

# Lab Perspectives™

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# Editor's LETTER

3-D printing is here. And it's only getting bigger.

To see the popularity of 3-D printing grow in such an explosive manner is very exciting, as it truly has the capability to change not only the world of manufacturing, but also the world in its entirety. Already, batteries, shoes, even clothing are being printed, and businesses like those innovating medical devices are wild with excitement at the endless possibilities.

But beyond large-scale industrial applications, we are also seeing the tendency toward putting printers into private homes, and providers of small-scale 3-D-printing services for the consumer are popping up nearly everywhere. It might start as a hobby; but for all those with a drop of inventor blood circulating through their veins, the lack of knowledge on how to go about realizing a great idea, or the high costs associated with pursuing that idea, are no longer a barrier. Suddenly, all those ideas have a chance to become reality. The blockades to becoming an inventor, or sharing creativity, have fallen. Three-dimensional plastic printing is the new thing to do.

What does this mean for the dental laboratory? Small, manageable printers will take the place of wax technicians. Waxing will be a combination of software doing the designing and 3-D printers doing the manufacturing. The horror of re-waxing a restoration will become a painless service.

Quality fluctuations and oft-criticized inconsistencies in occlusal anatomy or tissue design will become a thing of the past as the CAD library is dialed in to customer tastes. More additive systems will enter the market and take over preexisting ones. New materials will accompany these changes, and better material properties will open doors to even more possibilities. The crown, the bridge, the partial, the full denture: All are subject to this change.

Personally, I am looking forward to, and welcome, this change. That a handful of fashion designers can decide what is available to the market one day and unavailable the next, simply because they deem it 'out of fashion,' has never sat well with me. For many industries, 3-D printing should help put that type of market control back in our hands. I am excited to see the realization of new designs, and much-needed improvements to old; to enjoy breathtaking innovations that ease everyday life; to be able to accomplish any special task that, today, remains too expensive to complete; and all that in the blink of an eye.

I am ready for it.



*Mit freundlichen Grüßen* (With kind regards),

A handwritten signature in gold ink that reads "Friebauer" in a cursive script, followed by a horizontal line.

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Robin Bartolo graduated with honors from Southern Illinois University at Carbondale in 1984. With a bachelor's degree in technical careers, he joined the dental laboratory industry at Vident, Inc., followed by a five-year stint as international sales manager at Kerr Dental Laboratory Products, a division of Sybron Dental Specialties. In 2009, after three

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Ryan Fau Fau entered the dental field at the University of Iowa, where he facilitated the Dows Institute for Dental Research in developing leading products that are still currently on the market. Prior to joining Custom Milling Center, he worked in Georgia for both Microstar Dental and VIV-IDX Lab, where he gained a unique and powerful perspective on the CAD/CAM

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Darius Raudys began his career at Glidewell Laboratories in 2010 as a piecework technician and since has assumed various lead positions. He has made significant contributions toward establishing the Inclusive® Tooth Replacement System subdepartment. Darius graduated from Huntington College of Dental Technology in Westminster, California, and, in 2012, completed the "Implants A to Z" course at UCLA School of Dentistry. He currently oversees the Fixed division of the Implant department. Contact him at [labperspectives@glidewelldental.com](mailto:labperspectives@glidewelldental.com).

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3sha



# STEP-BY-STEP

# Fabrication of the

# BRUXZIR® FULL-ARCH

## Implant Prosthesis

*The sequential workflow that follows outlines the process of designing and manufacturing the BruxZir® Solid Zirconia Full-Arch Implant Prosthesis, providing a step-by-step restorative protocol from the lab's perspective. The fabrication process combines CAD/CAM technology and traditional laboratory techniques to produce a durable, esthetic and well-fitting prosthesis.*



article by

*D*arius Raudys and  
Angela Rusu

**Darius Raudys** oversees the Fixed division of Glidewell Laboratories' Implant department, and is a material contributor to the company's Inclusive® Tooth Replacement System strategy. **Angela Rusu** is the general manager of the Removables department at Glidewell Laboratories, where she oversees the growing field of implant-retained prosthetics.

### 1. Working Model and Bite Block

After the doctor takes and submits the preliminary impression to the lab, the case is evaluated and the working model is fabricated. First, implant analogs are attached to the impression copings, and silicone-based soft-tissue material is injected into the impression tray and allowed to dry for five minutes (Figs. 1a, 1b). This provides precise reproduction of the gingival contours around the margins of the copings. Plaster is then poured into the tray, allowed to set, and trimmed. The impression copings are detached from the analogs, and the preliminary working model with soft tissue in place is complete.



1a



1b

**Figures 1a, 1b:** After attaching implant analogs to the impression copings, silicone-based material is injected into the impression, forming the soft-tissue model.

Next, the bite block is fabricated. Non-engaging titanium cylinders housing prosthetic screws are attached to each implant analog in the working model to ensure that there is no movement when the bite block is fabricated as well as when the jaw relations are recorded by the doctor. Separator is applied to the model to prevent wax from adhering. Light-cure base-plate material is molded over and around the cylinders and pressed down over the working model, ensuring that no material obstructs the cylinder holes. The base plate is then trimmed along the facial and lingual walls that overlap the alveolar ridge. After light-curing the base plate on the working model, the titanium cylinders are unscrewed, and the base plate is removed from the model and inverted to complete the curing process.

The now hardened facial and lingual flanges are reduced so they are scalloped and short and do not extend over the ridge. The titanium cylinders, which remain attached to the trimmed base plate, are screwed back into the working model and cut down to within a few millimeters of the base plate. Pins are placed inside the shortened cylinders to prevent wax from flowing into the holes, allowing continued access through the cylinders to the underlying screws. Next, wax bite rims are curved to align with the alveolar ridge, placed over the pins, pressed down and formed over the base plate. With a hot wax iron, the wax rim is attached to the base plate and shaped, and is then smoothed with a butane torch to form a solid, uniform bite block. The occlusal height of the bite block from the base of the vestibule should measure approximately 18 millimeters, and is trimmed accordingly (Fig. 2).

To facilitate jaw function, the bilateral posterior ends of the bite block are cut at 45-degree angles in an anterior-posterior direction. Access holes are created where the pins served as guides through the wax to the underlying screws. After unscrewing it from the model, the bite block is trimmed and shaped as needed to form a smooth surface. It is then resealed on the model, and bilateral V-notches, or retention grooves, are carved into the posterior



**Figure 2:** The distance between the vestibule of the bite block and the top of the bite block should be about 18 millimeters.



**Figure 3:** V-notches are carved into each posterior end of the bite block.

occlusal surfaces (Fig. 3). These notches are added for the purpose of retaining impression material from the opposing arch in order to provide accuracy in recording the patient's bite. The bite block is then ready to be sent to the doctor.

## 2. Wax Setup, Implant Verification Jig and Bite Block

After the doctor takes the jaw relation records, bite registration, and impressions of the opposing dentition and current denture, the definitive restorative option is determined by the lab. The bite block is secured to the working model and mounted on the articulator, and the case is evaluated for possible implant trajectory issues. Multi-unit abutments may be required to correct implant angulation, accommodate screw access holes that are angled too far to the facial, or connect the prosthesis to implants that are positioned more than two millimeters subgingival. Also, at least 10 millimeters of vertical clearance is required for the BruxZir Solid Zirconia Full-Arch Implant Prosthesis. If the implant angulation and vertical clearance are acceptable, the process continues with the fabrication of the implant

verification jig, custom tray and denture setup in wax.

The denture setup is used as a preliminary wax try-in for the patient and doctor to assess the function and esthetics of what will ultimately become the final prosthesis, so meticulous care must be taken to achieve an accurate prototype. After verification of tooth color and size, the process of adding teeth to the facial surface of the bite block begins at the central incisors and proceeds posteriorly. The teeth are set in wax based upon generally accepted denture setup guidelines. During this process, protrusive and lateral excursive movements are repeatedly assessed to confirm appropriate tooth position and occlusion.

As the individual teeth are positioned on the bite rim, holes may need to be drilled in one or more of the teeth to create access to an underlying implant in the event that the placement of a tooth obscures its position.

The gingival margins are clearly defined and any depressions in the facial and lingual walls are evened out. The facial and lingual walls are carved out along the ridge to reduce the overall thickness of the

appliance. The surface of the appliance is then brushed and cleaned on a polishing lathe. The final festooning of the teeth proceeds, as the gingival anatomy is more intricately outlined along the facial and lingual margins (Fig. 4). Finally, the appliance is placed back onto the articulator and its occlusal relationship to the opposing arch is verified (Fig. 5).

Next, the lab proceeds with the fabrication of the implant verification jig, which will be used to ensure a passive fit of the final prosthesis. Temporary titanium cylinders and guide pins are selected. Separator is brushed onto the soft-tissue model (Fig. 6). The titanium cylinders are screwed into the implant analogs or, in cases where they are required, the multi-unit abutments. Light-cure material is rolled out in a thin band, wrapped around the cylinders and pressed together, ensuring that it does not rest on the soft-tissue model, where it would prevent impression material from flowing under the jig and around each cylinder. The implant verification jig is light-cured and remains in place on the model during the next step: fabrication of the custom tray (Fig. 7).



**Figure 4:** The wax is festooned around the gingival margins to simulate the contours of natural soft tissue.



**Figure 5:** The wax setup is mounted on the articulator to verify proper occlusion.



**Figure 6:** Separator is applied to prevent light-cure material from adhering to the model.

“ The denture setup is used as a preliminary wax try-in for the patient and doctor to assess the function and esthetics of what will ultimately become the final prosthesis. ”



**Figure 7:** The implant verification jig is inspected after the temporary cylinders are light-cured together.

The process for creating a custom tray begins with forming warm soft wax over the implant verification jig and onto the model. Additional wax is added to remove any undercuts, and petroleum jelly is applied to the model to facilitate easy removal of the custom tray. The custom tray is light-cured, and while the wax is still warm, the tray is removed from the model, inverted and cured again. Holes are opened in the tray at the position of each titanium cylinder of the verification jig. The edges of the custom tray are trimmed, and its fit over the model is verified (Fig. 8). The implant verification jig is then sectioned and numbered, and forwarded to the doctor along with the custom tray and the wax setup (Figs. 9a, 9b). If the decision was made to utilize multi-unit abutments, they will also be delivered to the doctor at this time.



**Figure 8:** After opening access holes for the titanium cylinders and trimming the edges of the wax, the fit of the custom tray is verified over the model.

### 3. Master Model and Provisional CAD/CAM Implant Prosthesis

Once the wax setup has been approved and the final impression containing the implant verification jig has been taken, the master cast is poured and the provisional CAD/CAM implant prosthesis is fabricated. First, the lab pours the master model as a guide to confirm that the definitive prosthesis is accurately aligned with the implants. The wax setup is then attached to the model and mounted on the articulator. An index putty matrix is fabricated, which will later be used to verify that the tooth positioning and incisal edges of the approved wax setup are replicated in the final prosthesis.

Next, a series of scans is taken to produce an accurate digital depiction of the model and approved setup. Scans are taken of the approved wax setup on the model, the model with scanning abutments in place, and the model with soft tissue only (Fig. 10). Then, the wax setup is scanned alone. The CAD/CAM dental software program 3Shape DentalDesigner™ (3Shape Inc.; Warren, N.J.) automatically aligns the scanning abutments with the soft-tissue model and provides an accurate, distortion-free representation of the prosthesis and master model, including the position and angulation of the implants (Figs. 11a, 11b).



**Figures 9a, 9b:** The implant verification jig is sectioned and numbered on the model before being sent to the doctor for the final impression.

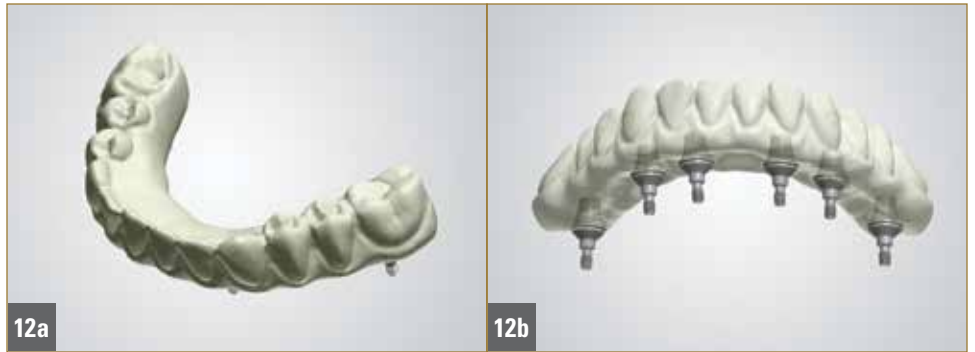


**Figure 10:** The approved wax setup is scanned.



**Figures 11a, 11b:** A series of scans is taken to generate a digital wax-up of the case.

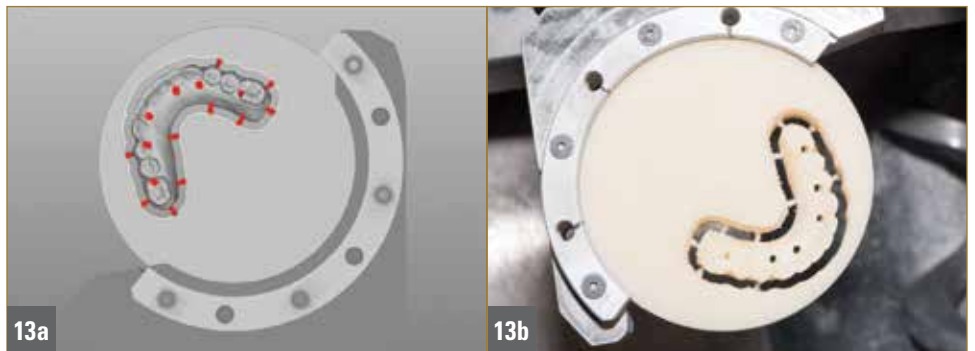
From this information, a provisional implant prosthesis, which allows the patient to evaluate the proposed restoration prior to fabrication of the final prosthesis, is digitally designed (Figs. 12a, 12b). Then, the provisional is milled from poly(methyl methacrylate) (PMMA), a biocompatible material that is easily adjusted to fine-tune occlusion (Figs. 13a, 13b). The milled provisional denture replicates the approved wax setup, and is stained to function as a lifelike temporary restoration during the trial period (Figs. 14a–14c).



**Figures 12a, 12b:** CAD software is used to design the provisional implant prosthesis, which allows the patient a trial period to evaluate the definitive restorative design.

#### 4. The Final Prosthesis

After completion of the trial period and patient approval of the restorative design, the BruxZir Full-Arch Implant Prosthesis is ready for fabrication. If any significant adjustments are required, the provisional implant prosthesis is returned to the lab so a new series of scans can be taken and the definitive design can be updated, ensuring a precise and accurate fit of the final restoration. Following milling, the full-arch prosthesis is removed from the milling blank and excess material is removed (Figs. 15a, 15b). The support structure is kept intact so the milled appliance can sit upright during the sintering process.



**Figures 13a, 13b:** The provisional is digitally readied for milling and must be removed from the block of PMMA following fabrication.



14a



14b



14c

**Figures 14a–14c:** The facial surface of the provisional implant prosthesis is stained to serve as a natural-looking restoration during the trial period.



15a



15b

**Figures 15a, 15b:** Following milling, the prosthesis is removed from the BruxZir™ blank (Glidewell Laboratories; Newport Beach, Calif.), with the support structure left in place so the appliance can remain upright during sintering.

