

A Specialty Reunited – Finding Common Clinical Ground in Arch Development

by Dr. Robert Waugh
Private Practice
Athens, Georgia

Educational objectives

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

1. Correlate tooth size, dental arch size and shape, and anterior tooth display
2. Define “platinum proportion” in dental aesthetics
3. Explain problems that overdevelopment of the dental arches can introduce
4. Recognize the impact that unwanted post-treatment muscle forces have on the completed case
5. Describe methods of modifying current treatment mechanics to address these problems
6. Recognize simple methods of identifying patients whose care might present challenges in closing spaces and creating an ideal smile
7. Use patient-tailored arch wires to cultivate dental arches to specific tooth sizes

A lack of unity within our profession regarding methodologies concerns me, since it seems to reason that we share the same clinical goals of creating happy, healthy patients with beautiful smiles. Why does one orthodontist open his or her mind to changes in a traditional system, clinical technique or material while another is opposed to the same new measure(s)? I would suggest that we are our own worst enemy and that finding common clinical ground would likely reunite the pioneers within our specialty who currently seem split over “better, faster and more efficient” clinical methodologies that remain largely undocumented in the literature.

While a world of entrepreneurial orthodontists and manufacturers currently spend their time and resources trying to advance their bracket designs, it seems interesting to me how little emphasis is placed on the core clinical issue dividing our specialty, namely, the limits of lateral arch development (Figure 1). Just within my circle of influence using the Damon System, I recognize the majority of energy is spent on promoting passive versus active self-ligation rather than bringing orthodontists to a greater



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 44.

This course offers two ADA CERP CE Credits.

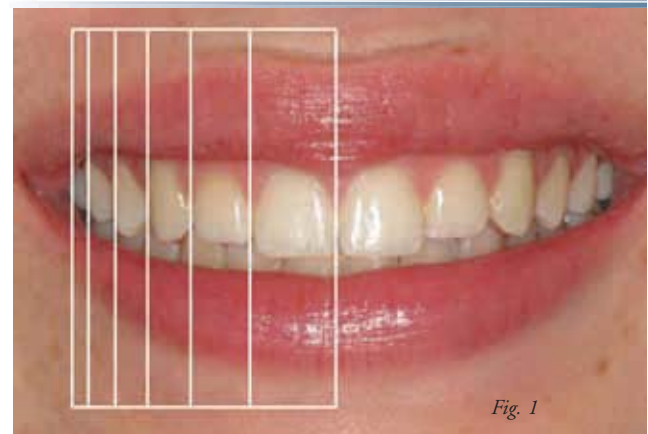


Fig. 1

ADA CERP® | Continuing Education Recognition Program

Dentaltown.com, Inc. is an ADA CERP Recognized provider. ADA CERP is a service of the American Dental Association to assist dental professionals in identifying quality providers of continuing dental education. ADA CERP does not approve or endorse individual courses or instructors, nor does it imply acceptance of credit hours by boards of dentistry.

For more information, please visit <http://www.towniecentral.com/orthotown/onlineCE.aspx>

