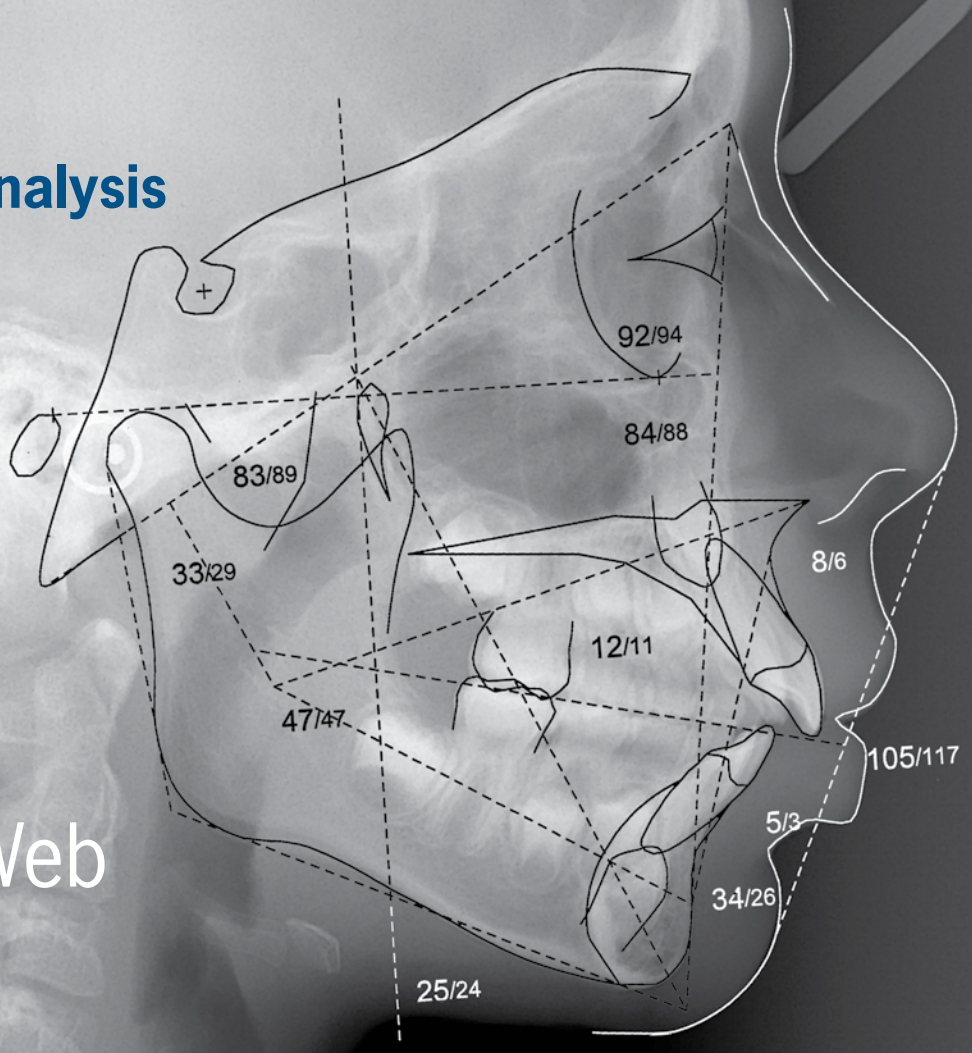
CLINICAL REVIEW

Orthodontic

DIAGNOSIS
DIAGNOSIS
DIAGNOSIS

A Comprehensive Cephalometric Analysis



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RMO® is proud to be recognized as the longest-running exhibitor at the AAO. Since the company's inception, Rocky Mountain® Orthodontics has pioneered numerous orthodontic breakthroughs such as pre-formed molar bands and the metal-injection-molding process.

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"RMO® is proud of our heritage, history, and legacy. Tony and Jody have recently completed the formation of an entirely new executive management team that will guide the next generation as we move towards the future."

Back Row: (Left to Right) Frank Augustine, Jeff Smith, Adam Pollack, Hugh Carr

Front Row: Jody Hardy, Tony Zakhem

TABLE OF CONTENTS

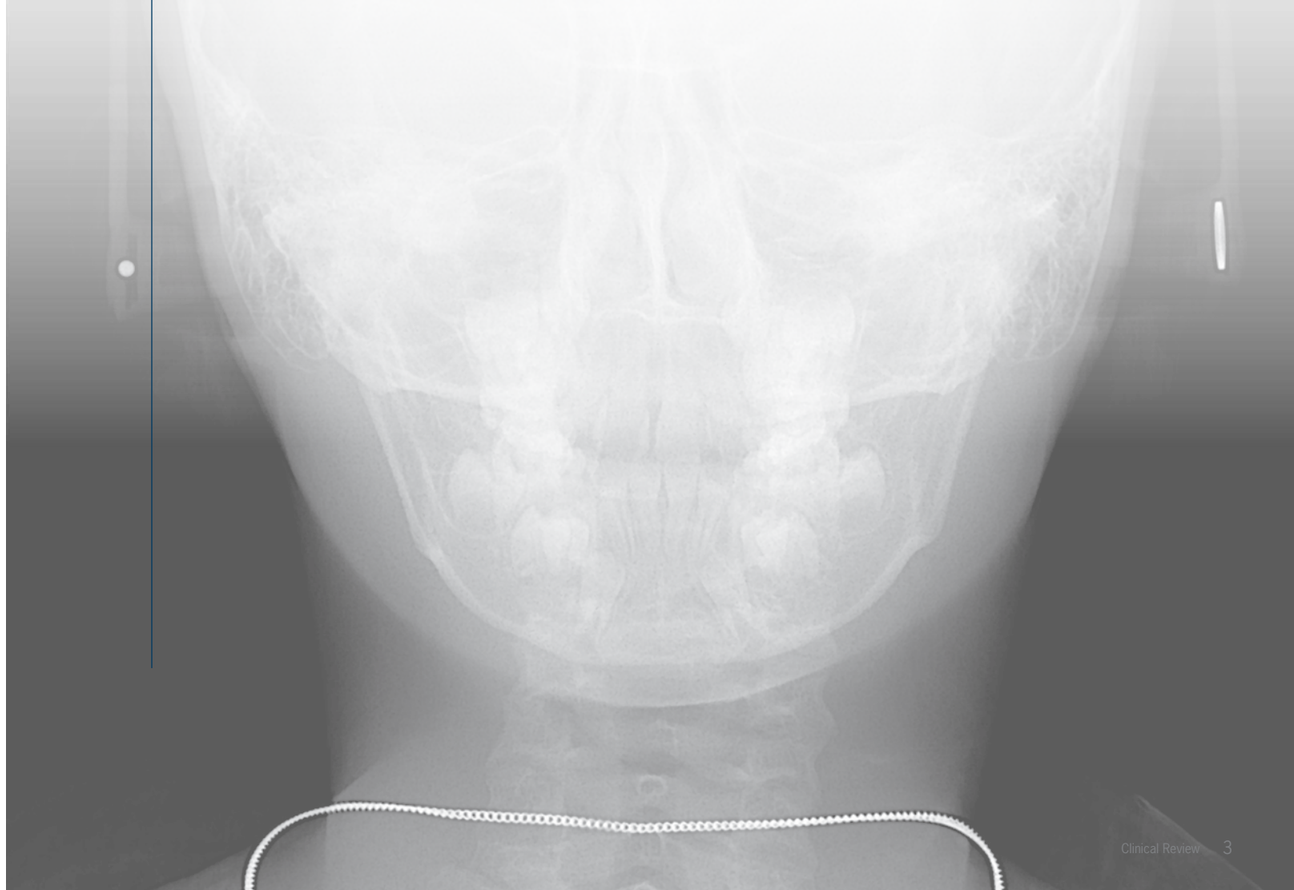
4 LOW FRICTION: TRADITIONAL MECHANICS: A PERFECT FIT
By Gary Holt D.D.S.

9 SYNERGY R: A CLINICAL PEARL
By Travis Barr B.S. and Gary Holt D.D.S.

12 DIAGNOSIS DIAGNOSIS DIAGNOSIS: A COMPREHENSIVE CEPHALOMETRIC ANALYSIS
By Bradford N. Edgren D.D.S., M.S.

32 RMODS / E-CEPH Q & A WITH DR. BUDI KUSNOTO

35 THE FUNCTIONAL MATRIX: A PRACTICAL SOLUTION USING THE MULTI FAMILY
By Dr. Franco Bruno



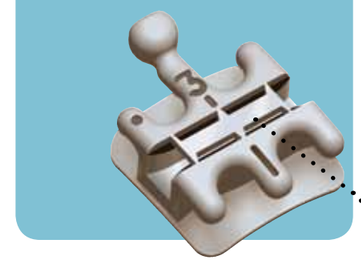
Low Friction:
traditional mechanics: a perfect fit

By Gary Holt
D.D.S.
Denver, CO

Dr. Gary Holt graduated Magna Cum Laude from the University of Maryland Dental School and then completed his orthodontic residency at the University of Missouri-Kansas City. He has completed the training to be Dawson Level I certified. His interests are efficient treatment with attention to detailed occlusion, the use of TADs to improve treatment time and effectiveness, and the use of Diode Lasers in the orthodontic practice. He has completed three Ironman races and lives in Littleton, CO with his wife and three children.

The orthodontic profession has three major technologies or trends that are evolving and offering new and exciting ways to practice according to the editor of the Journal of Clinical Orthodontics.[1] These are 3-D cone beam computed tomography (CBCT), mini implants or temporary anchorage devices (TADs) and low friction bracket systems. At the forefront of the orthodontic profession right now is the question of low friction systems or passive self-ligating bracket systems and how they may benefit the orthodontist. One needs to look no further than a recent issue of American Journal of Orthodontics to discover that low friction brackets are a hot button topic.[2] In this particular issue there were two impassioned letters to the editor expressing polar views on the topic. In fact, the editor of AJO, Dr. David Turpin, recently penned an editorial urging more in-vivo studies of self-ligation, low friction brackets and urged prudence when investigating these brackets. [3]

Why the interest in low friction brackets? Orthodontists are trying to minimize total treatment time, reduce the patient burden, expedite each adjustment appointment, increase appointment intervals while providing superior results and many doctors are examining the bracket system as a means to achieve these goals. This is nothing new. In the 1930s the Russell bracket was introduced and reported to do just that. This bracket would produce more comfort, fewer office visits, and shorter overall treatment time.[4] Other examples of the early self-ligation brackets were the Ormco Edgelok (1972), Forestadent Mobil-Lock (1980), Orec SPEED (1980), and A Company Activa (1986).[5] The self- ligation concept was given a big boost when Dr. Dwight Damon entered his namesake bracket in 1998 and has continued to enjoy a resurgence in popularity since that time.[6,7] The Damon system was interesting because it was a passive bracket that had a "fourth wall" (door) that was comparable to a buccal tube. There is another bracket on the market that is truly passive and acts like a buccal tube—Synergy R® from Rocky Mountain® Orthodontics. This novel bracket system has a removable cover over the arch slot on the cuspids, first bicuspids, and second bicuspids that enable the bracket to function similar to a buccal tube during the initial leveling and aligning treatment stages. However, Synergy R® differs from every passive self-ligating bracket currently on the market because it converts, while bonded to the tooth, to a traditional active bracket with full ligation capabilities for space closure and finishing during the later treatment stages.

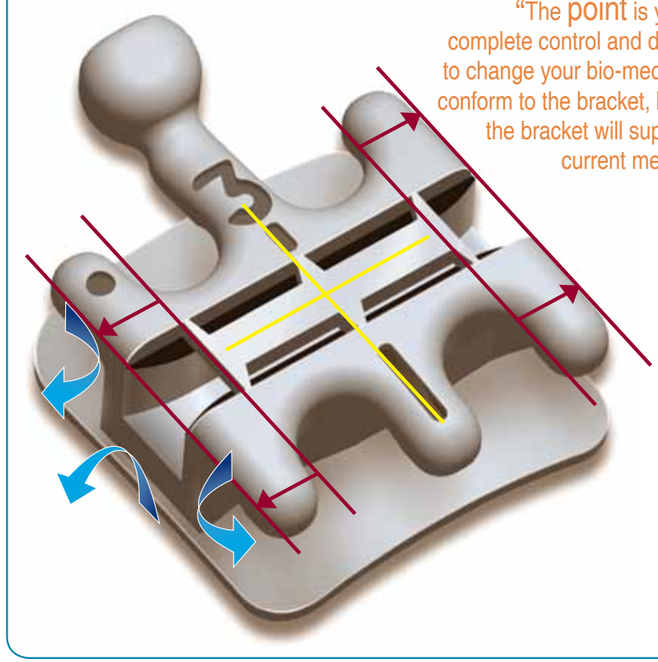


Note the novel 6 tie wing design and hook. Note the rounded walls and funnel shape tube for easy entry of wire.

The wire is simply thread through the tubes on the 3s, 4s, and 5s. The central and lateral incisor brackets (Synergy® brackets) have a unique passive ligation system when an elastomeric tie is used, but the tie has minimal contact with the wire due to an intelligent design. Clearly, the Synergy R® bracket is the most versatile, active bracket ever. It gives complete control to the doctor to dictate active vs. passive forces, reduces friction dramatically, and total treatment time duration. Some of the highlights of the system include rounded arch slot walls to reduce binding and friction, and offers multiple ligation options—minimal friction ligation or conventional ligation, maximum rotation ligation or minimal rotation ligation.[8] The bracket has rounded slot walls and bosses on the bracket tie wings to minimize the possible contact surface with the arch wire and prevent the ligation force from exertion on the arch wire.[9]

Friction is typically the enemy in two areas of orthodontic treatment—leveling and aligning as well as space closure because frictional forces generated between bracket and arch wire have a significant effect on tooth movement.[10] The low friction bracket systems seek to reduce friction compared to conventional orthodontic bracket systems. There is evidence that these brackets offer lower frictional resistance (FR) values than conventional brackets when coupled with small round arch wires.[11,12] To reduce friction in the mouth some authors have recommended the use of low friction brackets, small initial wires, and less stiff wires.[13] The benefit of lower friction is more rapid alignment of teeth, quicker leveling of arches, and progression into bigger arch wires sooner in treatment. This allows the doctor to start anterior-posterior changes sooner, i.e., start using Class II elastics. The Synergy® system is unique in that it can be used with your current anterior-posterior mechanics: you can use a Wilson® Distalizing Arch, Pendulum, or any other distalizing arch. You can use other inter-arch mechanics such as a Forsus, Herbst, AdvanSync, etc. We have noted rapid treatment times for Class II cases when we couple the leveling and alignment efficiency of the Synergy R® with the concurrent Class II correction using AdvanSync. The point is you're in complete control and don't need to change bio-mechanics to conform to the bracket, but rather the bracket will support your current mechanics.

With lower frictional forces, the space closing phase of orthodontic treatment can be accomplished quite quickly. The Synergy R® bracket supports your current space closing technique. If you prefer to distalize canines into Class I with Energy



"The point is you are in complete control and don't need to change your bio-mechanics to conform to the bracket, but rather the bracket will support your current mechanics."

FRICTION SELECTION CONTROL
Figure "FSC"

REDUCED FRICTION

MODERATE ROTATION

MAXIMUM ROTATION

CONVENTIONAL CONTROL

MAXIMUM CONTROL

Chain™, then that is exactly what you do with Synergy R®. The Energy Chain™ is placed in the same manner as you place it with a conventional bracket. If you like to distalize the canines into Class I using a Ni-Ti coil spring then that is exactly what you do with Synergy R®. The brackets have a hook in the middle of the bracket for easy access and bio-mechanic advantage. Once the canines are Class I and you want complete space closure you can chain 6-6 or you can place a crimpable hook on the arch wire and slide with a Ni-Ti coil spring. The low friction system lends itself to sliding mechanics and space closure is accomplished very quickly.

One concern with self-ligating systems is the loss of torque control, especially in the maxillary anterior. To many orthodontists, the desire to maintain careful 3D control of the maxillary incisors is a very important aspect of orthodontic treatment.[14] Enter the Synergy R® bracket. This bracket has the ability to allow the doctor to dictate the necessary friction in the maxillary and mandibular incisors. The clinician can dial in the bracket / arch wire friction to fit his / her specific treatment needs. If the doctor wants passive ligation in the anterior, that can be accomplished with the use of an elastomeric tie just around the center tie wings. If he / she desires more detailed rotation control, then he / she can tie only the mesial or distal tie wings. If the doctor wants complete 3D control of the bracket then the doctor can place the ligatures around all wings. This bracket system takes advantage of a completely passive system from the cuspids to the molars, but allows for more control in the anterior. This bracket offers some of the same advantages as a Giannelly bidimensional system without the bracket dimensions needing to be different. The bracket can be passive early in treatment, but can be made to have complete 3D control at any point in time.

