Integrating Mechanotherapy with a Three-dimensional Diagnosis and Treatment Plan

by Drs. Larry White, Cody Moore, Kelton Stewart

Educational objectives

Upon completion of this course, participants should be able to achieve the following:

- Understand how to implement a 3D diagnosis and treatment plan
- How to do a cephalometric analysis that emphasizes the soft tissue profile
- Have access via the Internet to supplemental techniques that provide step-by-step instructions regarding their use
- Appreciate the advantages offered by 3D Diagnosis and Treatment Planning

Introduction

For as long as anyone can remember, mechanotherapy has driven the orthodontics profession rather than diagnosis and treatment planning. This comes as no surprise since, by training and patient expectations, dentists are primarily therapists – not diagnosticians. Nevertheless, in an effort to avoid therapeutic diagnosis where orthodontists place appliances on teeth and proceed with treatment, only to discover later that their therapy has failed, clinicians should start with an accurate diagnosis of the patient's problem and then proceed to a reasonable treatment plan and finally apply the correct mechanotherapy. This approach, which saves time, prevents round-trips for teeth and provides the patient with more efficient and efficacious treatment encouraged Holdaway¹ to coin the phrase, "Start with the end in mind."

This article presents the treatment of one adolescent female patient in the late mixed-dentition stage who had a complete three-dimensional diagnosis and treatment plan prior to the beginning of orthodontic therapy. We refer to this as three-dimensional since a Visualized Treatment Objective^{2,3,4,5} determines what space and positions the teeth will occupy in the horizontal and vertical dimensions, whereas occlusograms⁶⁻⁹ will describe the teeth and arches in the transverse dimension.



Orthotown is pleased to offer you continuing education. You can read the following CE article in the magazine, take the post-test and claim your CE credits. See instructions on page 40.

This course offers two ADA CERP or AGD PACE Continuing Education Credits.



Approved PACE Program Provider FAGD/MAGD Credit Approval does not imply acceptance by a state or provincial board of dentistry or AGD endorsement. 12/01/2004 to 12/31/2012



continued on page 36

35

continued from page 35



Figure 1: Pretreatment clinical photographs.



Figure 2: Patient's cephalometric measurements.



Figure 3: Patient's models and occlusograms

Clinical Assessment and Problem List

The patient presented with a chief complaint of "my bottom teeth." The clinical examination revealed the following problems (Figure 1):

- a deep overbite of 100 percent;
- an overjet of 5.5mm;
- a modest Curve of Spee (3.5mm);
- a mandibular arch length discrepancy of 3mm;
- end-on left and right canine relationships;
- imperfect left and right Class I molar occlusions;
- incomplete eruption of permanent dentition.

Cephalometric Analysis of Patient

The cephalometric tracing for this patient (Figure 2) used a technique developed by Dr. White¹⁰ that assesses both osseous measurements and the soft-tissue profile. Readers can download the English version at: www.larrywwhiteddsmsd.com (Lectures, A Pragmatic Cephalometric Analysis; user name - orthotx; password – orthotx). The basis of this cephalometric analysis resides in positioning the patient in true horizontal while making the image¹¹⁻¹⁶. This is the way we habitually view people, and any reasonable aesthetic assessment must start from this natural position of the head. This cephalometric method borrows liberally from Harvold¹⁷, Cooke^{15,16}, Holdaway^{2,3}, Creekmore¹⁸ and Alvarez¹⁹.

The patient had a lip sulcus depth within normal depth, which required no change. The maxillary-mandibular discrepancy of 4mm as shown by the A-B difference fell within normal limits. The mandibular length of 113mm fell within normal limits, while the maxillary length of 94mm was slightly longer than the norm for this age. The lower anterior face height was just below the normal height. The maxillary central incisor had a normal angulation of 110 degrees to true horizontal although some prefer the axial line to extend through the distal margin of the orbit. The maxillary central incisor measured 1mm too labially to the line NA. This patient's occlusal plane bisected the lip embrasure, whereas at this age should have fallen below the embrasure 4-6mm. The maxillary incisor touches the Alvarez A Line, which indicates that it has an ideal anterior-posterior position in the face.