Preliminary staining of the prosthesis begins, and three unique stains are applied to pattern the incisal edges of the dentition and the soft tissue. Before applying stain, a red pencil is used to define the gingival margins on both the facial and lingual surfaces.

The stained and milled prosthesis is then ready for sintering. It is placed upright on its support structure in the sinter box and fully covered with an alumina sinter cover. After sintering, the full-arch prosthesis is removed from the support structure. The prosthesis is then sandblasted in preparation for final staining (Fig. 16). The final staining process achieves natural-looking esthetics for the tooth and soft-tissue surfaces of the final prosthesis (Fig. 17).

Next, the titanium abutments that connect the prosthesis to the implants are sandblasted. After applying an alloy primer to the abutments, they are cemented into the prosthesis (Fig. 18). After removing any excess cement, the prosthesis is placed on the master model, and a curing light is applied to the abutment bases (Fig. 19). The model with the full-arch prosthesis is placed into a light-curing machine. After the light-curing is complete, the final BruxZir Solid Zirconia Full-Arch Implant Prosthesis is ready for delivery (Figs. 20a, 20b).

“The final staining process achieves natural-looking esthetics for the tooth and soft-tissue surfaces of the final prosthesis.”



**Figure 16:** After preliminary staining and sintering are complete, the final prosthesis is sandblasted in preparation for final staining.



**Figure 17:** Final stains are applied to the gingival and tooth surfaces of the prosthesis.



**Figure 18:** After being sandblasted and coated with an alloy primer, the titanium abutments are cemented into the prosthesis.



**Figure 19:** The prosthesis is attached to the model prior to light-curing the abutment bases.

After the doctor receives the prosthesis and delivers the final restoration, the lab fabricates an occlusal splint. The bite splint offers added protection to the appliance itself and relieves undue stress on the temporomandibular joint.

### Conclusion

With the production of the BruxZir Solid Zirconia Full-Arch Implant Prosthesis, the lab has played a leading role in the application of digital technology to restorative dentistry and the concomitant role of implants. Ultimately, it is the patient who benefits from the precision of the design and fabrication process by receiving a durable, well-fitting and esthetic restoration. **LP**



**Figures 20a, 20b:** After light-curing is complete, the final prosthesis is checked for proper occlusion and contacts, and is then ready for delivery.

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# Marketing MATTERS



## My Experience as an Authorized BruxZir™ Laboratory

An Interview with Matt Winstead, CDT, Vice President of Oral Arts Dental Laboratory in Huntsville, Alabama

by Jim Shuck, Vice President, Sales & Marketing, Glidewell Laboratories



interview of

Matt Winstead

**Matt Winstead, CDT**, is vice president of Oral Arts Dental Laboratory, a full-service laboratory headquartered in Huntsville, Alabama. Since its founding in 1970, Oral Arts has grown to be an industry leader by delivering a high level of quality with every restoration. Matt took time out of his busy production schedule to share his views on the current dental climate, as well as how joining the Authorized BruxZir™ Laboratory program and the Authorized Comfort H/S™ Bite Splint Laboratory program have benefited his company.

### Could you provide a little background on Oral Arts Dental Laboratories and your locations?

Oral Arts Dental Laboratories was founded by my father, Thomas Winstead, in 1970. He started with one employee in Huntsville, Alabama. Including that lab, we now have three locations, the other two being in Mobile, Alabama, and Knoxville, Tennessee. Today we employ 265 employees companywide, with 240 in the Huntsville location. My father is semiretired now, only working about one week per month. My sister and I have taken on the day-to-day leadership of the company.

### What is your position there?

My position is vice president.

### For the 265 employees, why would you say Oral Arts is such a great place to work?

I think it's a great place to work because it's family-owned, and





we do our very best to take care of the customers and the employees. We are exceptionally quality-oriented, and we're involved in community outreach, donating dental care as well as supporting free dental clinics in the area. We are heavily focused on employee training, education and leadership to develop the future generation of technicians and leaders. I think the employees like to know that they work for a place that cares about advancing their careers in dental technology.

**Can you tell us a little bit about how your laboratory growth is going this year?**

2014 has been a great year so far. The sales numbers definitely took a hit due to the snowstorms in February, but outside of that, things are going extremely well. We're continuing to get new accounts as well as retaining existing accounts. BruxZir® Solid Zirconia has helped us do that, of course. It's a consistent and easy product to make without the need for remakes or repairs. I'm very thankful for the growth that we have experienced.

**Can you talk a little bit about the business model of Oral Arts, maybe to give the readers a bit of insight into your company?**

Oral Arts is a full-service commercial laboratory that works with doctors across the nation, with a large portion of our business concentrating on the southeastern United States: 50 percent of our

work is local pickup, and 50 percent is via nationwide carriers. Our product offerings fit within the following categories: orthodontics, fixed and removable implants, and fixed and removable prosthodontics. We focus on providing a high-quality product with a reliable turnaround time of five days or less at a reasonable price.

**Is your mail-order business a fairly recent direction for you?**

My father actually made the decision to service doctors outside his local area back in the early 1980s. He did this to mitigate any local economic downturns or local competition pressures. Today we continue to expand both our mail-order and route volumes.

**And you're getting customers from all over the country?**

Yes, we are.

**What do you believe are some of the key factors to your success at Oral Arts?**

Wow, that's a big question! First, we have very good technicians. I would say we have the best technicians in Alabama, if not the Southeast. Many have been with us for a very long time; some are 25- to 30-year employees. Our employees are the key, and that's really what it boils down to. The management team and I are very focused on cultivating a new generation of technicians, because



we recognize that they are the future of our business. We are very focused on identifying high-level talent and developing our people from the ground up. Another key factor is that we are relentless when it comes to focusing on quality and speed. We talk about quality and turnaround time constantly. We cannot win based on price; we don't even try. We will win on our quality and service.

**CAD/CAM is affecting everyone. What type of impact is it having on your laboratory?**

We are completely automated now in our crown & bridge fabrication, from our PFMs, temps and wax-ups, to our metal-free restorations. We do very little hand waxing or layering of porcelain anymore. Mostly everything in our fixed department is now done using 3Shape DentalDesigner™ (3Shape; Warren, N.J.).

**That's amazing. What percentage of your business is fixed and what percentage is removable?**

It's about 70/30 fixed-to-removable.

**Is your Implant department a growing segment of your business?**

Oh yes! Last month and the month before that, we did more custom abutments than we have ever done. So it was a record month for custom abutments. We are seeing more and more titanium implant bars as well.

**That leads me to my next question: You and your management team made a decision along the way to become an Authorized BruxZir™ Laboratory. What was your reasoning behind that, knowing in a way you were partnering with a competitor?**

There are a lot of different reasons. One is that I knew Glidewell Laboratories would build the brand awareness behind the product, so I wouldn't have to spend as much money to generate that

awareness if I rode on your coattails. Another reason was that you were really the first at bat, and all the other vendors were playing catch-up after you launched BruxZir Solid Zirconia. They were kind of scrambling and thinking, "What are we going to do?" and trying to release their own product that probably wasn't ready yet. Even to this day, we have vendors constantly trying to take our zirconia units away from Glidewell. I entertain the idea every time I look at the product and consider if adding another full-contour zirconia would be a wise decision. So far there has not been a noticeable difference, and in most cases, the alternative looks worse. The price is hardly any different either; so to me, it's a no-brainer to stay with the BruxZir brand.

Also, when you look at the R&D at Glidewell Laboratories versus the R&D at a different materials provider, your environment is drastically different. With other vendors, we're usually buying materials that have been launched, but don't always work as well as the companies may claim, which often is a result of the environment they come from. Many products are being developed in a small R&D test lab, whereas Glidewell is producing 50,000–60,000 units per week. There's no question that Glidewell's product has been thoroughly tested before we ever begin to use it, and that gives me a lot of assurance.

**That's great! In your opinion, do you think the marketing of the Authorized Laboratory program has helped the brand image?**

It has. I think when doctors see the list of labs, it establishes brand credibility in their minds. I think the couponing program has also been successful to drive accounts to BruxZir restorations, regardless of what lab they use. There is no one else that can come close to building the level of brand awareness that Glidewell has for BruxZir Solid Zirconia. It's just not going to happen. Thankfully, we were an early adopter. I think we were one of the first labs that took BruxZir Solid Zirconia on. As they say, the early bird gets the worm. So I think that was a big factor in how successful we were with the product.



**Speaking of full-contour zirconia, what percentage of your business today is PFM compared to full-contour zirconia?**

BruxZir zirconia is 46 percent of all our fixed restorations while PFM is 21 percent of all fixed restorations.

**And what about IPS e.max® (Ivoclar Vivadent; Amherst, N.Y.), in proportion to BruxZir zirconia?**

The split is 21 percent e.max to 79 percent BruxZir Solid Zirconia.

**You also made a decision at Oral Arts to become an Inclusive® Certified Lab, and member of the Authorized Comfort H/S™ Bite Splint Lab program. Have those worked well for you?**

The Comfort H/S™ Hard Soft Bite Splint has been a huge success. I love that product! It is so easy to make. We've put a lot of money into marketing it, and it has given us a lot of dividends. I'm not sure why Inclusive hasn't done the same. Maybe we can explore that later.

**I think, in part, it's a lot smaller. For some dentists we have talked to, it's kind of a new frontier, and they're like, "I'm not used to talking about custom abutments. My lab guy does that. You guys decide that."**

Right. What I see is that doctors don't really ask for implants by brand. They just put, "custom abutment." But to dentists, a Comfort H/S is a Comfort H/S. That's what it is, and you have to ask for that by name.

**I think you're right on track there. With the growth that you've got going, even this year in a down economy, have you had to constantly be looking for new employees? Do you have**

**any techniques that you use there? I've heard that you use a service to do the hiring.**

We actually use a recruiting firm to hire our entry-level employees. We do a 90-day temp-to-hire. Over that period, we put a lot of eyes on those new employees because we know that new employees really show what they're made of in the first 90 days. We do a lot of pre-employment screening of each candidate; we don't just hire anybody. When potential employees are with us, we do a battery of tests that indicate their ability.

**That's a lot. Do you do any special tests in your laboratory to evaluate candidates for CAD/CAM? Or will you train them if they pass the previously mentioned tests?**

We don't test them any differently; however, we have found that some employees naturally gravitate more toward working with a computer vs. working with materials and their hands or vice versa. I think it really boils down to knowing the individuals and not trying to force them into something they don't really want to do.

**If individuals want to find out more about your company, or if they're thinking about employment there, where should they go?**

They can do it all online. Our website is [www.oralartsdental.com](http://www.oralartsdental.com). If they're interested in applying, they're able to fill out an application there as well.

**When did you start doing full-page journal advertising? Was that fairly recent?**

Probably six years ago.



**For some companies, journal advertising is tough. In some cases, they're unable to represent their work to its fullest potential through an image, so they have a hard time selling themselves as a necessary part of the workflow. You can't necessarily judge the results of a lab just by the quality of its ads. You are one of only a handful of labs in the United States that do journal advertising on a routine basis.**

I think marketing effectiveness is a synergy of marketing methods. I feel the best results are gained when you combine all marketing methods into an organized campaign and don't focus on doing just one thing all the time.

**Matt, I sure appreciate you taking the time to sit down and talk with us about the necessity of marketing and the changing dental climate.**

I believe that what Glidewell Laboratories has accomplished and what Jim Glidewell has done will never be done again by another dental lab. There are not that many companies that have a standing within their industry like Glidewell has in the dental lab business. Your willingness to share information is unheard of, and it's something that I really have been thankful for and have certainly appreciated.

**Well thank you. It's awesome to have people like you associated with our company. Beyond that, it's nice to have such a successful lab be a part of our Authorized Lab programs. What's astounding is that you're growing faster than some of our own labs! We have all the skill and knowledge to do what we did here at Glidewell Laboratories, yet we struggle to impart that to some of the remotes. Maybe your company has the right people and some of the other extenuating circumstances to replicate and expand upon our model. I commend you guys for**

**doing such a fantastic job.**

Thanks, Jim. As a company we have a goal of giving our customers the best of our abilities every day, and we have a team of great people working here to achieve that goal. At the end of the day, every employee has to believe in what he or she is doing and go for it 100 percent. When you look at the sharing of information, I had a friendship with Glidewell Laboratories before we even decided to purchase anything from Glidewell Direct. I know personally that the willingness to share information has nothing to do with buying your material. The relationship was there before the materials ever existed.

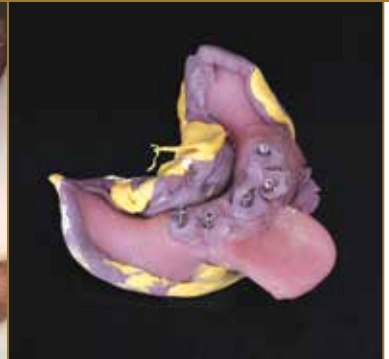
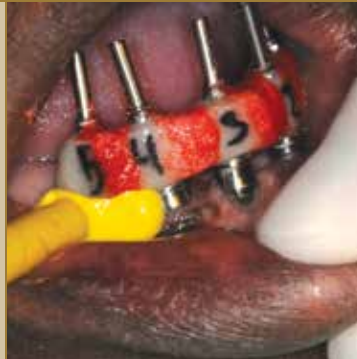
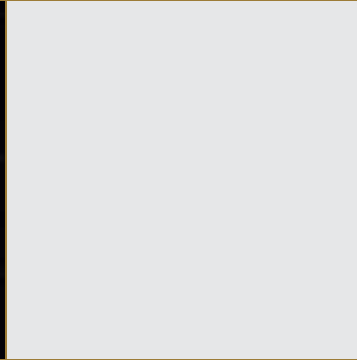
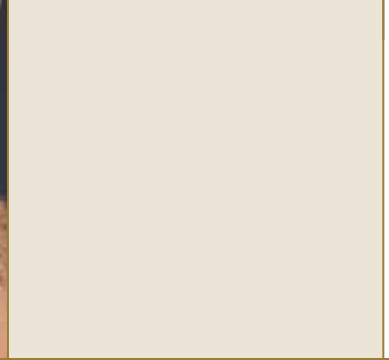
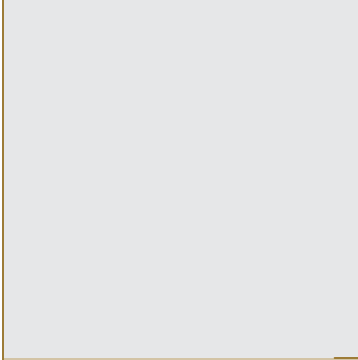
**That's right. Whenever we have a lab call us and ask questions, we tell them how we'd do it no matter what. It is important to us to be a knowledge center for the entire industry. I appreciate you taking the time to speak with us. Thanks a lot. LP**











## RESTORING THE EDENTULOUS

# Arch with the BRUXZIR® Full-Arch Implant Prosthesis



**T**he fixed implant-supported prosthesis presents numerous advantages over traditional removable complete dentures. By stabilizing the prosthesis to the maximum degree possible, this implant solution effectively restores oral function, comfort and esthetics, while minimizing bone loss and the devastating soft-tissue changes associated with edentulism.<sup>1</sup> The protocol for delivering these full-arch restorations is relatively simple, and the positive impact this treatment can have on patients cannot be overstated. Patients who have suffered from edentulism for years are simply thrilled when they experience the improved quality of life offered by a fixed restoration.<sup>2,3</sup>

Fixed hybrid dentures, which attach to implants via screws inserted through a titanium substructure, have been used to successfully restore fully edentulous patients for decades. Their durability, however, leaves room for improvement. There are three issues that can complicate the long-term success of the traditional fixed hybrid denture: the acrylic teeth tend to wear; the teeth can fracture



article by

*M*ichael McCracken and  
Jonathan P. Ouellette

**Michael McCracken, DDS, Ph.D.**, is a professor at the University of Alabama at Birmingham School of Dentistry and codirector of the Comprehensive Implant Residency Program. **Jonathan P. Ouellette, DMD**, is a Florida-based dentist who specializes in implant dentistry and an active member of the AAID, ICOI, AGD and ADA.

or dislodge from the acrylic base; and the acrylic base itself can fracture. The BruxZir® Full-Arch Implant Prosthesis eliminates these issues, providing a restoration that is more durable in the long term, while sacrificing nothing when it comes to esthetics.