As many orthodontists say, "It is not how you start the case, but how you finish the case." That is indeed the truth. The attention to detail in the finished cases is what separates us as specialists. Another concern with low friction systems is the inability to finish cases as desired. The Synergy R® has overcome this weakness of other bracket systems. Detailing and finishing of the orthodontic case is usually accomplished by either repositioning the bracket or placing bends into the arch wire. Synergy R® supports both methods. The bracket is very durable because it is manufactured using the Metal Injection Molding (MIM) process and gives the strongest appliance available. Thus, you can simply debond the bracket, clean the tooth, clean the bracket pad and rebond the same bracket into the desired position. If you prefer to bend the arch wire to finish and detail the case then you place the desired bend into the arch wire and you simply convert the 3, 4, or 5 brackets by removing the cap. You don't have to convert all the brackets, just the teeth where the bend is placed. After converting the bracket, the arch wire is tied in with an elastomeric ligature or steel ligature. In this manner you can utilize the passive, low friction benefits during the initial leveling and alignment phase and then you can finish the case with the detail you desire. This is a big advantage of the Synergy R® system.

Synergy R® Cap Remover Pliers - T01200

- Uses joint plier transer to shear off convertible caps effortlessly
- Easy access the buccal region with little obstruction
- Can be used on any convertible buccal tubes and convertible brackets

CASE 1

Patient presented with Class II division 2, deep bite, and retroclined incisors. The treatment plan was to level the Curve of Spee, align the teeth, followed by Class II elastics.

Note: Maxillary bicuspids
Maxillary retroclined incisors
Maxillary left lateral

Note: Mandibular rotations incisors
Mandibular rotations biscuspids

13 week follow up photos aligned with .018 x .018 arch wires. The patient was ready to proceed into the working mechanics phase of treatment.

CASE 2

Patient presented as Class I crowded with blocked out maxillary right cuspid and severe crowding in mandibular arch. Treatment plan was to open space for UR3 and level and align the lower arch.

At initial bonding note the blocked out maxillary cuspid and high irregularity in the lower arch.

After 12 weeks of treatment space had been created for the upper right cuspid and the lower arch alignment had improved dramatically.

CASE 3

Patient presented with a Class II malocclusion. The treatment plan was to bring the cuspid into the maxillary arch as quickly as possible. Then proceed into the working wires and initiate Class II mechanics. The low friction brackets aided in the vertical alignment of the high cuspid without impact to the other anterior segments.

After 12 weeks of treatment the vertical correction of the cuspid was almost completed without affecting other aspects of the arch form.

CASE 4

Patient presented with a Class II deep bite, posterior cross-bite, and rotations in the lower arch. The treatment plan was to correct the cross-bite with an RPE and then level and align the arches with Synergy R.®

After 12 weeks of treatment and expansion the mandibular bicuspids were improved.

CASE 5

Patient presented with a Class III tendency, open bite, and high maxillary left cuspid. The treatment plan was to bring the cuspid into occlusion without impact to the anterior segment.

After 15 weeks of using a low friction bracket, the cuspid was in occlusion, and the anterior segment 2-2 had not been negatively affected.

"Synergy R® can make all these things easier..."

In conclusion, I would like to comment on a patient that re-visited the practice recently and caused me to reflect on brackets. My office had seen this patient several years ago for an initial orthodontic consultation and the family elected to go with another orthodontist in the area. I had thought nothing more about the case until they recently showed up at my practice. The patient has been in appliances for over two years and there has been little progress. The patient was bonded with a leading self-ligating bracket and as you can see there has been minimal progress over the course of a two year treatment.

Two years of treatment- self ligating

Why do I bring this up? Because the bracket is not the doctor. The bracket can't diagnose, can't treatment plan, and can't treat the case. The patient should not be asking for a specific bracket, nor should the marketing of a specific bracket be the place of any practice. Even a fantastic bracket is worth little if the doctor lacks the knowledge or skill to treat the case. The bracket should be a tool to aid the doctor in accomplishing the goal of moving the teeth in a faster, easier, and more comfortable and convenient way. That is our job. We are still the doctor. Synergy R® can make all these things easier and can help treatment progress faster. Synergy R® can aid in the A-P, vertical, and transverse correction and Synergy R® can aid in the detailing and finishing of the case, but remember that you are still the doctor and every case still deserves the personalized attention to detail that Synergy R® can provide.

CASE 6

Patient presented with a Class II, division 2 malocclusion, deep bite, rotations, and a poor arch form. The treatment plan was to open the bite by leveling the Curve of Spee, improve the arch form using Synergy R, and then move into Class II elastics.

After 16 weeks of treatment, the arch forms were significantly improved and the patient was ready to move into working wires and Class II mechanics.

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"The bracket should be a tool to aid the doctor in accomplishing the goal of moving the teeth in a faster, easier, and more comfortable and convenient way..."

Synergy R®

a clinical pearl

Article written in by Travis Barr B.S. and Gary Holt D.D.S.

RMO®'s Synergy R® bracket System is a new and unique frictionless bracket system utilizing covered slots on all cuspids and bicuspids (figure 1) as well as a frictionless anterior ligature tie setup using Synergy R® brackets (figure 2). Synergy R® brackets offer a frictionless design without the hassle of doors while still providing patients with the much loved ligature colors at the later treatment stages. However, as with all new and improved technology come challenges. With the Synergy R® bracket the challenge is presented at the initial bonding, when placing the first archwire. As with most orthodontic cases, the interbracket mesial to distal distance can be very small, and/or have rotational angles that exceed 45 degrees, and/or have a height difference of several millimeters (figure 2). Using Synergy R® brackets to treat these cases works well when full wire engagement in the brackets occurs. Complete wire engagement in Synergy R® brackets requires the "threading" of the wire between and through each bracket (figure 2).

In this article we describe a technique that utilizes the natural flexibility of Ni-Ti to fully engage the archwire. This technique results in complete expression of the wire and best utilizes the frictionless environment provided by Synergy R® brackets.

"Synergy R® brackets offer a frictionless design"

Figure 1. Shows the slot and slot cover for the RMO Synergy R® bracket.

Figure 2. Example of full arch wire engagement using Synergy R® brackets. Also shows the slotted cover on cuspids/biscupid brackets as well as the frictionless anterior lateral to lateral setup.

Procedure

Starting the wire sequence with a .014 Thermaloy® Plus archwire is preferred for the material property benefits. The .014 Thermaloy® Plus wire works well due to its flexibility, ability to regain its initial shape after placement, and adequate force level.

The focus of this technique is wire insertion/threading through cuspid and bicuspid brackets, because the greatest challenge is to "thread" the wire from 1st to 2nd bicuspid, and/or from 2nd bicuspid to 1st molar. The following four-step sequence describes this process:

Step 1. Push the wire through the bracket until you can see it coming out the distal part of the bracket.

Step 2. Place a scalar on the distal part of the bracket behind the wire and grab an anterior part of the wire with a Hemostat.

Step 3. Push the wire buccally with the scalar while simultaneously pushing distally on the wire with the Hemostat. This will allow the wire to come through the slot. Push an ample amount of wire through; this will be your working wire. Usually the length of two bicuspids is enough.

Step 4. Grab the wire with the Hemostat and thread it through the next tube. The wire will curl back around on itself. The extra wire allows for flexibility and if the wire is damaged during this step you can remove the damaged area.

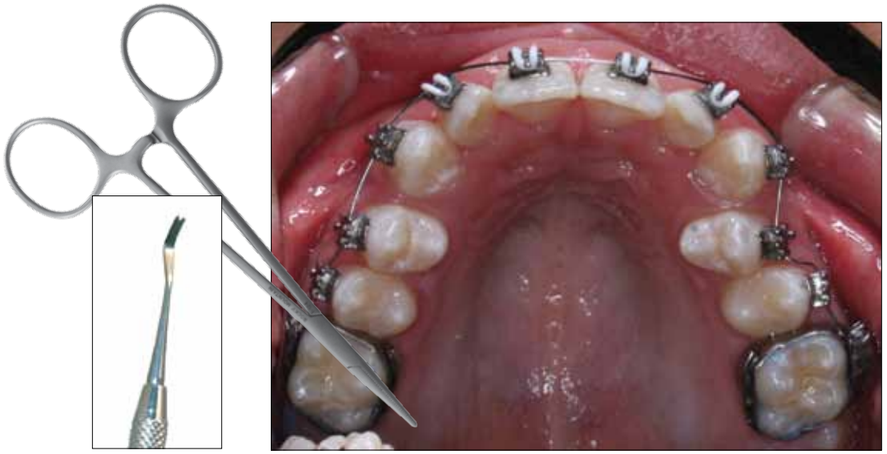

Figure 3. Instrumentation used for wire placement; Clinical photo showing the rotational challenges often encountered.

Discussion

This simple four-step procedure works well in most cases to allow full wire engagement in the most difficult bracket placements (figure 3). However, if there is less than 2 mm interbracket distance, the technique is not as effective. This is due to either not having enough wire flexibility to complete the threading or not having enough free movement to allow the torque built up in the wire twisting to be released. A semi-permanent curl can result in the wire (figure 4) until more room is available.

Figure 4. Demonstration of a curled wire that was unable to release the torque build-up until further room was made between the brackets.

Another challenge that occurs at initial bonding is when the distal bracket slot is pressed against the adjacent tooth, not allowing room for the wire to slide through the slot. This can easily be overcome with bracket placement and a reposition later in treatment.

Conclusion

By following a simple procedure, full arch wire engagement is achieved in Synergy R® brackets unless there is an extreme case of anatomy misalignment. The full functionality of the frictionless Synergy R® bracket system is expressed at the initial bonding.

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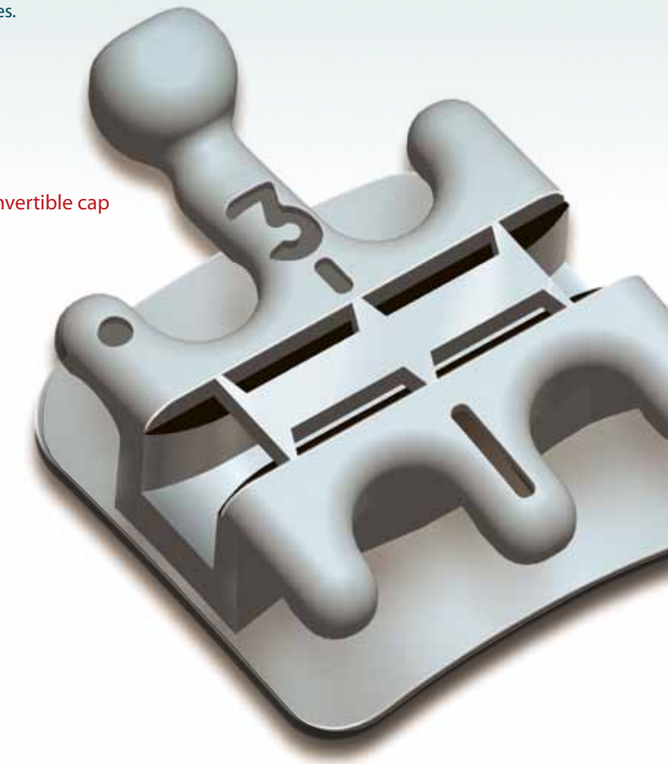
- no moving parts—no broken clips, doors, or slides
- large flared lead-ins reduce kinking and binding
- low profile—comfortable for your patient
- convert to a standard Synergy®-style bracket at any time for advanced FSC® modes



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DIAGNOSIS DIAGNOSIS DIAGNOSIS

a comprehensive cephalometric analysis

By Bradford N. Edgren D.D.S., M.S.

Dr. Bradford Newhall Edgren was awarded his D.D.S. (valedictorian), M.S., and Certificate in Orthodontics from University of Iowa College of Dentistry. His academic experience yielded numerous honors and awards such as Magna Cum Laude (undergraduate) and National Dean's List (both undergraduate and D.D.S. studies). Dr. Edgren is a Diplomate of the American Board of Orthodontics, and has presented to numerous organizations. His articles have been published in both the AJO and American Journal of Dentistry, and he is an active member of the AAO, COF, ADA, CDA, and Angle Society.

Importance of Cephalometric Diagnosis

Orthodontic treatment faces many obstacles that can be directly related to existing excessive disharmonies of the dental and skeletal components. These disharmonies can be further compounded by aberrant dento-facial growth. Diagnosis of such discrepancies, as well as forecasting facial growth, prior to initiating treatment can alert the orthodontist of what problems to expect during treatment.

The orthodontist's treatment plan is only as good as the quality of information derived from the diagnostic records.[1] Performing a proper diagnosis is essential to good treatment planning. Without a proper and thorough diagnosis, treatment planning is at best a guess. Only the naïve clinician utilizes a handful of cephalometric measures or a single appliance to correct all malocclusions.[2] Diagnosis is derived from the Greek word for knowledge. We can only diagnose from what we have learned. We must understand the dentofacial skeleton, recognize normal from abnormal, and the limitations of treatment to develop an appropriate treatment plan.[2]

Cephalometrics is the measurement of the dentofacial complex utilizing lateral and posteroanterior radiographs. Properly used, cephalometrics can significantly improve the orthodontic diagnosis and treatment plan. Originally, cephalometric radiographs were taken as a research tools to evaluate craniofacial growth. B. Holly Broadbent is credited with developing the cephalometric procedure in 1931. He simultaneously took frontal and lateral radiographs on his patients to evaluate the craniofacial skeleton. In 1937, Broadbent offered a mean facial pattern.[3]

Growth pattern studies from the third month of life until eight years of age were analyzed by Allan G. Brodie in 1941.[4] In 1948, William B. Downs developed a system of measurements in an effort to define craniofacial dysplasias. Downs only utilized a total of ten measurements for his analysis of lateral cephalograms.[1] In 1953, Cecil Steiner developed the Steiner method.[5] The Steiner method became popular because it demonstrated an interrelationship between measurements and gave specific guides to treatment planning.[6] Sassouni utilized various arcs and planes through the craniofacial complex to describe dysplasias.

Taking what he felt were the strengths of the above cephalometric methods; Ricketts developed a comprehensive analysis utilizing a combination of over 80 different measurements. Other than Broadbent, the Ricketts analysis was the only approach that tied together both the lateral and frontal views into one system.[7,2]

Cephalometrics initially was a static system; craniofacial growth was not even considered. The growing patient's face is constantly changing. By incorporating the prediction of growth, treatment planning for children and adolescents could be improved. In 1970, Ricketts incorporated the arcial growth of the mandible into his cephalometric analysis. This method of growth prediction proved to be reliable for predicting long-range growth and occlusal development.[7]

RMODS

Rocky Mountain Orthodontics Data Services® (RMODS®) has been providing comprehensive cephalometric analyses of lateral and frontal cephalograms since 1969. With over 600,000 cases analyzed, RMODS® has helped thousands of orthodontists determine the best, individualized treatment plans for their patients. RMODS® provides not only the Ricketts comprehensive analysis but also Steiner, Jarabak, Downs, and Sassouni Plus. Upper Airway obstruction is evaluated utilizing six different measurements devised by Handelman and Osborne[8], Linder-Aronson and Hendrickson[9], and Schulhof.[10]

Individualized norms are provided not only based upon age and gender, but also upon ethnic heritage. Utilizing the Visual Treatment Objective (VTO) (short and long term) with arch analysis of upper and lower dentition, assists in orthodontic treatment planning. The RMODS® system provides a visual blueprint of recommended dental and skeletal changes specific to each patient.

Each work-up is designed with the orthodontist's treatment preferences concerning extraction, convexity change, esthetics, limits of tooth movement, and mechanics. Long range growth simulation to maturity with and without treatment aids the orthodontist in predicting the treatment outcomes. Because of the method of long-range growth prediction, the probability of third molar eruption can be predicted within 90% accuracy and can prepare the patient for future removal.[7,11]

Each of my patients receives a comprehensive cephalometric analysis prior to any treatment. When taking progress records, prior to second phase treatment, I have RMODS® perform a comprehensive cephalometric analysis to evaluate the results of Phase I treatment as well as to determine changes in dentofacial relationships due to growth. RMODS® comprehensive analyses have aided me in diagnosing upper airway obstructions, abhorrent growth patterns, and endochronological problems. Long range growth simulations have also helped me to inform my patients and their parents about the probability of orthognathic surgery.

