FLORIDA'S OUTLOOK ON THE DENTAL LABORATORY PROFESSION
4th Quarter 2022
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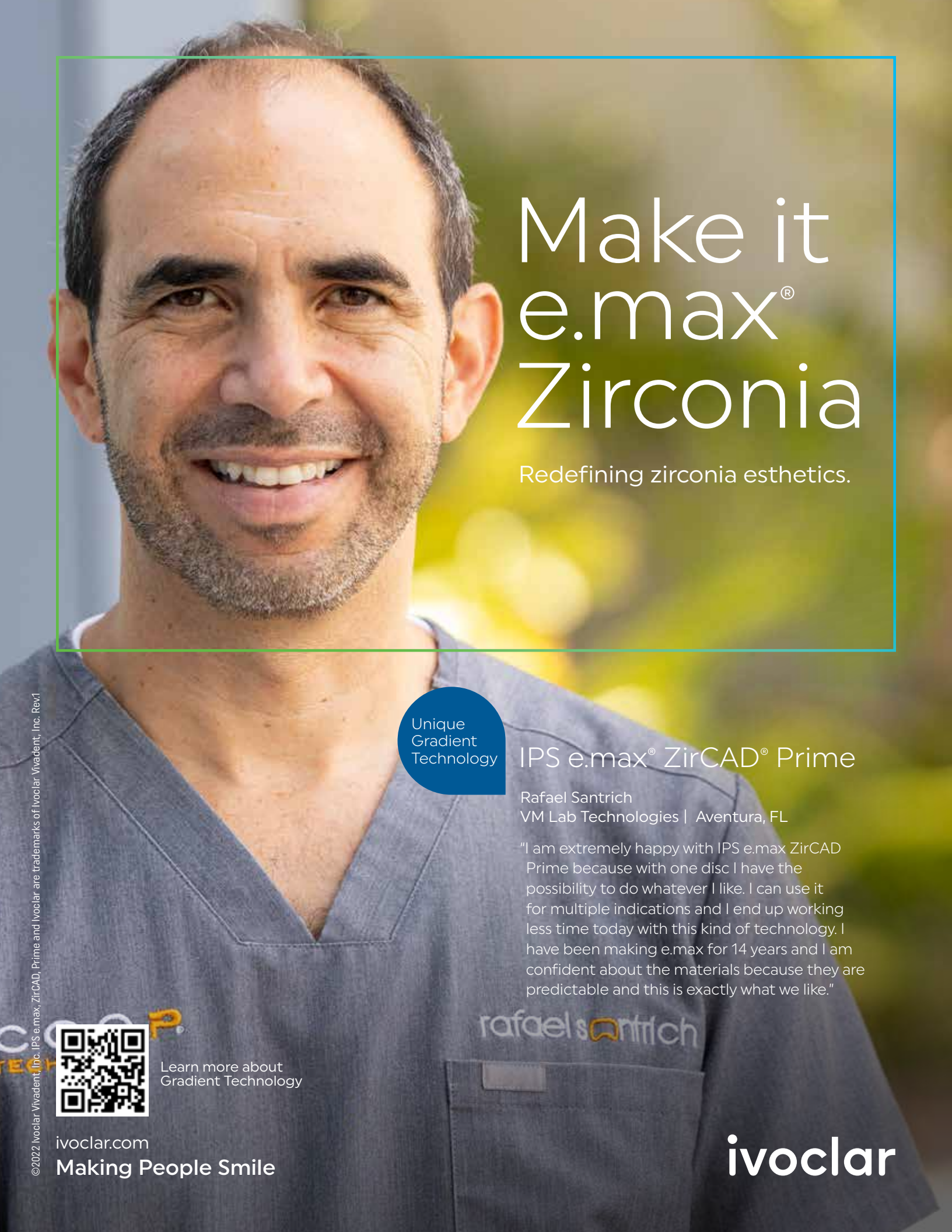
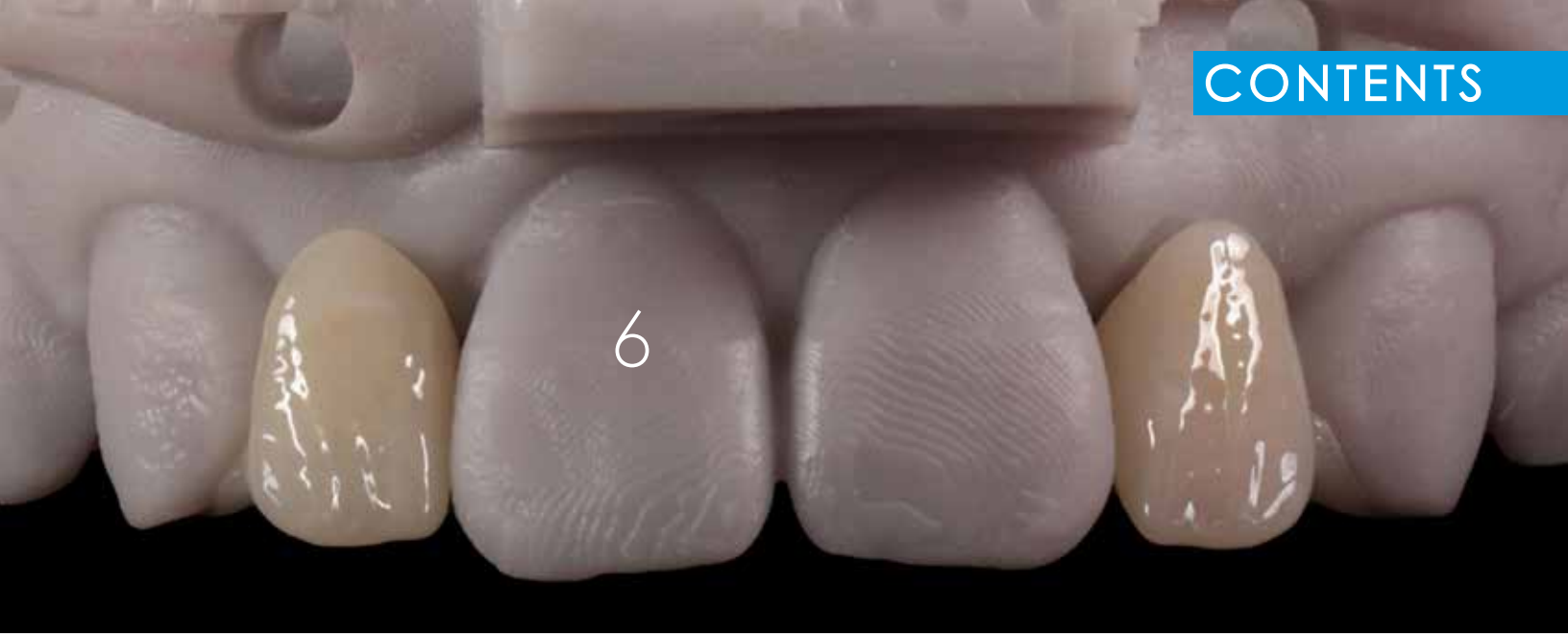
focus