This fixed prosthesis is milled from a single block of solid zirconia and attaches to implants through titanium inserts. Utilizing advanced staining and glazing techniques, the prosthetic teeth are colored to closely mimic natural dentition, and the gingival areas are colored to match the shade of the patient's soft tissue.

The prosthesis is incredibly strong because it is milled from a single block of BruxZir™ Solid Zirconia, an exceptionally fracture-resistant material that exhibits flexural strength up to 1,465 MPa. This leads to several benefits for both doctor and patient. First, there is no need to replace worn denture teeth, which is a common occurrence with traditional hybrid dentures. Next, as a single construction, monolithic zirconia reduces or eliminates the possibility of fractured or dislodged teeth, which can occur with traditional hybrid prostheses due to the prosthetic teeth being bonded into the resin base. This durability minimizes the odds that the patient will ever have to go without their prosthesis due to damage or repair.

The following case report illustrates the step-by-step protocol involved in restoring an edentulous arch with the BruxZir Full-Arch Implant Prosthesis. Clinicians can follow a straightforward clinical protocol to success, substantially improving the lives of patients by providing a fixed, esthetic and long-lasting full-arch implant restoration.

## Case Report

The patient is a 58-year-old male with no contraindications for implant treatment. Following bilateral sinus grafting, the patient had a total of 11 BioHorizons® Internal Hex implants (BioHorizons; Birmingham, Ala.) placed, including six in the maxilla and five in the mandible (Figs. 1a, 1b). The mandibular implants were placed 5 mm anterior to the mental foramen. The maxillary implants were placed in available bone from first molar to first molar using a flapless, guided surgical approach. The implants integrated for over six months, and the patient presented for restoration of his edentulous arches.

### Step 1: Preliminary Impression

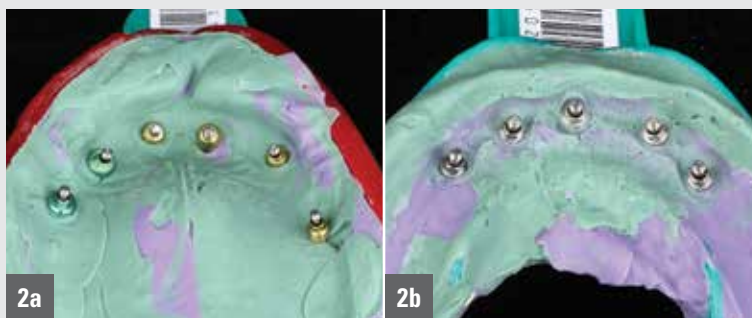
First, simple preliminary impressions of the implants were made. After removing the healing abutments, closed-tray impression copings were seated. The impressions were made using Capture® VPS material (Glidewell Direct; Irvine, Calif.) in stock plastic trays, and the impression copings were placed back into the impressions before the case was sent off to the laboratory (Figs. 2a, 2b).

### Step 2: Wax Rim and Centric Jaw Relationship

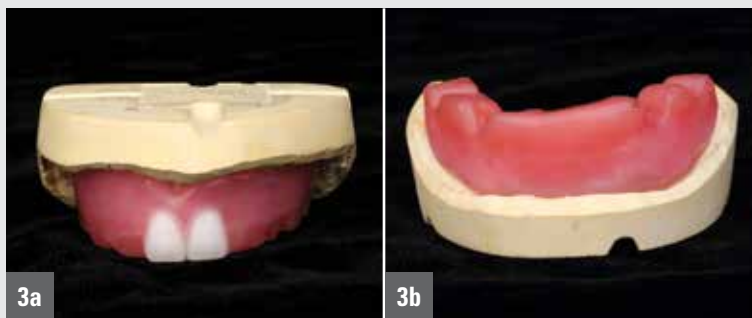
The laboratory poured casts from the initial impressions and fabricated bite blocks and occlusal rims for



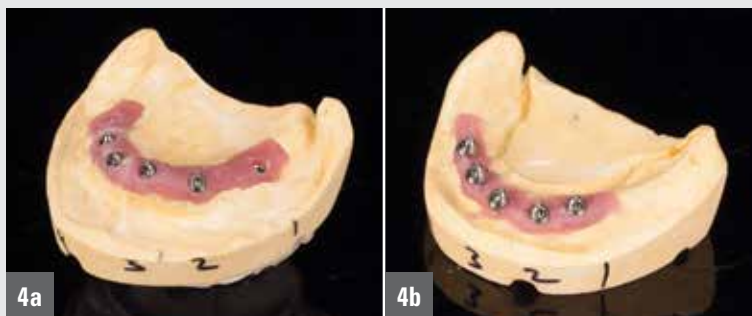
**Figures 1a, 1b:** The patient presented with six maxillary and five mandibular implants that were fully integrated and ready for restoration.



**Figures 2a, 2b:** After removing the impression tray, the closed-tray transfer copings were placed back into the impression.



**Figures 3a, 3b:** The lab fabricated both bite blocks onto the stone models so the CJR could be obtained.



**Figures 4a, 4b:** The lab selected the necessary multi-unit abutments for the maxillary and mandibular arches, placing them in proper position and sequence on the soft-tissue models.



**Figures 5a, 5b:** The healing abutments were removed, and the multi-unit abutments were tightened into the four maxillary implants requiring angulation correction. Note the use of a sponge to protect the patient's airway.



**Figure 6:** The silver implant driver demonstrates the actual angle of the implant placed in the premaxilla. This angulation was indicated by patient anatomy. However, without correction, the screw access hole would be visible on the facial surface of the restoration. The angled multi-unit abutment corrects the angulation, as reflected by the green plastic abutment carrier. Note the use of 4x4 gauze to protect the airway, as multi-unit abutment components are very small.



**Figures 7a, 7b:** Wax setups were provided by the lab, with each including temporary cylinders that attach to the implants in order to stabilize the bases.



**Figure 8:** The wax setups were seated, evaluated and adjusted to ensure proper contours, esthetics and tooth positioning.

the centric jaw relationship (CJR) records (Figs. 3a, 3b). The bite blocks were seated, the occlusal rims were contoured, the vertical dimension was established, and jaw relation records were taken using conventional denture techniques. Each bite block contains two screw-retained temporary cylinders that allow the wax rims to be screwed down, producing a very accurate CJR. The contoured rims were returned to the laboratory with the initial casts.

### Step 3: Wax Setup, Implant Verification Jig and Final Impression

#### Delivery of Multi-Unit Abutments (as necessary)

Upon receiving the wax rims and jaw relation records, the laboratory and dentist consulted to determine if multi-unit abutments were necessary. Many times, implants must be placed with a 15-degree angulation or higher, depending on patient anatomy. Often, angulated implant placement can result in screw access holes in the incisal edge or facial surface of the anterior teeth of the prosthesis. In these cases, multi-unit abutments are required to correct the angulation in order to avoid screw access openings that are visible on the facial surface of the anterior prosthetic teeth.

Based on the initial impression and the contoured occlusal rim, the patient required four multi-unit abutments in the anterior maxilla to ensure that the screw access openings were within the confines of the planned prosthesis. Multi-unit abutments also help simplify restorations in cases where the tissue is thicker than 2 mm by raising the prosthetic platform. In this case, all five of the mandibular implants benefitted from multi-unit abutments that were used due to implant angulation and tissue thickness. The laboratory selected straight and angled multi-unit abutments and arranged them in their proper positions on the working casts before sending them out for placement (Figs. 4a, 4b).

At the next clinical appointment, the patient's healing abutments were removed, and the multi-unit abutments were transferred to the patient's mouth and torqued into place (Figs. 5a, 5b). The multi-unit abutments effectively corrected the angulation of the implants, keeping screw access aligned toward the palatal aspects of the planned anterior teeth and out of the esthetic zone (Fig. 6).

#### Wax Setup Try-in

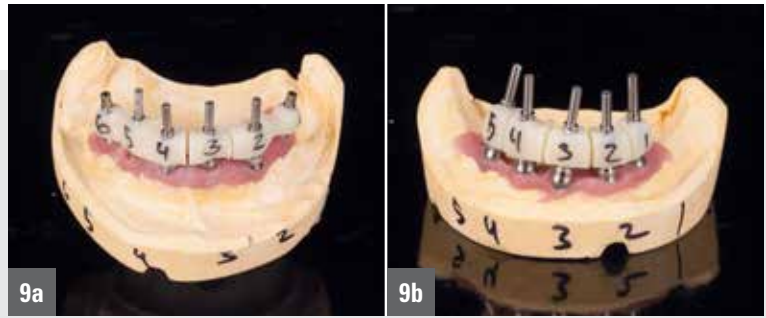
At the same appointment, trial denture setups in wax were evaluated (Fig. 7a, 7b). Each setup was seated and screwed into place via the included temporary cylinders (Fig. 8). The setups were evaluated for proper esthetics, phonetics, contours, occlusion and tooth arrangement, and the necessary adjustments were made per standard denture protocol.

## Implant Verification Jig and Final Impression

The lab fabricated, sectioned and numbered an acrylic implant verification jig for each arch on the working casts (Figs. 9a, 9b). Because the implant verification jig helps to ensure an accurate final impression and a precise fit of the BruxZir Full-Arch Implant Prosthesis, it is the most crucial step in the restorative process. Custom trays for the final impressions were supplied along with the verification jigs (Figs. 10a, 10b). Note that where multi-unit abutments were used, the implant verification jig was fabricated to connect to the abutments instead of the implants.

Each section of the verification jig contains a titanium cylinder, which is essentially a non-engaging impression coping. The titanium cylinders were inserted into each implant or multi-unit abutment according to their numbering sequence. After verifying that a small gap exists between each acrylic segment, the verification jig was fully seated by tightening the long abutment screws (Fig. 11). The acrylic pieces were then connected using PATTERN RESIN™ (GC America; Alsip, Ill.). The material was flowed completely through and around the gaps, and into the joints of the verification jig (Figs. 12a, 12b). The process was completed by placing a thicker mix of resin around the outside edges.

“Because the implant verification jig helps to ensure an accurate final impression and a precise fit of the BruxZir Full-Arch Implant Prosthesis, it is the most crucial step in the restorative process.”



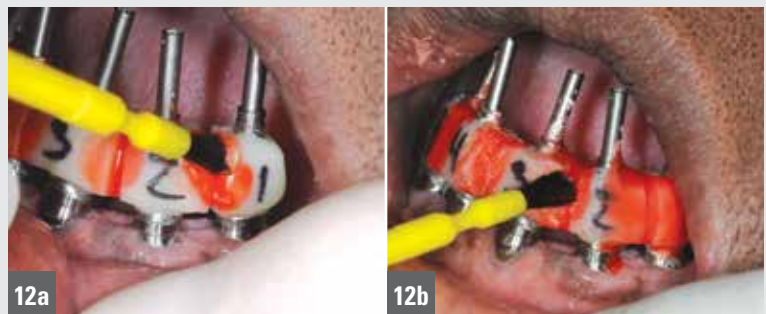
**Figures 9a, 9b:** The lab fabricated the implant verification jigs on the working models. Each acrylic section of the jig contains a titanium cylinder that attaches to the implant or multi-unit abutment. By precisely capturing the depth and angulation of the implants in the final impression, the verification jig ensures an accurate fit of the final prosthesis.



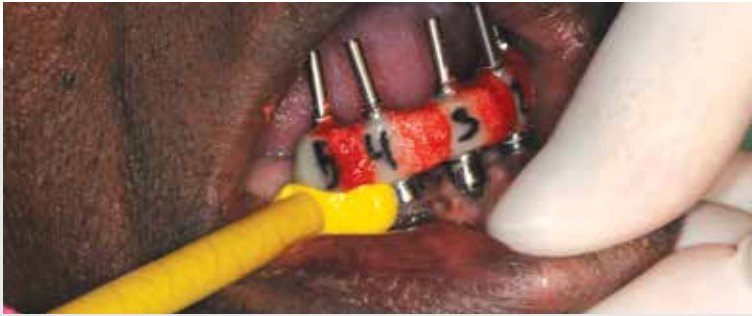
**Figures 10a, 10b:** The verification jig components were sent to the office along with custom trays, which were fabricated to fit over and pick up the implant verification jig in the final impression.



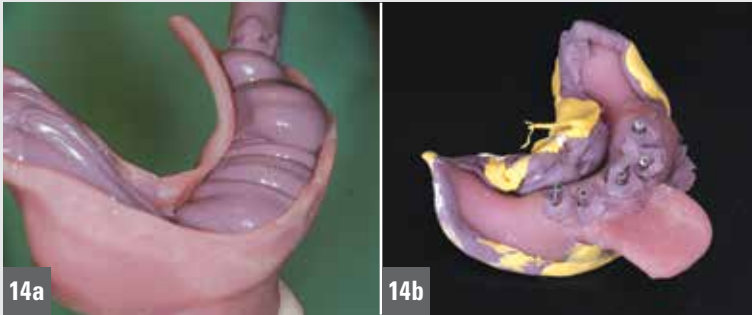
**Figure 11:** Implant verification jig fully seated in the mandible after tightening the long abutment screws.



**Figures 12a, 12b:** The acrylic sections of the implant verification jig were luted together, with material flowed completely through and around the gaps.



**Figure 13:** VPS material was injected under and around the verification jig to capture the soft-tissue contours.



**Figures 14a, 14b:** After being filled with VPS material, the custom tray was seated, ensuring the titanium cylinders extended through the holes in the tray. This allows for removal of the long abutment screws so the verification jig can be picked up in the final impression.



**Figure 15:** The splinted implant verification jig was picked up in the final impression. Because it was splinted together and contained within the VPS material of the custom tray, the verification jig produced an extremely accurate impression.



**Figure 16:** The fixed provisional appliances fabricated by the laboratory helped confirm the accuracy of the definitive prosthetic design.

After the acrylic had set completely, a final impression was made using an open-tray impression technique. First, the custom tray was tried in to ensure a proper fit over the titanium cylinders. Then, vinyl polysiloxane (VPS) material was injected under and around the implant verification jig (Fig. 13). The impression tray was filled and seated, ensuring that all of the titanium cylinders were accessible through the holes of the tray (Figs. 14a, 14b). Once the material had set, the long abutment screws were loosened and the custom tray was removed, picking up the implant verification jig in the final impression (Fig. 15). After performing this procedure for each arch, the case was returned to the lab for fabrication of the provisional prostheses.

#### Step 4: Delivery of Fixed Provisional

Fixed provisional appliances, which were produced using precise CAD/CAM technology that effectively preserves the doctor-approved setup, were provided by the laboratory (Fig. 16). Fabricated from poly(methyl methacrylate) (PMMA), these provisionals provide an extra layer of quality assurance by allowing the patient to live with and confirm the proposed restoration during a trial period. It is labor-intensive to mill and finish the BruxZir Full-Arch Implant Prosthesis, so it is important to take care in this step as it helps to ensure an accurate final restoration.

