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Message from the President

by Waldemar B. Szwajkowski



The 3M Unitek Vision is, in part, “to provide the customer...the most innovative, highest quality products and services”. In order to do this, we know that we must continuously strive to innovate and improve *Beyond the Best* there is available, even with our own products, in order to meet our Vision and our customer’s needs.

If you are among the thousands who have experienced our APC™ Adhesive Coated System, you know the unique advantages and efficiencies that it brings to the orthodontic bonding process. The recently introduced APC™ PLUS System with color change adhesive, discussed in this issue, takes those benefits even further, with improvements designed to make your life easier. We are also proud to announce the upcoming availability of our SmartClip™ Self-Ligating Appliance System, with features unlike any you have seen in a self-ligating appliance before.

3M Unitek has embraced the multi-dimensional Six Sigma process to help us hear the voice of our customers as we bring innovation to the products and services we offer today, and also to those we plan for you in the future. Six Sigma is part of the corporate culture of 3M Unitek, helping us go *Beyond the Best* for you. Thank you for being part of the 3M Unitek family. ■

Introduction

by Fredrik Bergstrand, D.D.S., 3M Unitek Professional Services Manager and Technical Editor



Welcome to a new issue of the *Orthodontic Perspectives*. This time our intention is to provide you with articles dealing with various clinical aspects of Orthodontics.

With the recent introduction of the APC™ PLUS Adhesive Coated Appliance System, you will find in this issue an article summarizing the first clinical impressions by Dr. Robert Miller, followed by a comprehensive Technical Review explaining the added features such as the color-change, the fluoride-release and the moisture tolerance.

We continue with an article evaluating the increasingly popular AlastiK™ Easy-to-Tie Ligatures. Authored by the inventor, Dr. Lee Logan, you will find results presented that show substantial time-savings and cost-savings well worth considering in the daily practice routine. Next, from a series of articles provided by Dr. Thomas Ziegler dealing with various aspects of Practice Transitions, you will find information focusing on Purchasers and Sellers.

It is again our hope you will find interesting reading in this issue of the *Orthodontic Perspectives* and I welcome your feedback and comments via email; fbergstrand@mmm.com. ■

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• A First Look at Bonding with the APC™ PLUS Adhesive Coated Appliance System

by Robert A. Miller, D.M.D.



Robert Miller, D.M.D.

Upon completing his Orthodontic residency at the Medical College of Virginia, Dr. Miller entered the Air Force where he was the Chief of Orthodontics at Clark Air Base in the Philippines. After 3 years he moved to Charlottesville, Virginia where he practiced in a group private practice for 12 years. He currently has a private office located in Culpeper, Virginia. Dr. Miller is a diplomate, American Board of Orthodontics, and has published numerous articles in the JCO on adhesives and Class II Correctors.

This is a first in a 3-part series on orthodontic bonding. In future issues, part two will cover ways of reducing bond failures, and part three will cover adjunctive bonding procedures using flowable and conventional adhesives for pontics and bite opening.

The evolution of current bonding techniques begins with the introduction of etching technique and the BIS-GMA resin described by G. Newman 1965. Most orthodontic adhesives using BIS-GMA as chemical base were designed, with few exceptions, as restorative adhesives.

The first adhesive with a specific orthodontic formulation was Concise™ Adhesive. Concise adhesive was found to be a reliable product and soon became accepted as an industry standard. With the introduction of the Light Curing Technique, the Concise adhesive formulation was used as a base for Transbond™ XT Light Cure Adhesive, a material which today has replaced Concise adhesive as the industry standard.

I recently had the opportunity to assist 3M Unitek in the clinical evaluation of a new product, called the APC™ PLUS Adhesive Coated Appliance System. The new adhesive in the APC PLUS system contains several advantages over the previously mentioned adhesives, and I submit that it has the potential to be the next “industry standard”.

Three distinguishing characteristics make APC PLUS orthodontic adhesive unlike previous adhesives:

- 1.) **Color Changing** – The adhesive starts bright pink for easy excess removal. Upon exposure to light, it fades to clear.
- 2.) **Improved Moisture Tolerance** – This adhesive is a compomer, which is a blend of conventional BIS-GMA resin and glass ionomer, giving it unique properties. When used in conjunction with a product like Transbond™ Plus Self Etching Primer, the system is hydrophilic.
- 3.) **Fluoride Release** – The APC PLUS adhesive releases fluoride.

Our bonding technique is as follows:

- Prepare all surfaces by pumice/rinse.
- Isolate using the NOLA dry field system or, if bonding one tooth, isolate individually.
- Etch/prime using Transbond™ Plus Self Etching Primer (Figure 1A).
- Bond with adhesive precoated brackets, one quadrant at a time.
- Cure with a calibrated LED curing light or Plasma Argon light (Figure 1F).



Figure 1A: Self etch primer applied to a clean dry tooth (swirled on for 4 seconds followed by quick air burst).

Figure 1B: Color change adhesive on bracket prior to placement.

Figure 1C: Excess adhesive extruded around the tooth.



Figure 1D: Excess being removed using a scaler.

Figure 1E: MBT™ System height gauge used for positioning prior to curing.

Figure 1F: Light curing process (photo taken through protective filter).



Figure 2A: Ready to debond.

Figure 2B: Plier in place, ready to debond.

Figure 2C: Debond complete, adhesive remainder shown on tooth.

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In our office, APC™ PLUS System Adhesive is compared to Transbond™ XT Adhesive in an ongoing clinical trial, whereby diagonal quadrants are bonded with Transbond XT adhesive and opposite quadrants are bonded with the new APC PLUS adhesive.

We have been tracking bond failures during treatment and the following results have been observed at the current time. During the test period of completed cases, we had no bond failures in the color change group and 3 failures in the Transbond XT adhesive control group. (4 cases completed prior to 10-03). (25 teeth per test group).

Subsequent cases still in treatment increased the sample size. In this group there are 34 Transbond XT adhesive /control brackets and 34 APC PLUS system brackets with color change.

There were 4 failures in the Transbond XT adhesive group, and none in the color change group. Although this sample size is small, most of these brackets were placed over one year ago, which indicates strength over the duration of treatment. I have concluded the bond strengths are very similar to Transbond XT adhesive. (See the following technical article by the 3M Unitek staff which discusses technical aspects of the new APC PLUS system – editor).

There are many distinct obvious advantages as mentioned above, but several other advantages have been noticed after working with this new adhesive. I observed that the color of the adhesive provides contrast between the tooth and the bracket while placing the Clarity™ Bracket (Figure 1B, 1C). This can assist in accurate bracket placement. The contrast improved the ability to remove flash, so less residual or excess adhesive is left to interfere with tie-wings, or cause debonding interferences. Easy clean up yields less flash which reduces plaque accumulation and white spot formations (Figure 1D).