Conclusion

A thorough and proper orthodontic diagnosis including lateral and frontal cephalometric analyses will only improve treatment planning. RMODS® has been providing me with comprehensive cephalometric analyses of my patients for almost 20 years. Remember, the orthodontist's treatment plan will only be as good as the thoroughness of the diagnosis.[6]

"RMODS® comprehensive analyses have aided me in diagnosing upper airway obstructions, abhorrent growth patterns, and endochronological problems. Long range growth simulations have also helped me to inform my patients and their parents about the probability of orthognathic surgery."

Case Study I

Airway Obstruction and Poor Facial Growth Patterns

Mouth breathing has been identified as a cause for a number of orthodontic problems including cross bites, low tongue positions, and vertical dysplasias.[12-15] Children who have a genetic predisposition towards a narrow, dolichocephalic facial pattern, and having airway compromise are particularly at risk to developing long face syndrome. Moreover, children with a genetic propensity to developing mandibular prognathism, possessing tonsillar hypertrophy and who are chronic mouth-breathers are at particular risk for developing advanced mandibular prognathism.[16]

Mouth breathing should also be regarded as an obstacle to successful orthodontic treatment and is likely to result in orthodontic relapse if not treated. It is imperative that the existence of mouth breathing, as well as its etiology, be recognized as soon as possible and ideally before orthodontic treatment has been attempted.[7] Since anteroposterior and vertical dentofacial discrepancies are linked to growth, interceptive measures should be initiated around age seven. To wait until age 12, when 90% of a dentofacial deformity has already been established, before instituting orthodontic treatment is not consistent with today's preventative philosophy.[17] The earlier the re-establishment of normal oropharyngeal function and nasal respiration, the more likely normal dentofacial development will occur. Oral breathing may persist for a year or more after the airway has been restored while the original chronic mouth-breathing habit is "unlearned".[18]

Ricketts described a condition associated with upper airway obstruction; he labeled it the Respiratory Obstruction Syndrome.[18] Clinically, Ricketts found the following characteristics generally associated with the presence of enlarged adenoids and tonsils:

- Unilateral or bilateral posterior cross-bites
- Tonsil or adenoids present or history of respiratory problems
- Open-bite
- Tongue thrust upon swallowing
- Mouth breathing
- Functional cross-bite with deflection of the mandible to one side or possibly deflected anteriorly producing a pseudo-Class I condition.

Many orthodontists are surprised to learn that the size of the adenoid, tonsil, and nasopharyngeal airway can be evaluated on the lateral cephalogram. Linder-Aronson and Henrickson[9], Schulhof[10], Handelman and Osborne[8], and Ricketts[19] have all devised airway measurements of adenoidal enlargement relative to the nasopharyngeal airway. Radiographic analysis in the lateral and posteroanterior aspects provides a systematic means of evaluating airway dimensions, the morphogenetic factors affecting lower facial heights, bimaxillary morphology and dentofacial growth in mouth breathers. Individuals with inherent vertical facial growth characteristics are the most significantly impacted by mouthbreathing.[20]

RMODS® uses the Schulhof[10] analysis of adenoid enlargement which includes the two linear measurements by Linder-Aronson and Hendrickson[9], a linear measurement by Ricketts[19], the airway percentage in an epipharyngeal trapezoidal area described by Handelman and Osborne[9], and the craniofacial angles N-S-Ba and BA-S-PNS. RMODS® analyzes each case for the potential adenoid obstruction of the mesopharyngeal airway. Adenoid blockage of the mesopharyngeal airway is deemed to be present if three or more measurements are one or more standard deviations from the norm.[10] If the patient is a mouth breather and the analysis indicates that the adenoid is too large for the airway[21], the orthodontist can make a referral to an otolaryngologist for further evaluation and appropriate treatment.

This case is a good example of upper airway obstruction and a poor facial growth pattern.

She had a history of snoring, mouth breathing, food allergies, and asthma. Her comprehensive cephalometric analysis demonstrated the following:

1. Class II canine

2. Severe skeletal Class II due to both jaws

3. Skeletal open bite due to the Mandible

4. Possible excessive mandibular growth

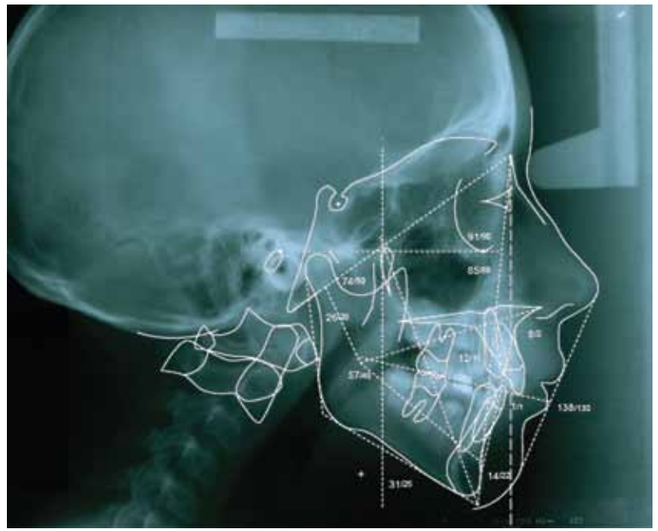
5. Adenoid blockage of the airway

6. Skeletal buccal cross bite pattern due to the mandible

7. Mandibular arch wide compared to jaw

8. Possible low tongue position

Because of her short porion location, high cranial base deflection and forward ramus position, she is more likely to grow a lower jaw that is too large relative to the upper face. As a result of the upper airway obstruction and poor growth characteristics, this patient was referred to an Otolaryngologist for evaluation of upper airway obstruction. The tonsils and adenoids were removed prior to the start of orthodontic treatment. Following maxillary expansion with a bonded RME (Rapid Maxillary Expander), the upper and lower arches were leveled and aligned.



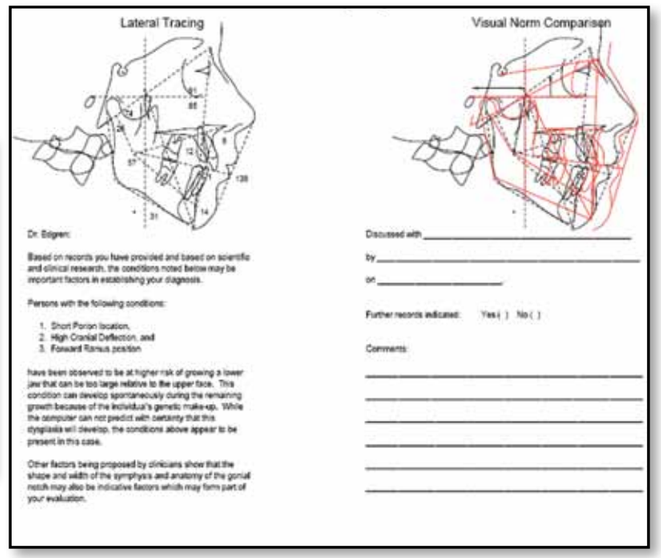
Diagnostic Panoramic Radiograph

SIGNIFICANT CONSIDERATIONS

CONDITION	REASON
Class II (canine)	
Mild Overjet	
Severe Skeletal Class II	due to the mandible & maxilla
Skeletal Open Bite	due to the mandible
Possible excessive mand growth	
Adenoid blockage of the airway?	Most probably

FACIAL PATTERN: DOLICHOFACIAL

# FACTORS	MEASURED VALUE		NORM		CLINICAL DEVIATION	
Interincisal Angle	137.6	dg	130.0	dg	1.3	*
Convexity	7.6	mm	1.6	mm	3.0	***
Lower Facial Height	57.0	dg	45.0	dg	3.0	***
A6 Molar Position to PTV	12.2	mm	15.5	mm	-1.1	*
B1 to A-Po Plane	1.0	mm	1.0	mm	0.0	
B1 Inclination to A-Po	13.6	dg	22.0	dg	-2.1	**
Facial Depth	84.7	dg	87.8	dg	-1.0	*
Facial Axis	74.0	dg	90.0	dg	-4.6	***
Maxillary Depth	91.4	dg	90.0	dg	0.5	
Mandibular Plane to FH	30.8	dg	24.9	dg	1.3	*
Mandibular Arc	26.0	dg	27.9	dg	-0.5	



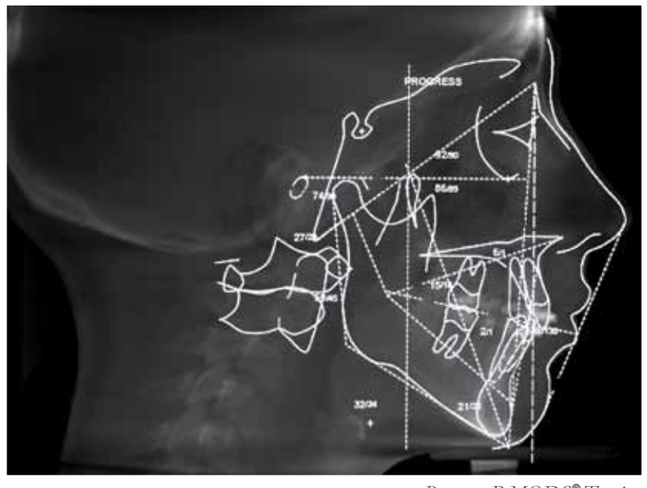
RMODS® Mandibular Growth Awareness Form alerts the orthodontist to possible abhorrent dentofacial growth.

Diagnostic Intraoral Photographs

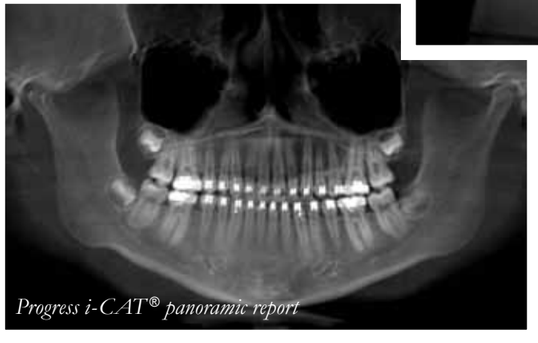
Case Study I continued

The following progress records were taken after 24 months of treatment, prior to banding the second molars and Class II correction. This patient no longer snores and her respiration is now nasal. Note that her low tongue position and forward head posture to open her airway has improved. Her dental overbite has been maintained.

Progress Intraoral Photos



Progress RMODS® Tracing



Progress i-CAT® panoramic report

"This patient no longer snores and her respiration is now nasal."

Case Study II

Frontal Analysis

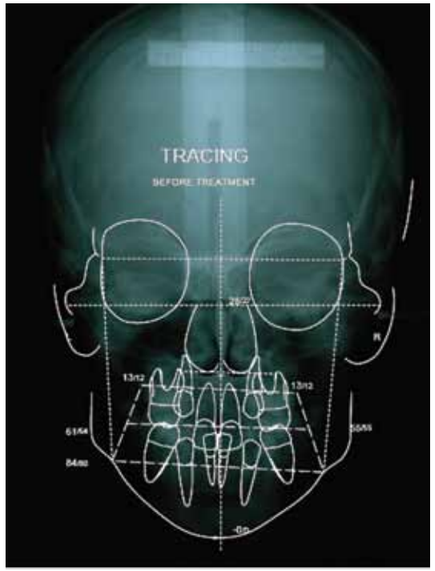
The frontal cephalometric analysis is often overlooked by most orthodontists. Asymmetries, dental cross bites, skeletal cross bites, maxillary and mandibular dental arch widths, nasal widths, turbinate enlargement, deviated nasal septums, and facial proportions can all be evaluated from the posteroanterior cephalogram. Many orthodontists think of the maxilla as being the only culprit of dental or skeletal lingual cross bite patterns. However, many times the width of the mandible can be the major contributor to skeletal lingual cross bite patterns.

Dental compensations can hide overt hypo-plastic maxillary and hyper-plastic mandibular transverse discrepancies. Rapid maxillary expansion can improve skeletal lingual cross bite patterns, but without a posteroanterior cephalogram, it is impossible to diagnose them. The affect of the excessive mandibular width may not be clinically evident until late adolescence, when rapid maxillary expansion may be more difficult. Taking a posteroanterior cephalogram on patients is simple and the benefits to the patient are immeasurable. Furthermore, with the development of cone beam computed tomography, all patients that have a CBCT scan will have both lateral and frontal images readily available for analysis with a single scan.

This patient presented with a Class I malocclusion, a tendency for a skeletal open bite, possible excessive lower jaw growth and a significant arch length discrepancy with ectopic maxillary canines.

Cephalometric analysis also revealed a skeletal lingual cross bite pattern due to both the maxilla and mandible; as well as possible excessive mandibular growth.

This patient's treatment plan included rapid maxillary expansion and fixed appliances. The result was a nicely treated Class I occlusion.

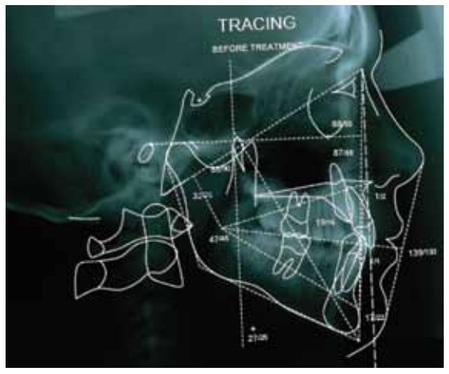


SIGNIFICANT CONSIDERATIONS

CONDITION	REASON
Skel Lingual Crossbite pattern	due to the maxilla & mandible

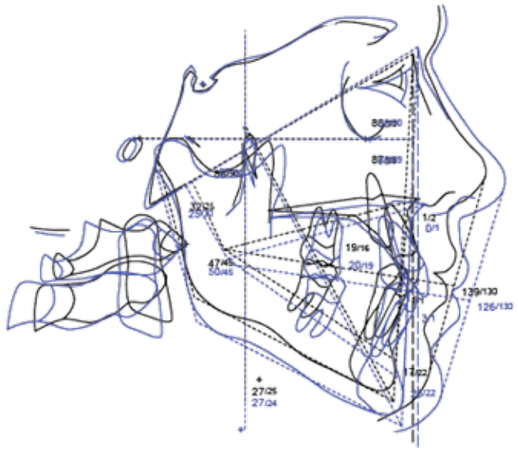
FACIAL PATTERN: MESOFACIAL

# FACTORS	MEASURED VALUE	NORM	CLINICAL DEVIATION
Intermolar Width (B6-B6)	55.3 mm	55.0 mm	0.2
Denture Midline	-0.2 mm	0.0 mm	-0.1
Max-Mand Width Left	-13.1 mm	-11.7 mm	-0.9
Max-Mand Width Right	-13.2 mm	-11.7 mm	-1.0 *
Denture to Jaw Midlines	-0.4 mm	0.0 mm	-0.3
Nasal Width	27.8 mm	27.3 mm	0.2
Maxillary Width (J-J)	61.5 mm	63.7 mm	-1.1 *
Mandibular Width (AG-GA)	83.6 mm	80.3 mm	1.7 *

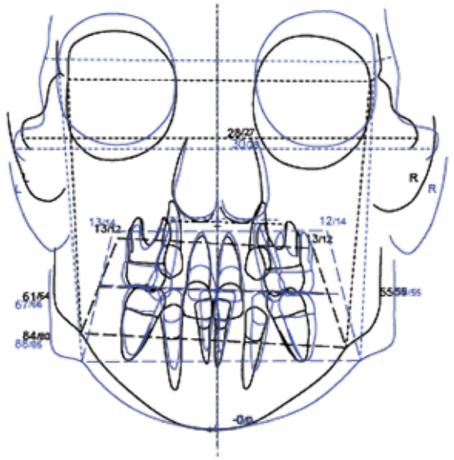


Diagnostic Panoramic Radiograph

Superimposition of the initial vs. the final lateral cephalometric analysis demonstrates both significant horizontal and vertical mandibular growth, as predicted in RMODS® initial comprehensive analysis.



Superimposition of the initial cephalometric vs. the final frontal cephalometric analysis on the occlusal plane shows improvement in the cant of the maxilla. Rapid maxillary expansion of the maxilla has also successfully corrected the skeletal lingual cross bite pattern and eliminated dental crowding, demonstrating the logic in a non-extraction treatment plan.