	Patient	Normal Range
Superior Sulcus Depth	4mm	(2mm-4mm)
A-B Discrepancy	4mm	(1-12mm)
Mandibular Length	113mm	(103.8mm-116.6mm)
Maxillary Length	94mm	(82.7mm-91.9mm)
Lower Anterior Facial Height	58mm	(58.7mm-68.1mm)
Maxillary 1 to NA	7mm	(4mm-6mm)
Maxillary 1 to True Horizontal	110°	(102°-118°)
Occlusal Plane to Lip Embrasure	0mm	(4mm-6mm)
Maxillary 1 to A Line	on A line	(A Line + 1mm)

Static Occlusal Assessment

Occlusograms, first suggested by Burstone and Marcotte^{6,20}, furnish orthodontists with information unattainable by any other reasonable means. Melsen and Fiorelli²¹ previously described and listed the myriad

uses of these two-dimensional tracings, while others have described their clinical application^{7.9}.

This patient's occlusograms (Figure 3) revealed no arch length discrepancy in the maxillary arch and a deficiency of -3mm in the mandibular arch.

Development of the Visualized Treatment Objective (VTO)

Ricketts⁵ and Holdaway^{2,3} first suggested the use of VTOs as a way of forecasting the effects of growth and therapy on individual patients. Although these VTOs can have remarkable accuracy for predicting treatment growth that extends no more than 15-18 months, chaos theory^{22,23} explains why they have much less precision when used for longer treatment predictions. The therapists of this patient elected to use a non-growing, static VTO because of the 24-plus months of anticipated treatment. This static VTO simply presumes what spaces the teeth should occupy immediately if they were to have ideal occlusion. Readers can download step-by-step VTO instructions at www.larrywwhiteddsmsd.com (Lectures, Chapter 1 Revised; user name: orthotx; password: orthotx).

This patient's VTO (Figure 4) relied upon a synthesis of cephalometric diagnostic discoveries by Holdaway^{2,3}, Creekmore¹⁸ and Alvarez¹⁹. Since this patient will grow throughout her treatment, the use of an occlusal plane that lies only 3mm below the embrasure as suggested by Burstone²⁴ will run the risk of having the upper lip completely cover her teeth by the time she reaches middle-age. For that reason the VTO occlusal plane bisects the molars and lies 6mm below the lip embrasure. The maxillary incisor will lie exactly on this new occlusal plane and precisely against the A Line; subsequently it needs only a small amount of torsion to place its axial line at the distal margin of the orbit but no other changes.

The mandibular incisor, on the other hand, requires intrusion to the point of lying 1mm above the occlusal plane and advancement so that it occludes with the maxillary incisor.

Advancement of the mandibular incisor will leave 4mm additional space for the mesial movement of the mandibular molars and 1mm of space to compensate for correction of the Curve of Spee.

The lack of arch length discrepancy in the maxillary arch will obviate any special anchorage preservation. The Modified Steiner Box reflects all of these changes for the teeth and gives clinicians a quick summary of the treatment rationale and a mathematical manner of determining space needs, anchorage required and the changes in tooth positions (Figure 5).

Mechanotherapy and Progress

Clinicians decided to treat this patient on a nonextraction basis without using headgears, retraction appliances or interarch mechanics. Rather an intra-arch treatment plan that used the mechanics advocated by Mulligan²⁵. The partially bonded mandibular arch used .022 Carriére selfligating brackets on the incisors and canines and double-tube bands on the molars. The maxillary incisors received .022 Carriére brackets with triple tube molar bands (Figure 6).

A long .014 x .018 stainless steel utility arch simultaneously advanced and intruded the mandibular anterior teeth and clinicians activated this arch over several visits until the anterior overbite resolved and posterior



Figure 4: Patient's VTO.

Figure 5: Patient's Modified Steiner Box

	Max	Man
Arch Length Discrepancy	0	-3
Arch Development		
Relocation Incisor	0	+8
Mesial Molar Movement		-4
Distal Molar Movement		
Curve of Spee		-1
Interproximal Reduction		
Extractions		
Relocation of Max. 3s		
Total Net	0	0



Figure 6: Note the created space in both arches, the corrected overbite and the spontaneous Class II correction of the posterior occlusion.

continued on page 38

continued from page 37

continuing



education

Figure 7: Full arch bondings and space consolidation. Note the compressed coil that pushes the mandibular left premolars forward into a Class I occlusion, while an elastomeric chain retracts the maxillary left canine into Class I.



