie passively in the vestibule and upon activation should hook over the archwire in the stabilizing segment. It is important that the hook be positioned so that it is able to slide distally as the molar uprights. A slight lingual bend placed in the uprighting spring is needed to counteract the forces that tend to tip the anchor teeth buccally and the molar lingually.

Removable Appliances

The uprighting of mesially inclined molars can often be accomplished with a removable appliance. This appliance should be designed to give you the best retention and anchorage. This is accomplished by having excellent tissue adaptation, two to three
clasps and a labial bow to prevent flaring of the anterior teeth. This appliance usually incorporates a spring or an expansion screw to accomplish the desired tooth movement.

In cases where the molar is severely inclined a fixed component can be added. Here an uprighting spring inserts into a fixed molar bracket which has a tube or slot. The spring then hooks onto the removable appliance which provides the necessary anchorage and prevents lingual tipping. When using this fixed/removable approach it is essential to place an occlusal rest on the distal aspect of the occlusal surface to prevent extrusion.2

While most general practitioners find removable appliances easier to use, these appliances afford much less control over tooth movement. The operator is also completely dependent upon the patient wearing the appliance full time for treatment to be successful.

Adjustment Tips

Fixed Appliances

1. Placement of the molar band or bracket should be down the long axis of the tooth and centered in the clinical crown.

2. The placement of pre-molar and cuspid brackets depends on the existing position of the teeth. When teeth are serving as anchor units, the brackets should be placed to engage the stabilizing arch wire passively. If pre-molars need to be repositioned as well, the brackets should be placed ideally, (perpendicular to the long axis of the tooth and centered in the clinical crown).4,5 If you desire, a matrix can be made by the lab to assist you in bracket placement.

3. Once the brackets are in place, try-in the stabilizing wire to make sure it fits passively.

4. Tie in the stabilizing wire. We recommend elastic ligatures ties over wire ligatures as they are more comfortable and easier to use.

5. Before placing your preformed helical uprighting spring make sure it has a slight lingual bend in it. This will prevent your anchor teeth from being tipped buccally and the molar lingually.1,4,6 The mesial arm of the uprighting spring should lie passively in the vestibule before it is engaged. At subsequent appointments, this spring can be reactivated by simply bending it gingivally.

Removable Appliances

1. When using removable appliances that have an expansion screw, have your patient activate the appliance one turn per week. This is equivalent to 1 mm of movement per month.
2. During the uprighting process, it is important to prevent unnecessary occlusal trauma. This is easily accomplished by doing some selective grinding throughout treatment.

Lab Requirements

1. Accurate casts poured in stone. Air bubbles, holes, excess stone or any other imperfections are unacceptable as they will effect the fit of the appliance.
2. Provide a carefully taken occlusal record. This will allow us to fabricate any additional appliances needed for disarticulation purposes.
3. Indicate the appliance desired on the prescription.

Care for the Appliances

Removable appliances should only be taken out after meals for cleaning. The appliance should be scrubbed thoroughly with a tooth brush and toothpaste, then rinsed in cool water.

Excellent oral hygiene is essential for patients wearing fixed appliances. Food debris is easily trapped and must be removed after eating.

Fixed appliances can be very irritating to the cheek and tongue, especially when first delivered. I recommend that you give your patient some utility wax or brace relief to protect their soft tissues.

Contra-Indications & Concerns

After doing a thorough clinical analysis, you must determine whether an uprighting procedure is appropriate. Some patients have physiologic occlusions where the edentulous areas have remained stable for many years. Others are periodontally resistant and can tolerate tooth malposition. For these patients it is optional whether a mesially inclined molar must be uprighted, unless it is necessary to accomplish optimal restorative treatment.

Inflammation must be controlled in a periodontally involved patient prior to initiating tooth movement. Not doing so can result in irreversible crestal bone loss, probably causing more harm than benefit to the patient.

When uprighting a molar, occlusal interferences are often created which can cause a patient to clench or grind. To prevent this occlusal trauma during tooth movement, one should use a combination of a bite plane for posterior disarticulation and selective grinding of the teeth in trauma.
The decision to use an appliance for disarticulation is dependent upon a thorough understanding of the patients skeletal and muscular pattern. For example, in the open bite skeletal pattern extrusive mechanics of uprighting can cause an open bite to develop. It would be contra-indicated to use a bite plane appliance for disarticulation in this pattern. In the deep bite pattern, the opposite is true. Here there may be a problem with trauma to the tooth during uprighting due to the extrusive forces. Trauma can be alleviated by using a simple bite plane appliance.2

In the presence of strong musculature, there is a greater chance for trauma to occur to the tooth being uprighted. There is also less of a tendency to create an open bite. In this situation, the use of an anterior bite plane would be appropriate.

In the presence of flaccid or weak musculature during uprighting, there is a possibility of extrusion that can be difficult to reverse. This is particularly true when there is both a superimposed skeletal open bite tendency and a weak musculature. A patient exhibiting these characteristics would not use a bite plane appliance for disarticulation.

Although it is possible to upright both a second and third molar at the same time, it is not always appropriate. Distal positioning of the third molar can move it into a position where good hygiene can not be maintained. Sometimes, uprighted third molars are not in functional occlusion. In these cases, it would be more appropriate to extract the third molar and simply upright the remaining second molar.

A helical uprighting fixed appliance causes considerable occlusal as well as distal crown movement. This type of spring should only be used when a tipped molar has an occlusal antagonist. Alternative uprighting springs can be used, but they are more difficult to use and are not the subject of this article.

Income Potential

I have never met a dentist that did not have at least several patients that could benefit from molar uprighting. In most practices, there are dozens of candidates for molar uprighting and the income potential is considerable. Also, integrating these simple techniques into your routine treatment will open up a whole new world of restorative dentistry for you. Instead of leaving an area untreated or placing a compromised bridge or partial, you now have the flexibility to offer your patients ideal prosthetic care. Happy patients refer. This is one of the best bottom line building procedures you can add to your practice.