Long Range Growth Forecasting
(CASE III, CASE IV, CASE V, CASE VI)

As previously stated, the ability to forecast the facial growth of a patient to maturity is of great benefit. Regardless of how thorough a cephalometric analysis is devised to evaluate a growing patient's present state, that technique will be insufficient for treatment planning because of future growth and dentofacial development. Incorporation of craniofacial growth into the method of diagnosis can only result in improved treatment planning. The craniofacial relationships seen even two years after the start of treatment in a growing child may not be the same at maturity. A case treated to suitable balance at age 12 may prove to be a failed result at age 25 due to continued growth. This is especially true in those patients that demonstrate abnormally large amounts of lower jaw growth during their late teenage years and early twenties.[22]

RMODS® computer performs growth simulations by combining the following four growth curves with individual average directions and amounts of change per year for approximately 200 cephalometric landmarks.

These four different growth curves are:

- Total body height
- Soft tissue
- Cranial base
- Mandibular growth

Each curve is subdivided by race, gender, and skeletal age (this final subdivision is used to classify which patients are normal growers vs. late and advanced growth categories). When treatment planning for a growing patient, it is important to consider how much growth will or will not occur within the treatment time. Skeletal age can be extremely valuable in determining remaining growth in late adolescence. Moreover, the most significant factor in evaluating growth is not absolute amount, but relative amount. It is important, that the relative growth of the maxilla and mandible be normal. Deviations of growth between the jaws within 20% can generally be tolerated, but those deviations greater than 50% will result in a considerable deformity.[22]

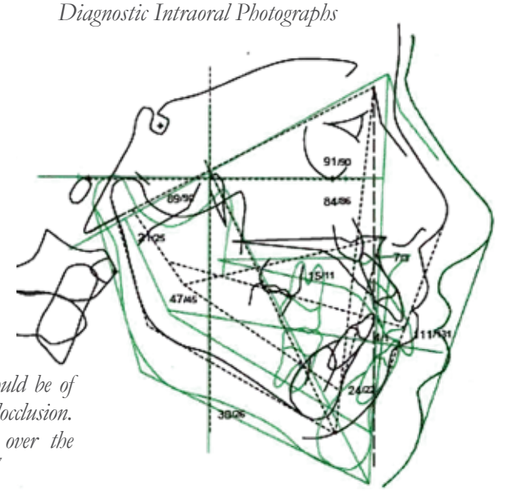
Case Study III

This patient presented with the following problems:

1. *Class II malocclusion due to the upper right first molar*
2. *Severe Overjet*
3. *Severe Class II Skeletal Malocclusion due to the mandible and maxilla*
4. *Open Bite*
5. *Tendency for Skeletal Open bite due to the mandible and maxilla*
6. *Wide mandibular arch compared to jaw*
7. *Midline asymmetry*

Diagnostic Intraoral Photographs

Superimposition of the current lateral cephalometric tracing over the growth to maturity without treatment demonstrates probable significant growth of both jaws, especially the mandible. However, despite the mandibular growth, the class II molar relationship does not improve without treatment. Treatment designed to take advantage of the remaining mandibular growth, while maintaining upper molar position would be of advantage to improve the class II malocclusion. An orthodontist has more control over the dentition than the skeletal component.[7]



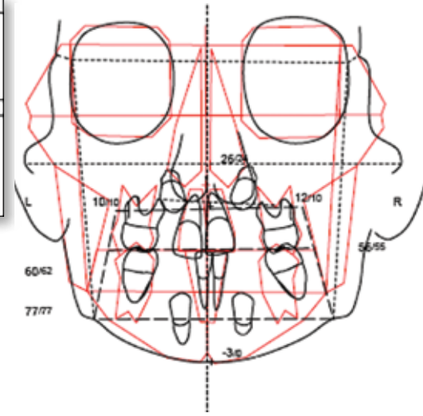
SIGNIFICANT CONSIDERATIONS

CONDITION	REASON
Mid arch wide compared to jaw Midline Asymmetry	

FACIAL PATTERN: MESOFACIAL

# FACTORS	MEASURED VALUE	NORM	CLINICAL DEVIATION
Intermolar Width (B6-B6)	65.9 mm	64.6 mm	0.6
Denture Midline	-2.6 mm	0.0 mm	-1.9 *
Max-Mand Width Left	-9.9 mm	-10.5 mm	0.4
Max-Mand Width Right	-11.9 mm	-10.5 mm	-0.9
Denture to Jaw Midlines	0.7 mm	0.0 mm	0.5
Nasal Width	26.5 mm	24.3 mm	1.1 *
Maxillary Width (J-J)	59.8 mm	62.2 mm	-1.2 *
Mandibular Width (AG-GA)	76.7 mm	76.7 mm	0.0

Diagnostic Panoramic Radiograph

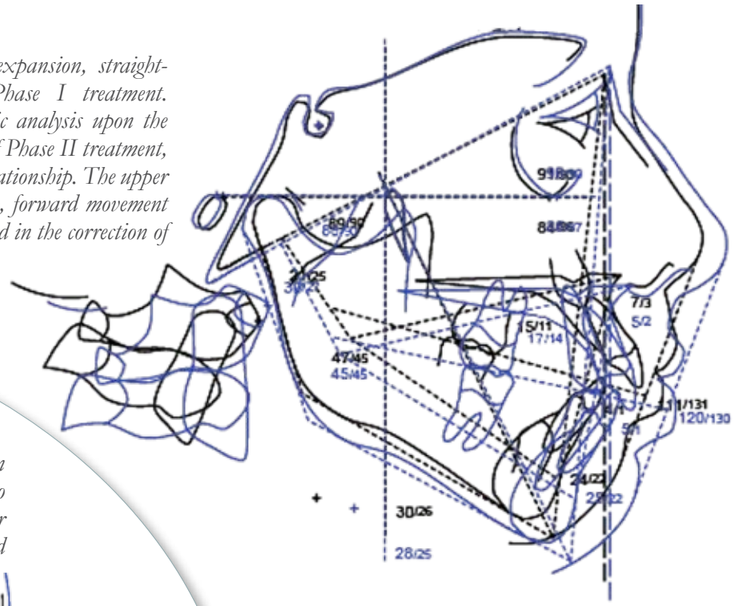


Superimposition of the initial frontal analysis upon the visual norm

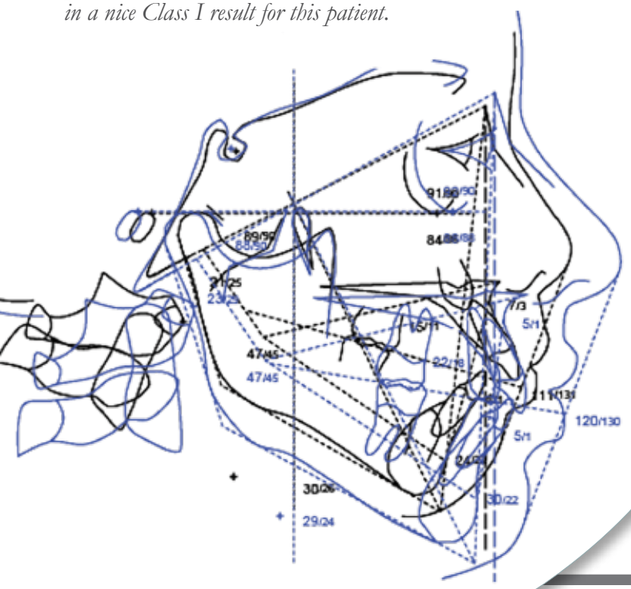
Case Study III continued

Progress Intraoral Photographs

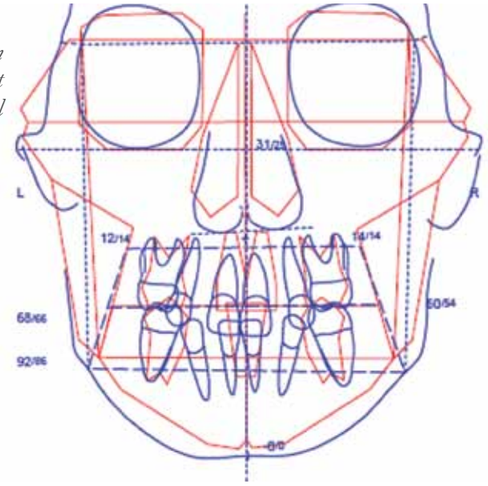
This patient was treated with rapid maxillary expansion, straight-pull headgear and fixed appliances during Phase I treatment. Superimposition of the initial lateral cephalometric analysis upon the progress cephalometric analysis, prior to initiation of Phase II treatment, shows significant improvement to a Class I molar relationship. The upper molar position was maintained within the maxilla, forward movement of the lower molar and growth of the mandible helped in the correction of the class II malocclusion.



Final superimposition of the initial and retention cephalometric analyses demonstrates the Class II to Class I correction. Taking advantage of the mandibular growth as forecasted at the beginning treatment resulted in a nice Class I result for this patient.



Superimposition of the retention frontal analysis upon the visual norm demonstrates that rapid maxillary expansion during Phase I treatment reduced the probable skeletal lingual cross bite pattern due to additional mandibular transverse growth.



SIGNIFICANT CONSIDERATIONS					
CONDITION		REASON			
FACIAL PATTERN: MILD VERTICAL					
# FACTORS	MEASURED VALUE		NORM		CLINICAL DEVIATION
Intermolar Width (B6-B6)	60.3	mm	54.0	mm	3.2 ***
Denture Midline	-0.4	mm	0.0	mm	-0.3
Max-Mand Width Left	-11.9	mm	-13.8	mm	1.3 *
Max-Mand Width Right	-14.2	mm	-13.8	mm	-0.3
Denture to Jaw Midlines	-1.6	mm	0.0	mm	-1.1 *
Nasal Width	31.4	mm	28.6	mm	1.4 *
Maxillary Width (J-J)	68.0	mm	66.1	mm	0.9
Mandibular Width (AG-GA)	92.4	mm	86.0	mm	3.2 ***

Retention i-CAT® Panoramic Report

Retention Intraoral Photographs

"The RMODS® computer performs growth simulations by combining the following four growth curves."

These four different growth curves are:

- **Total body height**
- **Soft tissue**
- **Cranial base**
- **Mandibular growth**

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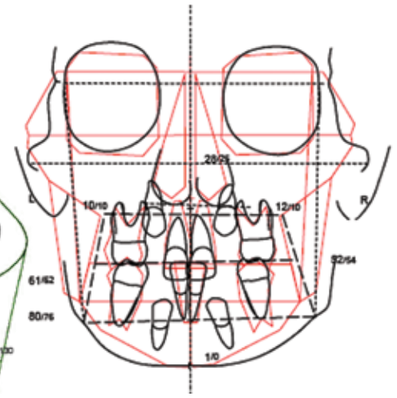
Case Study IV

This is the case of a Class II malocclusion with the potential for excessive lower jaw growth. Superimposition of the lateral cephalometric upon the growth to maturity forecast shows the potential for significant lower jaw growth.

The frontal cephalometric analysis reveals a skeletal lingual cross bite pattern due to the maxilla and the mandible.

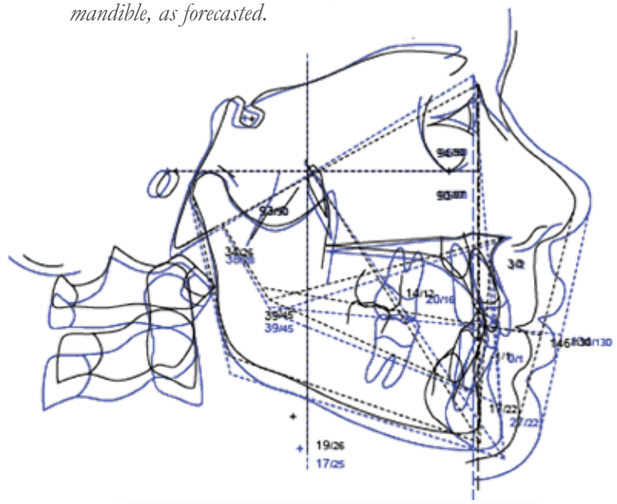


Growth to Maturity without Treatment

The growth forecast also illustrates no improvement in the Class II malocclusion, further upright of the lower incisors and deepening of the bite without orthodontic treatment. Maintaining upper molar position and taking advantage of future mandibular growth will aid in orthodontic correction.

Diagnostic Intraoral Photos

Superimposition of the initial cephalometric analysis upon the progress cephalometric analysis demonstrates forward growth of the mandible, as forecasted.



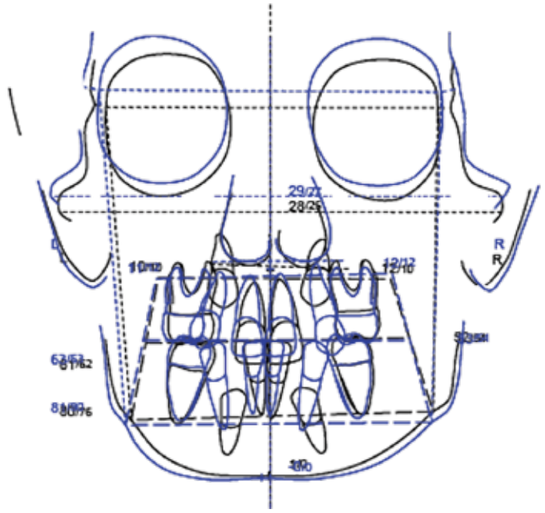
SIGNIFICANT CONSIDERATIONS	
CONDITION	REASON
Bimaxillary Protrusion Skeletal Deep Bite Adenoid blockage of the airway?	due to the mandible Probably not

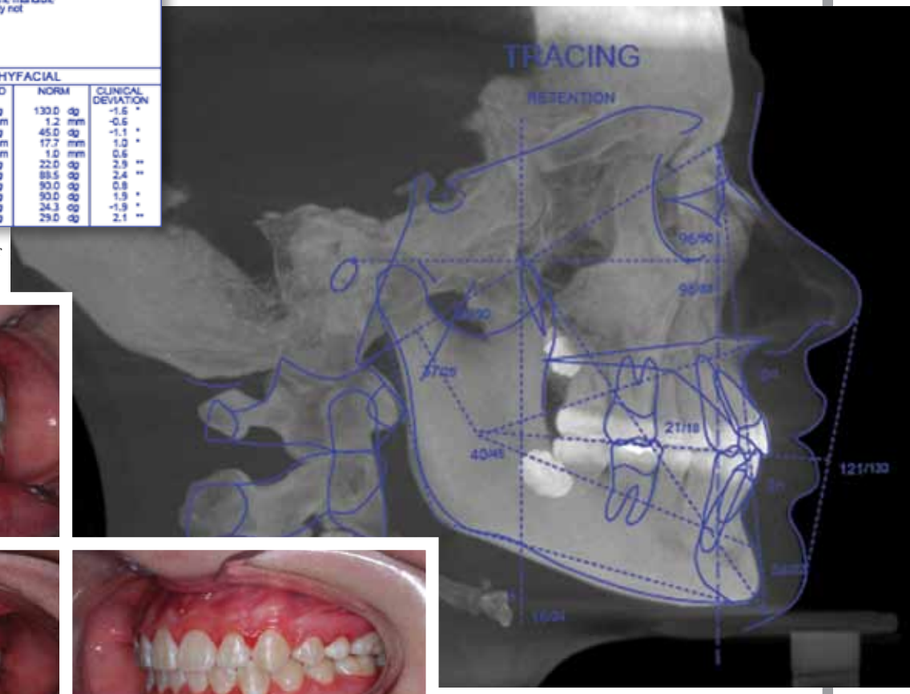
FACIAL PATTERN: BRACHYFACIAL

# FACTORS	MEASURED VALUE		NORM		CLINICAL DEVIATION	
Interincisal Angle	120.6	dg	130.0	dg	-1.6	*
Convexity	0.0	mm	1.2	mm	-0.6	
Lower Facial Height	40.4	dg	45.0	dg	-1.1	*
A6 Molar Position to PTV	20.8	mm	17.7	mm	1.0	*
B1 to A-Po Plane	2.5	mm	1.0	mm	0.6	
B1 inclination to A-Po	33.7	dg	22.0	dg	2.5	**
Facial Depth	95.8	dg	88.5	dg	2.4	**
Facial Axis	92.6	dg	90.0	dg	0.8	
Maxillary Depth	95.8	dg	90.0	dg	1.9	*
Mandibular Plane to FH	15.6	dg	24.3	dg	-1.9	*
Mandibular Arc	37.5	dg	29.0	dg	2.1	**

Retention lateral cephalometric analysis

Superimposition of the initial frontal analysis upon the progress frontal analysis.