Figure 8: Completed therapy.



Figure 9: Note the overall growth of the mandible down and forward.

38

space appeared. The maxillary dentition had a long $.014 \times .018$ stainless steel arch whose omega loops abutted the molar tubes, kept a retraction pressure against the molars and also aided in their distal rotation.

After each activation the wires in both arches lay about 1mm in front of the brackets. The design of these archwires allowed several activations without the need of replacements. Once the maxillary molars had retracted and rotated, and the mandibular incisors had advanced and intruded enough, the posterior teeth in both arches received .022 Carriére self-ligation brackets and consolidation mechanics began (Figure 7).

Consolidation mechanics continued with round stainless steel .016 archwires and elastomeric chains until all spaces closed and .017 x .025 titanium arches completed the final positioning of teeth (Figure 8).

Evaluations of Results

The intraoral photographs illustrate a firm Class I occlusion with ideal overbite and overjet, and the facial photographs show the patient displaying an unobstructed smile arc. Comparing the cephalometric superimpositions (Figures 9 and 10) of the final result with the original tracing, readers can see that the maxillary central incisor stayed in position with little change as the VTO suggested. The mandibular incisor intruded and advanced as the VTO intended, although not as much as predicted. Nevertheless, that amount of intrusion and advancement was mechanically unnecessary because the ample growth of the mandible carried the mandibular incisors down and forward and resulted in an ideal overbite and overjet. The overbite corrected through a combination of events, e.g., intrusion and advancement of the mandibular incisors; eruption of the maxillary and mandibular molars. The overjet corrected by the forward movement of the mandibular incisors aided by vigorous growth of the mandible.

Summary

This patient illustrates how a VTO and occlusograms can aid in planning the biomechanics for a patient so that clinicians can see before initiating treatment the positions teeth need to have and form a plan of therapy that puts them there. Placing brackets on all erupted teeth and starting the leveling and alignment of teeth as an initial procedure has had enormous popularity over the years and at first reflection seems reasonable to let the shape of the wire dictate teeth positions. However, teeth, more often than not, display unpredictable movements with shape-driven procedures, and clinicians frequently have to spend unreasonable amounts of time correcting these preventable events. This unforeseeable feature of complete bonding techniques gives the appliance an indeterminate quality that defies the accurate assessment of the moments and forces applied to the teeth and their responses to them.

Force-driven appliances, as used with this patient, allow the placement of predictable moments and forces on the teeth most responsible for proper occlusion and facial aesthetics at the very first of therapy, e.g. the first molars and incisors. Such a minimalist approach allows clinicians to place therapy where it is most needed and achieves the most efficient movement of those teeth. Clinicians will apply premolar brackets only after the major vertical and horizontal changes have occurred and little more than simple rotations remain.

Many avenues of therapy exist for the correction of malocclusions, and doctors will have to decide what works best for them. The biomechanics and treatment planning used with this patient simply describes an efficient and predictable method that orthodontists can rely on.