By Rob Veis D.D.S
Director - Practice Development
References


FORCED ERUPTION

Indications

Often, clinical conditions can make a tooth appear to be unrestorable. Fractures, caries, large old restorations, osseous defects, a poor root to crown ratio, and perforations at or below the level of the crestal bone are just a few of the factors that can contribute to tooth loss.\(^{3,4}\)

There are several common methods available to manage a tooth which is severely broken down or periodontally involved. These include extraction of the remaining root followed by a prosthetic replacement and techniques to expose sound tooth structure such as osseous surgery and forced eruption. The restorative and periodontal treatment which is most appropriate depends on the following:

1. The predictability of the treatment procedure.
2. The position of the tooth in the arch and its strategic restorative value.
3. The root to crown ratio after the tooth is restored.
4. Whether the periodontium or adjacent teeth will be compromised as a result of periodontal surgery.
5. The ability to maintain the periodontium in a state of health.
6. The achievement of an esthetic result.

Extraction

When faced with the difficult clinical situations mentioned above, removing a tooth may appear to be a simple solution. But on a long term basis, tooth removal is an expensive option with many disadvantages for the patient. Replacing the missing tooth with a fixed partial denture is possible, but this may lead to unnecessary compromise of the abutment teeth. Tooth extraction also causes a decrease in the thickness of the alveolar bone. This makes it much more difficult to accomplish an esthetic restorative result regardless of whether you utilize an implant or place a fixed partial denture.

Osseous surgery

Osseous surgery is usually done to correct periodontal defects and to apically position the bone and soft tissue permitting the reformation of a new dentogingival complex. The goal of this procedure is to provide enough sound tooth structure to allow the clinician to restore the tooth without violating the biologic width. This procedure is usually done when an osseous defect is isolated to only one area of involvement and the adjacent bone can be reshaped to establish gradual changes in the bony architecture.
Surgical exposure of sound tooth structure is fraught with compromise. Gingival and osseous surgery cannot be limited to the involved tooth and must be extended to adjacent teeth in order to blend the gingival and osseous contours. The ultimate result is a sacrifice of supporting bone on several uninvolved teeth. This can cause root sensitivity, expose furcations, and in some cases can involve the maxillary sinus.²

When crown lengthening is done in an anterior region, it can result in unesthetic open embrasures and long clinical crowns. This situation is particularly disadvantageous in patients with a high lip line, that show gingival tissues when speaking or smiling.⁵

Forced eruption

Forced eruption is often a more appropriate alternative when loss of tooth structure is in the region of the alveolar crest. It can be defined as an orthodontic movement in a coronal direction through the application of gentle, continuous forces.² Specifically when a root segment is forcefully erupted, the forces stretch the gingival and periodontal fibers producing a coronal shift of gingiva and bone. If done slowly, the gingiva and supporting structures will follow to a position that is further coronal than the adjacent teeth. These gingival and osseous changes can be used to manage many restorative problems.

For example, after forced eruption, periodontal surgery can be performed exposing sound tooth structure without sacrificing bone on the adjacent teeth. The soft tissue can then be sutured to blend with the gingival margins of the adjacent teeth to produce an acceptable esthetic result.

Forced eruption also has an effect on the root to crown ratio. For example, an upper bicuspid has an anatomic root to crown ratio of 14 to 8. But because of a 4mm osseous defect, this tooth’s actual clinical root to crown ratio is an unfavorable 10 to 12. By erupting the tooth 4mm to correct the osseous defect and removing 4mm from the crown as it’s erupted the root to crown ratio can be improved. After eruption, the clinical root will remain the same length at 10, but because of reduction in the crown, its length will be 8, giving you a substantial improvement in the root to crown ratio.

Biologic Width

Regardless of the technique used, adequate bone must be removed during surgery, not only to expose sound tooth structure for the restoration, but to accommodate for the reformation of the connective tissue attachment and the epithelial attachment. The combined dimensions of the connective tissue attachment and the epithelial attachment averages 2.04 mm and is described as the biologic width.⁶ This dimension is critical. The restoration of a tooth without regard to the biologic width results in the clinician burying the margins of the crown in an attempt to secure sound tooth structure. A tooth restored in this manner usually results in a poor gingival response because the connective tissue and epithelial attachments have been violated. Before any restorative procedures are performed, a minimum of 3mm to 4mm of tooth structure coronal to the alveolar crest of
bone must be provided for the reformation of the biologic width and to allow the final restoration to embrace at least 1 to 2 mm of solid tooth structure.1,2,3,4,7

Description of Appliances

There are several methods for erupting teeth. The dentist can choose either a fixed or removable appliance depending upon the clinical situation.

The Attachment unit

The attachment unit is the part of the appliance that attaches to the tooth needing eruption. The preferred method is bonding an attachment to natural tooth enamel. However, if there is no labial enamel to bond to, then the next best option is a temporary or final post and core and a temporary crown. A temporary crown offers several advantages; it is more esthetically pleasing and retains the tooth’s original position. After the temporary crown has been constructed, an orthodontic bracket is bonded to its surface as far to the gingival as possible.

Fixed appliances

When using a fixed approach, the equivalent of two teeth on either side of the tooth to be erupted must to be available. For example, with a second premolar, the first premolar and canine on one side and a multi-rooted first molar on the other will provide adequate anchorage. Using three or four teeth in this manner for anchorage eliminates any movement of the anchorage unit.

By direct etching and bonding, brackets are placed on the anchor teeth. It is important to align these brackets in the same horizontal plane. A stainless steel orthodontic wire - 0.018 inch by 0.025 inch is then tied into place with elastic ligatures. This wire has been bent, by the laboratory, to the general labial contours of the anchorage teeth and the crown of the tooth to be extruded. An occlusal offset has been placed in the wire over the tooth to be extruded. This wire, when properly positioned incisogingivally, will provide the needed extrusion distance between the wire and the attachment on the tooth needing eruption.8 After placing the arch wire, you can activate the appliance. An elastic is placed from the attachment, looped over the wire and back on to the attachment to initiate eruption.

Removable appliances

There are times when bracketing teeth for anchorage is either inappropriate or not possible. For example, placing brackets on porcelain veneers or crowns is contraindicated as the bonding process will damage their finish. Sometimes patients do not have enough teeth to use as an anchor. This happens quite frequently in partially edentulous patients where one of the remaining abutment teeth needs to be restored. In both these cases, a removable appliance allows you to use the soft tissue, teeth, and the appliance to form an
anchor. Appliance design will vary. In some cases you may be able to use a patient’s existing partial by simply adding a hook over the tooth needing eruption. In other cases, a simple acrylic orthodontic appliance with an activating spring arm can be used. This type of appliance works by simply engaging the spring over the attachment bracket. Though not the solution for all cases, removable appliances can expand the clinicians options to initiate forced eruption.