In conclusion, if you are already using the APC™ II System, the transition to the APC PLUS system should be a smooth one, with the new advances making the bonding process even easier. If you are using other bonding methods, I recommend you give the APC PLUS system a try. As with all new adhesive systems, change can be equated with stress in the office. But the improvements in this adhesive are so numerous, I see the advantages of change far outweigh the necessary learning curve of switching to the new APC PLUS system adhesive. ■

• The APC™ PLUS Adhesive Coated Appliance System: Features and Technical Review

by Joan V. Brennan, Ph.D., Darrell James, Philip P. Soo, Ph.D., Susan Tzou, Ph.D., 3M Unitek



Joan V. Brennan, Product Development Specialist, 3M Unitek, received a B.S. in Chemistry from U.C. Santa Barbara in 1981. She worked at the Institute for Polymers and Organic Solids in Santa Barbara before receiving her Ph.D. in Organic and Polymer Chemistry from the Univ. of Massachusetts, Amherst in 1991. She worked for six years in 3M Corporate Research developing electronic materials, joined 3M Unitek R&D in 1997 and has developed adhesives and liners and led several product development teams.



Philip Soo is a Senior Technical Service Engineer at 3M Unitek Research and Development. He joined 3M Unitek in 2002 following 3 years in the Corporate Process Technology Center at 3M headquarters. He originally hails from Long Island, N.Y. and received his Ph.D. in Materials Science and Engineering at M.I.T. in 2000.



Darrell James received his Bachelor of Science Degree in Biology from Kent State University in 1983. He has worked in Research and Development at 3M Unitek since 1985, primarily being involved in adhesive development. He served as team leader for Sondhi™ Rapid-Set Indirect Bonding Adhesive.



Susan Tzou is Product Development Specialist at 3M Unitek Research and Development. She joined 3M Unitek in 1999 after working at 3M Pharmaceuticals for seven years. She received her Ph.D. in Chemical Engineering from State University of New York at Buffalo in 1989.

The new APC™ PLUS Adhesive Coated Appliance System with color change adhesive provides a complete and efficient orthodontic bonding system. As with its predecessor, the APC™ II System, it is still the only orthodontic bonding system that precoats each bracket with adhesive, meaning no adhesive mixing, application, or opportunity to contaminate the base.

The color change adhesive has the advantage of a pink color for easy and more efficient clean up of adhesive flash, meaning less adhesive left behind for plaque build-up.

The pink color also may provide a better bracket reference for easier positioning. Color change means that the pink color is completely photobleached upon curing. See Figure 1.

The APC PLUS System delivers a soft, tacky and workable adhesive, allowing for easy seating and positioning. A moisture tolerant bonding system is obtained when APC PLUS adhesive is used in combination with the moisture tolerant primers Transbond™ Plus Self Etching Primer or Transbond™ MIP Moisture Insensitive Primer. Fluoride release is also an added feature, enhancing doctor and patient confidence.

Bracket rotation in transit is minimized and shelf life and color is retained with a patented release liner and unique, light-blocking packaging. When used in combination with Transbond Plus Self Etching Primer, etching and priming is conducted in

one step. The system is complemented by the use of the Ortholux™ LED Curing Light, a cordless, light-weight unit that cures the adhesive in half the time of the typical halogen light. Another feature of this light is that the LED light intensity is consistent throughout use.

Adhesive Chemistry

Chemically, the adhesive contains a hydrophilic monomer and an acidic oligomer (a carboxylated methacrylate) which provide improved moisture tolerance as compared to the completely hydrophobic APC II Adhesive and other adhesives largely comprised of BisGMA or other similarly hydrophobic monomers. APC PLUS adhesive does contain a small amount of BisGMA plus rheology modifiers to enhance handling and package stability. Fillers include silica and a fluoroaluminosilicate glass, which releases fluoride.

The adhesive contains a dye that, when exposed to light, ambient or curing, is fully photobleached. All standard orthodontic curing lights, including halogen lights, plasma arc systems, LEDs or any curing system which emits light in a similar wavelength range, are suitable for this product (recommended curing times from the light manufacturer should be used). Note that the bleaching of the dye is NOT an indication of cure or polymerization.

Color Change Technology Provides Easy Flash Clean-up with Bright Initial Pink Color

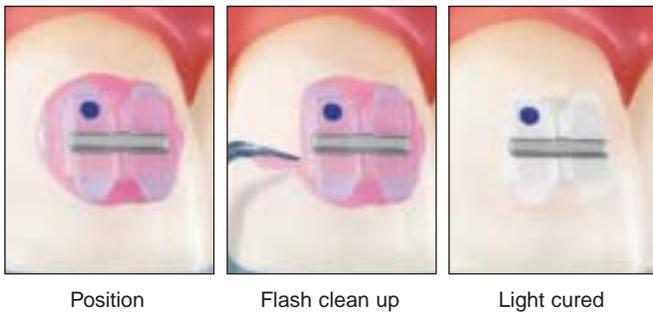


Figure 1: The pink colored adhesive helps provide a visual aid and more efficient flash clean-up, fading upon light curing.

Note: Color fading/bleaching is **NOT** an indication of cure or polymerization. The pink color will fade in ambient light or bleach during curing much quicker than final curing/polymerization.

The APC™ PLUS adhesive has been formulated to provide a distinct pink color that fades to clear when exposed to an orthodontic curing light. Adhesive color is measured using the CIELab system, a three dimensional numeric value for color.

L* is a measure of lightness/darkness, a* green/red and b* yellow/blue. The pink color of APC PLUS adhesive is represented by the a* axis, with a higher positive number indicating more pink and a near 0 value representing less pink. The bright pink initial color is completely faded with several types of orthodontic curing lights as shown in Figure 2.

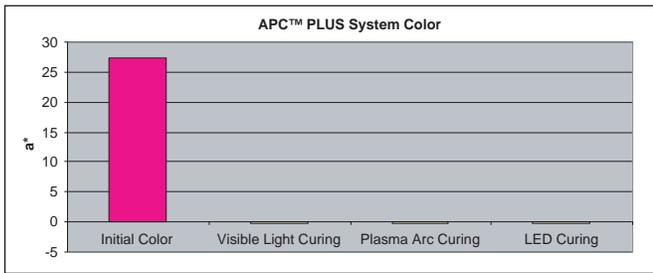


Figure 2: The initial pink color (high a*) is fully bleached (low a*) after the adhesive is cured with standard orthodontic curing lights.⁵

The formulation has been optimized to allow the bracket to be positioned and flash cleaned up while the adhesive retains its pink color.