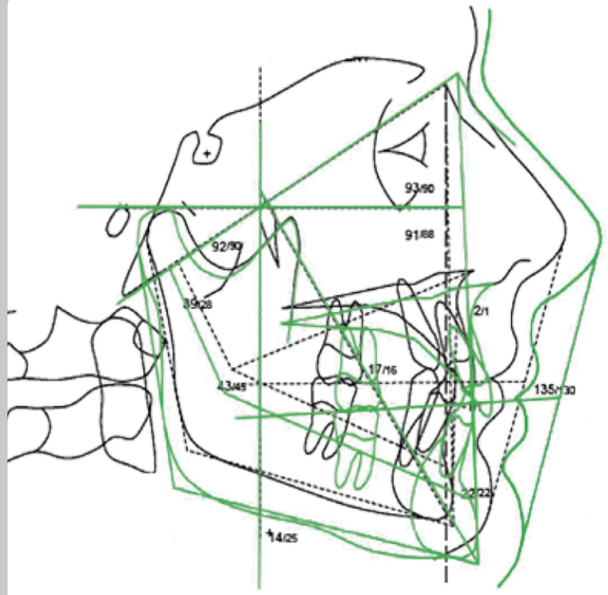




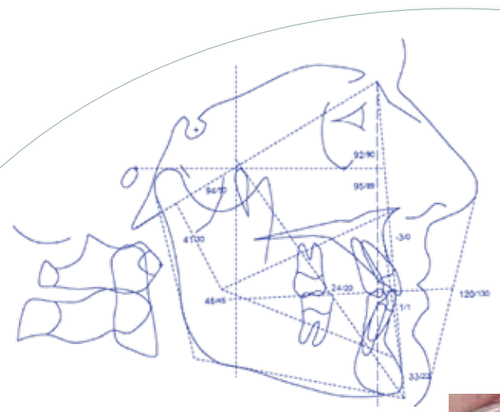
This patient now has a nice final Class I occlusion with the help of the growth prediction.

Case Study V

This patient presented with a Class II malocclusion. The growth forecast to maturity demonstrated strong lower jaw growth in a horizontal direction. Maintaining the upper molar position and allowing for the forecasted lower jaw growth will help in correcting the class II malocclusion.



Diagnostic Intraoral Photos



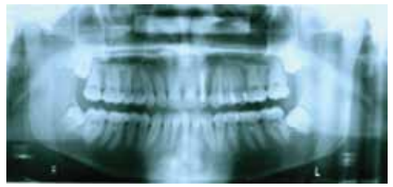
SIGNIFICANT CONSIDERATIONS

CONDITION	REASON
Bimaxillary Protrusion Skeletal Class II Adenoid blockage of the airway?	due to the mandible Probably not

FACIAL PATTERN: BRACHYFACIAL

# FACTORS	MEASURED VALUE	NORM	CLINICAL DEVIATION
Interincisal Angle	119.6 dg	130.0 dg	-1.7 *
Convexity	-2.9 mm	0.5 mm	-1.7 *
Lower Face Height	46.1 dg	45.0 dg	0.3
Ar to Xi Position to PTV	24.0 mm	20.4 mm	1.2 *
Bi to Xi-Pi Plane	1.0 mm	1.0 mm	0.0
Bi Position to A-Po	33.1 dg	22.0 dg	2.8 **
Facial Depth	94.9 dg	89.4 dg	1.8 *
Facial Axis	93.9 dg	90.0 dg	0.1 *
Maxillary Depth	92.2 dg	90.0 dg	0.7
Mandibular Plane to FH	10.8 dg	23.5 dg	-2.8 **
Mandibular Arc	40.9 dg	30.3 dg	2.6 **

Retention records demonstrating Class II to a solid Class I correction.

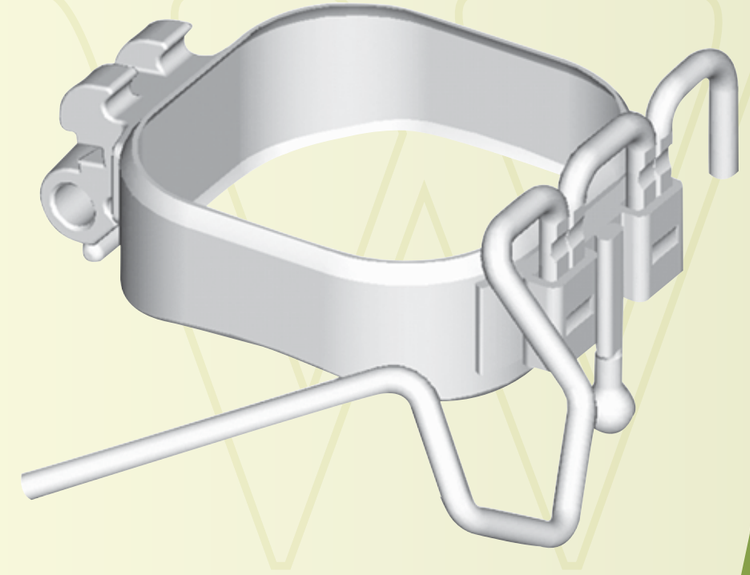


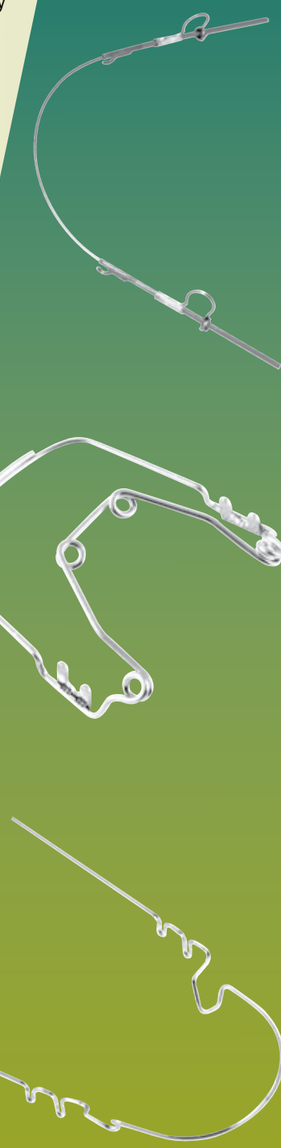
Retention panelipse

Retention Intraoral Photos

WILSON® 3D®

The Wilson® 3D® system comprises a series of interrelated fixed/removable intraoral modules that simplify and improve treatment. Wilson® 3D® appliances can be used to supplement all techniques while delivering practical and simple solutions to both typical and extraordinary movement challenges. RMO® sponsors numerous CE events that teach the skills needed to incorporate Wilson® 3D® concepts and materials into your present technique. Please call RMO® or visit our website for additional information about the legendary Wilson® 3D® system.





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- Over 100 different movements possible, including: expansion, contraction, distalization, space maintenance, bilateral, and unilateral
- Does not replace your current technique – the Wilson® system simply complements your current system
- First phase, early treatment, mixed dentition, and adults
- Preconfigured sizes to fit all patient dental ranges
- Fixed for the patient and easily removable by the clinician for rapid chairside adjustments

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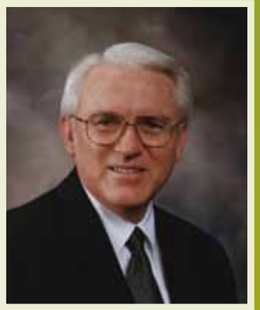
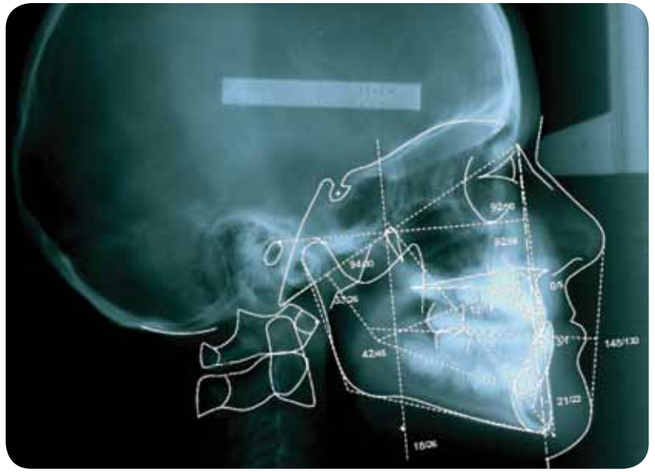


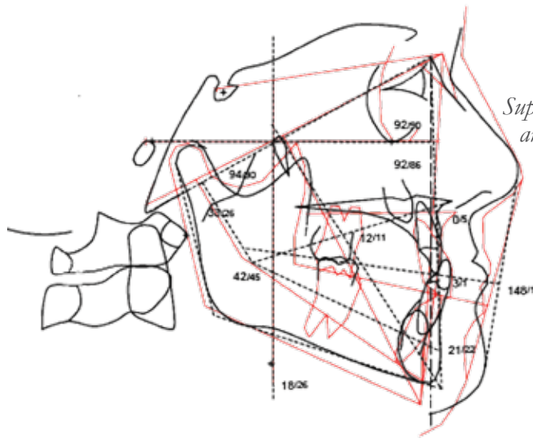
Case Study VI

The following patient had a severe Class III malocclusion.

SIGNIFICANT CONSIDERATIONS	
CONDITION	REASON
Anterior Crossbite Potential Severe Skel Class III Deep Bite Adenoid Blockage of the airway?	due to the mandible Probably not

FACIAL PATTERN: BRACHYFACIAL				
# FACTORS	MEASURED VALUE		NORM	CLINICAL DEVIATION
Interincisal Angle	147.6	dg	130.0 dg	2.9 **
Convexity	0.3	mm	4.7 mm	-2.2 **
Lower Facial Height	42.3	dg	45.0 dg	-0.7
A6 Molar Position to PTV	11.7	mm	11.0 mm	0.2
B1 to A-Po Plane	2.7	mm	1.0 mm	0.7
B1 Inclination to A-Po	20.6	dg	22.0 dg	-0.3
Facial Depth	92.0	dg	86.3 dg	1.8 *
Facial Axis	93.9	dg	93.0 dg	1.1 *
Maxillary Depth	92.3	dg	90.0 dg	0.8
Mandibular Plane to FH	17.8	dg	26.3 dg	-1.9 *
Mandibular Arc	32.8	dg	25.7 dg	1.8 *





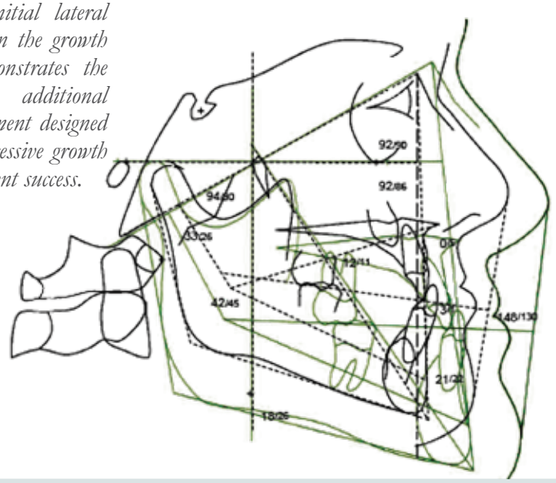
Superimposition of the lateral cephalometric analysis upon the visual norm illustrates the significant mandibular prognathism.

SIGNIFICANT CONSIDERATIONS	
CONDITION	REASON
Anterior Crossbite Potential Severe Skel Class III Deep Bite Adenoid Blockage of the airway?	due to the mandible Probably not

FACIAL PATTERN: BRACHYFACIAL				
# FACTORS	MEASURED VALUE		NORM	CLINICAL DEVIATION
Interincisal Angle	147.6	dg	130.0 dg	2.9 **
Convexity	0.3	mm	4.7 mm	-2.2 **
Lower Facial Height	42.3	dg	45.0 dg	-0.7
A6 Molar Position to PTV	11.7	mm	11.0 mm	0.2
B1 to A-Po Plane	2.7	mm	1.0 mm	0.7
B1 Inclination to A-Po	20.6	dg	22.0 dg	-0.3
Facial Depth	92.0	dg	86.3 dg	1.8 *
Facial Axis	93.9	dg	93.0 dg	1.1 *
Maxillary Depth	92.3	dg	90.0 dg	0.8
Mandibular Plane to FH	17.8	dg	26.3 dg	-1.9 *
Mandibular Arc	32.8	dg	25.7 dg	1.8 *

Diagnostic intraoral photos

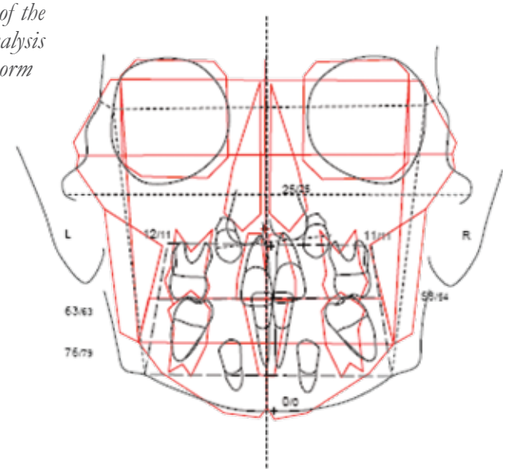
Superimposition of the initial lateral cephalometric analysis upon the growth to maturity forecast demonstrates the potential for significant additional mandibular growth. Treatment designed to address this possible excessive growth will improve overall treatment success.



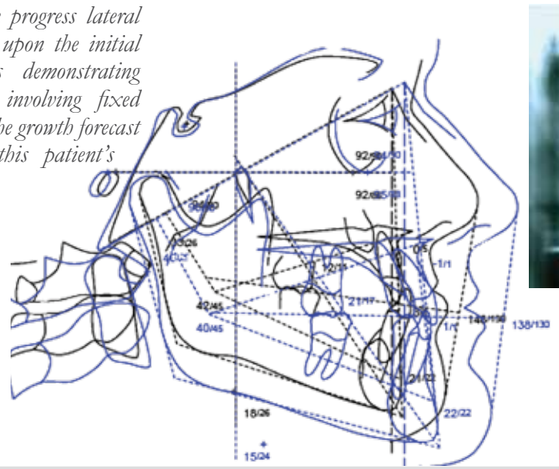
SIGNIFICANT CONSIDERATIONS	
CONDITION	REASON
Md arch wide compared to jaw	

FACIAL PATTERN: BRACHYFACIAL				
# FACTORS	MEASURED VALUE		NORM	CLINICAL DEVIATION
Intermolar Width (B6-B6)	57.6	mm	54.0 mm	1.8 *
Denture Midline	0.4	mm	0.0 mm	0.3
Max-Mand Width Left	-11.7	mm	-11.1 mm	-0.4
Max-Mand Width Right	-11.1	mm	-11.1 mm	0.0
Denture to Jaw Midlines	0.3	mm	0.0 mm	0.2
Nasal Width	25.0	mm	24.6 mm	0.2
Maxillary Width (J-J)	62.7	mm	63.0 mm	-0.1
Mandibular Width (AG-GA)	76.0	mm	78.6 mm	-1.3 *

Superimposition of the initial frontal analysis upon the visual norm

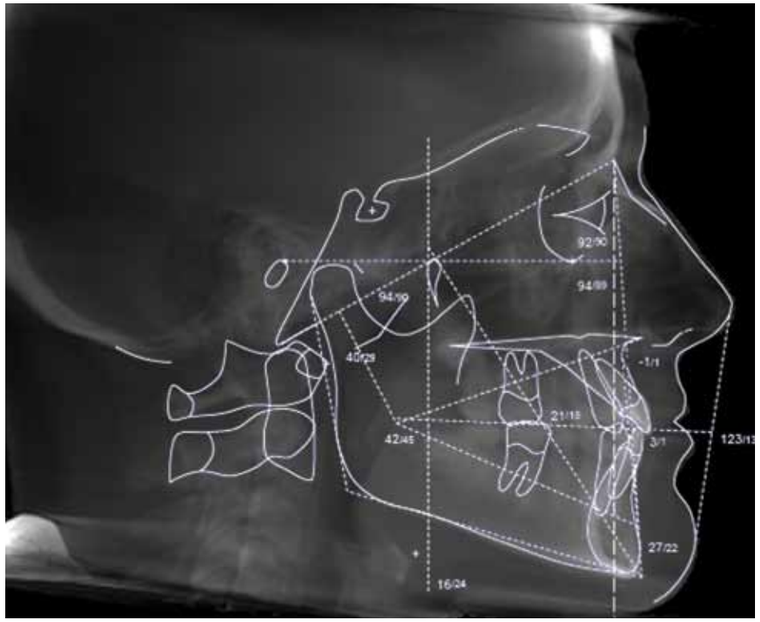


Superimposition of the progress lateral cephalometric analysis upon the initial cephalometric analysis demonstrating how early treatment involving fixed appliances along with the growth forecast aided in improving this patient's malocclucion.