**Treatment Procedures**

1. As always, proper appliance selection and application requires a well thought out and thorough diagnosis and treatment plan. This is especially true when you are dealing with a compromised dentition. Your diagnostic records should consist of the following:
   a. A complete medical and dental history.
   b. A thorough clinical exam. This should include:
      i. An oral cancer screening.
      ii. Documentation of any abnormalities in the oral mucosa and gingiva.
      iii. Radiographic evaluation of all necessary films (FMX, PAN, CEPH).
      iv. Charting of all existing restorations and carious lesions.
      v. A thorough periodontal evaluation.
      vi. An occlusal analysis.
      vii. A TMJ evaluation.

2. Before initiation of forced eruption, the restorability of the tooth after the orthodontic phase must be considered. The following steps are advised:
   a. Estimate the length of the healthy root embedded in bone from the radiograph.
   b. Estimate the space available for the clinical crown - articulated diagnostic casts may be used as a guide.
   c. Calculate the amount of eruption necessary to give you 3-4mm of sound tooth structure coronal to the alveolar crest. For example, if the pathosis is below the alveolar crest the dentist must add the distance from the pathosis to the alveolar crest plus the biological width (2mm) plus 1 to 2 mm to avoid placement of the restoration at the base of the sulcular crevice.
   d. Calculate the effective root length remaining after root extrusion and divide it by the clinical crown height as measured in step b. If the result is 1 or more, then favorable conditions exist for the completion of the restorative procedures. If the result is less than 1, then root extrusion will not provide the necessary basis for a properly constructed cast restoration.

3. Select the appropriate appliance technique. Use your mounted study casts to evaluate the bite relationship, the number of teeth available for anchorage, and
their position in relation to the tooth needing extrusion. This will allow you to select the appropriate appliance. For example, in an deep bite, clearance does not exist for bracket placement on lower anteriors. Here a removable appliance with a bite plane to open the vertical would be the appliance of choice.

4. Select the method of attachment to the tooth needing eruption. e.g. bonded bracket, temporary post and crown, permanent post and temporary crown.

5. Deliver the appliance. Bonding brackets is not difficult. We recommend a self cured composite called Rely-a-bond because it gives you plenty of working time. However any orthodontic bracket cement will work to bond these brackets in place as long as you follow the manufacturers instructions.

6. Activate the appliance. Once the appliance is properly placed, the actual tooth movement is the easiest part. A simple elastic tie is placed to join the attachment and anchorage units. To maintain the tension, the chain elastic length will need to be changed by the doctor on a weekly basis. When a removable appliance is used the spring arm should be engaged over the anchorage bracket. This spring should be adjusted weekly as well. The forces used must be light as extrusion requires only 20-30g of force.\textsuperscript{3,9,10}

7. Normal extrusion proceeds at about 1mm a week. Therefore at the patient’s weekly appointments, the occlusion must be relieved at least 1mm to allow the extruding tooth to move occlusally. If the occlusion is not relieved, the tooth will be placed in traumatic occlusion.

8. When the tooth is sufficiently erupted it should be stabilized to prevent relapse from occurring. This can be done by tying the attachment and anchorage units together with passive elastic chain or ligature wire.\textsuperscript{3} The occlusion must be relieved carefully to avoid centric or eccentric interferences during normal functioning. Excessive occlusal contact during the retention phase will prevent the periodontal ligament from returning to its normal width. As the periodontal ligament returns to normal, the mobility of the extruded tooth will return to normal. In most instances a stabilization period of 2 months is adequate.\textsuperscript{10}

9. If periodontal surgery is required to match the bony and gingival contours of adjacent teeth, the orthodontic appliance must be left on during and after surgery to further stabilize the tooth. Another month of retention before starting prosthetic treatment is usually adequate.

10. Finally, when it’s time to begin final restoration of the erupted tooth, you can feel free to remove the appliance. This is easily done with a direct bond bracket removing plier and a 12-fluted composite finishing bur in a high speed handpiece.
Adjustment Tips

Having predetermined the appropriate extrusion distance, the lab can fabricate an anchorage wire that when properly positioned inciso-gingivally will provide the needed extrusion distance between the wire and the attachment on the tooth. This allows you to accurately observe the amount of extrusion and when eruption is complete, the wire and the attachment unit will be at the same level. Although it may seem simplistic to build in the amount of extrusion into the appliance, the gingival and bony tissues extrude as well and it becomes difficult to determine how much the tooth has extruded.

The clinician should minimize the influence of trauma associated with normal function or parafunctional habits by reducing heavy contacts in maximum intercuspation and excursions.

Lab Requirements

1. An accurate set of dental casts poured in stone. Air bubbles, holes, excess stone or any other imperfections are unacceptable as they will affect the fit of the appliance.

2. Provide a carefully taken occlusal record. This will allow us to fabricate any additional appliances needed for disarticulation purposes (e.g. mandibular eruption deep bite case).

3. Fill out your prescription slip thoroughly. Indicate the following:
   a. The type of appliance desired.
   b. The amount of eruption needed.
   c. Whether or not you will need a guide for bracket placement.

Care for the Appliances

Removable appliances should only be taken out while eating. The appliance should be scrubbed thoroughly with a brush and toothpaste, then rinsed in cool water.

Excellent oral hygiene is essential for patients wearing fixed appliances. Food debris is easily trapped and must be removed after eating.

Fixed appliances can be very irritating to the cheek and tongue, especially when they are first delivered. I recommend that you give your patient some utility wax or brace relief to protect soft tissues.
Contraindications and Concerns

Inflammation must be controlled prior to initiating tooth movement. If it is not, forced eruption may contribute to the deepening of an osseous defect.4

Only the tooth to be extruded should move. Choosing the appropriate set up is critical. If the brackets are not carefully placed, the anchorage teeth will move, changing the occlusion.