continued on page 40

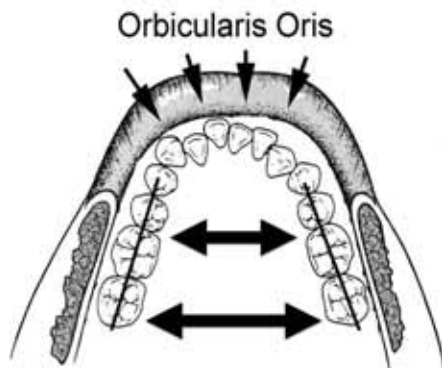


Figure 2

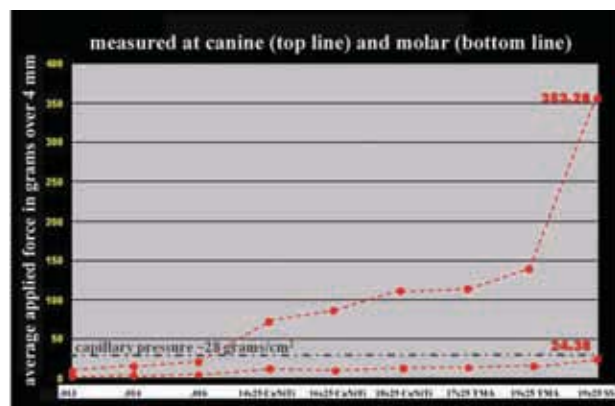


Figure 3

comfort level with wire forces and limits of expansive arch control. When all of the discussion has been exhausted, we are all still left using a very sophisticated, but still generic set of materials for a population where an unquestionable fact remains: no two patients are the same. Importantly, there has been no innovative link established between anterior tooth size, archform and lateral arch development strategy in our now all-too-common “one-size-fits-all” wire sequencing approach. In fact, the topic is not even addressed in our orthodontic residencies.

Patient-specific materials – both brackets and wires – are becoming popularized with virtual set-up tools and customized CAD methodologies. While these may be the “Holy Grail” of patient-specific techniques, they have not swept the profession off of their feet. I ask, “Why not?” if they are what is best for our patients? Consequently, expert clinicians continue to place brackets exquisitely to the quarter millimeter by hand for best advantage with respect to smile arc, and yet little more than a “read and react” principle governs the lateral development of a variety of patients with differing tooth sizes and muscle forces. Is this in a patient’s best interest?

Common ground between practitioners could likely be gained by establishing a goal for lateral development that addresses individual patients’ needs with the added flexibility of variable wire shapes, critical analysis of tooth-sizes (especially anterior teeth), and predictable anterior proportion and shape.

Since general treatment protocols demand a progression from beginning with light round flexible wires to intermediate rectangular flexible wires, we have to consider the stage of mechanics that has the most influence on the arch shape. When

using most modern wire sizes and sequences, lateral development seems most greatly affected by the broad rectangular high-tech wires, beginning with the 14x25 NiTi and ending with the 18x25 NiTi. Because NiTi wires cannot be shaped by the practitioner, a “one-size-fits-all” approach applies for all patients. Thus, flexible NiTi archwires, broader in the transverse dimension than most patients’ dental arches – are inserted through the molar tubes and actively constricted where brackets are engaged at the corners of the mouth. Arches begin to broaden laterally by the wires pushing on the inside of bracket doors, creating many desirable changes for patients with crowded dentitions and lingually inclined buccal segments. As wire sizes progress torques are expressed and begin to upright canines. Finally, with all crowding resolved, customized and coordinated steel or TMA wires are inserted and are rarely altered, “cementing” the final

archform for a patient as heavier mechanics and the detailing phases follow. On occasion, stainless steel wires are expanded in order to affect a broader arch form that previously limited the high-tech rectangular wires.

Forces in the Lateral Dimension

I have been aware for many years that the lateral development in Damon mechanics due to the wires begins when wire forces exceed the facial muscle forces (Figure 2). While biological principles dictate to the clinician to be patient and cultivate arches in light round wires, orthodontic mechanics often win out, resulting in the placement of heavier force rectangular NiTi wires. In retrospect, to me it seemed kinder to periodontal tissues when I was able to correct crowding by placing the lightest force wire that would tip the muscle equilibrium in favor of the tongue and begin laterally developing my patient’s dental arch. More recently, I have resolved that most of my cases unravel quickly in the rectangular high-tech wires and that my

protocols have evolved into systematically progressing through a graduated wire sequence with changes being made at each visit. More appropriately labeled the “working wires,” I have received the most patient complaints of discomfort at the point of transitioning from round to rectangular wires, specifically in the regions of the canines and the first bicusps, theoretically due to these higher forces.

In early 2006 I conducted a study with the help of the orthodontic residents at The Medical College of Georgia School of Dentistry to study the differences in resultant forces in the canine and the first molar regions when Damon wires of various sizes were compressed 4mm in each region (Figure 3). In theory, this would be comparable to the forces felt when a stock Damon wire was constricted 2mm per side (4mm total) and engaged in a patient with a narrow arch to the canines or molars only. The results consistently showed more force delivered to the canines than to the molars. More specifically, the high-tech rectangular series were the first wires to show forces above one ounce (28 grams) of force in the canine region, the approximate value of mean capillary pressure. Since these NiTi wires cannot be customized by the doctor, I concluded that they exceeded mean capillary pressure in the periodontium and adjacent bone and introduced traditional orthodontic tooth movement by way of hyalinization and undermining resorption. My rationale was that this was a necessary level of force, since I wanted a certain treatment outcome broader than what the patient currently displayed. Because the level of force measured in the canine region was linear with respect to the degree of constriction, I have always been diligent to carefully customize my steel and TMA wires in the regions of the canines and first bicusps to avoid these iatrogenically introduced high forces. I am always careful also to not leave 18x25 NiTi wires in for more than six weeks to avoid excessive lateral development and resultant spacing (Figure 4). My attention at this point was to create a more logical wire progression.