Progress Panelipse

Progress photos

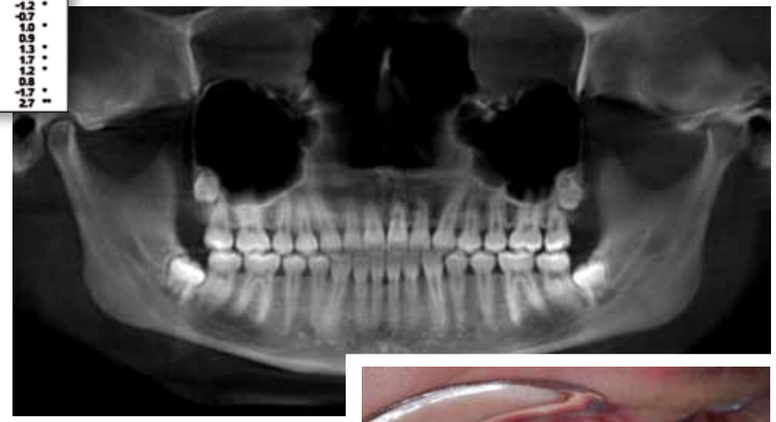


SIGNIFICANT CONSIDERATIONS	
CONDITION	REASON
Bimaxillary Protrusion	
Skeletal Class III	due to the mandible
Adenoid blockage of the airway?	Probably not

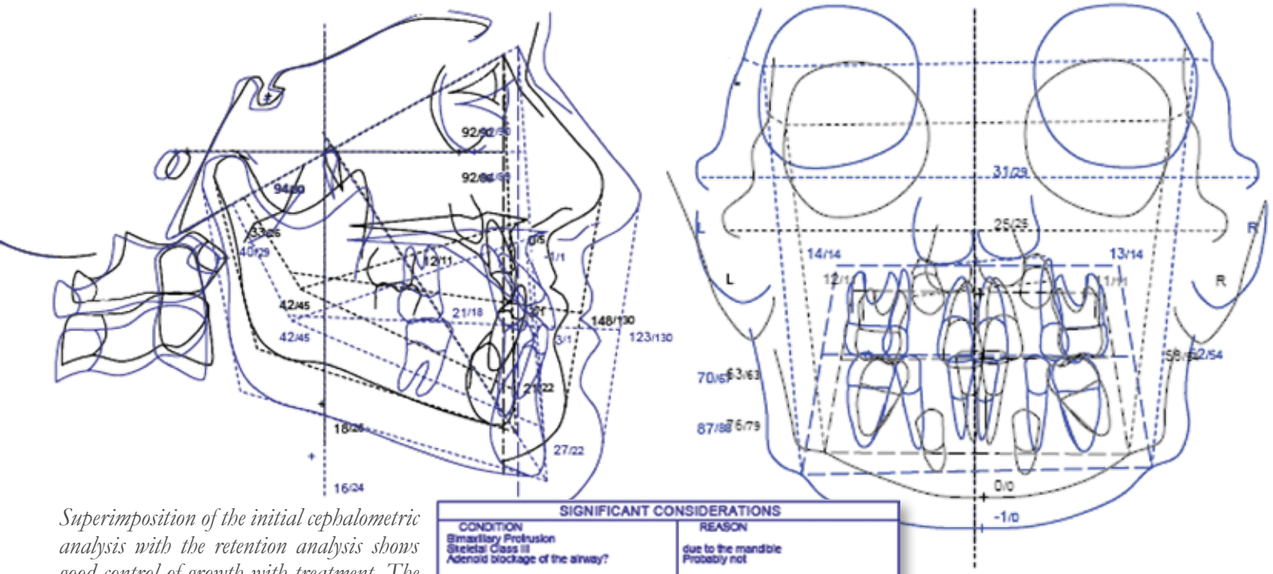
FACIAL PATTERN: BRACHYFACIAL					
# FACTORS	MEASURED VALUE		NORM		CLINICAL DEVIATION
Interincisal Angle	122.7	dg	130.0	dg	-1.2 *
Convexity	-1.5	mm	1.0	mm	-1.2 *
Lower Facial Height	42.2	dg	45.0	dg	-0.7
A6 Molar Position to PTV	20.9	mm	18.0	mm	1.0 *
B1 to A-Po Plane	3.1	mm	1.0	mm	0.9
B1 Inclination to A-Po	27.2	dg	22.0	dg	1.3 *
Facial Depth	93.8	dg	88.6	dg	1.7 *
Facial Axis	94.0	dg	90.0	dg	1.2 *
Maxillary Depth	92.3	dg	90.0	dg	0.8
Mandibular Plane to FH	16.3	dg	24.2	dg	-1.7 *
Mandibular Arc	40.0	dg	29.2	dg	2.7 **

Final lateral cephalogram and lateral cephalometric analysis

Retention i-CAT® panoramic report



Retention Photos



Superimposition of the initial cephalometric analysis with the retention analysis shows good control of growth with treatment. The final result was a Class I occlusion.

SIGNIFICANT CONSIDERATIONS	
CONDITION	REASON
Bimaxillary Protrusion	
Skeletal Class III	due to the mandible
Adenoid blockage of the airway?	Probably not

FACIAL PATTERN: BRACHYFACIAL					
# FACTORS	MEASURED VALUE		NORM		CLINICAL DEVIATION
Interincisal Angle	122.7	dg	130.0	dg	-1.2 *
Convexity	-1.5	mm	1.0	mm	-1.2 *
Lower Facial Height	42.2	dg	45.0	dg	-0.7
A6 Molar Position to PTV	20.9	mm	18.0	mm	1.0 *
B1 to A-Po Plane	3.1	mm	1.0	mm	0.9
B1 Inclination to A-Po	27.2	dg	22.0	dg	1.3 *
Facial Depth	93.8	dg	88.6	dg	1.7 *
Facial Axis	94.0	dg	90.0	dg	1.2 *
Maxillary Depth	92.3	dg	90.0	dg	0.8
Mandibular Plane to FH	16.3	dg	24.2	dg	-1.7 *
Mandibular Arc	40.0	dg	29.2	dg	2.7 **

Superimposition of the initial frontal analysis upon the retention frontal analysis

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WHY INDIRECT BONDING?

RMO®'s RMBond® Indirect Bonding system provides clinicians a simple and consistent solution for maximizing practice efficiency. The RMBond® Indirect Bonding (IDB) system delivers a step-by-step process that allows doctors to fundamentally reduce the amount of chair time involved when bonding appliances to a patient. This results in a greatly improved patient experience also, as the IDB process significantly reduces the patient's chair time and discomfort during bonding. The RMbond® system allows for extremely accurate bracket placement under convenient setup conditions working on a study model, and most of the procedures can be conducted by staff persons with modest training. The RMbond® start-up kit is a turnkey system that includes all of the materials necessary to begin Indirect Bonding your patients immediately.

UNIQUE COMPONENTS IN THE RMBOND® INDIRECT BONDING SYSTEM INCLUDE:

RMBOND® INNER TRAY MATERIAL:

- Provides predictable and reliable working time, with excellent flow characteristics for complete encapsulation of appliances
- Clear material visibility during bracket transfer assures accurate seating and rapid light curing
- Provides an ideal tear strength when removing Inner Tray Material – no debonds and minimal cleanup
- Eliminates the need for block outs around hooks and undercuts

RMBOND® LC FLOWABLE ADHESIVE:

- Precise dispensing system with needle tip
- Ideal viscosity
- Reduces flash
- Excellent bond strength

SYSTEM HIGHLIGHTS

- Reduces chair time
- Significantly more comfortable bonding experience for patient
- Convenient and more precise final appliance placement on a study model at doctor's leisure
- Reduces clinician neck and back pain by minimizing time bent over a patient during bonding procedure
- No need for two models – study model also functions as IDB model

Precise bracket placement on a study model

Transfer tray fabrication - Inner Tray Material fully encapsulates all appliances

Rapid patient bonding process - light curing directly through transfer tray

Dr. Budi Kusnoto is a tenured full time associate professor in the Department of Orthodontics, University of Illinois at Chicago. His computer science background and knowledge in biomechanics as well as management of craniofacial deformities are complimentary to his teaching in the field of orthodontic diagnosis and treatment planning. He also has been actively involved in clinical research in the area of temporary anchorage devices, invisible orthodontic appliances, computerized orthognathic-craniofacial surgical imaging, 3D imaging-computerized treatment simulation, and longitudinal digital data mining project. Currently Dr. Kusnoto also maintains a private practice and clinic directorship at the Department of Orthodontics, College of Dentistry University of Illinois at Chicago. He is an active member of American Dental Association, Illinois Society of Orthodontists, Chicago Dental Society, American Association of Orthodontists, and is a Diplomate of American Board of Orthodontics.

RMODS®/ e-ceph®

Q & A with Dr. Budi Kusnoto

Dr. Kusnoto has been using RMODS® services for the past 5 years for his research in validating computerized cephalometric prediction treatment outcome, he is also constantly involved in evaluating many other cephalometric imaging software in the market.

Q: Can you provide us with an overview of RMODS® and e-ceph® Web?

A: e-ceph® Web can be summarized as a web-portal (Internet virtual meeting place) to various cephalometric analyses, growth simulations, data/image management, and case management tools to aid in developing excellent treatment objectives/plans. It can also be a web-portal for potential inter-institutional as well as inter-clinician world wide exchange of study cases.

Q: Why use e-ceph® Web?

A: e-ceph® Web is purely web based, meaning it is not installed on a computer. It is easily accessible through any terminal connected to the Internet. No updates or maintenance will ever be needed, as this is done automatically through the e-ceph® Web RMODS® server. All data can be securely stored in the RMODS® server facilities and are easily accessible from anywhere on the planet with a high speed Internet connection.

Q: What is the benefit of e-ceph® Web?

A: e-ceph® Web functions as cephalometric digitizing software, and also gives you the flexibility of being able to send your records directly to RMODS® where well trained and highly experienced personnel will digitize them and return the results to you.

Q: How is e-ceph® Web better than the software that I would have in my office?

Budi Kusnoto, D.D.S., M.S.

Department of Orthodontics

University of Illinois at Chicago

A: It is the only cephalometric analysis software in the market that can actually produce interpretation of the cephalometric numbers and its parameters which can lead to formulating treatment objectives, thus coming up with suggested treatment plans and treatment mechanics including treatment sequence and timing.

Q: What different types of analyses does e-ceph® Web offer?

A: e-ceph® Web offers the same cephalometric tools and analyses as the RMODS® service; Ricketts, Downs, Steiner, Sassouni Plus, and Jarabak.

Q: Is any special equipment required?

A: A computer with standard high speed Internet (such as DSL or cable) running standard web-browser will be sufficient to run e-ceph® Web application.

Q: What if I don't have time to digitize my case?

A: If you would like the RMODS® analysts to digitize your case, you can simply click on the "PROCESS by RMODS®" option after uploading all the necessary radiographs/ digital images and patient information into the e-ceph® Web system. The final result will be sent back to you by email.

e-ceph®

Q: How long does it take for me to receive my results?

A: On average results will be returned within 3-5 minutes, depending on the complexity of the analysis requested and Internet speed. If you have submitted your records to RMODS® for the analysts to digitize, results should be returned within 3 days.

Q: Is there tech support available?

A: Yes, well trained analysts and technical support is available Monday through Friday during business hours.

Q: Why would I want to digitize a frontal?

A: Much more data, that can influence our treatment objectives and eventually treatment mechanics, can be gathered by simply adding frontal analysis. Often clinicians tend to skip looking at skeletal/dental asymmetry in the transverse dimension or possible airway obstruction which can be quantified using the frontal analysis.

Q: Why do I digitize the upper arch and what kind of information will it supply me?

A: By adding the upper arch you will be provided with the Bolton Analysis as well as a more complete view of the patient's current situation.

Q: What is a Visual Norm? Where does it come from?

A: e-ceph® Web is one of the extremely few cephalometric software programs currently available in the market that has the ability to accurately produce a Visual Norm (graphical representation of a NORM) which can be used as a template while treating the case (to guide clinicians in designing their orthodontic mechanics to move teeth/bone in space).

Q: What is a Visual Treatment Objective (VTO) and how does it help me in my diagnostics?

A: By using the VTO, we can map our treatment into a moving target (in a growing individuals) as well as graphically represent our treatment goal in terms of where should we position the teeth at the end of treatment. Clinicians can also utilize the VTO to improve the accuracy of their treatment. We have the ability to design how much certain parts of the occlusion should be moved, whether it is dental or skeletal, in order to achieve the optimal stable occlusion for the patient.

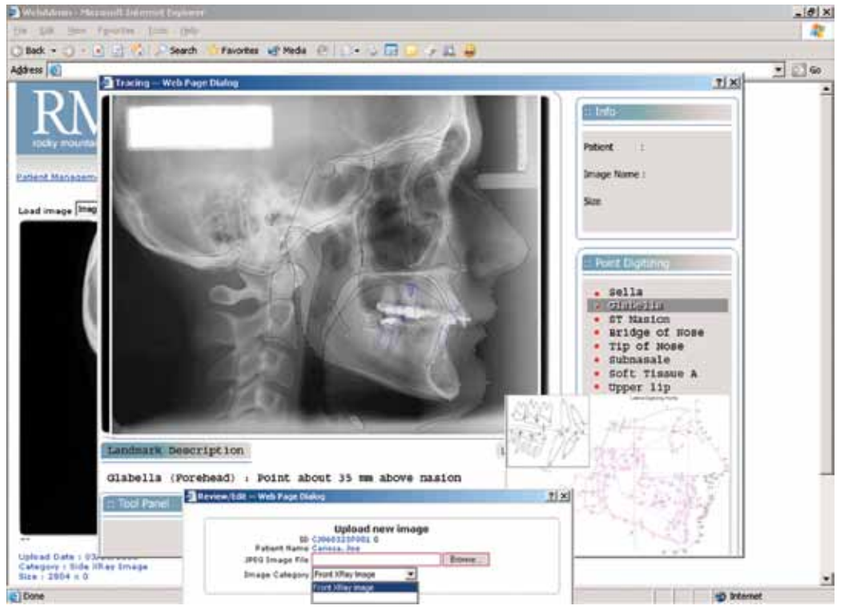
Q: Can I get just a height prediction? What information is required for this?

A: Yes, all that is required is the patient's date of birth and their present height. If you would like improved accuracy you can include the skeletal age from the current hand wrist film.

RMODS®
Rocky Mountain® Orthodontics Data Services™

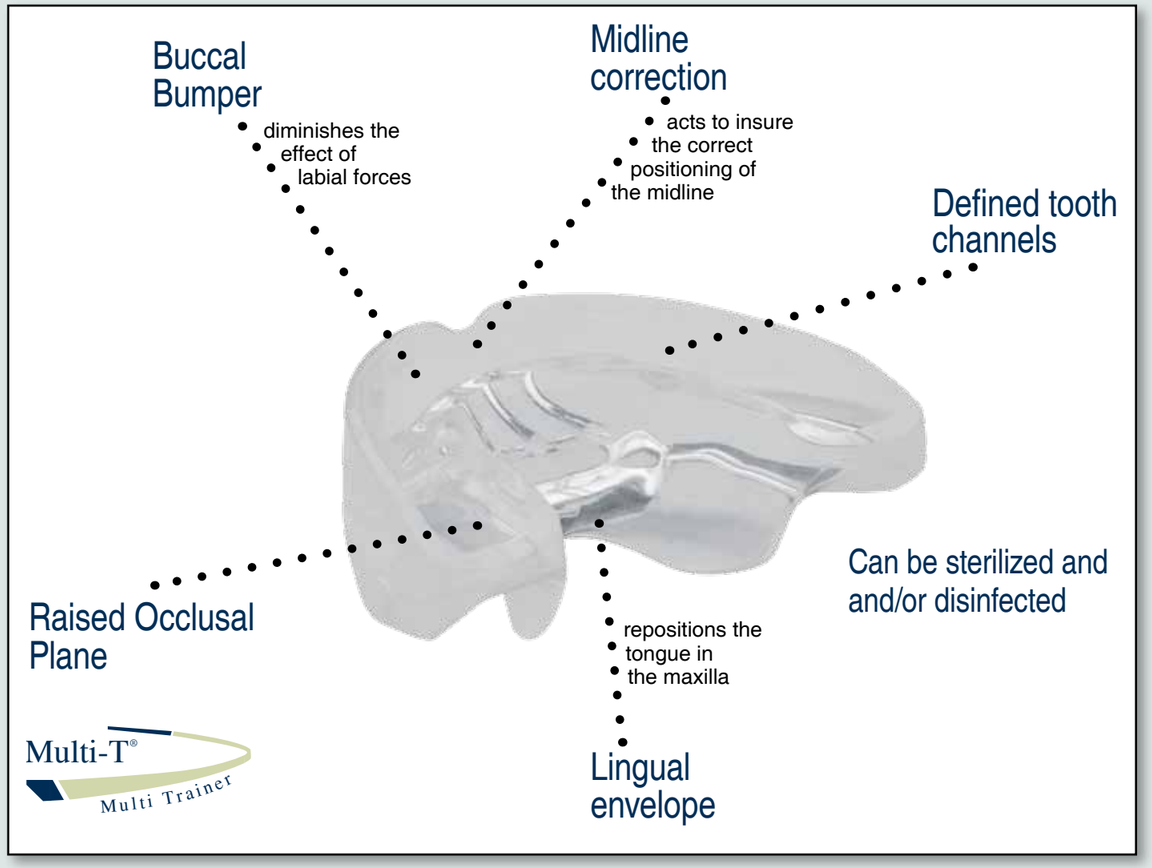
Q: Why do I need to digitize the lower arch and what kind of information will it provide me?