The amount of extrusion is important. If the tooth is not sufficiently extruded, the margin of the final restoration will be too close to the alveolar crest, violate the biologic width and require excess osseous surgery. Excess surgery will negate one of the advantages of orthodontic extrusion, preserving bone support and producing a normal gingival margin with adjacent teeth. Over extrusion results in decreased osseous support for the treated tooth and can create an unhealthy root to crown ratio.

Make sure your root to crown ratio will be 1 or more once forced eruption is complete. If it is not, then root extrusion is contraindicated as it will not provide the necessary basis for a properly constructed cast restoration.7

Ideally, the restoration margin should be placed coronal to the gingival margin for adequate plaque removal. However, the ideal cannot always be obtained. On anterior teeth of patients who show gingiva when they smile, showing the gingival margin is not always esthetically pleasing. For these patients, the margin should be placed in the sulcus. This can be done as long as you respect the biological width.

Restorative procedures after forced eruption require extra attention by the restorative dentist. When a tooth is erupted, the diameter of the root decreases as the preparation moves apically. This leaves you with a smaller diameter tooth in the same fixed mesiodistal space which a new crown must now occupy. Tooth preparation of this smaller root will demand greater attention if one is to achieve a healthy blending of restorative materials, gingival health, and esthetics.2,10

Posteriorly in the dental arch, surgical crown lengthening may be more appropriate because flared molar roots may present proximity problems if extruded and esthetics is less important.3

To use a removable appliance the patient must have the dexterity to engage and disengage the activating spring.11

The bulk of an acrylic resin orthodontic removable appliance may affect the patient’s speech and phonetics. It will take time for a patient to adapt to wearing this appliance.11

Patients undergoing this type of treatment must be anxious to save their teeth and at the same time be prepared to accept the time, costs, and inconvenience involved.10
Income Potential

Adding forced eruption to your restorative skills will give you the flexibility to treat those tough cases which would otherwise be unrestorable. General dentists usually find the orthodontic eruption part of this procedure to be easy and predictable. But most of us are uncomfortable performing esthetic periodontal surgeries. This offers you a great opportunity to work closely with your periodontist. What you will find is that your periodontist will become one of your best referral sources. Together, you will create esthetic results that you just could not achieve on your own. The results will be beautiful smiles and happy patients who will spread the good word about your work.

By Rob Veis D.D.S.
Director - Practice Development

References


PERIODONTAL APPLIANCES
Simple techniques that solve serious problems

Practice Potential

Many periodontal appliances that can be used to increase flexibility and control of your treatment. The six basic categories are:

Splints (intracoronal and extracoronal)
Temporary Bridges and Partial
Molar Uprightinq Appliances
Forced Eruption Appliances
Surgical Stents
Fluoride Trays

Indications

Tooth loss, drifting teeth, tipped molars, posterior bite collapse, anterior flaring, and occlusal trauma are some of the problems that are associated with periodontal disease.

In today’s dentistry periodontal, occlusal, and restorative needs must all be taken into consideration when trying to manage the stomatognathic system. Before restorative work can be completed, the active phases of periodontal disease must be controlled.

Appliance therapy can be used to enhance periodontal care. Periodontal appliances can realign teeth, level infrabony defects, create harmonious gingival lip line relationships, retain and stabilize compromised dentition, re-establish proper occlusial planes.

Maintenance of our restorative and periodontal care is also often overlooked. For example, using fluoride trays to give daily fluoride treatments can go a long way in preventing recurrent decay. It is also a great way to control root sensitivity after root planing or periodontal surgery.

Treatment Procedures

1. For appliance therapy to work, all care givers must work closely together. This integrated method of treatment will help you deliver the best care possible.

2. Appliance therapy is done in conjunction with your periodontal therapy. Before beginning any active orthodontic movement, thorough root planing and curettage must be completed to eliminate all inflammation.

3. Use of these appliances is quite easy. Careful diagnosis and treatment planning are the key elements to success. Before becoming involved in treatment the
patient should be informed of the total treatment required including periodontal, orthodontic and prosthetic therapy.

Appliance Designs

Extra and Intra Coronal Splints for Retention and Stabilization

A stable occlusion can usually withstand the normal forces produced by the stomatognathic system. Often stability does not occur, so some form of mechanical retention must be used to protect against further breakdown. Instances where mechanical retention is necessary are:

a. After periodontal surgery to distribute forces, decrease trauma, and aid in healing.

b. In cases of adult orthodontics where restoration of a broken down dentition coincides with the need for stabilization.

c. In cases of secondary occlusal trauma where changes in the attachment apparatus reduce its ability to resist the forces that normally occur in general functioning.

d. In case of a mutilated dentition, where there is both the loss of attachment and the presence of tooth mobility.

Removable Extra Coronal Acrylic Splints

These splints (nightguards) are used in periodontal therapy, postorthodontic stabilization and in the treatment of TMJ dysfunction. They are also used to control and protect against excess tooth mobility due to primary or secondary occlusal trauma. They are available in a variety of designs and may be readily modified for specific treatment requirements.

Removable Acrylic Retainers

Hawley retainers are the most common removable acrylic appliances. They consist of an archwire for labial support of the anteriors with either Adams or Circumferential clasps on the molars and a lingual acrylic plate. They are most often used to control post treatment mobility and occlusal trauma.

Fixed Extra Coronal Splints

Mesh/composite Lingual Splints

This splint is very esthetic because nothing can be seen from the facial aspect. Although it can be used for both arches it is more commonly used for the lower anteriors because forces on these teeth are contained within the maxillary arch and are mainly in a vertical
direction. A mesh is cut and adapted to the lingual surfaces. The teeth are etched and the mesh is secured in place with composite.

**Etched Metal Cast Bar Splint**

When using a cast metal bar splint, resistance to displacement is in the tooth preparation and the design of the appliance. Thus it is essential that accurate impressions be taken to assure the desired fit. This appliance is bonded into place with a composite resin.

**Easy Bond Retainer**

The Easy Bond retainer is a lingual multi-stranded wire retainer that is spot bonded to individual teeth. A patented transfer tray system allows you to control both the position of placement and the amount of composite used. It is a clean and efficient way to create a lingual splint.4

**Intra Coronal Splints**

**Wire/Composite Splint**

These are rigid splints that can be made to accommodate an entire arch using a variety of different wires, ie. (twist a flex). Because they are intra-coronal they will not interfere with your other restorative procedures such as partial design and placement. These splints can also be made to support pontics thereby acting as interim bridges. All we need is an accurate model of your prepared teeth.