The loss of color due to ambient light exposure does not indicate curing of the adhesive. The color change mechanism is substantially more sensitive to light than the curing mechanism. APC PLUS adhesive shows the loss of color when exposed to ambient lighting in Figure 3. The light source was fluorescent lighting six feet above the exposed adhesive. APC PLUS adhesive retains 70% of its initial color after 5-minute exposure to ambient lighting.

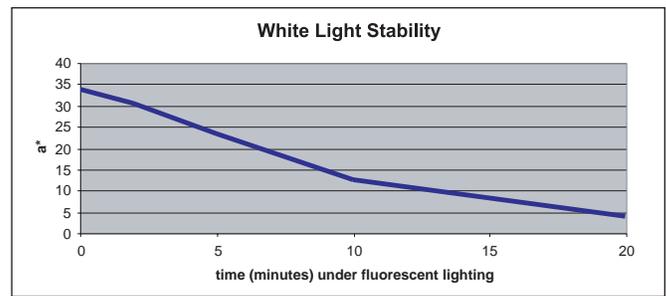


Figure 3: After 5 min. ambient fluorescent light exposure, though the adhesive has faded slightly, the color is still pink (customers polled in a simulated operator¹ preferred adhesives with a* >20 for easier flash removal).⁵

Adhesive Bond Strength Testing

In in-vitro shear peel bond strength studies comparing APC™ II, Transbond™ XT and APC PLUS adhesives bonded to knurled rings show no statistical difference in bond strength using Clarity™ upper left central brackets (REF 6400-601). See Figure 4.

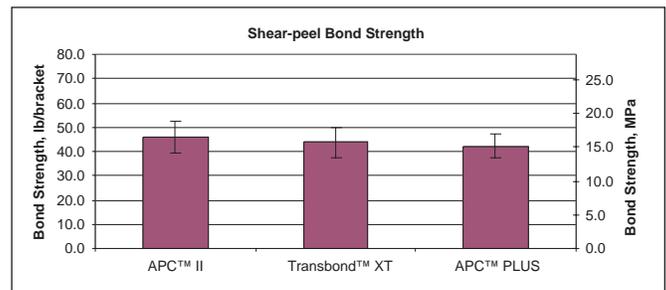


Figure 4: Comparison of bond strengths between APC™ PLUS, Transbond™ XT and APC™ II adhesives with Clarity™ Brackets after 24 hours.⁵

Sustainable high bond strength is a required property of any orthodontic adhesive. Thermocycling bonded samples between 5 and 55°C can simulate aging.

Thermocycling was conducted per the guidelines in ISO/TR 11405:1994(E), paragraph 6.1.1.3. Clarity upper left central brackets (REF 6400-601) were bonded to bovine teeth with APC PLUS or APC II adhesive. The bonded teeth were subjected to 1000 cycles; this is twice the requirement of the ISO standard. Bond strength of APC PLUS adhesive does not decline with age simulated by thermocycling (Figure 5).

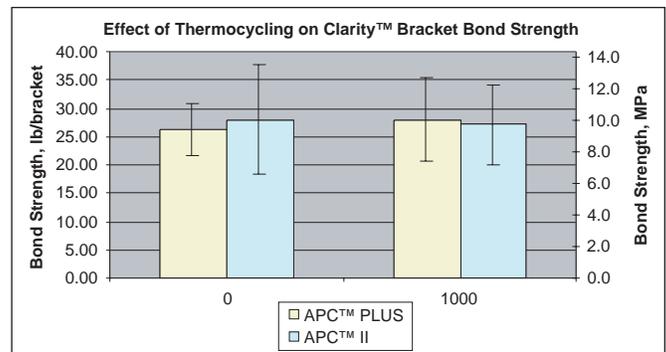


Figure 5: Comparison of bond strengths after thermocycling: APC™ PLUS vs. APC™ II Adhesives with Clarity™ Brackets after 1000 cycles. Storage in water.⁵

A secondary test to understand long-term bond strength is to store teeth at 37°C in water for extended periods of time. Clarity™ upper left central brackets (REF 6400-601), bonded with APC™ PLUS Adhesive show sustained high bond strength through a one-year period with both Transbond™ MIP Primer and Transbond™ Plus Self Etching Primer.

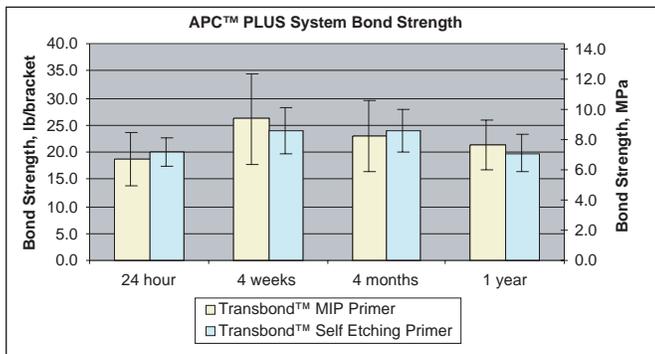


Figure 6: Sustained high bond strengths for APC™ PLUS Adhesive with Transbond™ Plus Self Etching Primer or Transbond™ MIP Primer with Clarity™ Brackets after 1 year storage at 37°C in water.⁵

Bond strength development studies were performed in the first few minutes after bondings, as this time period correlates to the time that archwire insertion would typically occur.

Clarity brackets, upper left laterals (REF 6400-651), were bonded to bovine teeth using APC PLUS adhesive and Transbond Plus Self Etching Primer with a 5 sec. exposure from the Ortholux™ LED Curing Light. Shear peel bond strength was tested at the following intervals post cure: 1, 5, 30 minutes and 24 hours. The 1, 5 and 30 minute samples were stored at room temperature in air and the 24 hour samples were stored at 37°C in water. As can be seen from the bond strength development curve in Figure 7 below, APC PLUS adhesive achieves higher bond strength earlier than APC II adhesive, likely due to the higher camphorquinone (CPQ) photoinitiator level in APC PLUS adhesive.

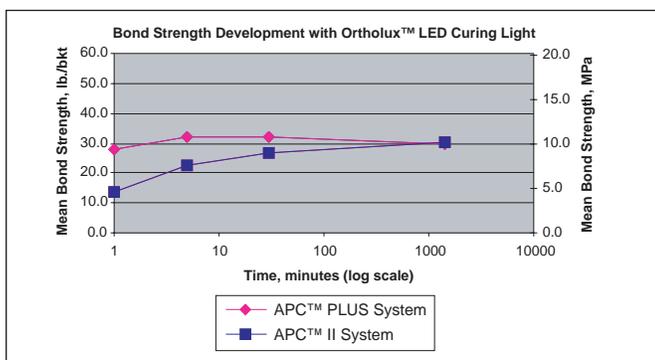


Figure 7: Comparison of bond strengths of APC™ PLUS and APC™ II adhesives for various time intervals following cure.⁵

Bracket Seating and Positioning

The APC PLUS adhesive has been formulated to provide a soft, pliable and tacky adhesive for excellent feel and easy seating and positioning. The specifications on softness of the adhesive and other handling properties were determined after various Simulated Operatory Evaluations, Focus Groups and Customer Trials.