“ The BruxZir Full-Arch Implant Prosthesis offers an important new treatment option for edentulous patients. ”

The fixed provisional appliances were seated, and the prosthetic screws were tightened. The prostheses exhibited a nice fit that was comfortable for the patient (Fig. 17). The patient functioned well with the temporary appliances for a few weeks. Once the patient approved the provisionals, the laboratory fabricated the final prostheses.

### Step 5: Delivery of the BruxZir Full-Arch Implant Prosthesis

The final restoration was fabricated using the CAD design that was confirmed during the provisional trial period (Figs. 18a, 18b). In this case, the AP spread and the opposing fixed all-zirconia prosthesis dictated a reduced arch for the lower prosthesis, with premolar occlusion. After removing the fixed provisional appliances, the final prostheses were seated. The prosthetic screws were tightened and the occlusion was verified. The screw access openings were first filled with a suitable material, and then covered with composite (Fig. 19). The patient received an occlusal device to wear at night in case of undiagnosed parafunctional habits.

The fit, occlusion and esthetics of the final restoration were excellent (Fig. 20). The patient was exceptionally pleased with the function offered by this fixed restoration. He even returned to the clinic the next day just to show his appreciation for his new smile, which he should be able to enjoy for a great number of years given the extraordinary durability of BruxZir Solid Zirconia.

### Summary

The BruxZir Full-Arch Implant Prosthesis offers an important new treatment option for edentulous patients. It provides excellent esthetics, and has better strength and wear properties than a traditional acrylic-metal hybrid prosthesis. Along with durability, this fixed full-arch implant restoration minimizes bone loss and maximizes prosthetic stability, function and comfort. This option should be part of the treatment plan discussion for every edentulous patient. <sup>LP</sup>

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**Figure 17:** The provisional prostheses fit well, and afforded the patient a trial period to evaluate the proposed restoration for esthetics and function over a period of weeks. Note that the gingival shade was adjusted for the fabrication of the final restoration.



**Figures 18a, 18b:** The lab fabricated each prosthesis from a single block of BruxZir Solid Zirconia and utilized advanced staining and glazing techniques to maximize the esthetics of the definitive restoration.



**Figure 19:** After being filled with a suitable material, the screw access openings were covered with pink composite resin for the gingival areas and tooth-colored composite for the prosthetic teeth.



**Figure 20:** The patient was extremely satisfied with the function and esthetics of the final restoration, which fit perfectly thanks to the precision of the CAD/CAM design process and the confirmation provided during the provisional trial period.



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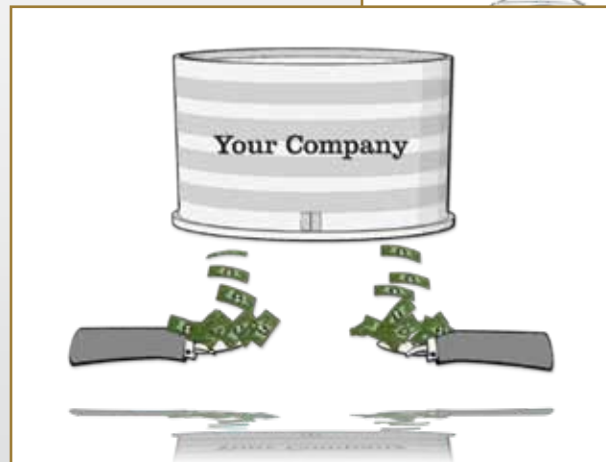
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# Gary THE LAWYER

## Protecting Your Lab from Potential Lawsuits



article by

Gary Pritchard

*First, the legal disclaimer: This is not a legal advice column! I can't give you legal advice. This column will be reserved simply for personal observations made during my more than 20 years of providing legal advice to various companies.*

One of the largest exposures to potential lawsuits that a business faces comes from its employees. In this age of downsizing, a laid-off or terminated employee is always the possible source of a legal complaint. From bus, billboard, and newspaper ads, lawyers point at the recently dismissed, pleading to “call us now,” promising moral and financial retribution with very little effort beyond making a phone call. Litigating these employment claims can be very costly, and the typical employer does not carry insurance to cover such proceedings. Moreover, there are usually “fee shifting” provisions in the laws that allow an employee to collect their own attorney’s fees in addition to whatever damages they might be rewarded. A business could end up paying two attorneys! Good for lawyers; bad for business. Isn’t that the way it usually goes?

However, there are two relatively easy steps a business can take to help protect itself. Be proactive!

**1) Harassment Training.** A company is always directly responsible for the acts of its managers and supervisors. More times than I care to remember, I have ended up in my office sitting with supervisors who were just “joking around” with the employees, never thinking they would end up in a lawsuit. Jokes and comments regarding the personal characteristics of employees, or anyone else, have no business in the workplace.


To avoid this scenario, take an hour or so every year and provide supervisors and managers with harassment training. Be sure you document the training, and put a dated certificate of completion for the training in each supervisor’s file. Some states require training (requirements with which, of course, a company should comply), and state-specific, low-cost training is readily available on the Internet. A company does not want to be in court facing

a lawsuit and be guilty of not providing training for its managers, so train supervisors and managers regarding how to identify, prevent and report harassment — and not just sexual harassment!

**2) Harassment Policy.** A company should always have a policy statement against harassment. The policy should define harassment and provide some examples (again, the Internet is a good source to find some samples of policy statements). The company’s harassment policy should be given to every employee, and signed by every employee to acknowledge receipt. Put this signed copy in each personnel file. Remember: If it’s not in writing, it never happened!

It’s also vitally important that the policy require the employee to immediately report any harassment. In my experience, the first claim of harassment usually comes at the termination of employment. Former employees may be in retaliation mode: They have just been “jilted,” and are lashing out. If a company has a policy in place in which employees are required to immediately report harassment, then employees cannot say that the company failed to inform them about how to handle harassment. They simply neglected to avail themselves of the remedy that was provided. How can they complain about harassment if they didn’t follow the company policy that they signed?

Implement training for your managers and create a policy against harassment, and you will have taken the first steps to beating a couple of lawyers out of some money. And you should feel good about that!

*Do you have a laboratory-related legal question, issue, problem or policy you would like to see discussed? Please contact Gary the Lawyer with your ideas at [garythelawyer@glidewell dental.com](mailto:garythelawyer@glidewell dental.com). *



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# One-on-ONE

## Interview with Custom Milling Center

Interview of Bob Miller, CDT, President, and Ryan Faufau, Director of CAD/CAM Resources

by Robin Bartolo, CDT, Glidewell Direct Sales Manager

**Why don't we get started with you, Bob? Can you tell us a little about your personal history?**

**Bob Miller:** I began in the industry as a certified dental technician. My sales career started with Jelenko Gold Company (as it was called at the time). I was with them for six years before being recruited by Williams Dental, which was acquired by Ivoclar Vivadent. I continued working as a regional manager with Ivoclar during the acquisition, and at that time I reconnected with a good friend and a great salesperson, Tom Underwood. Tom and I became really close while I was with Jelenko, and in the years afterward, Tom opened a dental-laboratory supply company. Tom had pursued the idea with me about opening a supply company in Denver, Colorado, which I eventually did. I owned the one in Denver, Tom owned the one in Kansas City, Missouri, and Bob Rath owned the one in New York City, New York. Darby Dental acquired DTS after I had owned it for 10 years. At that point, I became the marketing director for Noritake porcelain. Noritake was not a well-known ceramic system at the time, but we had a lot of success, mainly because we had exceptional instructors who traveled the country doing hands-on courses. Eventually, Henry Schein acquired Darby, and that more or less completes the whole circle. While I was at Darby, we were given permission from the Darby ownership to start an outsource milling center. That was nine years ago, in 2005, when I started Custom Milling Center here in Denver.

**So for Custom Milling Center, the goal was to provide the highest level of CAD/CAM products and services to establish a partnership with the dental lab community. Can you tell us how that vision developed and changed over the last nine years of your operation?**

**BM:** It's changed a lot, Robin. When I first went into it, I thought I knew everything, but I quickly realized I knew very little about the complexities of CAD/CAM. I believed the best course was to go in with an open-architecture system, so we started with a couple of different systems that were open. However, being an early adopter isn't al-



interview of

Bob Miller and  
Ryan Faufau

**Custom Milling Center (CMC)** offers advanced digital technologies to the dental industry. Founded by Bob Miller in Arvada, Colorado, in 2005, its mission is to be the go-to laboratory resource for cutting-edge CAD/CAM technologies and outsourcing services. With over 35 years as a CDT, Bob is an industry veteran with additional experience as a sales director and supply-company owner. Ryan Faufau joined CMC with a wealth of CAD/CAM technical knowledge, as well as a passion for continuously improving the dental applications of the technology. Read on to see what these industry experts think about monolithic restorative materials, the importance of computer-aided milling and the direction of modern dentistry.





ways the best: The manufacturer had an excellent scanner, but their software and mills weren't really ready. That was a learning experience, and a costly one.

I guess what really intrigued me and lit the fire under me, so to speak, was zirconia. I believed in the material, and had big ideas for what it could be. And then seeing what CAD/CAM technology was capable of, I thought there were some great possibilities for a production center. In the beginning, there were many bumps in the road, but those have been smoothed out — thank goodness — and we have good systems in place now. We always did have the idea and desire to be the partner of laboratories everywhere, so they could offer advanced digital products without having to invest in expensive equipment.

**With all the CAD/CAM technology that is offered by CMC, can you tell us about the team that you've assembled to support your customers?**

**BM:** I give Ryan a lot of credit. It'll be six years in July that we've been working together. Ryan's background is technical, but one of the brilliant things about Ryan is his passion for this industry. His grasp of software and the milling machine's language — the code needed to be able to program CNC machines, make templates, add tools and create tool paths — is extraordinary. This combined knowledge along with his love and passion for dental technology keeps CMC a leader in the industry. I mean really, Ryan's hobby at night is studying and creating efficiencies for CMC from his home office.

**That makes for a long day, Ryan.**

**Ryan Faufau:** It sure does.

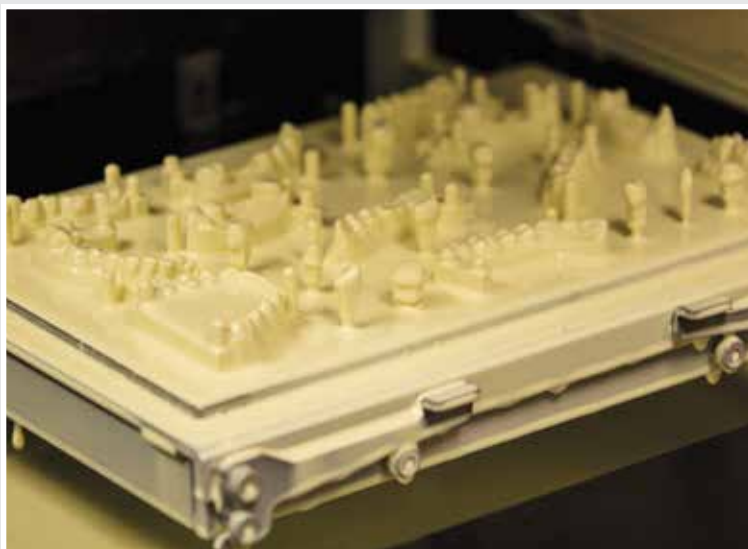
**BM:** Ryan's passion helps so much, whether it's creating efficiencies that make the milling more profitable, or enabling us to support customers from a material standpoint and helping them understand the technology. We have a team specializing in IT support. We sell 3Shape™ Scanners (3Shape; Warren, N.J.), and provide software support. A two-and-a-half-day interactive class is included for our clients. Support is what it's all about when you sell a laboratory a scanner, software or product, and I feel that we have a very responsive and qualified support team. Nine years ago, CMC started with three employees. Today CMC's team consists of 41, including CDTs, CNC operators, and CAD design specialists.

**“We always did have the idea and desire to be the partner of laboratories everywhere, so they could offer advanced digital products without having to invest in expensive equipment.”**

The support is definitely key. There's so much technology out there and so many things to know that, in order for people to take advantage of it, they need to have confidence that their partner is not only very fluent in the new computer languages, but can support them as well. How do you assist those laboratories that have not yet engaged in digital scanning and CAD/CAM? And does the support you give them contrast with laboratories that are very experienced with a digital process?

**BM:** We have two business models: one for laboratories that haven't yet made a purchasing decision to have a scanner; and one for those who send us scan and design files. A majority of our business is full-contour, whether its single-units or bridges (and thanks to Glidewell for being a visionary and creating that very popular and successful monolithic product, BruxZir® Solid Zirconia). For the more traditional laboratories that send in models, we scan and design, seat the restorations, check contacts and occlusion, and send them back to the labs so they can use their signature stain and glaze to give it their personal touch, or they can do minimal cutback and layer porcelain. We also do the same thing with IPS e.max® (Ivoclar Vivadent; Amherst, N.Y.). With e.max, we crystallize if the laboratory chooses that option, but we also send the restorations to the labs in the blue-block state, allowing them to do the crystallization and finishing processes themselves. Some of our laboratories choose the option of having us complete the case by staining and glazing the full-contour zirconia or e.max.

**RF:** I'd like to touch on a similar question I think I get just about every day now: How do laboratories work with doctors that are converting to the digital technology today, if the lab doesn't own equipment? Say laboratories don't necessarily have the money or can't invest in a scanner today, but they still want to receive digital files from their doctors: How do we help them accommodate that? We receive the file from the laboratories, print the model, and then send that back to the labs to enable them to continue doing the product of their doctor's choice. CMC empowers laboratories to deliver digital products without investing in the equipment.



Oh, that's great. So how do you see the model-printing part of the business growing? Is that something you see a great demand for?

**BM:** Yes. For a couple of years, we were a milling partner for Cadent iTero™ (presently iTero™ Digital Impressioning System [Align Technology; Santa Clara, Calif.]). They have an excellent model, there's no question about that; but the time it took to mill an upper and lower quadrant with one die was approximately 25–30 minutes. Our personal vision included a hope that every model would leave with something on top of it, but the technology at the time just wasn't ready to do that. What we learned from that partnership was that we should be using the Haas milling machines to mill zirconia (that's what Cadent iTero used), because we realized the precision and the capabilities of that machine would allow us to realize our vision. Ryan then converted the Haas machines, enabling us to mill zirconia.

**RF:** When comparing model-printing to milling, I think that the predictability of computer-aided design is a lot better than it was even two years ago, so doing model-less restorations today is probably in more demand than it has been before. Labs and doctors always like to see that "peace of mind" model, so that they can check contacts, occlusion and margins. What we'll probably see with single units in the coming future is just a contact model that enables them to verify everything.

**Yeah, that makes sense.**

**BM:** I think along the same lines, as doctors start to embrace digital impressions, we will see the demand for models increasing tremendously in the next couple of years.

**I'm just curious, because I have two experts on the line here: After the laboratories have seen the output and they've had the model to verify that everything is, indeed, correct, do you think eventually there will be a time when they will be comfortable just receiving the case knowing that the restoration has been checked three, five, ten times? How many times does it take before they know with confidence that the cases they receive are going to fit? And at that point, will the model-less restoration gain popularity? Or will they always require that "peace of mind" model?**

**RF:** For some labs, the feedback they were getting from their doctors with that "peace of mind" model was obviously turning out quite well. Once the labs gained the confidence of their client that the restorations could be fabricated with this technology, the labs no longer needed to use a model. It's kind of a working relationship between the laboratory and the dentist to ensure that they agree the product will work without a model. Models are unnecessary — they are an additional cost if you do decide to do them — so all parties are going to save time and money if they skip that step.