**Temporary Bridges and Partial**s

**Unilateral Interim splints**

Simple space maintainers, which are more commonly used after premature loss of primary teeth can also be used quite effectively as interim bridges in periodontally involved areas. These are inexpensive ways to stabilize an area until periodontal therapy is complete and a decision on the best restorative technique can be made. These temporary bridges can also maintain implant sites and are much more comfortable than a temporary partial or flipper.

**Adjustable Two Band Interim Splint**

**Two Band Interim Splint with occlusal bar**

Teeth to be stabilized are banded and joined by a adjustable buccal wire. This is particularly useful when buccal and lingual walls of the banded teeth are subject to fracture. The Two Band Interim Splint with occlusal bar is the same as 2013 but features a rigid, non-adjustable occlusal bar.
Two Band Interim Splint with occlusal acrylic pad

Two Band Interim Splint with pontic

Both are used to maintain space when supra eruption is a concern. In the Two Band Interim Splint with a pontic, biotone shade teeth are placed instead of an acrylic pad. A Direct bonded mesh pad may be used in place of the band when esthetic considerations are important.

Temporary Maryland Bridge

This appliance is excellent for the patient that will not tolerate a removable flipper and is often used during the period of implant integration.

Implant Site Protecting Appliances

The fixed/removable version is attached to the molars with special bands that allow you to remove and replace the appliance. This affords easy access to the implant site for additional procedures. It is also an excellent appliance to protect a ridge augmentation site.

This completely removable design is retained with wrought wire clasps. Both appliances afford the patient the advantage of an excellent esthetic appliance with no speech impeding lingual acrylic as found in regular partials.

Molar Uprighting

When a tooth is missing arch integrity is lost and teeth begin to shift. The mesially inclined molar is one of the most common dental maladies in the adult population. The typical clinical picture consists of extrusion and migration of teeth, accelerated mesial drift, uneven marginal ridges, angular bony crests, altered coronal to gingival form, food impaction, caries, periodontal disease, and ultimately posterior bite collapse with loss of the vertical dimension. 3

The patients most likely to benefit from molar uprighting are those who have periodontal disease with mesial infra bony pocket formation.

Molar Uprighting Fixed Appliance

This simple appliance can successfully upright a molar tipped up to 60 degrees from vertical and eliminate an isolated periodontal pocket while realigning the occlusal forces along the long axis of the molar.
Uprighting Partial

A removable partial can upright a lingually tipped molar by using an expansion screw. Biotone shade teeth are used to replace missing teeth and restore function until the uprighting procedure is complete and a permanent restoration is ready to be placed.

Forced Eruption

Forced eruption is the use of gentle continuous orthodontic forces in a coronal direction. This movement can change the architecture of both the hard and the soft tissues allowing you to alter or eliminate an isolated periodontal defect. This coronal movement also gives you the ability to restore a tooth with lost tooth structure at or below the bony crest.

SAFE Appliance

Using fixed direct bond brackets and sectional arch wires, an otherwise non-restorable tooth can be repositioned coronally. Because crestal bone comes along with it, osseous surgery can be accomplished without sacrificing the bone around the adjacent teeth. This decreases the chances of sensitivity, enhances the final esthetic results and eliminates the need to prepare two healthy teeth for a bridge.

Forced Eruption Removable Appliance

This appliance can be used in place of the SAFE appliance above when a fixed (direct bonded) approach is not possible due to porcelain jackets, etc.

Surgical Stents

Gingival Grafting

A common periodontal procedure is to harvest palatal tissue to be transplanted in areas that lack attached or keratinized tissue. This procedure creates an open wound that heals by secondary intention and can be quite painful for the patient. A properly designed surgical stent will accomplish the following:

1. It protects the open wound making the procedure more comfortable for the patient.
2. It helps control bleeding when used in conjunction with a dressing.

These stents can be designed to the doctors exact specifications.
Fluoride Delivery System

Fluoride is routinely used in most dental offices when a patient comes in for their regular prophylaxis. Many patients however need extra fluoride protection on a daily basis. The best method of delivery is using 1.1% neutral sodium fluoride in a custom tray for five minutes.

This technique can effectively help:

1. patients with a high caries index
2. patients undergoing periodontal therapy
3. chemotherapy and radiation therapy patients
4. patients with tissue recession, exposed roots, and root caries
5. over denture patients
6. patients with extensive restorative work
7. orthodontic patients
8. patients with a high level of tooth sensitivity
9. anyone who needs extra hygiene motivation

Care for the appliance:

Whether your periodontal patient is undergoing complete fixed orthodontics, is having anteriors splinted with a Maryland splint, or space maintained with an interim bridge, all fixed appliances will demand special oral hygiene care. We highly recommend the use of fluoride with a tray delivery system to help prevent caries activity.

Removable appliances need special care as well. Our patient instruction care booklet "A Passport to a Healthy Smile" can be ordered from Success Essentials.

Lab Requirements

1. A set of accurate upper/lower models poured in dental stone.

2. An appropriate bite registration.  
   Note - a bite registration for an interim bridge can be a simple CO record taken in wax. However, a registration for an implant surgical stent may need to be designed to support edentulous areas in a proper vertical and centric relationship allowing for the correct articulation of the working casts.

3. Select the type of appliance from this bulletin. Then give us a detailed description of any modifications in the design or special instructions you would like us to follow.
Contra Indications and Concerns:

1. If inflammation is not controlled, tooth movement in a periodontally susceptible patient can result in irreversible crestal bone loss. This will probably cause more harm than benefit to the patient.

2. Whether a splint is to be used temporarily or as a permanent form of cross arch stabilization you need to make sure that:
   a. It is strong enough to accomplish the job.
   b. It will not interfere with normal hygiene.
   c. It will be easily maintained and repaired.
   d. It will be esthetic whenever possible.

3. Temporary bridges must not interfere with normal hygiene. To assure this we recommend that the bands for these appliances be lab made. Only in this way can we assure that proper contours and embrasure spaces will be respected in the appliance fabrication.

4. There are patients with physiologic occlusions where the edentulous areas have remained stable for many years or who are periodontally stable and can tolerate tooth malposition. For these patients, uprighting a mesially inclined molar is optional unless you need to achieve parallelism for your restorative dentistry.