Maximize Results:

ZIRCONIA

MONOLITHIC RESTORATIONS





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focus

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Invest the Profit

By Chris Peterson, CDT

FDLA President

In life, we all have a choice when it comes to our resources: will we hold, or invest?

In the last *focus* article, I shared my thoughts on "Investing in People" and the great effects it has personally had on me. This month, I'd like to make the case for investing profit to fuel continued growth and success.

We must be disciplined and understand the concept of delayed gratification.

If you're a technician or auxiliary team member, you might be thinking, "What does this mean to me?" Don't worry! Stay with me, and I promise you will glean something.

Investing requires delayed gratification. This is the practice of resisting temptation of immediate pleasure in the hopes of having valuable, long-lasting rewards. I'm sure we can all think of a time when we bought that pair of shoes or that shiny new fishing rod impulsively, and later regretted it. When I go into Publix, I always drink a bottle of water. Why? So, I won't be hungry and buy everything on the shelves. This is a physical control to keep me disciplined and healthy.

These examples above are similar to how I think about company profits and investing. We need them to survive and flourish, and we need discipline and long-term perspective to maximize its benefits. We must be disciplined and understand the concept of delayed gratification. This essential skill will support our company growth strategy.

Our small company simply invests in three areas: real estate, equipment, and people. Whether you need another bench in the lab to start improving a production step or an entire new wing in the facility to launch a new product line, keeping your goals in mind is essential. We started years ago by creating a separate bank account to fund these long-term goals. Every month we set aside a certain amount of planned profit based on our budget. From this account all investments into real estate, equipment and people are made. We don't withdraw from other bank accounts to pay for things until we have saved enough for them. We utilize reserves to purchase large volumes of materials, to fund equipment purchases and reduce financing, for merger costs or to help someone simply that is in need.