**BM:** Like you said, there's a trust factor. I think at some point, we have to be able to trust the data that the doctor scanned

and delivered to us is accurate, and that they've done all the necessary scanning for contacts and occlusion.

**We see it in our lab as well. If you look at all the data, we actually have fewer remakes and fewer cases going back and forth when they're done model-less. So while it's nice to have the peace of mind, the accuracy is there and confirmed, as you well know. It's just a matter of making sure that the market catches up to that fact, and I'm guessing that after the laboratories do catch up, they too will say, "My doctor is happy. We can save that cost of printing the model and go straight to the digital manufacturing."**

**BM:** Exactly. Very well put.

**You mentioned that you were an early adopter of zirconia. What are your personal thoughts on the rapid shift to full-contour zirconia restorations?**

**RF:** I believe what drove the shift is the design software had greatly improved. Because of that fact, the monolithic restoration is now not only based off physical properties of the material, but also the software capabilities. The driving force is that the materials have advanced far enough to be used as monolithic restorations for the full-contour product today.

**Bob, you're a veteran CDT, you're a ceramic expert, you've launched porcelain systems in the market, and now you're pioneering zirconia milling. I'd like to know what your personal opinion is on the esthetics and the oral compatibility of a full-zirconia restoration.**

**BM:** The esthetics are very pleasing, and in the anterior region you can even make it more so just by doing a minimal cutback at the incisal and layering enamel. We have laboratories that do six-unit anterior bridges on a regular basis. We've even had laboratories tell us that they've had doctors comment on the full-contour restoration they've received, saying, "I asked you not to layer it with

porcelain." And the lab says, "I haven't touched it." I truly believe the material can be very esthetic. We still get questions about the wear factor, although I know Glidewell has done numerous studies showing that if zirconia is properly adjusted, polished or glazed, and in proper occlusion, it wears less than porcelain.

**It's far less aggressive in the mouth.**

**BM:** And it can be polished like a Type III cast gold. It polishes beautifully. For so many reasons, full-contour zirconia has really made a lot of inroads in the marketplace, and the materials have advanced tremendously. We're excited about the delivered consistency of your newly launched BruxZir® Shaded 16. There are other shaded zirconias, but for those systems, you're getting four and five shades out of one disk. While BruxZir 16 wouldn't be for every laboratory, it would certainly be for production centers, because they'll have the ability and need to inventory BruxZir 16 blanks in four or five different thicknesses. It opens up another avenue for us, which we truly appreciate: the consistency of getting the 16 VITA® Classic shades (Vident; Brea, Calif.), and having the base shade be right on.

**Exactly. We're 100 percent in agreement with you, Bob. We're definitely excited about the 16 shades all the way through and all the advantages that you highlighted.**

**BM:** We see great possibilities with that product.

**It makes perfect sense for your operation, without a doubt. Looking at another interesting digital technology, you also offer the additive manufacture of metal copings and bridge understructures, correct?**

**BM:** Yes, we do. Chrome cobalt.

**Could you elaborate a little bit on what some of the benefits are to your laboratory customers with this unique process?**

**BM:** We've seen more requests for chrome-cobalt abutments actually; single, screw-retained chrome-cobalt abutments. Porcelain can be fired directly to chrome cobalt. Or I suppose you can do the same with titanium abutments, but titanium can be rather technique-sensitive when it comes to having the right porcelain. So chrome-cobalt abutments really seem to have taken the lead in that area.

**It's very interesting to hear about the need to have a material that can have porcelain fired directly to it. If you have an easier solution that's more predictable, that certainly makes good sense, as opposed to the difficulties experienced with titanium. So with your connection to Zahn Dental and Henry Schein, you know which dental technologies are making inroads in the market. What changes can you predict for the laboratory industry over the next five years?**

**BM:** What we see right now is the mini mills being a popular





method for the laboratory to get into the milling arena. I really see the growth of abutments and dental bars taking off and having tremendous growth (especially in the next few years as baby boomers are aging), and being able to do single-tooth abutments or implant replacements with a general practitioner. I think there's real growth potential, and it's one of the reasons why we decided we needed to have a more diversified offering. We support 15 different platforms that are compatible with some of the leading manufacturers. So being more diversified with abutments and bars is certainly one of the areas where I think we'll see tremendous growth.

**So those mini mills you mentioned earlier: Do you see them as the first step for a laboratory to get into the CAD/CAM process and potentially eliminate the need to outsource anything to you? Do you see that impacting your business? Or do you see it as just another great opportunity to showcase the products you offer? Going into this arena alone without support can be quite challenging.**

**BM:** Right now, I believe laboratories see it as an opportunity to get into CAD/CAM and at least mill zirconia (they still can't mill titanium). But to your point, it's not plug-and-play. In my opinion, mini mills don't give the same result that CNC-type machines provide because they don't hold the calibration as well. When that fine zirconia dust finds its way into every moving part, you have issues. Right now, it's kind of a growing trend for manufacturers to give mini mills away in hopes that it'll increase the use of their zirconia, which is very attractive for the laboratory. But if problems occur and their machine goes down, we'll be there to back them up. We still offer that kind of support.

By merely owning a scanner, a laboratory opens up a whole world in terms of products that they weren't able to offer before. Now

they're able to scan and design an abutment and offer those to their doctors. It's so easy, and it's even cheaper than buying a stock abutment. When you look at what a custom abutment costs from Glidewell or from CMC, I'm not sure how laboratories can afford to buy a stock abutment and sit there and still have to grind on it. The scanner opens up opportunities for the laboratory. It makes accessing a lot of materials very seamless.

**I couldn't agree with you more. The best way to get into the technology is to get a scanner and outsource to CMC or other similar places and let them do the milling. There's so much maintenance required: You have to keep these things clean, and if laboratories don't have a full-time maintenance department to keep these milling machines running, there are problems. It's a very sharp learning curve. It's probably a better method to just do the design, do the artistry, make sure it's the way they want it to be, and let the milling part be done by someone else who's an expert in that arena.**

**BM:** And we do offer education as well as the support. Even if a dentist has a scanner, for instance, they might not know what exactly is needed to be able to work with these files, or which file types can be used? We get calls from doctors, and they're obviously confused about it. They want to know what happens to that file when the tooth is scanned, or what the whole digital workflow is. We can be helpful in that area by shedding some light on that and providing some insight. So whether we're helping with design or milling, extending that kind of first-rate support is hopefully one of the keys to our success.

**Wow. That's great. I'll take this opportunity to thank you, Bob and Ryan, for your time today. You guys obviously have built a phenomenal business. Congratulations to both of you. LP**





# PREMIER THERMOFORMING: Erkodent's 50 YEARS OF EXCELLENCE



On July 10, 2013, outside a 60,000-square-foot warehouse in a small German town with a long German name, Mayor Dieter Bischoff stood in front of a sizable crowd with a handheld microphone. Seated at rows of picnic tables, sated by a meal whose passing was marked only by stained tablecloths and smiling faces, the families of current and former Erkodent employees had come together to celebrate five decades of quality, pride and success. After a day of festivities that included a magician, a live band and a host of outdoor games, the assembly, comprised of every age from infant to elderly, listened as the mayor summarized the company's achievement in a single quote attributed to famed American industrialist Henry Ford: *"Erfolg hat der, der die Ideen hat, die gerade gefragt sind."*

"Success is the result of having the right skills at the right time."

For thermoforming monolith Erkodent, the right skills were those of dental clinician Dr. Erich Kopp, a general practitioner whose first foray into dentistry occurred on the front lines of World War II in Russia. After four years of captivity following the Allied vic-



article by

Robin Bartolo

**Robin Bartolo, CDT**, uses his three decades of expertise to help dentists and laboratory professionals affordably access high-quality products as the sales manager for Glidewell Direct.

tory over the Third Reich, Dr. Kopp returned to his homeland, where he finished his training in Karlsruhe, Germany, before settling down in Erkodent's present-day home of Pfalzgrafenweiler.

Although he was already a prolific inventor and patent-owner by 1964 (his design of a new dental elevator was considered particu-



larly groundbreaking), it was the introduction of his Erkopress™ thermoforming machine (ERKODENT Erich Kopp; Germany) in that year that garnered the most accolades and revolutionized the largely stagnant dental thermoforming sector. Prior to Dr. Kopp's contribution, fabricating protective intraoral devices by heat-shrinking plastics to dental molds was an affair reminiscent of the Wild West: Materials research was not advancing, heating times and pressing techniques were without standard, and studies to determine impact resistance and effectiveness against force trauma were nonexistent. Dr. Kopp's nascent company introduced testing methodology to the industry that led to more effective, biocompatible materials; efficient layering of hard and soft materials to promote maximum protection with minimum intrusiveness; various primers to ensure bonding of the disparate plastics and polycarbonates; minimum melting points required to guarantee that the compounds' shape memories were reformatted to the desired contours; and standardized heating times that took local variables like temperature and humidity into account. In short, he brought science to the old boil-and-bite.

By 1996, Erkodent's reputation for being a premiere source of quality mouthguards for sports and nighttime bruxism had been well established on the European continent. But it wasn't until a meeting of the minds took place on the floor of the 27<sup>th</sup> International Dental Show that the profound impact of Erich Kopp's work would finally begin to transition across the pond to

North America. Roaming the floor of the trade show's exhibition hall in Cologne, Germany, was Jim Glidewell.

Since 1970, Jim's passion for expanding the availability of high-value, low-cost dental products and prostheses had materially contributed to the stateside success of Glidewell Laboratories. Recognizing constant improvement as a cornerstone to mission success, he was a regular at domestic and international trade shows, keeping a vigilant eye out for new technologies that would enhance his company's ability to deliver on that goal. A few weeks prior, Vice President of Sales & Marketing at Glidewell Laboratories Jim Shuck had received a phone call from Bengt Hoffman, a successful Swedish dental distributor, highly recommending Erkodent as a company with a product line that would not only have excellent potential in the U.S. market, but would also deliver a much-needed upgrade to technologies currently available there. Thus, by the time Jim Glidewell's plane touched wheels to the Cologne tarmac, he was already both aware of the elevated quality of thermoformed products available to the international market, and interested in finding a suitable partner to bring that expertise back with him. So far, the pursuit had been rife with uninspired products and overbearing businessmen bent on regulating the manner in which Glidewell was allowed to develop this new overseas opportunity; terms toxic to a man who had built his business under a fervent devotion to self-governance and self-sufficiency.



Upon meeting Erich Kopp's son and successor, Dr. Hans-Peter Kopp, at the Erkodent booth, the difference was night and day. Jim was familiar with the precision and effectiveness of Erkodent's products; he had once owned an Erkopress back in the late 70s, bought from a U.S. distributor on the East Coast and used to make thermoformed patterns for casting PFM metal understructure copings. The technique was very precise and effective, but was replaced in the 1980s by the faster wax dipping method, resulting in a loss of demand for the press and subsequent closing of the distributor's shop. Yet it was not just the quality of Erkodent's equipment that planted the initial seeds of what would become a flourishing enterprise; it was a marriage of similar ideals for balancing mutual benefit with in-house reliance. An immediate friendship between the two entrepreneurs quickly grew into a business partnership, with the original discussions hinging on Glidewell Laboratories offering the PlaySafe® (Glidewell Laboratories; Newport Beach, Calif.) line of custom sports mouthguards to American dentists. It didn't take long, however, to recognize the possibilities Erich Kopp's other innovations would have across a new continent — innovations that had multiplied to include not only more robust, colorful, BPA-free materials for various levels of athletic protection, but also cutting-edge equipment like the Erkoform 3™ (ERKODENT Erich Kopp) that took thermoforming in a direction previously considered impossible.

Before the Erkoform, air pressure was the only viable way to reli-

ably mold material to a dental model. A local or central air compression unit would be hooked to the pressing unit — Dr. Kopp's Erkopress, for example — and isolated while the polycarbonate material was heated to the proper viscosity. Once the material was suitably malleable, it would be quickly rotated to the center of an airtight chamber with the model arch below. Pressurized air would then be rapidly injected above, forcing the plastic composite down over the model and adapting it to the desired organic shapes. While this method remains the most effective for achieving meticulous accuracy of a conformation, most applications would be better served sacrificing a modicum of precision for earlier access to the opposing occlusal surface. Unfortunately, the top-down seal of a pressure unit locks out access to this surface until the material has solidified. Opposing occlusal indentations could only be added through a post-thermoforming regimen of articulation and reheating, at best, or manual sculpting, at worst. The sight of a dental technician carving the opposing bite was not uncommon.

A bottom-up system — that is, one that used vacuum pressure from underneath to draw the heated material downward while leaving the occlusal surface accessible — had been widely pursued to solve the issue of immediate, accurate articulation of the opposing dentition; however, attempts to implement such a system had met with consistent failure because of the sluggish speed at which air could be pumped out of the underlying area.



In these situations, materials would set long before conforming to the model, let alone to any opposing models. Although ideal in theory, competing researchers and developers were largely convinced a vacuum-pressure system could never be fast enough to thermoform effectively.

Dr. Kopp's rapid vacuum extraction unit (RVE), the basis for the Erkoform vacuum thermoforming system, proved the pessimism unfounded. With it, air removal became almost instantaneous; and with the addition of the Occluform® attachment (ERKODENT Erich Kopp) — an articulating arm that connects to the Erkoform — immediate impressing of opposing arch grooves became a reality.

Today, the Erkoform and Occluform pairing is integral to the creation of the Comfort H/S™ Bite Splint, a wildly popular nighttime mouthguard made possible by another Erkodent innovation, Erkoloc-pro. This bilayer disc of polycarbonate material weds a hard top sheet with a soft bottom sheet which, when thermoformed to a dental impression model, creates a removable device strong enough on the occlusal to protect against overnight bruxing, yet gentle enough on the intaglio to avoid irritation. Additionally, with a clinician-supplied bite registration, the apparatus is personalized during laboratory fabrication to the contours of a patient's unique intraoral biology for a comfort-

able preventive solution.

Erkodent's enduring commitment to advancing dental technologies through dedicated scientific methodology has earned it a rightful place among the premier providers of clinical intraoral solutions. From the very beginning days of its incorporation in November of 1963, Erich Kopp instilled a corporate mindset of service, cooperation, and an insatiable desire to improve and build upon past success to achieve future prosperity — values that continue to this day under the guidance of Hans-Peter. From the seemingly simple concept of enhancing existing technology through standardization of techniques and structured testing of formerly accepted concepts and materials, Erkodent has materially contributed to a wide swath of dentistry-related treatments. Its Silensor-sl™ (ERKODENT Erich Kopp), or Silent Nite® sl in the States (Glidewell Laboratories), is commonly effective as a first-tier, noninvasive tool for managing apnea; its PlaySafe mouthguard materials provide preeminent levels of protection against sports injury through studied force redistribution, all while maintaining comfort and personalized esthetics that can even include team colors and logos; and its Comfort H/S Bite Splint has garnered such a respected reputation for effective nighttime protection that a network of Authorized Comfort H/S Bite Splint Labs was created to provide for the overwhelming demand. <sup>LP</sup>

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**\$2,750\*\*** Erkoform-3d™ with  
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The Erkoform-3d™ with the Occluform-3® attachment is the latest advancement in thermoforming technology. The Occluform is designed to quickly imprint the opposing bite right after thermoforming, saving time. The unit includes a touch-less temperature control, reserve vacuum chamber, preprogrammed settings and a touch panel screen. It produces high-quality results for thermoformed appliances up to 5 mm thick.



As an **Authorized Comfort H/S™ Bite Splint Lab**, we will help dentists find you by providing your contact information on our website and in national print advertisement campaigns. To help you promote this new product, we also offer an array of marketing materials, including patient and doctor Comfort H/S™ Bite Splint brochures.