5. Prosthetic procedures after forced eruption require extra finesse by the restorative dentist. In a tooth that has been erupted, the diameter of the root decreases while the space between the adjacent teeth remains constant. This means the final restoration will exhibit a greater degree of taper from the gingival margin to the incisal edge. To avoid over contoured margins greater attention will need to be paid to the gingival areas.

6. When using fluoride trays to help protect against decay and root sensitivity do not use acidulated fluorides. They can damage existing restorative work. We recommend using 1.1 % neutral sodium fluoride. This can be used without worrying about damaging composites and porcelain restorations.

Income Potential

Treatment with these appliances offers an excellent opportunity for the specialist and the general dentist to work together. Either doctor can do this appliance therapy.

The advantages of doing Appliance Therapy are:

- Increased communication between treating doctors.
- Better comprehensive patient care.
- Increased referrals.
- Increased direct income.

Note - In the average practice, a conservative estimate is that a minimum of three patients each week need some form of periodontal appliance therapy. This will add at least $50,000 gross income to your practice.

By Rob Veis D.D.S.
Director-Practice Development

References


Accurate Alginate Impressions

“The Impression You Take is the Impression You Make”

Because taking an alginate impression appears to be so easy, it has become one of the most incorrectly done techniques in dentistry. Not taking the time to do this procedure correctly is one of the most expensive mistakes you can make in your dental practice.

Description

Dental alginate is the most widely used impression material. Its wide use is a result of its low cost, ease of manipulation, need for minimal equipment, and acceptable accuracy for many dental procedures. Some of the more common procedures which can be accomplished using alginate are:

- Impressions for partial dentures.
- Primary impressions in edentulous mouths.
- Impressions for diagnostic casts.
- Impressions for removable and fixed orthodontic appliances.
- Master casts impressions for dental sleep apnea appliances.
- Impressions for splints and nightguards.
- Impressions for opposing casts for crown & bridge work.¹,²

Dental alginate is an impression powder that, when mixed with water, will undergo a series of chemical reactions that will take it from a viscous sol to an elastic gel.¹,²,³ A typical formula for an alginate impression powder is:

1. Potassium or Sodium alginate - the chief ingredient which comes from sea kelp and forms a sol in water.
2. Calcium sulfate - reacts with potassium or sodium alginate to produce a gel.
3. Trisodium phosphate - retards the reaction to provide more working time.
4. Diatomaceous earth - a filler used to control the consistency of the mix and the strength and flexibility of the impression.
5. Potassium zinc fluoride - used to counteract an inhibiting effect that alginate has on the setting of the gypsum.
6. Organic glycol - used to coat the powder particles to minimize the dust during dispensing.
7. Quaternary ammonium compounds - Sometimes added as a self disinfection agent.¹
These ingredients allow alginate to:

1. Easily be mixed in water to form a viscous gel.
2. Have enough body to be contained in an impression tray.
3. Have enough working time to be carried to the mouth.
4. Change into an elastic gel once it is placed in the mouth.
5. Be removed from the mouth without distortion and to have enough strength and stiffness to ensure a firm surface.²

Alginate is available in both individual packages and bulk containers. Although bulk alginate is used more often because of its lower initial cost, packages containing only enough alginate for an individual impression are preferred. These packages minimize moisture contact with the powder and extend the storage life of the alginate.¹

Regardless of how it is dispensed, alginate should always be stored in a dry place where the temperature is maintained between 50° and 80° Fahrenheit and if the material is over one year old it is best to discard it.²

Treatment Procedures

The following is a list of the precise, step-by-step procedures that must be followed exactly in order to obtain an impression and a cast that will meet the high standards of treatment desired for your patients.

1. Select an appropriate impression tray.
   a. The selection of the proper size and shape of the tray is essential. A properly sized tray must include all the areas wanted in the impression and still allow for adequate clearance between the tray and the tissues. If this is not done the impression will distort or tear upon removal from the mouth.
   b. Many different tray types can be used ranging from disposable plastic to metal perforated trays. We recommend the use of a metal rimlock tray for two reasons. First, because alginate is a compressive material a solid tray will force the material around the teeth better than a perforated tray. Second, the rimlock design will hold the impression material in place without the need of an adhesive.

2. Prepare to take an impression by placing your alginate, rubber mixing bowl, spatula, and alginate measuring instruments on the counter.

3. Accurately measure out in the mixing bowl the amount of powder and water you will need to take an impression.
a. If you choose to use alginate from bulk containers always make sure to shake the can to ensure an accurate measurement of the material as it tends to settle when its left on the shelf.1,2,3

b. One scoop of powder should be used for every mark on the water cup. When dispensing the powder, over fill the cup, tap it lightly, then remove the excess from the top.1,2

c. Distilled water is recommended for use with all alginate mixes because it will eliminate contamination of the mix with calcium, fluoride and other materials often found in tap water.

d. The temperature of the water should be at 21°C (70°F).1,2,3 (See Contraindications and Concerns)

4. Just before taking the impression, have the patient rinse to cut the mucin and lower the surface tension. Then, lightly dry the teeth with compressed air just prior to insertion of the impression material and the tray. Do not over dry the teeth as the material may tend to stick to the teeth when the impression is removed.

5. Slowly add the powder to the water making sure to incorporate all the powder into the mix. The alginate should then be mixed vigorously by pressing the alginate between the mixing bowl and the spatula until a smooth creamy consistency - free of graininess - is reached.

Mixing time should be 1 minute for regular set alginate and 45 seconds for fast set alginate.1,2 If the material is under mixed, the chemical reaction will not proceed uniformly throughout the mass. This can decrease the strength of the gel by 50%. On the other hand, over mixing also decreases the gels strength as too much spatulation will break up the gel as it forms.2

6. After the impression material is mixed, place the alginate in the tray in small amounts, and make certain that you force the material into the rim-locks of the tray. Then, dip your finger in cold water and smooth the surface of the alginate.4

7. Take some of the excess impression material and forcefully press it into the vestibule and on the occlusal, buccal, and lingual surfaces of the teeth. If a high palatal vault exists, place some there as well.