Advanced Treatment Protocol – Coordinated Sets

Applying this thinking to my current rationale for graduated wire shapes in the “high-tech” wire phase simply gives me the ability to reduce the lateral forces received by an arch by more closely matching the wire to the existing dental arch and concomitant tooth sizes (Figure 5). Consequently, I have been impressed when introducing these wires with more modest levels of lateral force, patients do not complain about the transition from round to rectangular wire when the transverse forces are minimized both through customizing and coordinating the wires and by using reduced-size NiTi wires. I am getting far less iatrogenic spacing when a more appropriate wire selection is made, which un-complicates treatment and dramatically shortens treatment time. I can now theoretically provide a patient with smaller teeth a wire sequence that creates no lateral changes for cases requiring a transitional wire for leveling and slot alignment. And, with this variety of wire sizes we have a more specialized selection that better addresses transverse needs when working with bilateral crossbites and telescopic bites.

Most Damon practitioners would agree that, on careful analysis and study, their most aesthetic smiles are achieved when treating patients with average- to large-sized teeth when 100 percent stock Damon archforms are used. In these cases, bigger teeth mean broader archforms can be cultivated. However, these same protocols do not usually apply to cases with small teeth (Figure 6).

The cultivation of broad archforms without regarding tooth size and crowding may complicate certain cases by creating unwanted spacing through too broad of an archform for patients with smaller teeth. While the smaller width teeth might then be consolidated on the anterior aspect of the large archform, they could never be distributed to the point where the canines would properly turn the corner in the den-