The touch panel display features an easy-to-use touch-and-go feature, which accurately programs all ERKODENT® thermoforming materials.



A temperature control accurately measures the heat of the material to ensure optimum properties and fit.



The Occluform-3 allows for the articulation of upper and lower models to the unit for accurate creation of the opposing bite plane.



After thermoforming, the occluding bow is closed until the supporting pin makes contact, to create the bite plane.

Erkoform-3d is a trademark of ERKODENT Erich Kopp. ERKODENT and Occluform-3 are registered trademarks of ERKODENT Erich Kopp.  
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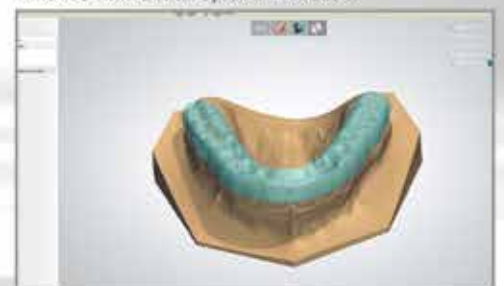
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# Interview with COSMODENT DENTAL LABORATORY

Interview of Przemek Seweryniak, CDT, founder  
by Wolfgang Friebauer, MDT, CDT



interview of

Przemek Seweryniak

**Przemek Seweryniak, CDT**, is the founder of Cosmodent Dental Laboratory, a Swedish dental laboratory that focuses on providing the highest quality cosmetic and esthetic services. Catering to clientele throughout Scandinavia and Europe who demand the most out of their restorations, Przemek utilizes his knowledge of modern material sciences to enhance his cases with unique methods. As the first Authorized BruxZir™ Laboratory in Europe, his Malmö facility developed techniques that highlight the esthetics of BruxZir® Solid Zirconia. Sitting down with *Lab Perspectives™*, Przemek recently took time to share his insights on dentistry in Sweden, working with zirconia and the importance of CAD/CAM technologies.

**Przemek, can you tell me a little about yourself? When and from where did you receive your training and education?**

I graduated from Lund University's School of Dental Technology in 1993. In both my private life and in my business, I'm easygoing and goal-oriented. I have an open mind and the attitude that all problems have a solution.

**You started very young in dentistry, correct?**

I started at a dental technology school at age 16 after graduating high school. My choice at the time was between dental technology and electrical engineering, and I'm still very glad to have decided upon dentistry. I am one of the founding members, former president and an accredited member of the Swedish Academy of Cosmetic Dentistry (SACD), and a certified member



of the European Society of Cosmetic Dentistry. I give lectures and hands-on workshops throughout Scandinavia, and am a visiting lecturer at the Faculty of Odontology at the University of Gothenburg. In 1999, I visited the American Academy of Cosmetic Dentistry, and have been visiting regularly as a way to gain inspiration since that time. I have taken hands-on courses with Professor Tanaka, Willi Geller, and also at the Dawson Academy. I try to keep up to date by visiting a major conference at least once a year, as well as by reading articles and studies. But most of my training is made through a trial-and-error process; I believe that's how you learn the most. I started my career working with PFMs, and was glad when the IPS Empress® pressable ceramic (Ivoclar Vivadent; Amherst, N.Y.) came out shortly after. I jumped right on it because my boss did not know how to do it, and handed the IFU booklet to me, saying, "Here, you do it."

So I started Cosmodent Dental Laboratory in Malmö, Sweden, in 1998 at the age of 23, only five years after I had graduated as a dental technician. I have always been inspired to work the way I like, and in dentistry, for me, that means working with esthetics. Starting my own lab at that time was a risk that I was willing to take, because it permitted me to do the style of work I liked, as well as to work with materials of my choice. I started by renting space with another laboratory, and the owner of that lab was actually my first customer. I was firing ceramics for him at the beginning of my career. After a couple of years of building my own business, meeting great people and slowly building a network of great clients who expected more of me every day, we outgrew the facility. In 2006, we moved to our new facilities with 2,200 square feet and six employees. Over the years, we have grown to 13 employees, and we now have 3,900 square feet.

**So when will you outgrow this space? Is the next move around the corner?**

No, we've doubled our workspace and still have room to grow. We are a high-end laboratory that caters to a specific type of client,

so the space we have now will last for a while. I have two technicians in implants, two in model work, two for logistics, two for pressable ceramics, two for ceramics, and I work with everything. I do not like working with partials or orthodontics. Don't get me wrong, orthodontics are great for the patient. I just don't like my fingers getting poked by a wire-bending procedure. We do our best to keep our workday from 8:00 a.m. to 5:00 p.m.

**What is the business model for your laboratory? Do you work mostly with doctors in your area, or do you work with some that are farther away?**

The business model for our laboratory is to deliver premium products. We actually work with three product groups: implants, all-ceramics and splints. Over 60 percent of our work is with bite-rehabilitations and esthetics. Most of my customers are three or more hours away from the lab, so I do have a lot of mail coming in and going out. Malmö has the densest area of dental laboratories and technicians in Sweden, so we have customers sending work from all over Scandinavia. We are a high-end, high-priced laboratory; and sometimes when I get asked over the phone what our price schedule looks like, I get a, "What? Can you repeat that, please?" To maintain the quality we require as a company, we have to have higher rates than other labs.

**Approximately how many dentists and dental laboratories are there in Sweden?**

The latest figure I heard was that there are 7,300 dentists, and about 1,200 dental technicians working in approximately 600 labs.

**How many of those labs do CAD/CAM?**

I would think 20 to 30 at the most, mainly with the small CEREC® units (Sirona Dental Systems, Inc.; Charlotte, N.C.). Around 100 or so do have scanners and will outsource. There are four or five laboratories that outsource their scan files to us.

“*The development from the first zirconia copings we started using 12 years ago to today represents a giant leap, and we are still in the early years of the material compared to porcelain-fused-to-metal, which has been around for more than 60 years.*”

**Are there many milling centers in Sweden?**

There is a handful. I believe six or seven when you count Nobel and Straumann.

**Do you advertise to dentists? How do you approach them and gain new business?**

I have never been into advertising. I get new customers through word-of-mouth recommendations, or from my lectures or workshops. The word gets around.

**As the former president of the Swedish Academy of Cosmetic Dentistry, what are your thoughts on the esthetics of full-zirconia restorations?**

The esthetics are totally acceptable if you work in the posterior region, but today we still need to touch up the esthetics with porcelain in the anterior zone. It certainly depends on the patient's needs and wants, but if we want to do a single-unit central in the anterior? It is extremely hard to do a monolithic restoration that matches the natural tooth perfectly. Zirconia has a completely

different refractive index than enamel, which works against you. In such cases I prefer to either do microlayering or facial layering with porcelain to get more translucent depth and a more natural appearance. Even if we do a full-mouth rehabilitation, we still prefer doing some kind of layering in the esthetic zone, from either canine-to-canine or premolar-to-premolar area. What we try to do is always keep zirconia in the pathway of function and passivity. Even though monolithic zirconia is still not my first choice for high-esthetic cases, I believe it might be in a couple of years. The development from the first zirconia copings we started using 12 years ago to today represents a giant leap, and we are still in the early years of the material compared to porcelain-fused-to-metal, which has been around for more than 60 years. I'm quite sure we will see a monolithic zirconia with even better esthetic properties in the coming years.

Certainly there are differences between the different brands and coloring techniques. For the last two years, we have been using BruxZir Solid Zirconia as our choice for monolithic zirconia restorations, and to achieve an even better outcome, we use Prettau® Aquarell coloring liquids (Zirkonzahn® USA; Norcross, Ga.) prior to sintering. This gives us better control of the shade, and we get better depth at the incisal than by just dipping the crowns. We are continuously searching the market for new brands of, and new manufacturing techniques for, zirconia blanks; but so far, BruxZir Solid Zirconia has been the best brand we've found for monolithic crowns.

**Are doctors aware of full-contour zirconia restorations?**

Yes, more and more so. Believe it or not, they know the BruxZir brand.

**Do dentists in Sweden prescribe a lot of solid zirconia?**

Often BruxZir Solid Zirconia in the posterior and IPS e.max® (Ivoclar Vivadent) in the anterior.



**What types of cases are Swedish dentists sending to you for full-contour zirconia?**

They'll start with a single-molar restoration, and then follow that up with another one. And as they get familiar with the material, they do more and more and finally try an anterior restoration. Quite often they've heard of the BruxZir brand, although it's a mix where they'll prescribe it. Some prefer just the molars, some use it just on implants and some want it everywhere. I like to give anterior BruxZir bridges a micro coat of veneering ceramic to touch them up for esthetic reasons.

**What types of CAD/CAM equipment do you have in your laboratory?**

When we started with CAD/CAM 12 years ago, we had a scanner connected to a milling center in Sweden that was among the first to mill zirconia bridges. In 2005, we got our first system from 3Shape, which at the time was a very small company based in Copenhagen, just 30 minutes from our lab. Working together with 3Shape has been really beneficial to us, and I believe we have had all of their generations of scanners. Today we have three 3Shape™ Scanners (3Shape; Warren, N.J.), as well as a Procera® Forte scanner (Nobel Biocare USA; Yorba Linda, Calif.). Even though it's not used often, it still sometimes comes in handy. We also have two milling systems from Wieland Dental: one ZENO™ 4030 M1 (Wieland Dental; Pforzheim, Germany), which was our first investment in 2007; and since 2011, we have also had a Zenotec® T1 (Wieland Dental) simultaneous five-axis milling unit with a blank changer.

**Did you start with a hands-on or manual MAD/MAM (machine-aided design/machine-aided milling) machine?**

No, because I was an Empress technician and also worked a lot with VITA In-Ceram® (Vident; Brea, Calif.) at that time, I skipped that rush entirely and went straight to computer-aided design, then added computer-aided milling.

**What types of cases do you personally enjoy making the most for your dentists?**

High-end natural esthetic cases. I find I enjoy doing the complicated cases: the large implant cases, the full-mouth rehabilitations and single centrals. I also love to do natural esthetic cases, where I can play with morphology, color and asymmetric positions to copy nature, where the teeth look the most natural. These cases push me to focus and be better than I was the day

before. Unfortunately, the so-called "Hollywood smile" has been influencing patients a lot. When I started the lab 15 years ago, the A3 shade was probably the standard. Today, most people in Sweden (as well as in the U.S., I believe) want the brighter bleach shades like 0M3 and 1M1. Making these shades on a young person where it matches their natural or bleached teeth is fun, but making it for a 60-year-old male is definitely not my ideal. But at the end of the day, we need to do what the patients want us to do with their smile. Though I sometimes think it's crazy to make totally straight white teeth, the patients just love it, and for the dentist, it's a success. I might not feel happy or fulfilled with the case, but the patient is happy and loves the way it looks, and I have to respect that.

**Do you occasionally get to see your cases in patients' mouths after they are delivered by the dentist?**

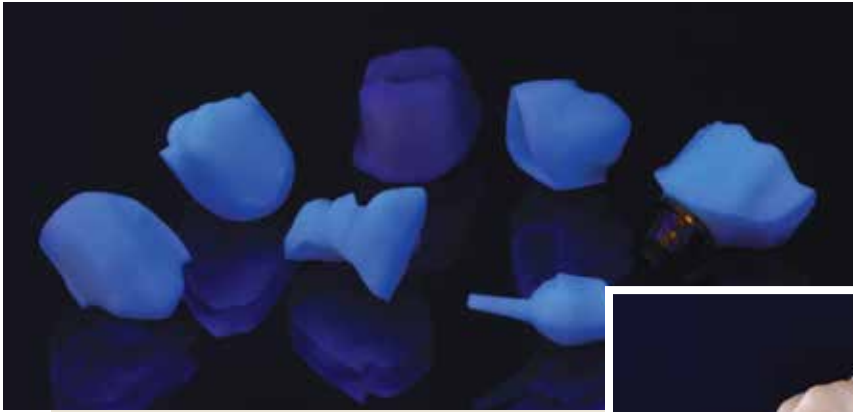
Some of our customers are just marvelous, sending us feedback with pictures after the cementation and also after checkups a couple of months later. The ones doing this know that we get better with every job we see placed in the mouth. That is the best learning experience for any technician: being able to see what's been done right and what areas can be improved. We always do our best for these customers since we know we are going to get feedback and post-op pictures.

**You recently found a way to incorporate fluorescence into one type of monolithic zirconia. Can you explain why this is important to the final esthetics, and how you achieved this effect?**

As we all know, zirconia in itself is not a fluorescent material. It looks just like titanium or gold under ultraviolet light. So we always need to alter the core with a highly fluorescent ceramic to achieve this effect, or, when doing monolithic crowns, we need to use a fluorescent glaze. Unfortunately, there are not many good glaze products that achieve this effect. I am constantly testing different materials from different manufacturers, and one of the tests I do is putting the material under ultraviolet light. There are even manufacturers marketing their materials as fluorescent, but when you study their product under ultraviolet light, you see nothing. I will not mention any of them here by name, but I recommend that you try it out for yourself and see if you really are getting what your manufacturer claims.

Actually, I didn't find the way to make zirconia fluorescent; Zirkozahn has a fluorescent staining liquid that is used to make zirconia fluorescent. This has been out in the market for a couple

**“ That is the best learning experience for any technician: being able to see what's been done right and what areas can be improved. We always do our best for these customers since we know we are going to get feedback and post-op pictures. ”**



of years, but it has only been working on uncolored zirconia. So, for instance, if I wanted to make a coping or crown in A3, I had to choose either to do the coping in A3 without fluorescence and have a nice base for the final crown, or to do it in white with fluorescence and then have a bright and undesirable shade for the final outcome. I have been trying to incorporate a shaded coping or crown with fluorescence since the first day I got the fluorescent staining liquid. I probably tried 10 different brands of pre-shaded blanks, tried to mix the fluorescence liquid with different staining liquids, but none have worked until now. Before, I achieved either fluorescence or the desired shade, but never both. Recently I received the first blanks of BruxZir® Shaded 16, and I finally had success. Now it's possible to make a nice coping in the desired base shade and use it as a dentin core that is naturally fluorescent. Because it can also be made thicker, I can eliminate the use of some of the layers to achieve this fluorescence. At the same time, the ceramic has better support. With a thinner and better-supported ceramic, we also should be able to see less chipping of the porcelain. When making a monolithic zirconia crown, you don't have to rely on the glaze being fluorescent, nor do you have to be sure that the glaze is thick enough to get the fluorescent effect.

Fluorescence in the final crown is important in many ways. In different lights, teeth and restorations can look very different. This is called metamerism. For example, in operatory light or in photos, restorations can be beautiful, but when the patient goes to the bathroom mirror, suddenly the crowns look dead or dull. So I believe that as we begin to be able to reproduce the optical characteristics that we find in natural teeth, we will achieve a better match for our restorations under different light conditions. The brightness of natural teeth, for instance, changes significantly under UV light, which has an effect on the level of perceived vitality of the restorations we make. When the patient goes outside,

especially in California where you have a lot of sunlight, you can imagine how a restoration without fluorescence will stand out. Or you can imagine a young patient going to the club with a central incisor restored with a nonfluorescent restoration.