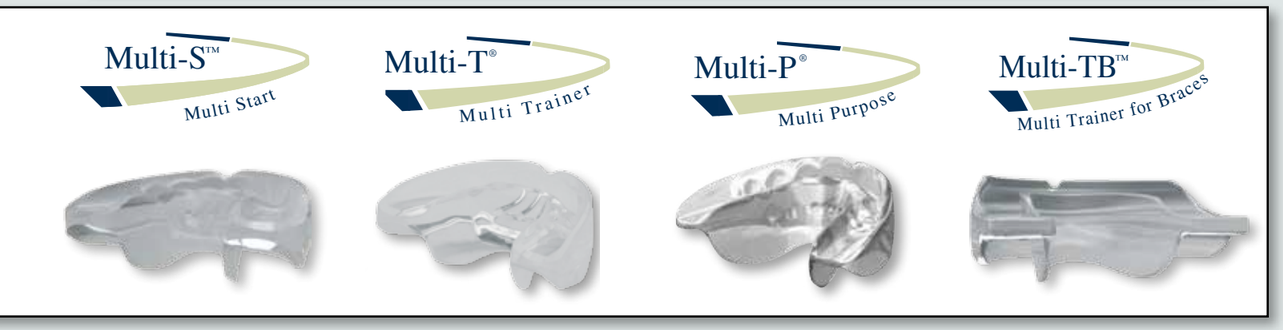
A: Digitizing the lower dental arch will give the clinician much more information (about occlusion, tooth size discrepancy, dental development) as it relates to the skeletal and facial structures which were derived from lateral and frontal cephalometric radiographs. The digitized information from the lower arch is required by the RMODS® program to produce the treatment planning segments of the results. It provides a 3rd dimension of the view of the patient.



Multi-Family
Functional Education

The **Multi-Family** Appliances are an integrated system of appliances that allow the orthodontists to choose the ideal appliance according to the age and the malocclusion of the patient.





Dr. Franco Bruno received his Medical Degree from the University of Pavia, Italy. His Orthodontic Specialty degree was awarded at the University of Cagliari, Italy. Postgraduate Degrees include Straight Wire Therapy and and TMJ Therapy from the University of Milan and Lingual Orthodontics from the University of Varese.

Dr. Bruno completed the 2 year Zerobase Bioprogressive Course and is the Chair of Bioprogressive Philosophy at the University of Cagliari. He is also Head of the Bioprogressive Department, Dental Clinic, at the same institution.

Dr. Bruno has a Private Practice Limited to Orthodontics, which he opened in 1986.

THE FUNCTIONAL MATRIX:
a practical solution using The Multi-Family

By Dr. Franco Bruno
Italy

INTRODUCTION

A long-term goal in orthodontics has been to understand the interaction between the Functional Matrix and malocclusion. Research in this area began in the early 19th century and, to date, there is no definitive understanding. Contemporary orthodontics recognizes two opposing views. The "functionalists" believe that the Functional Matrix, especially that of a muscular nature, is the determinant principle of malocclusion. Contrary to this belief is the "mechanistics" view, whose proponents say that muscular dysfunctions are a result of malocclusion. Unfortunately, the latter have yet to submit a theory on the etiology of malocclusion. There are various positions between these two extremes that, to a greater or lesser degree, recognize the influence of the functional matrix on malocclusion. It is difficult for the clinician to address malocclusion both in etiological terms and long-term stability. A primary issue is the probability of relapse after orthodontic treatment. If the Functional Matrix is the cause of malocclusion, and it is not neutralized during treatment, there will be a greater possibility of relapse. However, if the dysfunction is a result of the malocclusion, only its complete resolution will guarantee stability of the case. From our perspective, this ideological dualism is irrelevant.

The philosophy of "Self Confident Orthodontics" views the interaction between the Functional Matrix and malocclusion as a continuous exchange of information between the two components and, therefore, foresees a therapeutic protocol that aims at correcting both parts of the system in order to find the most appropriate solution for long-term stability. The main therapeutic idea is to work on each component at different treatment times. In the absence of definitive scientific evidence, the clinician must develop his/her own viewpoint and objectives to best resolve the patient's problems and reach a clinical outcome that will be stable over time.

Our therapeutic protocol calls for a three-step treatment sequence to address the Functional Matrix:

1. Preparation Stage: use myofunctional orthodontics at an early age, from 4-5 up to 10-12 years of age, while waiting for the appropriate time to start treatment with conventional orthodontic mechanics.

2. Treatment Stage: use myofunctional appliances in association with conventional fixed appliance therapy.

3. Retention Stage: use myofunctional orthodontics at the end of treatment to promote adaptation of the Functional Matrix to the new occlusion.

This approach is based on simple considerations. If alterations of the Functional Matrix are the cause of malocclusions, its neutralization guarantees simpler active treatment. If, however, the dysfunctions are the result of a malocclusion its treatment will be more complex; therefore, neutralization of the Functional Matrix would allow faster and more simplified treatment. Lastly, if the resolution of the malocclusion is decisive for correction of the dysfunction, control during active treatment allows a quicker adaptation of the Functional Matrix to the new occlusion. Therefore, the guideline is to act on both components without certain knowledge of which is the cause and effect. Simplified therapeutic protocols will produce a better and more stable result.

Based on these concepts we have tried to find a solution to patient treatment with a simple, economical, and easy to use myofunctional approach that can be utilized at any age and at all stages of orthodontic treatment.

The appliances of the MULTI SYSTEM respond very well to these characteristics and therefore are included in the "Self Confident Orthodontics" philosophy of treatment.

THE MULTI SYSTEM OF ORTHODONTICS

The MULTI SYSTEM of Orthodontics represents an integrated series of myofunctional appliances that allow the orthodontist to utilize the device that is most suitable based on the age and characteristics of the patient's malocclusion.

The MULTI series of appliances are primarily myofunctional in nature and, as such, each appliance is designed for specific functions. All appliances in the series have various characteristics in common, although each has unique features rendering them case specific for various stages of treatment.

Type	Age	Sizes	Holes	Lip-Bumper Effect
Multi- S	5-8	1	yes	yes
Multi-T	6-10	1	yes	yes
Multi-P	9-13	multiple	yes	no
Multi-TB	all	1	no	yes

THE COMMON CHARACTERISTICS OF MULTI SYSTEM APPLIANCES

Like all myofunctional devices, these appliances have a monoblock shape in order to simultaneously work on both dental arches. The mandibular position protrudes with respect to a edge to edge incisor position. Moreover, the appliances have a raised occlusal plane. This positioning promotes an immediate mechanical unlocking of the TMJ in association with the functional unlocking of muscles.

In addition, all of the appliances have a large vestibular shield which serves to activate the perioral muscles; the shield is adequately extended in order to provoke stretching and activation of the musculature although not arriving up to the fornix given that it is preformed and not customized for the patient. Lingually, the appliance has a frontal lingual ramp for the re-teaching of lingual posture and two lateral wings which increase the re-education effect of the frontal elevator.

In summary, the specific design characteristics of the MULTI SYSTEM are:

a. Vestibular Shield

b. Lingual Elevator

c. Lateral Wings

d. Occlusal Plane

e. Mandibular Protrusion

SPECIFIC CHARACTERISTICS OF THE MULTI SYSTEM APPLIANCES

The MULTI appliances, MULTI-S, MULTI-T, MULTI-P, are designed to be used independent of other orthodontic devices. As part of their design, dental tooth eruption/positioning guides are included as innovative additions to myofunctional therapy. The extent of the guides vary among the appliances to follow the development of tooth eruption with age. MULTI-S contains a guide only for the incisors; MULTI-T contains guides for the incisors and canines; MULTI-P has additional guides for premolars. MULTI-TB, was designed to be used in combination with conventional orthodontic treatment, and therefore does not have any dental guides.

Type	Guidance
Multi- S	Incisors
Multi-T	Incisors and Canines
Multi-P	Incisors, Canines and Bicuspids
Multi-TB	No guidance

All of the appliances, with the exception of the MULTI-TB, have 3 holes in the front of the appliance to allow for partial oral respiration. These holes, which have the effect of increasing the elasticity of the frontal plane, permit a greater elastic response during closing exercises and, therefore, a more effective intervention on anterior teeth in cases of deep-bite.

MULTI-S, MULTI-T and MULTI-TB utilize the shield to create a thickening in the anterior segment designed to increase the effect of the lip-bumper.

MULTI-S, MULTI-T and MULTI-TB are available only in one size.

MULTI-P is available in two models: low and high volume, that is, with a different frontal thickness of the occlusal lift.

The low volume MULTI-P is available in 13 different sizes.

The high volume MULTI-P is available in 11 different sizes.

The sizes, easily identified by a special measuring instrument, differ in the mesial thickness of the incisors.

BASIC INSTRUCTIONS FOR USE

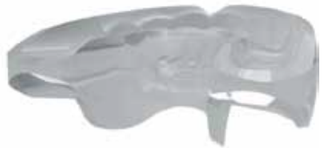
Based on the specific characteristics of the malocclusions, it is relatively easy for the orthodontist to make an accurate determination as to what appliance is appropriate for the case at hand.

MULTI-S is indicated for younger patients and is applicable starting from 5 up to 7-8 years of age.

Multi-S

Following eruption of the first permanent molars it is often preferable to utilize MULTI-T that is applicable from 6 to 9-10 years of age.

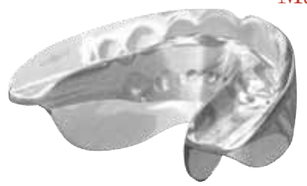
Multi-T



MULTI-P is used after the exchange of the lower canines or first upper bicuspids (depending on the patient's pattern of exchange) up to 13-14 years of age with braces/myofunctional orthodontics.

MULTI-P has specific indications for use for each of its two models. The low volume model is designed for mesofacial or brachyfacial patients; the high volume method is designed for a dolichofacial patients.

Multi-P



Beyond age 13-14, it is advisable to use MULTI-TB in association with conventional orthodontics.

Multi-TB

When should the MULTI series of appliances be used? As previously discussed, these are primarily myofunctional devices. They are designed to stretch the lateral and periodontal muscles to generate strength in order to modify the skeletal and/or dental relationship. As per classical myofunctional therapy, their main use is in Class II and certain Class I cases and they possess three principal functions:

a. UPPER RIDGE: Dental tipping and guide for tooth eruption.

b. SKELETAL: Possible interference with the growth of the jaw bone; increase of lower jaw growth; remodelling and modification of the TMJ.

c. MODIFICATION OF THE FUNCTIONAL MATRIX ACTIVITY: MULTI family appliances do not require impressions or the need for a dental laboratory. This is very important because most patients would prefer to avoid having impressions taken, and initiating orthodontic treatment without the need for impressions may incline the patient and parents to be more comfortable with their orthodontist. In addition, when the dental laboratory is by-passed, the MULTI SYSTEM becomes exclusively an in-office procedure without a costly laboratory fee.

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CASE # 1: Roberto; age 7

Class 1, Crowding upper and lower, Cross-Bite, Deep-Bite

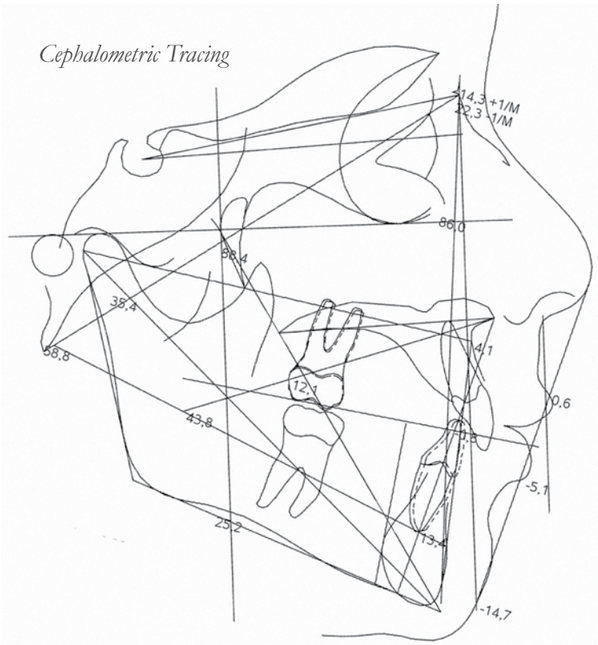
Treatment Plan: Multi-T for correcting the cross-bite, reshaping the arches, and correcting the deep-bite. Quad-Helix for gaining space and mesio-distal rotation of upper first molars.

BEFORE

Before treatment

AFTER

After 7 months of Multi-T, ready for Quad-Helix phase



In summary, the specific design characteristics of the MULTI SYSTEM are:

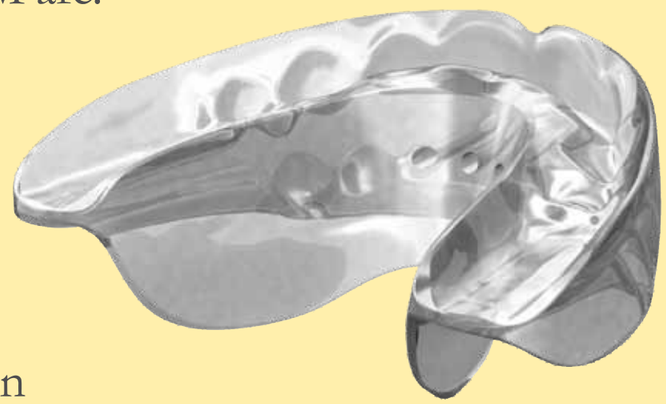
a. Vestibular Shield

b. Lingual Elevator

c. Lateral Wings

d. Occlusal Plane

e. Mandibular Protrusion



CASE # 2:
Ivan; age 6

Class II, Open-Bite, Thumb Sucking

Treatment Plan: 2 Phase Treatment

Phase # 1: Habit correction, Facial Axis Control: Multi-S and Re-education

Phase #2: Class II Correction, smile analysis and gummy smile correction: Fixed Appliances

After phase 1 treatment

Figure 1

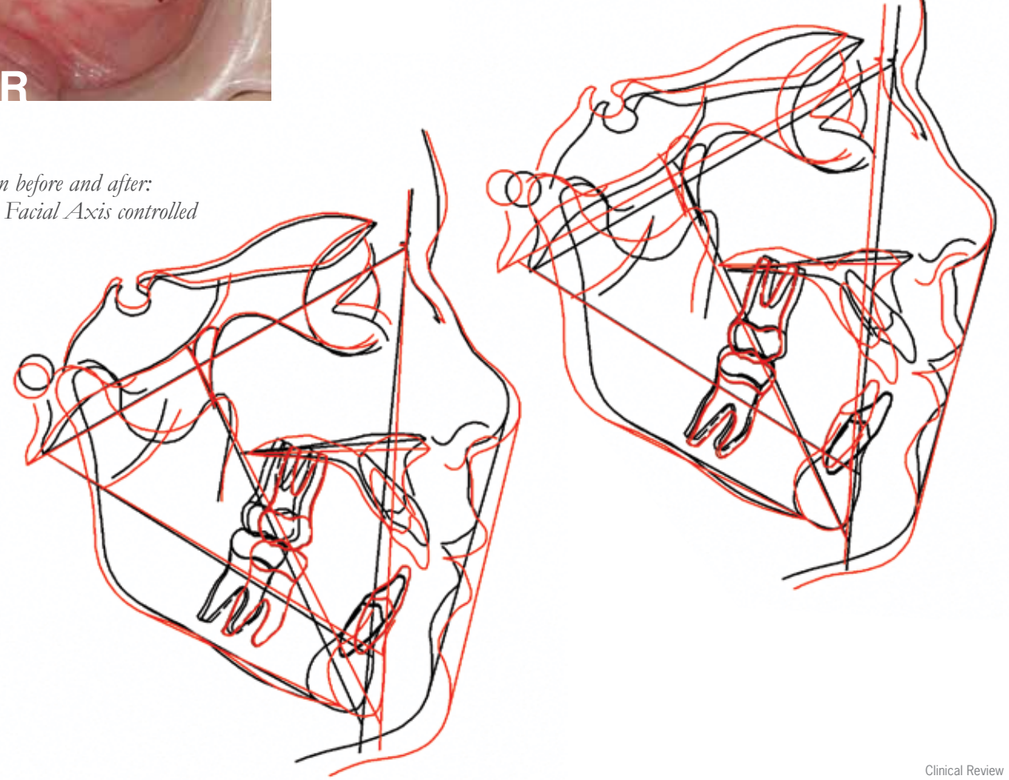
Before treatment

Our therapeutic protocol calls for a three-step treatment sequence to address the Functional Matrix:

1. Preparation Stage: use myofunctional orthodontics at an early age, from 4-5 up to 10-12 years of age, while waiting for the appropriate time to start treatment with conventional mechanical orthodontics.
2. Mechanical Stage: use myofunctional appliances in association with conventional fixed appliance therapy.
3. Retentive Stage: use myofunctional orthodontics at the end of mechanical treatment to promote adaptation of the Functional Matrix to the new occlusion.