Figure 4

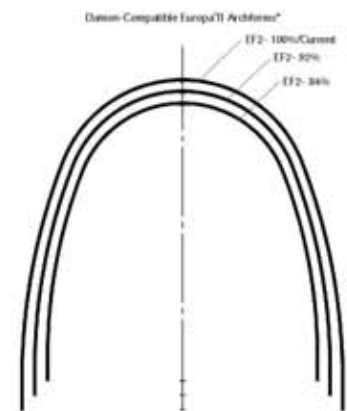


Figure 5

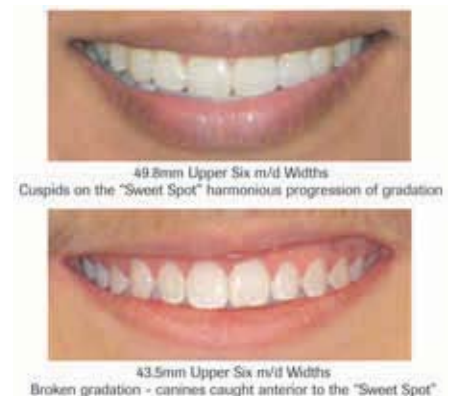


Figure 6

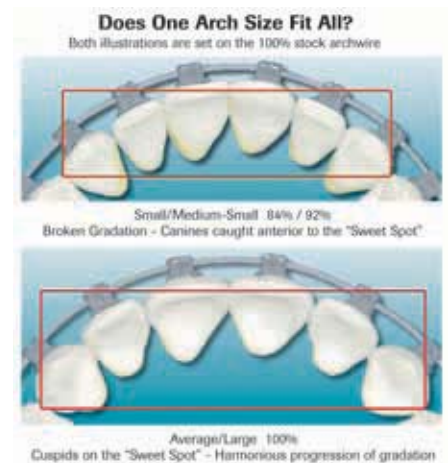


Figure 7

continued on page 42



Figure 8



Figure 9

Figure 10

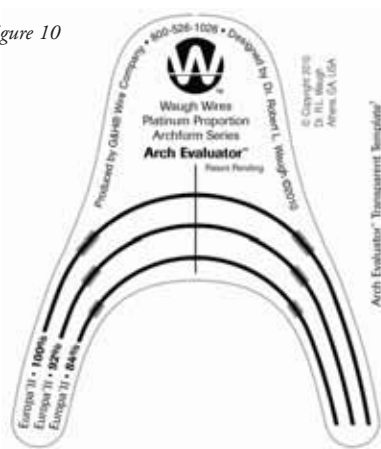


Figure 11

tal arch; in many cases the smallest teeth end up grouped on the anterior segment of the wire well ahead of the turn (Figure 7). While traditional tapered orthodontic archforms achieve at least classic Golden Proportion (60 percent gradations) and Damon enhances this with what I term "Platinum Proportion" (70+ percent gradation), I ask myself this question: "What comes after Platinum Proportion?" In fact, I am convinced that there are diminishing returns in aesthetics and function when the first bicuspid instead of the canine turns the corner of the dental arch.

Over the last three years, my well-trained staff helped me measure the mesio-distal tooth widths of the upper and lower anterior teeth for every patient in treatment. I historically put more energy into solving Bolton's ratio problems than thinking about how the upper anterior total tooth widths distribute along the curve of the Damon wire. The most revealing moment came when I summarized the statistics of these measurements, which range in upper anterior tooth widths between 37mm and 57mm on review of 325 cases. It was surprising to see how different the cases with small teeth appeared on frontal center view compared to patients on the larger end of the range. The distribution of the large teeth on the 100 percent Damon stock archform filled the wire nicely and created the most aesthetic smiles. The cases with smaller teeth showed loss of torque and flatter anterior displays (Figure 6). In the most extreme cases of small teeth (i.e., less than 40mm total mesial-distal width), the first bicuspid were distributed along the wire where the canines would normally be seen creating unwanted dynamic interferences. In many cases of smaller teeth (less than 43mm), the anterior aesthetics appear compromised when cultivated on the stock Damon archform.

Methodology of Wire Selection

The current method I use for selecting the appropriate wire size is to first evaluate the degree of lingual canine inclination, along with the amount of anterior dental crowding (Figure 8). I initially make an effort to view the patient from the front or, better yet, look at a current center dentition intraoral photo. Viewing a patient from the front allows the orthodontist a clear view of the labial or lingual inclination of all canines, which should be carefully combined with the presence or absence of crowding or, alternately, spacing. For crowded cases with lingually inclined canines, it should be obvious that an increase in transverse dimension would be desired; thus, selecting a broader wire would help increase needed arch width. Conversely, smaller teeth with spacing would not benefit from the use of a broader wire and archform, so a reduced wire would be selected (Figure 9).

Next, a transparent template of the proposed archwire size is positioned over the lower arch in order to visualize the lateral changes needed for a patient, if any (Figure 10). If none is needed, then clearly the closest sized wire to that archform would prevail. However, from my experience most cases entering the high-tech phase need a broader archform. Simply holding the Medium archform template over the lower brackets, centered on the midline, provides a diagnostic tool to select the large, medium or small size for the lower arch (Figure 11). With only three choices, the best selection is easily made. For example, if the Medium template looks too wide for a patient's needs, the Small is selected for the lower arch.

Finally, the total mesial-distal tooth widths of the patient's upper anterior six teeth is considered before making the final wire selections for the upper and lower arches. I have come to classify total upper anterior tooth sizes as small (less than 43mm), medium (43-47mm) and large (greater than 47mm). In categorizing these patient groups it seems logical that a simple method might exist whereby a reduced archform could be appropriately sized and applied to meet the relative needs of a patient. Additionally, a coordinated set of wires would be helpful to promote the upper and

lower arch shapes coordinating throughout the high-tech phase. In this way, a patient with small-to-medium width teeth would predictably receive a small lower wire grouped with a medium upper wire. The medium upper wire is manufactured so it is coordinated, or 2mm beyond the small lower wire in all measures when laid concentrically beside it on a flat surface or when in the mouth. Similarly, a large upper wire and medium lower wire would be appropriate for patients with medium-to-large sized teeth. Extremely large teeth would need a pair of large wires, while extremely small teeth would ideally receive a pair of small wires. Bilateral posterior crossbite cases might receive a large upper wire and a small lower wire. The beauty of these wires is that they give the practitioner a chance to avoid unwanted forces in the transverse dimension and consequently, the patient has fewer negative side effects. Additionally, the patient's anterior rotations are allowed to round out unrestrained by coil or ties, all the while without the concern of too much lateral development.