Bibliography

- Holdaway RH. A Professional Profile. Rocky Mountain Society of Orthodontists Newsletter 1988;33:12-16.
- 2. Holdaway RH. A soft tissue cephalometric analysis and its use in orthodontic treatment planning, Part I. Am. J. Orthod. 1983;84:1-28.
- Holdaway RH, op. cit. A soft tissue cephalometric analysis and its use in orthodontic treatment planning, Part II. Am. J. Orthod. 1984;85:279-293.
- 4. Kuseler A, Melsen, Birte. Orthodontic Treatment: Art or Science. J Clin Orthod 2000;34:371-375.
- 5. Ricketts RM, et al. Bioprogressive Therapy. Denver: Rocky Mtn Orthodontics; 1979.
- Marcotte MR. The use of the occlusogram in planning orthodontic treatment. Am. J. Orthod. 1976;69:655-667.
- 7. White LW. Individualized ideal arches. J. Clin. Orthod. 1978;12:779-787.
- 8. White LW. The clinical use of occlusograms. J. Clin. Orthod 1982;16:92-103.
- 9. Faber RD. Occlusograms in orthodontic treatment planning. J. Clin. Orthod 1992;26:396-401.
- 10. White LW. A pragmatic orthodontic analysis. Ukranian Orthodontic Journal 2008;1:9-11.
- 11. Showfety KJ, Vig, P.S., Matteson, S. A simple method for taking natural head position cephalogram. Am. J. Orthod. 1983;83:495-500.
- Moorees CFA, Kean, M.R. Natural head posture, a basic consideration in the interpretation of cephalometric radiographs. Am. J. Phys. Anthropol. 1958;16:213 -234.
- Michiels LYFaT, L.P.M. Nasion true vertical: a proposed method of testing the clinical validity of cephalometric measurements applied to a new cephalometric reference line. Int. J. Adult Orthodontic Surg. 1990;5:43-52.
- Lundstrom FL, A. Natural head posture as a basis for analysis. Am. J. Orthod. 1992;101:244-247.
- 15. Cooke MS, Wei, S.H.Y. A summary five factors cephalometric analysis based on natural head posture and the true horizontal. Am. J. Orthod. 1988;93:213-223.
- Cooke MS, Wei, S.H.Y. Nasion true vertical: a proposed method for testing the clinical validity of cephalometric measurements applied to a new cephalometric line. Am. J. Orthod. 1988;93:280-288.
- 17. Harvold EP. The Activator in Interceptive Orthodontics. St. Louis: C.V. Mosby Co.; 1974.
- 18. Creekmore TM. Where teeth belong and how to get them there, J. Clin. Orthod. 1997;30:586-608.
- Alvarez A. The A Line: A New Guide for Diagnosis and Treatment Planning. J. Clin. Orthod 2001;35:556-569.
- 20. Burstone CR, Marcotte, M.R. Problem Solving in Orthodontics. Chicago, IL: Quintessence; 2000.
- 21. Melsen B, , Fiorelli, G. Biomechanics in Orthodontics. Arezzo. Italy: Libra Ortodozia; 1995.
- 22. Gleick J. Chaos, Making a New Science. NY, NY: Viking Penguin Group; 1987.
- 23. White LW. Modern Orthodontic Diagnosis, Treatment Planning and Therapy. Glendora, CA: Ormco Corp; 1996.
- 24. Burstone CJ. Lip posture and its significance in treatment planning. Am J Orthod 1967;65:262-284.
- 25. Mulligan TF. Common Sense Mechanics in Everyday Orthodontics. Phoenix, AZ: CSM Publishing; 1998.



Figure 10: Superimpositions of the mandible and maxilla. Note the maxillary central incisor stayed in place and the mandibular incisors intruded and advanced as planned in the VTO.

Drs. White, Moore and Stewart are orthodontists in private practice.

Disclosure: Drs. White, Moore and Stewart declare that neither they nor any member of their family have a financial arrangement or affiliation with any corporate organization offering financial support or grant monies for this continuing dental education program, nor do they have a financial interest in any commercial product(s) or service(s) they will discuss in the presentation. continued from page 39

Post-test

Claim Your CE Credits

Answer the test in the Continuing Education Answer Sheet and submit it by mail or fax with a processing fee of \$36. We invite you to view all of our CE courses online by going to http://www.towniecentral.com/Orthotown/OnlineCE.aspx and clicking the VIEW ALL COURSES button. Please note: If you are not already registered on www.orthotown.com, you will be prompted to do so. Registration is fast, easy and of course, free.