Unique, Light-Blocking Package for Color Stability and Shelf Life

The APC PLUS System package consists of three parts: a blister, foam release liner and lidding material, shown in Figure 8. The APC PLUS system package is new and unique and was developed to be compatible with the adhesive chemistry and protect the color-changing adhesive from light. In addition to protecting the photoinitiator, camphorquinone, in the adhesive from light exposure, the package must also protect the extremely light-sensitive color-changing dye, which is a far more stringent requirement. UV/VIS spectra in Figure 9 indicate that the silver-color blister developed for APC PLUS brackets blocks light in the wavelength regions where both the dye and camphorquinone absorb. The photostability of the product was tested using a Suntest Accelerated Exposure Unit (Atlas Material Testing Technology) per ISO 4049. After 5-weeks of exposure at 8000-lux illuminance, the product retained the pink color of the adhesive, represented by a* in Figure 10. Thermal stability of the product was conducted at elevated temperatures. The color was retained well after 16 weeks at 60°C (Figure 11).



Figure 8: New, light-blocking blister package containing a Clarity™ Bracket with APC™ PLUS Adhesive, positioned on foam release liner.

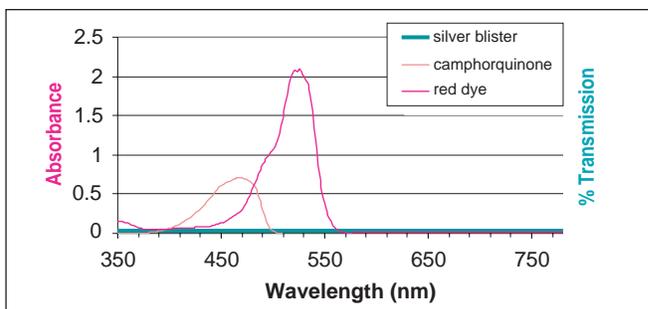


Figure 9: UV/VIS spectra of silver blister, camphorquinone and red dye.⁵

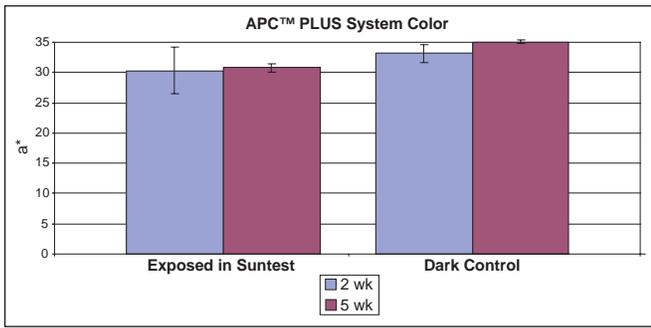


Figure 10: Photostability after Suntest exposure of product in sealed blister for 2 weeks or 5 weeks.⁵

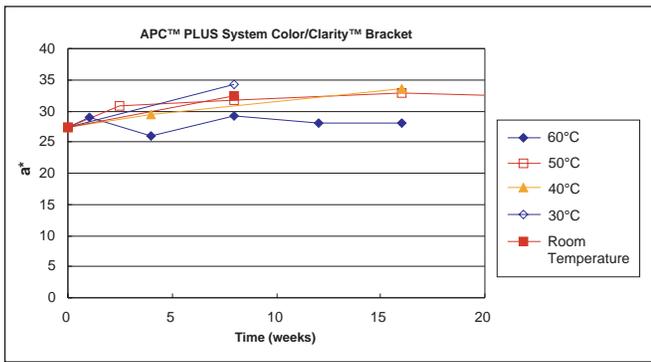


Figure 11: Color stability at elevated temperatures.⁵

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Patented Liner Technology

Each individual bracket is pre-oriented on a special foam liner. This patented liner² minimizes bracket rotation and bracket slip in transit. The low surface energy foam is made of a special, crosslinked polyolefin material.

The release surface of the foam has been uniquely prepared to provide optimal release and, at the same time, provides an anchoring effect of the adhesive coated bracket to the liner. It is this anchoring property that greatly minimizes and, in most cases, eliminates bracket movement during shipping.

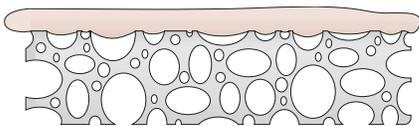


Figure 12: Adhesive flowing slightly into the porous foam surface, "anchoring" the bracket in place until ready for removal from package.

Gentle Liner Release Technique

Because the patented foam surface has been prepared for optimal release, only gentle upward force is required to remove the APC™ PLUS System Adhesive coated bracket from the liner. Do not snap or pull vigorously. Pull with minimal force in an upward motion until the bracket easily releases from the liner.

Transbond™ Plus Self Etching Primer

One of the opportunities for increasing efficiency in the bonding process involves elimination of steps. Transbond™ Plus Self Etching Primer³ contains a methacrylated phosphoric acid ester which provides simultaneous etching and priming, effectively combining these steps and thereby increasing efficiency.

The phosphate group on the ester provides the acidity to selectively dissolve calcium from the enamel. In turn, the calcium neutralizes the acidic primer (Figure 13). At the same time, the primer molecules permeate the enamel structure (Figure 14). Finally, light curing locks the primer into place (Figure 15). One of the advantages of this simultaneous etching and priming is that the primer penetrates to the entire depth of the etch, ensuring an excellent mechanical interlock. The addition of camphorquinone to the Transbond Plus Self Etching Primer offers the additional advantage of a pale yellow tint that allows the liquid to be seen more easily on the applicator. For a complete discussion of the mechanism and performance of Transbond Plus Self Etching Primer, see *Orthodontic Perspectives* Volume VII Number 1.

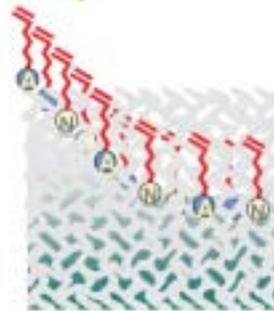


Figure 14: Primer molecules penetrate the enamel rods concurrent with etching.

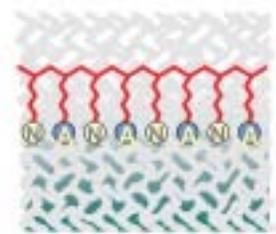


Figure 15: Following light cure, primer molecules are polymerized to form a network.