Summary

While debate over bracket design dominates the discussion in most orthodontic circles, a variety of archwire sizes that relate to the needs of a patient can simplify and reunite our collective approach to archform cultivation. Because the broad archforms create an appealing smile for patients with average to large width teeth, a reduced version of these archforms are more appropriate in creating the same gradation for patients with smaller width teeth. A host of benefits are realized when patient specific archforms are selected using a simple assessment technique. When properly selected, the simultaneous insertion of coordinated upper and lower wires throughout all mechanical treatment phases promotes efficiency and coordinated lateral development of both arches.

New users and those considering switching to a self-ligating bracket system who are concerned about adopting a "one-size-fits-all" wire sequencing approach now have more choices. Even advanced users are seeing the advantages to "scripting" lateral development instead of accepting the variable results associated with a read and react approach. A selection of pre-coordinated upper and lower archwire sets for passive self-ligation mechanics are now available that are customized to the widths of the anterior six teeth in order to produce a predictable and more aesthetic display. ■

References

1. *A New Accurate Approach to the Anterior Ratio with Clinical Applications.* Braun, S; Kusnoto, B; Hnat, W. *Amer J Ortho and Dent Orthopedics.* Vol. 115, No. 5, 494-497.
2. *The Golden Proportion Revisited.* Preston, J. *J Esthet Dent.* 1993; 5(6):247-51.
3. *The Form of the Human Dental Arch.* Braun, S; Hnat, W; Fender, D; Legan, H. *The Angle Orthodontist,* 1998; 68(1):29-36.
4. *A New Accurate Approach to the Anterior Ratio.* Braun, S; Hnat, W; Kusnoto, B; Hnat, T. *American Journal of Orthodontics and Dentofacial Orthopedics,* Vol. 115, No. 4, 368-372.
5. *Dynamic Relationships of the Mandibular Anterior Segment.* Braun, S; Hnat, W. *American Journal of Orthodontics and Dentofacial Orthopedics,* Vol. 111, No. 5, 518-524.

Author's Bio

Dr. Bob Waugh, a native Georgian, has practiced orthodontics in the Athens area since 1989. He received his B.S. degree from Mercer University in 1983 and went on to become the Medical College of Georgia School of Dentistry's first combined degree graduate in 1987, earning his D.M.D. as well as an M.S. in Oral Biology. Upon graduation he was elected to Omicron Kappa Upsilon, dentistry's national dental honor society. Dr. Waugh attended his residency in orthodontics at the Baylor College of Dentistry, earning a second Master's degree and his certificate of specialization in 1989. He became a Diplomate of the American Board of Orthodontics in 2000.

Dr. Waugh participates in many related activities that keep him abreast of the latest developments in orthodontic care. He has been teaching orthodontics at the Medical College of Georgia since 1990, giving resident courses in a variety of areas that include Interdisciplinary Dentistry, Orthognathic Surgery, the Damon System of orthodontics, and Orthodontic Business Management. In addition, he lectures nationally on contemporary topics in orthodontics including passive self-ligation and the use of the diode laser. Dr. Waugh is a member of the International and American Colleges of Dentists and has served as president of the Clarke County Dental Society and the Georgia Association of Orthodontists. For more information, please visit www.intellident.org.

Disclosure: Dr. Waugh declares receiving financial or material support from G&H Wire Company. He also has a patent pending and royalty on the archwire evaluator.