8. Insert the filled tray immediately, gently jiggling it into place until it is completely seated.

Maintain only enough pressure to hold the tray in place making sure to avoid moving the tray until after complete gelation. If the tray is moved during this period, strains will be incorporated in the alginate. Upon removal of the
impression from the mouth, these strains will be released, cause distortion of the impression, and make the cast inaccurate.

9. Always keep a small test sample of the alginate in your mixing bowl. When this sample loses its tackiness gelation has begun. Then, wait another two full minutes before attempting to remove the impression. Waiting several minutes after the initial gelation increases both the tear and compressive strength of the material.

10. Remove the impression with a firm, quick snap.

Do not rock or twist the impression before removing it. An alginate impression is easily deformed if it is removed slowly, but it is not permanently distorted if it is removed quickly.

11. As soon as the impression is removed from the mouth, inspect it carefully for defects.

12. With a water air syringe, rinse the impression free of any blood or saliva. Shake out as much of the excess water as you can then lightly blow the rest away with the air syringe being careful not to disturb the impression.

13. Disinfect the impression.

All impressions should be rinsed and disinfected before they are poured up and sent to the lab. Sodium hypochlorite, iodophor, glutaraldehyde and phenylphenol solutions are all being used, and some manufacturers have even added disinfectants to the alginate powder.¹²³⁴⁵⁶⁷ (See Contraindications and Concerns)

14. All impressions should be poured immediately with vacuum-mixed stone and with the use of a vibrator.

15. Accurately measure out an appropriate amount of stone and water. Stone requires a water powder ratio of .30 or 30g of water for every 100g of stone.¹

16. Slowly add the stone to the water to ensure that all the powder is completely incorporated. Then vacuum mix the mixture. The consistency of the stone should be that of a pseudoplastic viscous liquid which has a glossy surface to it.¹

17. Holding the impression on a vibrator, start adding stone in the molar region of one side. Slowly allow the stone to work its way around the impression. Continue adding stone to the same side until the impression is completely poured.

18. Once the impression has been poured, hang it on an impression tree, wrap it in a moist paper towel and let is set up. Models that harden in 100% humidity have a superior stone surface.
19. Give a minimum of thirty minutes but not longer than one hour for the stone to set up. Then separate the alginate impression from the stone model.

All alginate materials contain alginic acid which, if left in contact with stone too long, will “eat into it” and give the stone a moth-eaten appearance. To avoid this problem, remove the cast immediately after it has an adequate set.

20. Evaluate the stone model carefully. Check to make sure that you have recorded all the areas necessary to achieve a successful result and that the model is distortion free.

Contraindications and Concerns

Alginate does not reproduce fine detail as reliably as do the other elastomeric impression materials. This may be due to the somewhat more porous surface of the impression material or to a reaction between the stone and the irreversible hydrocolloid. Therefore alginate is not accurate enough for crown and bridge impressions.

All impressions should be rinsed and disinfected before they are poured up and sent to the lab. The goal in choosing a method to disinfect alginate impressions is to select a material that will work without affecting the accuracy of the impression. Sodium hypochlorite, iodophor, glutaraldehyde and phenylphenol solutions are all being used. It is always best to follow the manufacturer’s instructions since some companies have already added disinfectants to their alginate powder.

Prior to mixing up a batch of alginate you must remember that the ratio of water to powder will vary among brands of alginate and frequently, even between batches of the same brand. So, whenever you are using a new batch of alginate you should always run a test batch to determine the quantity of powder required for the consistency of mix that you prefer.

There are occasions when you will need to vary the setting time of the alginate. For example, if your patient gags you may want the alginate to set faster. This can be controlled by varying the temperature of the water. Warmer water allows the mix to set faster than cold water. Never control the setting time by varying the consistency of the mix. Changing this ratio will also effect the impressions permanent deformation, flexibility and strength.

Alginate impressions lose their accuracy rather quickly. If the impression is stored in air, water evaporates and the impression shrinks. If it is stored in water it will absorb the water and expand. Therefore it is always best to pour up an alginate impression immediately. But, when you cannot, keep it in a humidor. Storing it in 100% relative humidity will give you about an hour before serious dimensional changes occur.
Always allow your poured impression to set up in the tray with the teeth down. As stone sets in an alginate impression excess water in the stone mix rises to the highest point. If the tray is turned upside down onto a base of stone, that water will go to the cusp tips. This could result in faulty shaped cusp tips that are very soft.  

Never let an alginate impression sit on a bench top. If you place the impression with the alginate side down the weight of the tray can deform the impression. If you place the impression with the tray side against the bench any untrimmed excess alginate can deform the impression. Therefore, it is always best to use a tray tree to hold your impressions.

Trouble shooting

The following is a list of the most common problems and their causes.

1. The consistency of the alginate is grainy.
   a. Improper mixing- add the powder to the water to make sure that all of it is incorporated into the mix. Then mix vigorously for one minute to get a creamy consistency.
   b. Incorrect water / powder ratio- too much powder in the mix usually occurs because the alginate was not fluffed up in the can before measuring it out.
   c. Incorrect water temperature- if your water temperature is too warm it will decrease your mixing time and prevent you from achieving a smooth mix.

2. The impression tears upon removal from the mouth.
   a. Inadequate thickness of the material- if the material is too thin it will usually tear. This is directly related to having too much water in the mix.
   b. Premature removal from the mouth- the impression must be left in the mouth for 2 full minutes after your test sample has begun to set in the mixing bowl. Alginate doubles its tear strength in this time period.
   c. Incorrect removal technique- remember alginates are less likely to tear during removal from the mouth when they are removed rapidly. Therefore remove the impression with a snap.

3. There is a loss of detail or voids on the surface of the impression.
   a. Premature removal from the mouth- if the material is still in a plastic state detail will be lost.
b. Moisture or debris in the mouth - remember to always have the patient rinse thoroughly before taking the impression.

4. The surface of the stone model is rough or chalky.

   a. Inadequate cleaning and drying of impression- Always rinse the alginate impression thoroughly with water to clean out any blood or saliva. Then shake out as much of the excess water as you can and lightly blow the rest of it away with an air syringe. Do not over dry the impression.

   b. Incorrect handling of the gypsum- excess water in the mixture can cause the stone to be soft and chalky. This is especially true if you turn the impression over onto a base of stone as all the excess water will move towards the teeth.

   c. Failure to separate the cast after one hour- the alginic acid in the alginate will eat away at the stone if it is left in contact too long.