Ortholux™ LED Curing Light

Another opportunity for improving efficiency in the bonding process is in adhesive curing. Typical curing times with a standard halogen curing light are 10 seconds interproximally and 10 seconds for each ceramic bracket. Use of the Ortholux™ LED curing light reduces both of these times to 5 seconds (Figure 16). The Ortholux LED light uses one blue LED or Light Emitting Diode that emits in the 430-480 nm range at an intensity of 1000 mW/cm² (Figure 17). Consistent light output and effective performance throughout the power range of the internal rechargeable Nickel Metal Hydride Battery are assured via microprocessor-based circuitry. This light has been optimized specifically for orthodontic bonding and is quiet and cordless for convenience and contains a built in Light Meter for verifying light intensity. Bond strengths for the Ortholux LED light are comparable to those of standard halogen curing lights.

Comparative Cure Times in Seconds			
	(LED) Ortholux™ LED Curing Light	(Halogen) Ortholux™ XT Curing Light	(Plasma Arc) Quick Curing Light (Typical)
Metal Brackets (APC™ PLUS Adhesive Coated Appliance or Transbond™ XT Adhesive)	5 seconds mesial + 5 seconds distal	10 seconds mesial + 10 seconds distal	3 seconds mesial + 3 seconds distal
Ceramic Brackets (APC PLUS Adhesive Coated Appliance or Transbond XT Adhesive)	5 seconds through the bracket	10 seconds through the bracket	3 seconds through the bracket
Molar Bands (APC PLUS Adhesive Coated Appliance or Transbond XT Adhesive)	10 seconds mesial + 10 seconds occlusal	20 seconds mesial + 20 seconds occlusal	6 seconds mesial + 6 seconds occlusal
Molar Bands (Transbond™ Plus Light Cure Band Adhesive)	20 seconds (5 seconds per cusp)	30 seconds	16 seconds
Molar Bands (Unitek™ Multi-Cure Glass Ionomer Band Cement)	20 seconds (5 seconds per cusp)	40 seconds	16 seconds

Figure 16: Curing times for the Ortholux™ LED Curing Light, Ortholux™ XT Curing Light and a typical plasma arc curing light.⁵

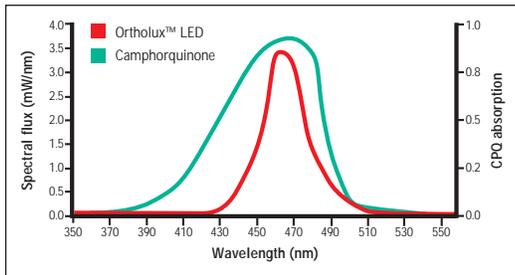


Figure 17: Ortholux™ LED Curing Light spectral flux vs. camphorquinone absorbance (3M ESPE).

Customer Preference Trial: Survey Results

A customer preference trial⁴ was conducted to gather information about the APC™ PLUS System in a clinical environment. In this study, key factors of interest included ease of flash clean up, usefulness of the color, and adhesive handling.

Both Clarity™ Brackets and Victory Series™ Brackets, as well as buccal tubes, were included in this study and sent out in separate evaluation kits. Each evaluator was asked to treat a minimum of 4 patients. APC PLUS system brackets were provided for one upper and one lower quadrant for each patient. APC™ II System brackets were provided for the other 2 quadrants of each patient as a control. Evaluators were asked to complete comprehensive surveys and return them immediately after bonding all patients. The responses of 17 evaluators to the APC PLUS adhesive are shown pictorially in Figure 18. Note that while every customer was given a survey, not every question was answered and not every survey was returned.

Every orthodontic evaluator found the color helpful for flash clean up and approximately 3 out of 4 evaluators found the amount of adhesive acceptable. Three out of 5 users found the pink color advantageous in positioning Clarity brackets.

The customer was also asked to rate the handling of the adhesive on a scale of 1-5. The results, shown in histogram format, are shown in Figure 19. The initial tack and consistency were centered at the preference of the majority of customers, and most customers found the adhesive coated appliance stable after placement and flash clean up easy.

The overall adhesive results can be summarized in Figure 20. This histogram reveals a bell-shaped curve resulting from customers having different preferences regarding adhesive consistency, and

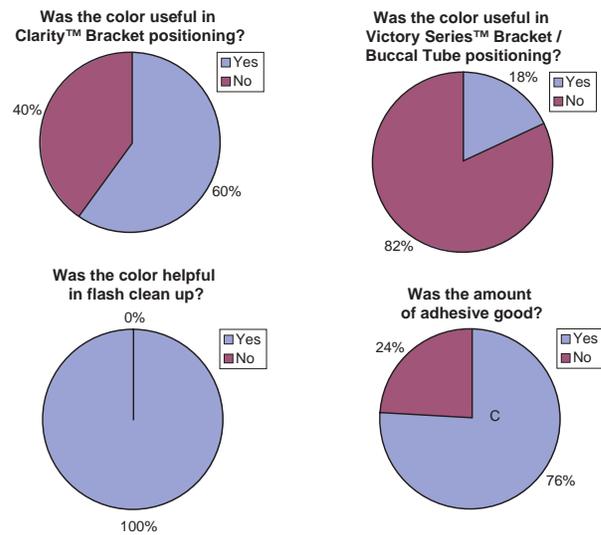


Figure 18: Survey results for APC™ PLUS System.

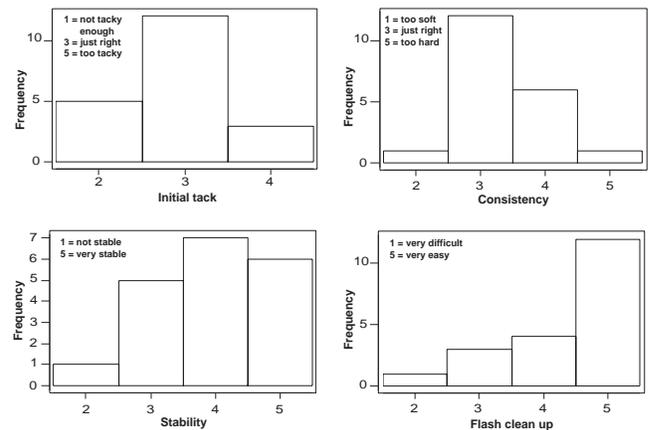


Figure 19: Survey results for APC™ PLUS adhesive handling.