continued on page 44

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. To complete the test online: After reading the preceding article, type the following link into your browser and click the button I Wish To Claim My CE Credits: <http://www.towniecentral.com/Orthotown/OnlineCE.aspx?action=PRINT&cid=168>. 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. The stage of treatment that most greatly affects lateral arch development is:
 - a. The light round wire stage
 - b. The rectangular NiTi wire stage
 - c. The stage where stainless steel and TMA wires are used
 - d. The stage has not yet been determined
2. Greatest patient discomfort is experienced when transitioning too quickly from:
 - a. The round wires to rectangular wires
 - b. Smaller to larger rectangular wires
 - c. Rectangular NiTi wires to customized TMAs or stainless steel
 - d. None of these necessarily causes a patient discomfort
3. In the limited MCG study on wire forces on capillary pressures in the canine periodontal ligament spaces, which wire characteristic first exceeds estimated capillary pressure of 28 grams/cm² and blocks off blood flow?
 - a. The largest round wire
 - b. The smallest rectangular wire
 - c. A stainless steel wire
 - d. A TMA wire
4. Carefully customizing TMA and/or stainless steel wires to the patient's arch shape works to:
 - a. Avoid iatrogenic excessive force
 - b. Introduce lateral arch development
 - c. Both a) and b)
 - d. None of the above
5. When using the largest NiTi wire (18x25) what is the best way to ensure that lateral overdevelopment is avoided?
 - a. Careful customization and coordination to the patient's arch size
 - b. Selecting a form specific to the patient's tooth sizes
 - c. Not leaving it in more than 6 weeks before evaluating its effects
 - d. None of the above
6. Using patient-specific NiTi arch wires accomplishes the following:
 - a. Reduces iatrogenically-introduced spacing
 - b. Reduces unwanted forces on patients' teeth, especially in the canine region
 - c. Maintains an aesthetic anterior display from canine-to-canine
 - d. All of the above
7. Which anterior teeth display the most aesthetic 'Platinum Proportion' on a full-sized stock Damon arch form?
 - a. Small
 - b. Medium
 - c. Large
 - d. All display the same
8. Average mesio-distal widths from distal of canine-to-distal of canine total ____ mm.
 - a. Less than 43 mm
 - b. 43 to 47 mm
 - c. More than 47 mm
9. The reason(s) for patient-specific arch wires include(s):
 - a. More aesthetic anterior tooth display
 - b. Lower lateral forces
 - c. Less induced spacing with smaller teeth
 - d. All of the above
10. Using coordinated wires throughout a patients treatment provides:
 - a. The best chance for coordinated lateral development of both the upper and the lower arches
 - b. The best means to eliminate spaces in all patients types
 - c. Treatment protocols with no iatrogenic lateral forces
 - d. All of the above

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 judgment of a trained healthcare professional. You might be contacted by the sponsor of this course.

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.

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.**

A Specialty Reunited – Finding Common Clinical Ground in Arch Development by Dr. Robert Waugh

License Number _____

Name _____

Address _____

City _____ State _____ ZIP _____

Daytime phone _____

E-mail (optional) _____

☐ **Check** (payable to Orthotown.com)

☐ **Credit Card** (please complete the information below and sign; we accept Visa, MasterCard and American Express.)

Card Number _____

Expiration Date – Month / Year _____ / _____

Signature _____ Date _____

☐ **Yes, I would like to continue receiving *Orthotown Magazine* free of charge**
(Signature required for subscription - free to U.S. only)

☐ No, thank you.

Field of practice (optional)

☐ Orthodontist

☐ Orthodontic Resident

Program Evaluation (required)

Please evaluate this program by circling the corresponding numbers: (3 = Excellent to 1 = Poor)

- | | | | |
|---|---|---|---|
| 1. Course objectives were consistent with the course as advertised | 3 | 2 | 1 |
| 2. Course material was up-to-date, well-organized and presented in sufficient depth | 3 | 2 | 1 |
| 3. Instructor demonstrated a comprehensive knowledge of the subject | 3 | 2 | 1 |
| 4. Overall, I would rate this course | 3 | 2 | 1 |
| 5. Overall, I would rate this instructor | 3 | 2 | 1 |

For questions, contact Rita Zakher, DMD, MBA, director of continuing education at rita@orthotown.com

CE Post-test

Please circle your answers.

- | | | | | |
|-----|---|---|---|---|
| 1. | a | b | c | d |
| 2. | a | b | c | d |
| 3. | a | b | c | d |
| 4. | a | b | c | d |
| 5. | a | b | c | d |
| 6. | a | b | c | d |
| 7. | a | b | c | d |
| 8. | a | b | c | |
| 9. | a | b | c | d |
| 10. | a | b | c | d |