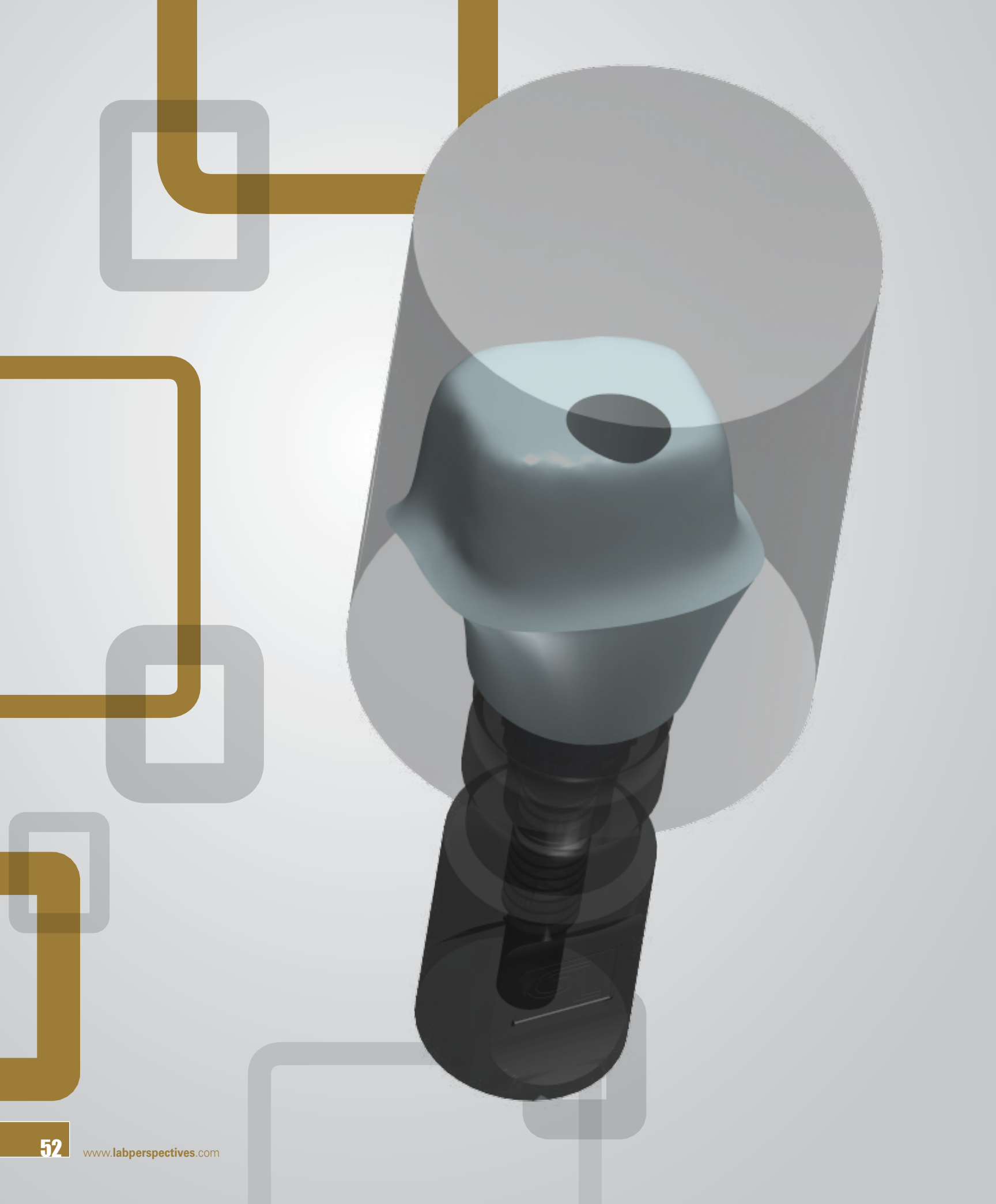
**Do you have any tips for dental technicians in the U.S. who work with full-zirconia restorations like BruxZir Solid Zirconia?**

Never use separating discs at the connectors, or the restoration will break. Tell your doctors to prep as minimally as possible. If they remain in the enamel, they'll get a better bond, and the BruxZir restoration will be thinner and take up color from the tooth. I would recommend using the coloring liquids (e.g., Tanaka or Zirkonzahn Aquarell) prior to sintering because they allow you to get a polychromatic crown that has a better color from the start, with more depth in the translucency. Also, make all your adjustments after milling and prior to sintering. And if you want esthetics in the anterior, the key is in microlayering.

**Where do you think dental technology is headed ten years from now?**

Ten years from now — noting the speed that we experienced in the last 10 years — I foresee huge milling centers, new monolithic materials and computerized shade-taking during intraoral 3-D scanning. Combining all of that technology together could lead to a future of additive manufacturing methods where you're able to print ceramic crowns in an exact shade. There's a pretty exciting time ahead of us.

Thank you, Przemek. 📞



## Tips and TRICKS: Custom Abutment Design

With *Lab Perspectives*™ magazine opening a window into production here at Glidewell Laboratories, an opportunity presents itself for us to share our proven, practiced knowledge on the modern direction of CAD/CAM laboratory technology for the benefit of the entire dental industry. This article is intended to be the first in a series of articles that offer specific advice for 3Shape DentalDesigner™ (3Shape; Warren, N.J.). I'd like to make it clear from the beginning: Glidewell Laboratories is not suggesting that these methods are the only way to achieve the goal. There are countless methods that might work better for other laboratories and technicians, but this is what has been successful for us.

Our Implant department has garnered a significant amount of experience when it comes to designing and milling, with cases from all around the world and from many different types of customers coming through daily. In the article that follows, I mean to offer some of the tested practices that have improved the workflow for our design technicians, effectively saving both time and money while increasing the quality of the final restorative result.

### Before Beginning Abutment Design

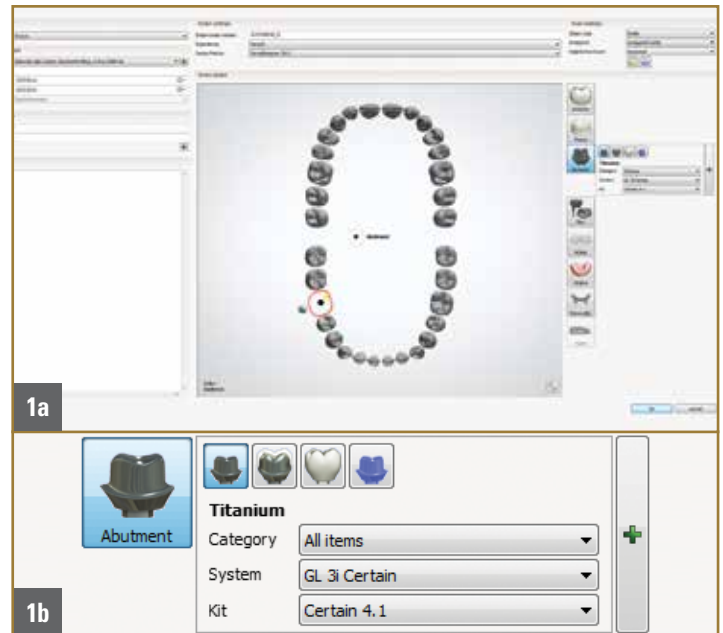
For technicians who are new to designing abutments using 3Shape DentalDesigner, even knowing where to begin can be wholly baffling. Users who may have worked with cast-UCLA pieces for more than a decade now must acclimate to design tools and methods represented by clickable buttons on a screen. But just like these hands-on approaches, to achieve the desired results, you must start with the correct pieces. One of the first difficulties encountered can be selecting the correct, corresponding piece in the CAD system to match the exact physical part your company offers. On the right side of the Order Form screen in DentalDesigner, there's a button that says "Abutment," with three selectable drop-down menus next to it. Many users don't know which selection to choose in these drop-down menus, especially when taking into account the expanded options that can be accessed via the green plus sign located directly beside that button (Figs. 1a, 1b). When teaching courses on this material, a solid 20 percent of the questions I receive concern how to verify that the image on screen is the correct part. The trouble lies with the lack



article by

Alec Di Lullo

**Alec Di Lullo** is the CAD Specialist and a 3Shape training expert at Glidewell Laboratories, and has initiated improvements in the design of abutments, copings, crowns and bars.



**Figures 1a, 1b:** On the order form screen, there are abutment selection options located on the right. Accurately selecting the correct options to match your case is paramount.

of common technical language between dental technicians and the computer programmers who developed the software; most of the selectable names will not exactly match the popular dental-preferred term. Still, it is of paramount importance that the part selected is the intended piece, because the final millable object will be derived from the choices made at this stage.

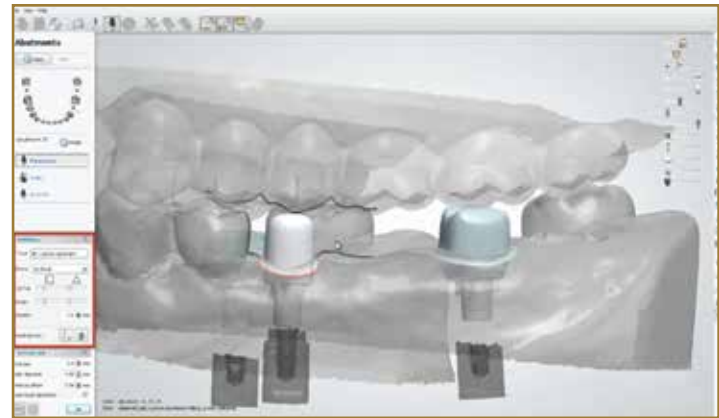
Despite the challenges in starting the design process, there should be no issue once users have become familiar with their specific system. With the correct information selected, the design module launched, and the Parametric toolset selected, there is a settings tab located on the left (Fig. 2). Here, you can select the type of design, as well as the library from which the possible shapes and tools are determined. Under “Type,” the three choices for abutments are: “custom abutment,” “bar interface,” and “robotic abutment.” Selecting “custom abutment” will give you access to tools that are both easy to work with and that create the consistent, geometrically retentive shapes preferred in abutment designs, rather than those created by the “robotic abutment” option. I highly recommend using the custom setting, especially when paired with the “artificial library” option for the “Library” setting, which will further allow you to keep the geometries of your abutment millable, biocompatible and tissue-promoting.

Three additional selections to be aware of under the “Settings” tab are: the “Top Cap” and “Margin” sliders, the “Chamfer” dimension setting, and the “screw access hole” button next to “Visual options” (Fig. 3). Adjusting the sliders associated with the top cap and margin will allow you to instantly and dramatically reshape the abutment, with a more squared design applied to posterior dentition and a more triangular design applied to the anterior. Next, the chamfer dimension should be set to 0.6 mm or above. This number controls the bevel of your chamfer and shoulder area; keeping the setting above 0.6 mm will ensure that your mill will work with the design. And finally, depressing the “screw access hole” button will make the screw hole visible on your virtual abutment, giving you a more accurate view of the complete design throughout the process.

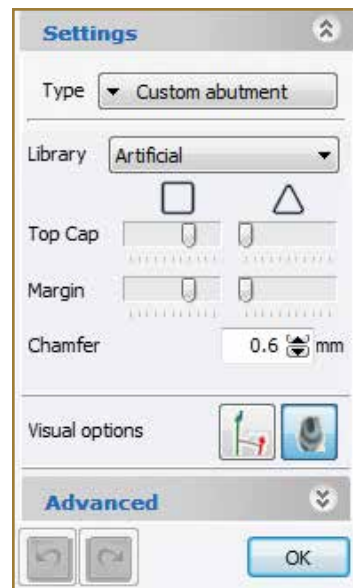
Before beginning the actual design, I also recommend activating all three measuring tools by clicking the three associated buttons at the top center of the screen (Fig. 4). Utilizing these tools allows you to instantly measure between various points, placing the numbers directly in front of you so you do not violate occlusion or material-thickness constraints. Selecting the options listed above has proven extremely useful for our designers, and we encourage those new to the program to do the same.

### Parametric Stage

About 90 percent of our work occurs in the Parametric stage. Parameters chosen here will ensure that your abutment stays as retentive and geometric as necessary for the final cemented crown. While the sculpting step, next in the design chain, allows you greater freedom of customization, it also has fewer protections against creating an unintentionally organic, less retentive abutment.



**Figure 2:** Located within the design module, under the Parametric tab at left, are additional design setup settings.



**Figure 3:** The additional design setup tools.



**Figure 4:** Located on the menu bar at the top of the screen are three measurement tools that, when enabled, provide a significant amount of information useful for design.

“Despite the challenges in starting the design process, there should be no issue once users have become familiar with their specific system.”



Convincing your customers to submit additional items like study models, wax-ups or suck-down stents with a case is not easy; as a lab, we don't require our customers to send these items. However, utilizing the pre-preparation slider to fade in and out on-screen scans made from these sometimes-included objects has proven extremely helpful to our technicians by providing both an exact guide and parameters for the spaces available. The largest benefit of CAD technology is that it enables you to visualize the entirety of a case, reducing the risk of remakes while producing an altogether more accurate product.

Designing the abutment involves just clicking and dragging colored handles to create the necessary contours. When you are satisfied with the design of the abutment, you can move to the Sculpt stage.

## Sculpt Stage

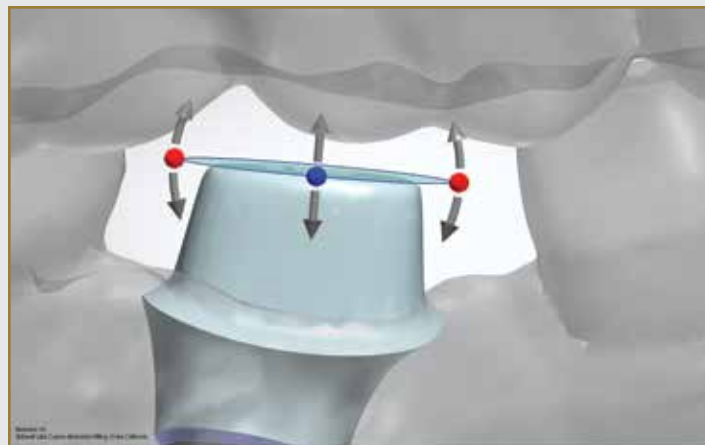
The Sculpt stage contains the tools to design the fine details of the abutment. Whereas the parametric step provides tools that adjust the design on a large scale, affecting the whole setup relatively evenly, sculpting allows for individual point contouring to make a more biocompatible design.

Two very helpful features in the sculpt kit are the “plane cut” tool and the “attachment” tool. Both of these tools allow you to take an exact section of material away from your design without harming your already established contours. The “plane cut” tool — true to its name — takes a cut across a single plane of your design. We often use this on the top of the abutment to “knock off” the initial v-cut left over from parametric adjustments, as a flat top on abutments can be useful when occlusal space is compromised. Based on the angulation of the 3-D model in the digital space, the tool will allow you to draw a line across your design (Fig. 5). This line can be re-angled and adjusted using the accompanying handles. Once you're fine with the proposed line, click OK, and the program will remove the material.