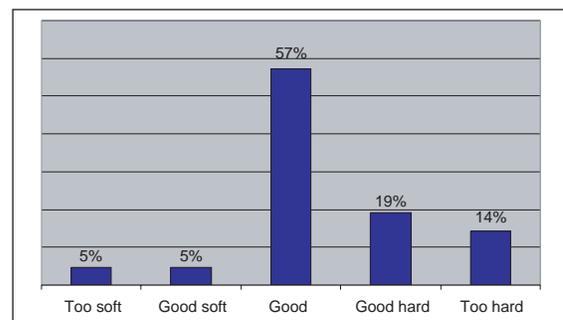


Figure 20: Histogram displaying customer satisfaction with APC™ PLUS Adhesive consistency.

that the consistency of the APC PLUS adhesive was centered at the preference of most customers. One full year after bonding, low overall bond failure rates (<4%) were noted for both APC II and APC PLUS appliances used in this study. ■

REFERENCES

- 1 Simulated operatory evaluation conducted May, 2001.
- 2 See *Orthodontic Perspectives* Vol. IX, No. 1, Winning Combinations, for a complete discussion of the patented foam release liner.
- 3 See *Orthodontic Perspectives* Vol. VII, No. 1, Focus on Bonding, for a complete discussion of the mechanism and performance of Transbond™ Plus Self Etching Primer.
- 4 APC™ PLUS System field evaluation conducted in the U.S. in August 2002.
- 5 3M Unitek internal testing results.

Time and Cost Savings By Using AlastiK™ Easy-to-Tie Ligatures



by Lee R. Logan, D.D.S., M.S. and Philip P. Soo, Ph.D., 3M Unitek



Lee R. Logan D.D.S., M.S.

Dr. Lee Logan is in the private practice of Orthodontics in Northridge, California. He has patented the "Curved Elastomeric Orthodontic Ligature", the design of which is used as the basis for the AlastiK™ Easy-To-Tie Ligature. A graduate of Northwestern University Dental School and Northwestern University Graduate School of Orthodontics, he is a diplomate of the American Board of Orthodontics and is past National President and Southern California Component President of the Edward H. Angle Society of Orthodontists.



Philip P. Soo, Ph.D.

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Since its introduction in February 2001, AlastiK™ Easy-To-Tie Ligatures have presented a popular alternative to conventional toroidal (i.e. donut-shaped) ligatures. Easy-To-Tie ligatures are designed with a 45° bend (Figure 1) to assist in tie-wing hook up, a feature that creates a convenient angle of approach for forceps and reduces the range of motion required for bracket ligation. These ligatures also have a D-shaped cross-section, resulting in an increased inner surface diameter compared with toroidal ligatures. As the inner diameter of the ligature increases, its overall flexibility is enhanced. These results have been reported previously¹.

Time is money to the orthodontic practitioner, and the aforementioned ergonomic benefits of AlastiK Easy-To-Tie ligatures would logically be thought to reduce chair time. But will they? What indeed is the accumulated cost savings in a typical assistant's salary? Often we neglect to consider some indirect but potentially significant costs such as rent, capital cost of equipment per hour, even parking validations. Here, the value of time (i.e. time and cost) associated with AlastiK Easy-To-Tie ligatures shall be rendered in a clinical study.

The analysis in this study is predicated purely on measured staff time savings and shall not include other potential benefits, such as improved patient comfort and reduced ligature breakage and slippage.



AlastiK™ Easy-To-Tie Ligature



Conventional Ligature

Figure 1: Comparison of ligature shapes.

Clinical Study

This study aims to obtain an objective and statistically significant measurement of ligation time associated with AlastiK Easy-To-Tie ligatures, benchmarked against conventional, donut-shaped A-1 AlastiK™ Modules.

Metal .018 MBT™ System twin brackets were used exclusively in this study. No ceramic or composite brackets were included. Both nickel-titanium and stainless steel archwires, however, were used and varied in size from .014 x .014 to .016 x .022. Four orthodontic assistants in Dr. Lee Logan's office in Northridge, CA participated in this study during May-June 2003. The assistants varied in orthodontic experience from 20 years to as little as 3 months.

AlastiK Easy-To-Tie ligatures and conventional A-1 AlastiK modules were placed on 73 consecutive patients using mosquito forceps. A stopwatch was used to measure the time required to tie-in archwires using AlastiK Easy-To-Tie modules on one half of each arch as well as the time required to tie-in the opposite half with A-1 AlastiK modules. Data was collected from a total of 125 upper quadrants and 111 lower quadrants. The ligation time per module was determined simply by dividing the measured time (per quadrant) by the number of brackets ligated in that quadrant.

To compensate for the bias of being right- or left-handed, the evaluators alternated between ligating AlastiK Easy-To-Tie ligatures on the left and right sides of the patients. Exactly the same number and color of ties were used for right and left sides of consecutive patients. To ensure a valid comparison, the number of brackets on one side of the mouth were matched to those on the opposite side of the mouth for all cases.

The mean times to tie AlastiK™ Easy-to-Tie Ligatures and A-1 AlastiK™ Modules are **9.1 seconds** (std dev 3.2 sec) and **11.9 seconds** (std dev 4.5 sec) per ligature, respectively. One-Way Analysis of Variance (ANOVA) was conducted on this data and the mean 95% confidence intervals for mean ligation time are displayed in Figure 2. This result indicates that, *for a given assistant*, there is a strong statistical difference between AlastiK Easy-To-Tie ligatures and A-1 AlastiK modules. This result is further validated by the associated P-value of 0.00, which is below 0.05 and indicates the difference is significant.

The data indicated that it occasionally took more than 20 seconds to tie a ligature. These data points were all included since there was no known reason to exclude them. The effect of the assistant is shown in Figure 3. Note that the variability associated with the assistant was considerably greater than that associated with ligature type, consistent with the wide range of assistant experience.

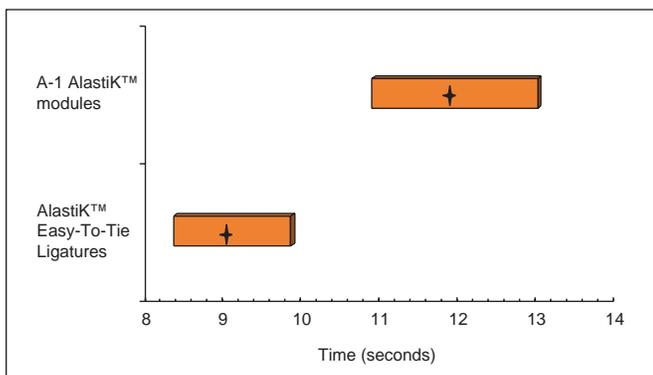


Figure 2: Individual 95% confidence intervals for mean ligation time (from One-Way ANOVA statistical analysis).³

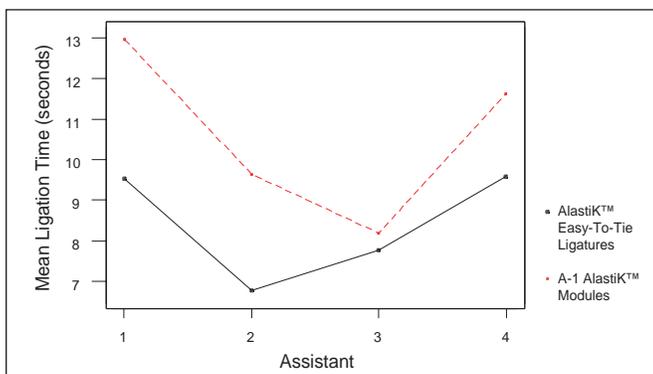


Figure 3: Mean ligation time for different orthodontic assistants.³



Time/Cost Analysis

With a time savings of approximately 2.8 seconds per ligature, it is possible to estimate the cumulative time saved during the course of a typical day in the orthodontic office. Shown in Table 1, the total savings in chair time/staff time ranges from about 20 minutes per day for a small practice to about an hour per day for a large practice. As shown in the chart, these numbers will vary somewhat based on the average number of ligature changes per appointment.