5. The model came out distorted and inaccurate.

   a. Delayed pouring of the impression- when ever possible pour up your impressions immediately. If you keep the impression in a humidor at 100% relative humidity you still have only 1 hour before your impression will be too distorted to use.

   b. Inadequate retention of impression material in the tray- if the impression material pulls away from the tray redo the impression. Even if it fits back into the tray perfectly do not use it. It is distorted!

   c. Incorrect technique used to remove the impression from the mouth- alginate must be removed quickly with a snap. Slow removal will permanently distort the impression.

   d. Premature removal from the mouth- remember to wait a full two minutes after your sample alginate has set up in the mixing bowl.

   e. Movement of tray during gelation- If the tray is moved during this period, strains will be incorporated in the alginate. On removal of the impression from the mouth, these strains will be released, causing distortion of the impression.
Lab Requirements

At Space Maintainers, we evaluate hundreds of models every day. Our people are trained to recognize a distorted model. But even the best trained eye can miss a subtle distortion. Therefore, the key to having the lab produce a quality product is to give us a quality model which is distortion free. To do this you must start at the beginning by taking an excellent impression. There is an old saying that I learned in dental school; “The impression you take is the impression you make.”

In many offices, the chairside assistant is responsible for taking alginate impressions and pouring them up in stone. Therefore to get consistently successful results we recommend the following:

1. Make copies of this bulletin and share it with your staff.
2. Make sure your staff has all the tools they will need to be successful (see Supply List).
3. Take the time to check your impressions before they are poured up in stone.
4. If you are unsure that your impression is good, take another one now!
5. Always carefully check your models for accuracy before you send them to the lab.

In a busy practice, it may not be easy to find the time to check an alginate impression for accuracy or stop what you are doing to check your models before they go to the lab...but believe me, doing so will save you time, money, and a lot of heartache.

By Rob Veis D.D.S.
Director - Practice Development

References


THE CONSTRUCTION BITE
Benefits and Procedure

A carefully taken Construction Bite is essential in order for the lab to correctly fabricate any appliance requiring occlusal coverage. This includes Bruxism Splints, TMJ Splints, Functional Appliances, and any appliance needing occlusal coverage.

PROBLEM: When the lab receives a set of models without a Construction Bite, the models are carefully hand-articulated on a hinge-axis articulator in maximum intercuspation, or with the centric wax wafer bite if one is provided. When the bite is then opened on the articulator quite often the mandibular model “drops-away-from” the maxillary model on a different trajectory than it does in reality when the patient opens naturally. This difference invariably results in a finished occlusal bite plane that does not uniformly contact the opposing dentition when the appliance is placed. In fact, any prematurities that exist are generally found at the posterior-most teeth on the arch, leaving the teeth further anterior, usually out of occlusal contact altogether.

SOLUTION: Spend the few minutes necessary to carefully take an accurate Construction Bite as described below. The few minutes that it takes will save valuable time, and frustration, when delivering the completed appliance. These steps should be performed after you have taken and poured up accurate working models.

NOTE: All steps are important, but Step 7 is Critical

1. First, determine the amount of vertical and/or anterior-posterior repositioning that you want to achieve with the appliance. For example:

   a. Bruxism Splints - (if just vertical opening is desired)
      Be sure that the Construction Bite taken has at minimum 1.5mm to 2mm of thickness at the posterior-most teeth in the arch for strength.

   b. T.M.J. Splints - (if vertical and anterior-posterior corrections are needed)
      Ideally use transcranial imagery to determine the amount of repositioning needed as it may be different bilaterally. This will require taking a facebow transfer and using a fully adjustable articulator. Arbitrary vertical and anterior-posterior repositioning may prove effective in many cases but may require periodic adjustments.

   c. Crossbite Cases:
      Be sure that the Construction Bite gives a sufficient, but not an excessive, amount of vertical opening to allow for crossbite clearance. (Remember the minimum opening rule of 1.5mm at the posterior-most-teeth in the arch)
2. Utilize a "Bite Stick", without any wax applied, to initially place the mandible in the desired position. Commonly used "Bite Sticks" are: the Exacto Bite, the George Gauge, or even a notched golf tee if used properly. (see attached Technical Bulletin as well as the enclosed Exacto Bite instructions)

   For Example: When using the Exacto Bite, use the appropriate notches on the 2mm or 4mm Exacto Bite that gives you the desired position. If the standard Bites do not provide an acceptable position simply create your own notch on the long upper portion of the Bite that has only one notch initially. With a small tapered bur you can create your own custom notch that will place the mandible in the precise position that you desire.

3. Once you have used your chosen Bite Stick procedure to position the mandible where you want it, have the patient practice closing into the bite several (at least 5) times.

   VERY IMPORTANT: Check to see that the patient is closing without deviating the mandible to the right or the left. It is helpful to have the patient look into a mirror as they practice so that they clearly understand your instructions and perform them properly.

4. After your patient is proficient at properly closing into the appropriate notches on the Bite Stick it is helpful to have them sit with the Bite Stick in place for several minutes before applying the wax to the forks. This is especially important for Construction Bites used for the fabrication of TMJ or Functional appliance patients. If the repositioning is excessive the patient may immediately experience uncomfortable muscle tension. If so, you may find it necessary to further adjust the notches and repeat Steps 2 and 3.

5. After careful completion of Steps 1 through 4, it is appropriate to now place the wax on the forks. Carefully place sufficient wax to cover as many teeth as possible per quadrant, then soften the wax in a water bath set at 140° F. This is absolutely essential, because if a patient closes into hard wax it can cause a slight dislocation of the condyle in the glenoid fossa in an inferior direction. If such a bite is used to relate two models to one another in the laboratory during appliance construction, the resulting appliance will come back with acrylic that is too thick posteriorly. This will result in the posterior most molars being in contact with the acrylic while the bicuspids are open and out of occlusion with the acrylic.

6. After the wax has cooled, then and only then, remove the Bite Stick from the mouth and chill the bite in cold water. After chilling the wax, replace the Construction Bite in the patient’s mouth to check that it is giving you the desired vertical and/or anterior-posterior correction that you desire. Also, check to see that the patient has not deviated the mandible to the right or left. (This is commonly overlooked)