- 1. Dentists are by training and patient expectations primarily:
 - a) Diagnosticians
 - b) Therapists
 - c) a and b
 - d) None of the above
- 2. Therapeutic diagnosis consists of:
 - a) Careful planning before initiation of therapy
 - b) Initiation of treatment and waiting to see how treatment can proceed
 - c) Asking the patient how they want to be treated
 - d) None of the above
- 3. The Visualized Treatment Objective determines:
 - a) Objectives for the teeth in the vertical dimension
 - b) Objectives for the teeth in the horizontal dimension
 - c) a and b
 - d) None of the above
- 4. Occlusograms give clinicians
 - a) A 3D assessment of the malocclusion
 - b) A 2D static assessment of the malocclusion
 - c) Transverse positions of the occlusion
 - d) b and c
- 5. Occlusograms were first proposed by:
 - a) White
 - b) Faber
 - c) Melsen
 - d) Burstone and Marcotte
- 6. The cephalometric analysis with this patient used: a) True horizontal

- b) Basion Nasion
- c) Tweed Triangle
- d) APo line
- 7. The Visualized Treatment Objective used with this patient was a synthesis of techniques by:
 - a) Holdaway
 - b) Creekmore
 - c) Alvarez
 - d) All of the above
- 8. Since this patient would grow during her therapy, the maxillary incisors were positioned on an occlusal plane:
 - a) 3mm below the lip embrasure
 - b) 2mm above the lip embrasure
 - c) 6mm below the lip embrasure
 - d) None of the above
- 9. This patient's VTO suggested that the mandibular incisors should:
 - a) Intrude
 - b) Advance
 - c) a and b
 - d) Retrude and extrude
- 10. The maxillary mandibular discrepancy used with this patient was measured by:
 - a) The ANB angle
 - b) The APo line
 - c) Perpendicular lines from True Horizontal to Point A and Point B
 - d) None of the above

Licensure: Continuing education credits issued for completion of online CE courses may not apply toward license renewal in all licensing jurisdictions. It is the responsibility of each registrant to verify the CE requirements of his/her licensing or regulatory agency.

Dentaltown.com, Inc., a subsidiary of Farran Media, is an ADA CERP and AGD PACE Recognized Provider.

Legal Disclaimer: The CE provider uses reasonable care in selecting and providing content that is accurate. The CE provider, however, does not independently verify the content or materials. The CE provider does not represent that the instructional materials are error-free or that the content or materials are comprehensive. Any opinions expressed in the materials are those of the author of the materials and not the CE provider. Completing one or more continuing education courses does not provide sufficient information to qualify participant as an expert in the field related to the course topic or in any specific technique or procedure. The instructional materials are intended to supplement, but are not a substitute for, the knowledge, expertise, skill and judg-ment of a trained healthcare professional.

Continuing Education Answer Sheet

Instructions: To receive credit, complete the answer sheet and mail it, along with a check or credit card payment of \$36 to: Orthotown, LLC, 10850 S. 48th Street, Phoenix, AZ 85044. You may also fax this form to 480-598-3450. You will need a minimum score of 70% to receive your credits.

Please print clearly. Deadline for submission of answers is 24 months after the publication date.

Integrating Mechanotherapy with a Three-dimensional Diagnosis and Treatment Plan by Drs. Larry White, Cody Moore, Kelton Stewart

Lice	ense	Nun	nber					
AG	D# _							
Nar	ne _							
Ado	dress	S						
City	/				StateZIP			
Day	/time	e pho	one_					
	Cred Card Card	it Ca Nun ratior	yable t rd (pl nber n Dat	o Dentaltown ease comple :e – Mont	n.com, Inc.) te the information below and sign; we accept Visa, MasterCard and American Expre 	×ss.)		
S	Signa	ature			Date			
CE Post-test Please circle your answers.		ers.	Program Evaluation Please evaluate this program by circling the corresponding numbers: (3 = Excellent to	o 1 =	Po	or)		
1. 2.	a a	b	c	d	1. Course objectives were consistent with the course as advertised	3	2	1
3.	а	b	С	d	2. Course material was up-to-date, well-organized and presented in sufficient depth	3	2	1
4.	а	b	С	d	3. Instructor demonstrated a comprehensive knowledge of the subject	3	2	1
5.	а	b	С	d	4. Overall, I would rate this course	3	2	1
6.	а	b	С	d	5. Overall, I would rate this instructor	3	2	1
7.	а	b	С	d				
8.	а	b	С	d				
9. 10.	a a	a d	с с	a d	For any questions, please contact Rita Zakher, DMD, MBA, director of c education at rita@farranmedia.com	onti	nui	ng