Patient visits per day	% of patients requiring ligature changes*		
	70%	80%	90%
25	17 min.	19 min.	21 min.
50	33 min.	37 min.	42 min.
75	49 min.	56 min.	63 min.

* assuming 20 ligature changes/patient

Table 1: Extrapolated daily time savings in chair time and staff time associated with using AlastiK™ Easy-To-Tie Ligatures vs. A-1 AlastiK™ modules.

There are different ways to consider the financials of reduced staff time. While practices will differ, let us consider a large practice that sees about 75 patients a day and typically changes ligatures on 80% of those patients. Suppose the typical orthodontic assistant is paid \$35,000–\$40,000 per year for working an average of 16 days per month². Assuming 8-hour working days, replacing A-1 modules with Easy-To-Tie ligatures would result in a staff time savings of 16 hours, or 2 days, for one assistant per month. For a large practice, this translates to an annual cost savings of approximately 2/16 x \$37,500, or \$4,690 a year.

Much higher numbers are realized if the additional hour of staff time is reinvested to see additional patients. Assuming one appointment can be completed in 20 minutes, Easy-To-Tie ligatures will allow a large practice to see approximately 3 additional patients per day. If each appointment is worth \$200 to the practitioner, this corresponds to an additional \$600 per day, or \$115,200 in income per year.

Acknowledgements

The authors gratefully thank Dr. Jerry Clark (Greensboro, N.C.), and Dr. Fredrik Bergstrand (3M Unitek), for their expertise in the financials of an orthodontic practice. Thanks also to Lori Brandt, Michele Hernandez, Angelica Loomis, and Kristy Wheat (office of Dr. Lee Logan) for conducting the experimental work in this study. ■

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• Orthodontic Practice Transitions: Some Important Information for Purchasers and Sellers

by Thomas F. Ziegler, D.D.S., M.S., J.D.



Thomas F. Ziegler, D.D.S., M.S., J.D.

Dr. Thomas Ziegler is a native of Cincinnati, Ohio. He received his B.A. degree from Miami University in Oxford, Ohio. He graduated Cum Laude from the Ohio State University College of Dentistry. He then served three years in the U.S. Army Dental Corp.

Dr. Ziegler is a noted orthodontist and attorney, and president of Ziegler Practice Transitions, Ltd., offering representation to Purchasers and Sellers in orthodontic practice transitions in the United States. Although the information presented is specific to the United States, it may be valuable for anyone considering buying or selling a practice. For more information, you may contact Ziegler Practice Transitions through their website www.ZieglerPracticeTransitions.com, by e-mail at Tom@ZieglerPracticeTransitions.com or by phone at (513) 271-0053.

Once a Purchaser (Junior) and Seller (Senior) determine they have found a match, a formal transition procedure begins and each party needs to decide if they want help in the proceedings. Modern practice transitions need not be adversarial, with the Purchaser and Seller each hiring an attorney and squaring off. Today, **dual-representation** is becoming common, helping to assure that a fair appraisal and agreement is reached for both sides. It is valuable to seek out a firm that can handle the aspects of the transition from beginning to end and that has experience dealing with orthodontic practice transitions.

The Appraisal

Obtaining an independent appraisal of the practice to establish its **Fair Market Value (FMV)** is important whenever an owner is considering offering a practice for sale. The Appraisal is based on complete photographs of the office and tax returns for the past three years, indicating gross collections and net receipts for the Seller. In addition, inventory lists for each category of the **Tangible Assets of the Practice** are made (*Dental Equipment, Office Furniture & Equipment, Dental Supplies & Instruments, Office Supplies and Accounts Receivable*).

A complete Census of Employees including their compensation and benefits is made. Details of Phase I and Phase II starts, Recall Files and Aging of Accounts are used. One important consideration is the total of "Contracts Receivable" in the practice (money to be billed for future work on patients currently under contract). All of this data will be considered to determine the FMV, and will be available for potential purchasers to review.

The most crucial determinant in establishing the purchase price is the amount of the Contracts Receivable being purchased. Seventy percent (70%) of the value of the purchase price should be represented by Contracts Receivable. Stated another way,

after running an Aging of Accounts to determine the total Contracts Receivable, divide that total by seventy percent (.7); the quotient should approximately equal the purchase price, but could vary slightly from the formal appraisal, as the Contracts Receivable are not the only consideration.

Tax Allocation

Once the FMV has been determined, attention needs to be focused on an equally important consideration – the tax allocation of the purchase price.

The Seller's goal is for the sale proceeds to be taxed at the Capital Gains Rate (15%) rather than the Ordinary Income Tax Rate (35%). The Purchaser's goal is to be able to pay for the practice with pre-tax dollars – to deduct expenses as paid. There is no single allocation that can satisfy these conflicting goals. Individual attorneys who represent individual Purchasers and Sellers will draw battle lines in this area.

We believe, contrarily, that purchasing and selling orthodontists can and should enter into cordial, non-confrontational negotiations through a moderator/counselor, in order to arrive at agreements that are fair to both parties. This method results in faster, easier and cheaper service to the orthodontic community.

Asset Sale vs. Stock Sale

An orthodontic practice is purchased one of two ways – totally or partially. Totally means, the Purchaser will be acquiring one-hundred percent (100%) of the practice all at once. This method is called an **Asset Sale**. A small fraction of the purchase price will be allocated to the actual practice assets – Dental Equipment, Office Equipment & Furniture, Dental Supplies, Office Supplies and Accounts Receivable (money due for work already completed and billed).

• Online Order Management

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Order management is a critical function in an orthodontic practice, requiring an efficient process of tabulating, transmitting and tracking of order needs to ensure ideal inventory levels. The new interactive feature to www.3MUnitek.com leverages the strengths of convenience and timely information offered by the Internet, providing a central location to handle real-time order activity tasks in an organized manner. A practice may now log in to their secure, encrypted account and access personalized information about specific order details. This online solution offers assistance to an office at every stage of order management, from placing an order to tracking it to submitting payment. A review of the main features demonstrates how this new enhancement can be a valuable addition to an office's order management process.