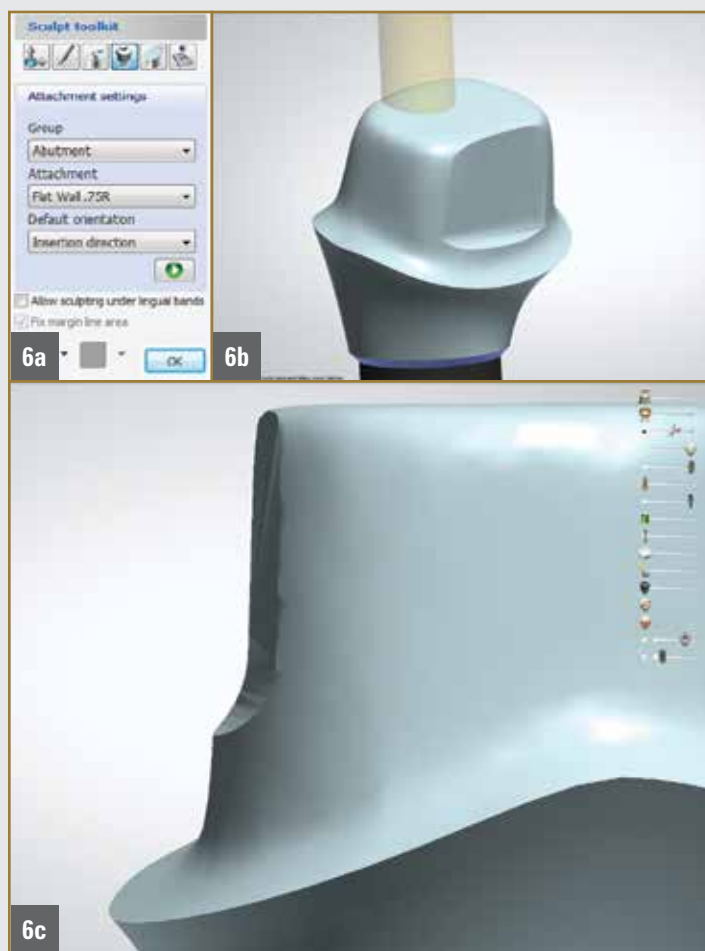
Creating a retention groove or anti-rotational feature is similar to creating a plane cut, except it utilizes a three-dimensional area to subtract from your design rather than removing material across a single plane. To place the retention groove or anti-rotational feature, select the “Attachment” tool. By choosing “Abutment” for the group setting, “Flat Wall .75R” for the attachment setting, and “Insertion Direction” as the default orientation, you'll be given a tool that will remove a three-dimensional block of material with a tapered edge from your abutment (Figs. 6a–6c). The block can be resized using the associated handles to reduce your design by as much or as little material as desired. When you've cut away anything necessary and finalized the style of the design, it's time to proceed to the third and final stage.

## Assembly Stage

The Assembly stage puts all the components together, and is the time to verify that your design is exactly as desired. This stage doesn't have tools to edit the design, but rather tools that confirm your previously applied changes.



**Figure 5:** The “plane cut” tool divides the design across a single plane, removing the unnecessary portions.



**Figures 6a–6c:** Settings required to create a retention groove or anti-rotational feature, as well as two views of the abutment with the “attachment” tool's settings applied.

In computer-aided design, it is extremely easy to forget that the end result is physical, and therefore has material constraints. Simply designing the on-screen ideal for a clinical situation is not always enough. The design must also conform to the realities of the chosen abutment material, as well as the specific milling machine's capability. There are two tools located on the left of the assembly screen that will help you verify these requirements have been met: the "thickness map" tool and the "millable blank" slider.

The thickness map displays a color-coded view of the abutment design, with red and orange displaying the thinner areas where milling may be problematic, and green showing the areas that adhere to the material's constraints (Fig. 7). It is important to note that you can slide the color scale on the right side of the screen to match the exact dimensional needs of the material, providing a precise illustration customized to the specific allowable thickness.

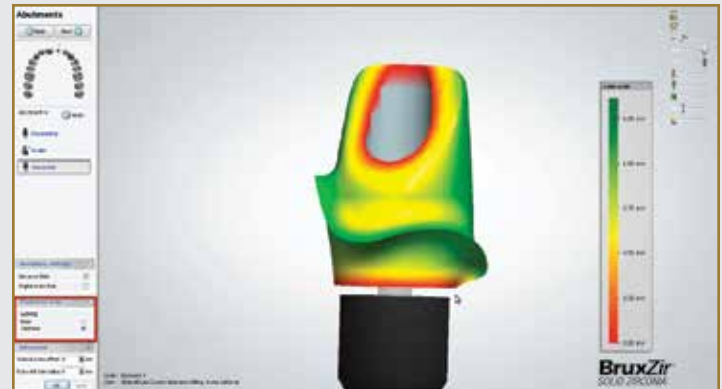
It is also not uncommon to accidentally design an abutment shape that extends beyond the parameters of the millable blank. Without confirming that the design fits within the blank's millable area, the milling process can have poor results, thus costing everyone involved both time and money. Before sending your design to milling, it is wise to ensure that every segment of the design is within the millable area by moving the milling blank slider on the right side of the screen (Fig. 8). With both the thickness of the material and the ability to mill confirmed, it is now safe to send the file to the milling machine.

## Conclusion

By adopting these strategies, you too can achieve great results. Since 2006, Glidewell Laboratories has been growing its Implant department at an annual rate of 27 percent, and a key part of the process has been the simplification of abutment design. As more and more doctors are realizing the benefits of custom implant abutments, the demand for fast, reliable and repeatable service will rapidly increase. We sincerely hope that providing this information can help raise the level of quality while lowering costs across all of implant dentistry. LP



“ Without confirming that the design fits within the blank's millable area, the milling process can have poor results, thus costing everyone involved both time and money. ”



**Figure 7:** The color-coded thickness map enables designers to more accurately view the specific dimensions of the design to guarantee milling success.



**Figure 8:** The milling blank slider should be used to verify that the design can be contained within the dimensions of the millable area.

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A BRUXZIR<sup>®</sup> SOLID ZIRCONIA VENEER CASE

# Case of the WEEK: Episode 105

Glidewell Laboratories' weekly Web series "Chairside Live" has given us a great opportunity to communicate with clinicians across the nation and educate them on topics that they're actually interested in learning. We've shared useful clinical tips and discussed potential pitfalls with our dentist viewers, helping them be more in sync with the lab. In this issue of *Lab Perspectives* magazine, we've decided it would be beneficial to share some of our dentist customers' concerns with the greater industry. If you haven't yet had the opportunity, episodes can be viewed on-demand at [www.chairsidelive.com](http://www.chairsidelive.com), or on YouTube and iTunes.

In the Case of the Week from Episode 105, I wanted to try something that I really hadn't done before. I've done some anterior BruxZir<sup>®</sup> restorations, and they turned out well, but I had yet to do an anterior crown case in conjunction with a BruxZir veneer. We've seen dentists prescribing more and more of these types of veneers, but it had made me a little nervous because, at times, it's difficult to get a good bond to zirconia oxide unless you do everything right. But we've been seeing dentists who want to place veneers on patients who have a lot of attrition, or who have broken PFM restorations before; for them, the strong zirconia oxide material is the right decision. So this is going to be a simple, straightforward case on tooth #8 and #9 with a BruxZir crown and a BruxZir veneer adjacent to it. Let's take a look.



article by

Michael C. DiTolla

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**Figure 1:** As you can see, this patient's got a preexisting PFM on tooth #8 that's kind of high-value, and kind of opaque. He's a Class II, Division II; you can see the deep overbite he's got going on here. So I like the idea of a BruxZir crown because I can keep it almost as thin as that PFM was on the lingual. Starting the case, we're going to go ahead and anesthetize him and take off this crown.



**Figure 2:** That's a Razor® bur from Axis Dental (Coppell, Texas). Oh, what a joy it is to cut off a PFM these days. After cutting off nothing but IPS e.max® (Ivoclar Vivadent; Amherst, N.Y.) and BruxZir Solid Zirconia for so long, I feel like I'm on vacation when I'm taking off a PFM. I will practically put my feet up and have a drink with an umbrella in it as I take off the PFM because it's that relaxing. You just rotate with the crown remover back and forth and it just falls off. If that was a BruxZir crown, I would have had to cut it two or three more times to get it off of there.



**Figure 3:** You can see that the prep has been endodontically treated and that it looks like a gold post might have been placed in the incisal edge. I can't think of the last time I used a cast-metal post and core. Tooth-colored posts and cores have been standard for me for at least 15 years.



**Figure 4:** We're going to start by putting our first cord in. This is a #00 Ultrapak® cord (Ultradent; South Jordan, Utah). On these types of preparations, where you're taking off a crown that's already shaped and not starting from scratch with a virgin tooth, all you really have to do is prep the gingival third of the tooth, which is harder than it sounds.



**Figure 5:** You can see how it's a little over-tapered on the incisal third. All we're really doing here is preparing the gingival third of this tooth with my favorite bur, the 856-025 bur (Axis Dental). It's an endodontically treated tooth, and I don't have to do a ton of reduction; it's more about where I'm doing the reduction, so I've got the speed turned down to 2000 rpm, and I'm going to do most of this reshaping dry.



**Figure 6:** I must have brushed that bur against the gingiva; that's why we've got a little bleeding there. So we're going to use ViscoStat® Clear (Ultradent), always my first choice for an astringent in the anterior because we don't get any discoloration of the gingiva. If that doesn't work, then we have to move on to ferric sulfate, which works better, but will cause some discoloration on the gingiva.



**Figure 7:** I've exposed a little bit of gold there, so I'm just going to cover it up. This is a little Vertise™ Flow (Kerr Corp.; Orange, Calif.), a self-etching composite resin. I put it on the tooth and just agitate it with the brush for about 15 seconds. Then we'll go ahead and cure that. Once we've cured it, we can just add a little more composite; and because it's a self-adhering composite, we don't need to etch or use a separate bonding agent.



**Figure 8:** Here I'm smoothing off the prep with an 856-025F bur (Axis Dental), so that's the exact same shape as that coarse bur I was using, but it's much smoother, so it gets rid of all the little chips out of the margin.



**Figure 9:** The top cord that goes into place is the #2E UltraPak cord (Ultradent). The "E" stands for epinephrine. In a case with a tooth like this, where I have abraded the gingiva a little bit to the point of irritation, it feels good knowing that I've got some epinephrine in there because I've got a better chance of getting a nice impression. Also, this patient was able to tolerate the epinephrine and the local anesthetic injection, so I think he's going to be just fine with the epinephrine being in the cord.



**Figure 10:** While reducing the prep further, I exposed a small part of the gold buildup that's in place. That's going to be okay though, as nothing is going to show through the BruxZir crown. I placed an anatomic Comprecap (Coltène/Whaledent; Cuyahoga Falls, Ohio) at this time, though he had a little difficulty biting down on it because of the way his bite is.



**Figure 11:** And you can see when that top cord comes out, we have a wide-open sulcus. It's hard to miss an impression with a sulcus like this. The first cord we placed is responsible for the vertical retraction of the tissue, and the second (top) cord is the one that provides the lateral retraction, which creates space for the impression material.



**Figure 12:** It would be hard to miss that impression, frankly. I mean, you've basically got a moat around the castle that has to be filled with the vinyl polysiloxane (VPS) material, and you could probably just seat a tray full of material with no syringe material and still get an acceptable impression. That's what I love about the two-cord technique.



**Figure 13:** Take a look at that lower anterior tooth and notice the wear on it from the PFM. As much as I'm always looking to help dentists find a better way to take impressions so we don't have to pack two cords (I'm experimenting with a device right now that looks like it might work), you just don't get this same kind of consistent result with other techniques. That's one of the reasons I'm compelled to stick with the two-cord method.



**Figure 14:** So, it's been about six days, and we're going to take off the temporary now and clean things up so we can try on the restorations and see if we like how they look. I am convinced that the shorter the time frame is between the prep and seat appointment, the lower chance there is for adjustments and remakes.



**Figure 15:** We've got a little temporary cement in that spot where we had cut into the gold buildup, so we're going to make sure that we clean that off. Sometimes we'll do it with a sonic scaler, especially if we use Durelon™ (3M™ ESPE™; St. Paul, Minn.) as the temporary cement. We just want to make sure everything is nice and clean. One of the main reasons crowns don't seat correctly is because a little piece of temporary cement is still on the tooth.



**Figure 16:** We tried in both of the restorations and the patient liked how they looked. So we're jumping right ahead to the cementation and the bonding. That's the Preppies™ pumice (Whip Mix Corp.; Louisville, Ky.). I love this product because it's disposable, so it just gets used once and tossed away. I'm pretty sure that with my dad's polishing lathe in his dental office, the pumice had been there for about 20 years, which is pretty disgusting. I like using the single-use ones.



**Figure 17:** Notice that sharp angle on the central incisor where the arrow is pointing, where that old composite is? I'm going to round that off a little bit because if I look on the model, I can't really see that the sharp angle is there. So we'll have to do some recontouring in the mouth.



**Figure 18:** Now I'm drying it off with the Warm Air Tooth Dryer (A-Dec; Newberg, Ore.). This is attached to the one hose on our unit that has never had a handpiece run on it, so it works really well to ensure an oil- and moisture-free stream of air.



**Figure 19:** Now we're putting the crown into place. We're going to cement this crown with Ceramir® Crown & Bridge cement (Doxa Dental Inc.; Newport Beach, Calif.). Again, the thing I love about Ceramir cement, besides the easy cleanup, is the fact that it bonds on its own to zirconia without requiring you to decontaminate the internal surface of the BruxZir crown or use a zirconia primer.



**Figure 20:** The cement will typically clean up in just one piece, and as you can see, I'm kind of teasing it with the explorer as my assistant picks it up. It cleans up so easily because it's the only permanent cement that I've ever used that goes through a doughy stage, so we don't get chunks there like if we used a resin-reinforced glass ionomer.



**Figure 21:** I isolated the two adjacent teeth with a couple of mylar strips, and then was able to go ahead and etch the enamel in order to place the veneer. Because the bond to enamel is so strong, we only needed to worry about the bond of the cement to the BruxZir veneer. As we had already tried in the veneer intraorally, I sandblasted the internal portion to decontaminate it, and then placed Z-PRIME™ Plus (BISCO; Schaumburg, Ill.) as my zirconia primer prior to bonding the veneer in place.





**Figure 22:** I can get the etch right up to the gingiva; in fact, I can even touch the gingiva because this is a no-prep veneer. Any time that we prepare gingiva and we do temporary veneers, the gingiva almost always ends up being irritated; and as a result, you have to be very careful getting acid etch near it, or it will cause spontaneous bleeding. But we don't have to worry about that here because this is a no-prep veneer.



**Figure 23:** And since we don't have any dentin exposed, we're just going right to the Scotchbond™ Multi-Purpose Plus bonding agent (3M ESPE) without needing to use a primer. So we're painting that on all the surfaces of the tooth. It's okay to get a little on the gingiva or in the sulcus. It's all going to be cleaned up later.



**Figure 24:** So we'll air-thin the bonding agent and cure it. The film thickness of the bonding agent is not going to effect the seating of this veneer. Even if it were a traditional prep veneer or a minimal-prep veneer, we'd do it the same way.



**Figure 25:** I've got a little bounce-back there on the gingiva. Because I want to make sure I get no-prep veneers nice and tight, I'll often almost have to hold it in place as it cures to make sure that it doesn't move. In fact, when we do larger no-prep cases, the way these veneers float around is definitely something to keep an eye on. It's not the same as seating crowns, or even regular prep veneers, where they just have one way to go on, so they just slide down into place.



**Figure 26:** There's really no margin for the restoration to contact as it goes down into place, and as a result, they can move around and will often slide too far gingival. So it's something to be aware of. Sometimes, my technician at the laboratory will build a little finger onto a no-prep veneer that actually wraps over the incisal edge, ensuring it will slide down and stop. But then you have to get a bur and cut off that little finger.



**Figure 27:** Here's the patient afterwards. These photos were taken that same day, so we still have a little dehydration there. It looks pretty good considering those are solid zirconia crowns. They don't look as good as natural teeth, but they're starting to look better and better because of the increased translucency of the material. So now I'm feeling more confident that if I'm placing a crown on a single anterior tooth, that I can place a BruxZir veneer on the tooth next to it. As long as #8 and #9 match, we'll have a chance of having a nice smile. If they don't match, there's no chance that smile is going to look esthetic or be pleasing to the patient. LP

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