Superimposition before and after: Xi-Pm on Pm mandible unlocked, over-jet correction with lower incisor movement to lingual

Superimposition before and after: Ba-Na on CC Facial Axis controlled



CASE # 3 :
Erica; age 7

Class II, Upper and Lower anterior crowding, Deep-Bite

Treatment Plan: 2 Phase Treatment

Phase # 1: Deep-Bite correction, crowding correction, Facial Axis control: Multi-P Low Volume for 13 months

Phase #2: Class II correction, Occlusal Plane inclination correction: Fixed Appliances

Before treatment

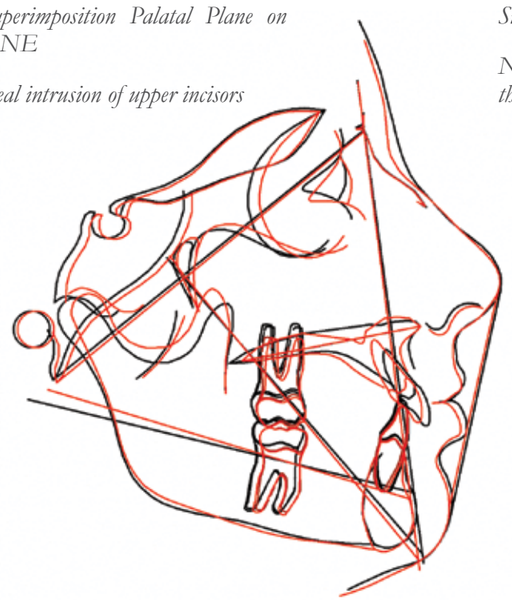
Before treatment

After treatment

10 Months after treatment without any retention: the case is stable

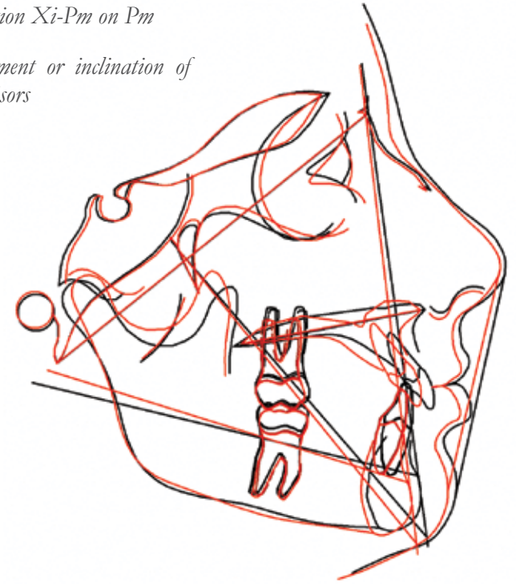
Superimposition Palatal Plane on ANE

Real intrusion of upper incisors



Superimposition Xi-Pm on Pm

No advancement or inclination of the lower incisors



APPENDIX I

Orthodontic Literature Review: Muscular Function

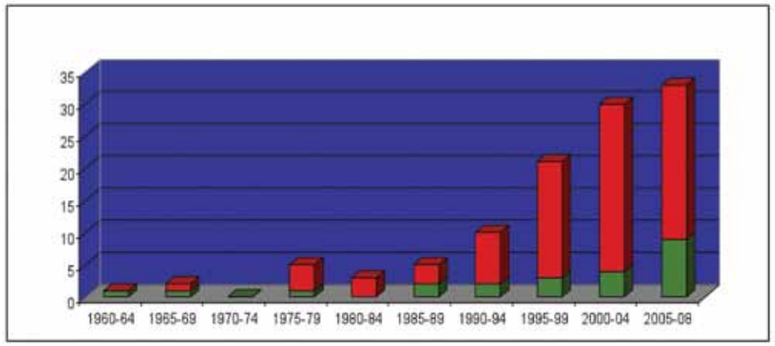
We have searched the Pubmed index from 1960 to 2008 to analyze interest in muscle action/interaction in orthodontics over this time period.

Papers (110) were divided into two groups:

Group A, Meta analysis or Theories

Group B: Clinical Trials

As shown in Graph 1, interest in the study of muscular function in orthodontics increased during this time period.



Graph 1

Green: number of papers in Group A

Red: number of papers in Group B

An increasing interest on muscular function and muscle interaction in orthodontics supports our analyzing the effects of myofunctional appliances in our patients. The MULTI Appliances represent a modern and complete system to apply the increased focus on muscular function to clinical orthodontics.

Dual-Top TAD System

RMO's Dual-Top Temporary Anchorage Device (TAD) system provides efficient and flexible biomechanics. Dual-Top TADs significantly enhance treatment capabilities and can be extremely effective in reducing treatment time, surgeries, and extractions. Appliances can be inserted chairside by the doctor and loaded immediately. Experience the next generation of appliances: RMO's Dual-Top TADs.

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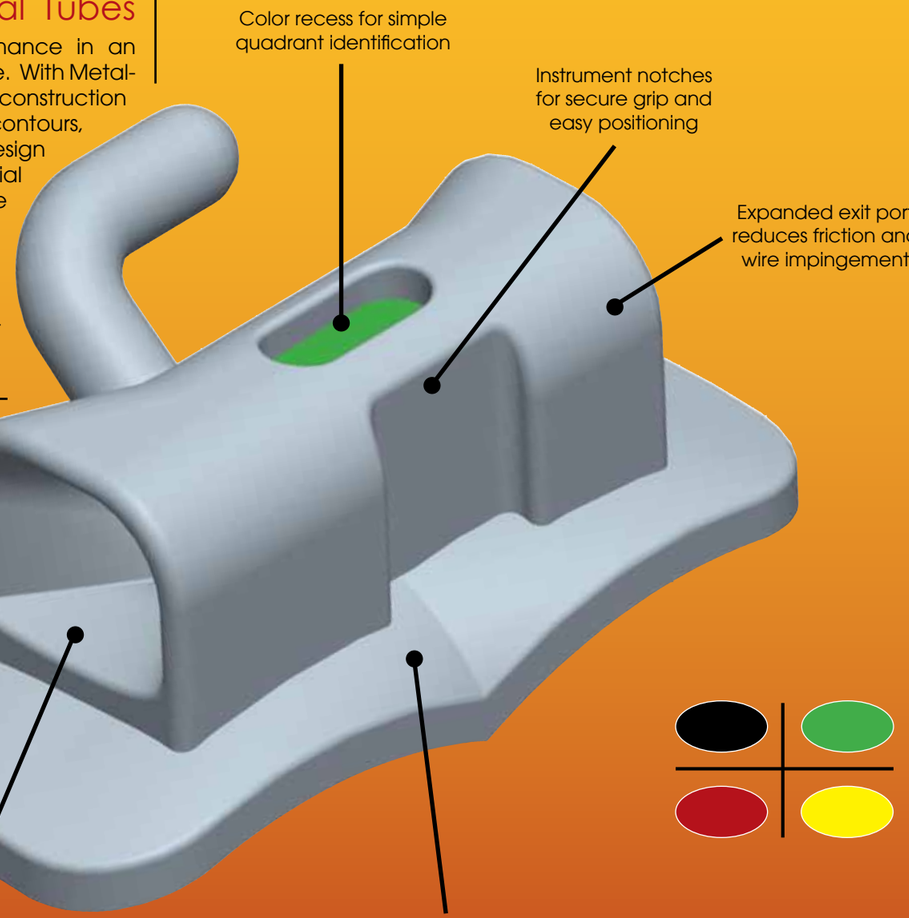

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SUPERIOR QUALITY MAXIMIZES SATISFACTION.

RMO®'s premium Schweickhardt instruments represent the finest quality available at any price. Each Schweickhardt instrument is precisely manufactured to our specifications in Germany with hardened inserts that can be sharpened or replaced, resulting in a more economical product over time than disposable instruments. All Schweickhardt instruments are crafted of 100% surgical stainless steel, are forged, finished by hand, and carry a superb warranty.

- Premium quality instruments result in a more satisfying experience because they allow for a more precise and ergonomic work process day to day, year over year.
- RMO® Schweickhardt inserts are made from a special alloy and are applied to the plier with a highly sophisticated soldering technique. Schweickhardt insert alloy combines hardness (around 62 HRc) with high corrosion resistance.
- All Schweickhardt beaks and inserts are milled on high precision machines and finished by hand by expert craftsmen. In addition, all beaks are protected with a tungsten carbine coating for improved wire grip and maximum reliability.
- All box locks and screw joints are produced with exacting care to ensure a smooth and precise action throughout the entire working angle.
- All edges are carefully chamfered for increased safety - (no pinching or wounding of soft tissue).
- Because the instruments are not chrome plated, they can be subjected to a variety of sterilization methods such as ultrasonic, dry heat, chemclave, autoclave, and cold sterilization.

Extremely accurate precision beaks guarantee perfect holding, bending, and cutting results

Optimum guidance of working ends through precision box locks and screw joints provide consistent action over time

Ergonomic design delivers safety and comfort through careful chamfering of all edges

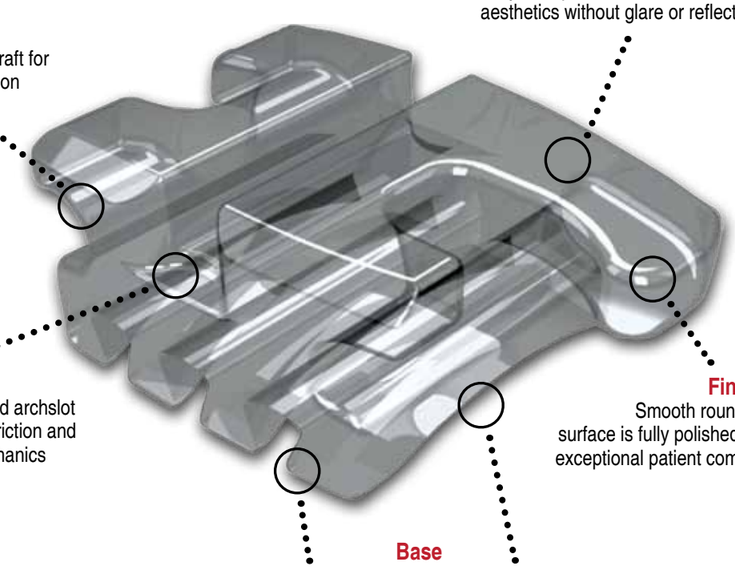
High corrosion resistance without chrome plating

FLI™ signature CLEAR

Design Extremely low profile ensures maximum patient comfort

Ligation
Tie wings incorporate undercuts and downdraft for easy and secure ligation

Finish
Fully transparent for unmatched aesthetics without glare or reflections



Reduced Friction
Smooth rounded flared archslot lead-ins for reduced friction and improved sliding mechanics

Finish
Smooth rounded surface is fully polished for exceptional patient comfort

Base

Patented mushroom-style base rails deliver superior mechanical bonding with reliable and consistent debonding

Contoured base design provides optimum adaptation to tooth surfaces

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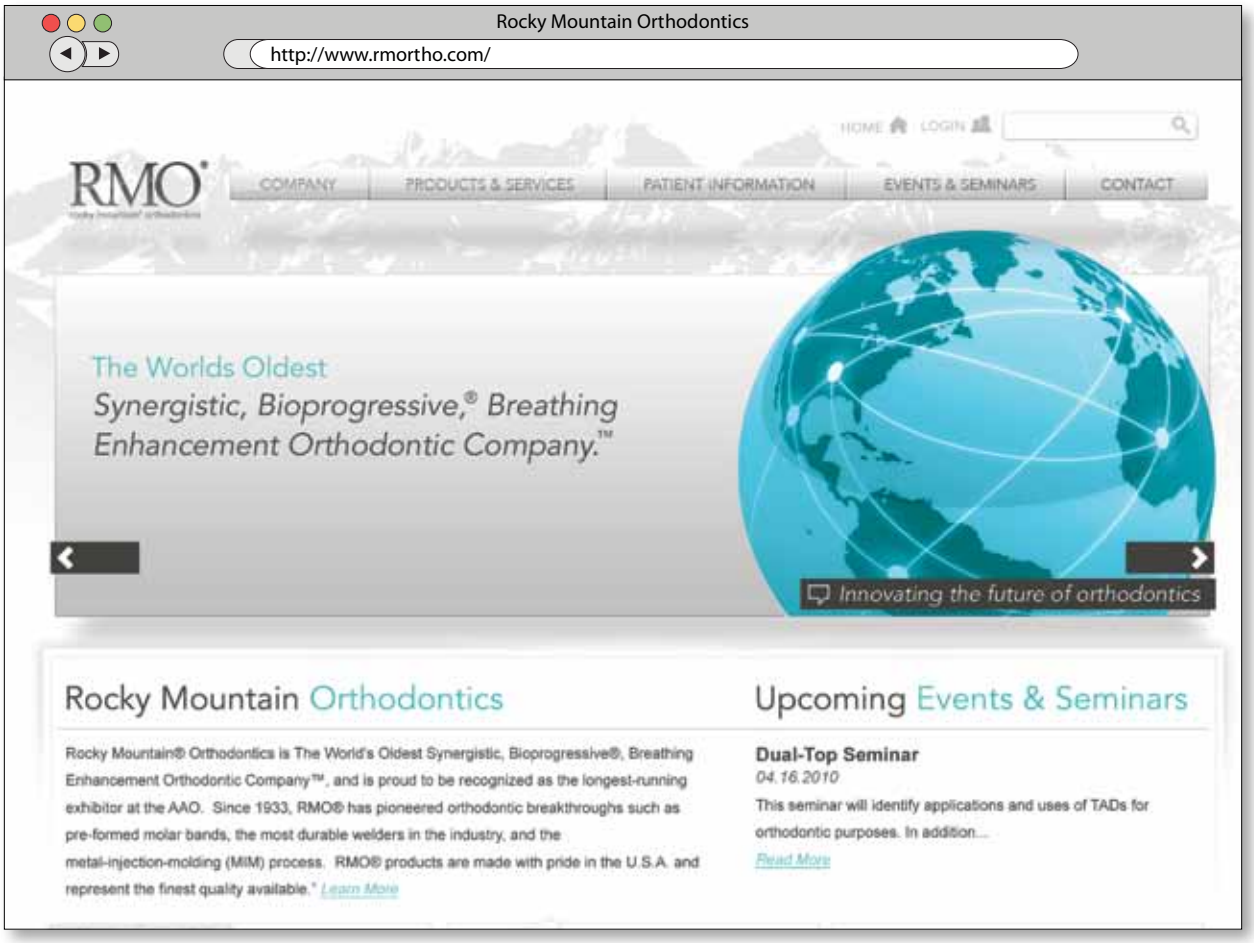

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