One of the most convenient order options is the ability to create and save customized Order Favorites lists. These lists can serve as a central location to store items that are regularly ordered, reducing the effort required to assemble part numbers and product names to place an order. As products are added to an Order Favorites list, they are automatically grouped into product categories to make the list more manageable, and it is possible to store order quantities as well. To place an order from Order Favorites, simply select a list, review and modify the items and quantities to order if necessary, and then add the list to your Shopping Cart to submit the order to 3M Unitek. The lists can be assigned any name, and there is no limit to the number of lists, so there are a number of ways they can be helpful to an office. By keeping the most frequently ordered items together in one list, an entire order can be sent for inventory replenishment without needing to assemble the list of items first.

There are a number of other ways to place an order, each one designed to meet different order management needs. There is a Quick Order form that allows the simple entry of part numbers and quantities for orders where that information is already known. In the same way, Band Order Forms provide the ability to enter in only the quantities needed on a grid of band sizes to assist in order entry. The eCatalog allows browsing for products by category, and products can be ordered straight from any page. It is even possible to order from past purchases made by the practice: selecting items from past invoices ensures that the same products are reordered. The different ordering methods offer a flexibility to adhere to different order placing processes in any practice.

After orders have been placed, the online account is a useful means of tracking any order. Delivery service tracking numbers are attached to the electronic records of the orders shipped, and by clicking on the tracking number the shipping and receiving information is immediately available. For record keeping, an



The home page is designed to allow easy access to information and ordering options.

order confirmation page is created when an order is made, and an email confirmation is sent to the designated address, so there is a tangible record of the order number, date, and items. All orders can be viewed online, including the products that are included on the order. In similar fashion, it is possible to view a list of all 3M Unitek items from all unshipped orders for a quick view of the products not yet received. Even after the shipment is received, the invoice record is available online for review if needed. The combination of these tracking features allows order visibility that is available whenever convenient.

There is similar visibility available to assist in the management of invoices. The online statement is consistently current, adding new invoices and applying payments nightly. Therefore, the financial summary is always as current as possible. The original invoice amount as well as the balance remaining is listed with each invoice, and it is also possible to view past payments and where they were applied. If there is any question about the details of a particular invoice listed on the statement screen, click on the invoice number to see the specific information related to that shipment. Once the necessary information is reviewed, invoices may also be paid online. A credit card number may be kept on file at 3M Unitek so that it is not necessary to enter the card number at the time of payment, reducing steps and adding convenience.

Office-specific information available on demand and numerous options to assist in order management make 3MUnitek.com a valuable addition to the order management process. To gain access to their online account, any practice can contact their

• *Orthodontic Practice Transitions: Some Important Information for Purchasers and Sellers*

by Thomas F. Ziegler, D.D.S., M.S., J.D. *continued from page 13*

The majority of the purchase price must be allocated to “something else” on IRS form 8594, to be attached to both the Purchaser’s and the Seller’s 1040 in the year of sale. We believe the “something else” should provide for equal tax benefit for the Purchaser and the Seller. Therefore, fifty percent (50%) is allocated to the **Personal Goodwill** of the Seller (15% tax to the Seller – must be amortized over 15 years by the Purchaser) and fifty percent (50%) is allocated to a **Consulting Agreement** (deductible as paid by the Purchaser – 35% tax to the Seller).

In the case of a partial sale (**Stock Sale**), the situation becomes more complicated. First of all, in the case of an incorporated practice, stock must be sold in two stages – 50% for the Buy-in (when Junior’s associateship ends) and 50% for the Buy-out (when Senior stops practicing full time). The value assigned to Stock is generally equal to the value of the practice’s tangible assets being purchased. Fortunately, that is a relatively small amount of the purchase price because that amount can not be deducted as paid by the Purchaser (must be purchased with after tax dollars).

A suggestion is that the balance (“something else”) be equalized regarding tax effects on the Purchaser and the Seller. For the Buy-in of the first fifty percent (1st 50%), this is accomplished through **Compensation Differential** between the Junior and Senior shareholders. For the Buy-out for the second fifty percent (2nd 50%), this is accomplished by categorizing all payments to the Seller, that are not for Stock, as payment for Seller’s **Personal Goodwill and Covenant Not to Compete**.

The Agreements

Once the Formal Appraisal is completed, drafts of the **Associate Employment Agreement** and terms of the **Purchase & Sale Agreement** are prepared for review by each party. The Purchase & Sale Agreement sets forth the sales price, tax allocation of the elements of the purchase price and the manner of payment. The Purchase & Sale Agreement is signed contemporaneously with the Associate Employment Agreement *before* Junior joins the practice.

It is very important that Junior not begin work as an associate without an accompanying Purchase & Sale Agreement in place. If Junior were to actually start working in the practice without the “roadmap” in place as to how and when ownership would be transferred, the risk would increase exponentially that the association will end in failure.

It would be far better to negotiate before moving to a new town and starting a practice. If the association is not going to work, it is better to know before hand. Even though the Purchaser and the Seller are not totally sure that they’ll want to continue with the Purchase & Sale, an agreement must be signed. Within the agreement, articulated reasons for either the Purchaser or Seller electing not to proceed and penalties for so doing can be spelled out. ■

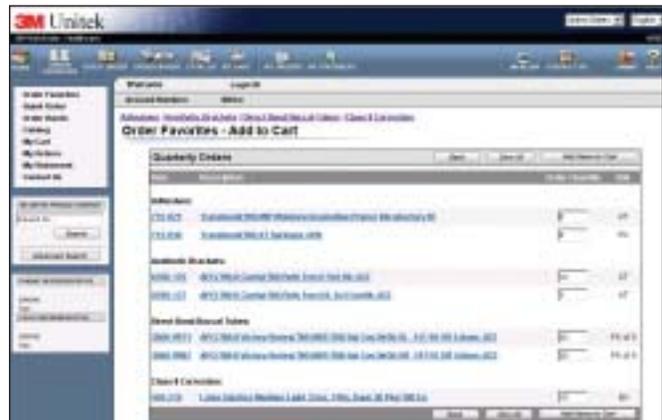
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• *Online Order Management www.3MUnitek.com*

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local 3M Unitek representative. A User ID and Password will be sent to the email address provided, and the representative can assist in getting started. Once these additional options are available to an office, the convenience and flexibility they provide will allow instant access to information needed relative to orders and invoices. It is a part of the continued 3M Unitek commitment to provide solutions that assist the orthodontic office, working in partnership with a goal toward efficiency in every aspect of the practice. ■



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