We have all been placed on this earth to work and to steward our time, talents, and monies to the best of our abilities. Staying focused and investing profit wisely will reduce stress and sustain long-term growth even with economic instability.

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Serving Florida's dental technology professionals as a valued part of the dental team enhancing oral health care.

FDLA Vision
Advancing the individual and collective success of Florida's dental technology professionals in a changing environment.

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By Conrad J. Rensburg and Jack Marrano, CDT

SINGLE-WINGED MARYLAND BRIDGES

MARYLAND BRIDGES, perhaps the most controversial restorative option in the history of our industry, is still being prescribed today, more than 50 years after the concept was initially described![1] In the mid-2000's, materials have evolved from alloy supported PFMs to modern-day lithium disilicate solutions. Unfortunately, because of strength issues in lithium disilicate, the basic design and unneeded invasiveness of the preparations stayed mostly unchanged through many decades of use. That was true until zirconia became a more esthetically acceptable anterior solution within the last decade. The inherent strength of modern-day zirconia allows for less invasive preparations and therefore thinner and more functional designs.

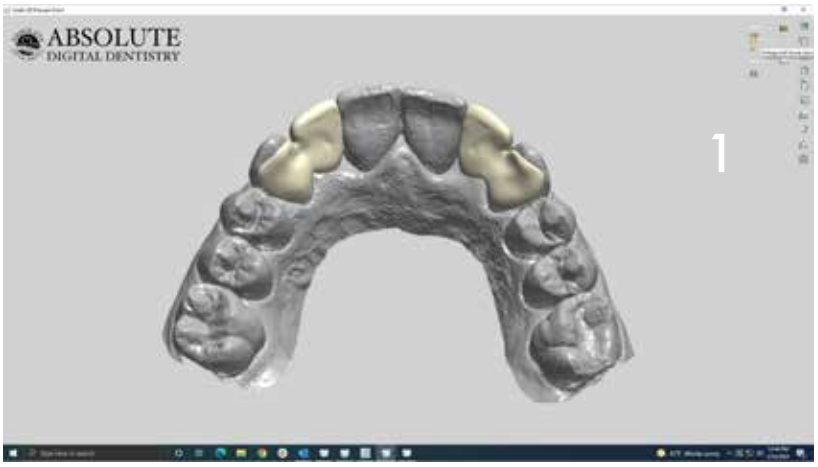

Figure 1
Digital case design from intra-oral scan ready for review and milling.

Figure 2
High translucency zirconia monolithic single-winged Maryland. Requires no layering ceramics for esthetics.

To fuel the controversy surrounding the use of Maryland bridges even further, some technicians and clinicians started prescribing and fabricating single-winged resin bonded bridges instead of the traditional dual-winged designs.

This article has its origin in social media posts that Absolute Dental Laboratory published in the spring of 2022. These case-study posts showed a few of these successfully delivered single-winged bridges. Responses from technicians and clinicians alike were either overwhelmingly in favor or scathingly against the concept. When evaluating controversial, and sometimes emotionally charged restorative options like these, it is too easy to dismiss the option based on opinion rather than fact. To mediate in a case like this, it is necessary to turn to published literature on the subject to provide some better guidance.

THE RESEARCH

In 2020, Carlos Alberto and his team closely followed a single retainer resin bonded bridge for a two-year period and reported their findings in Restorative Dentistry and Endodontics, published in May 2020. They reported that this single-winged retained bridge displayed satisfactory function and esthetics over a 24-month period.[2] Even though a two-year survival rate is not generally seen as a successful restoration, the article suggests that design shortcomings and/or bonding issues would have manifested itself in failure within that studied period.

Looking back to 2018, Bilal Mourshed et al. published a review on single-winged resin bonded bridges in the Journal of Prosthodontics. In this article, they documented a five-year survival rate of around 92 percent. What made this article even more relevant to this discussion was the fact that in this study, they compared the single-unit bridge to its more traditional double-winged counterparts. They found a higher prosthesis survival rate and showed a noteworthy lower debonding rate in single-winged bridges over dual-winged designs.[3]

In evaluating some more practical opinions, Dr. Lee Ann Brady (Glendale, Arizona) reports that she regularly prescribes single-winged bridges and has documented a much higher success rate when compared to the more traditional designs. In her article she writes, "When I first heard about this, it sounded counterintuitive until you think about the physics. When you use only one wing, the pontic can move with the abutment under load. With two wings, especially around a curve, the forces are directed differently and the movement of one tooth causes the bond to be flexed causing a bond failure over time."[4]

To further support her views, Dr. Julian Holmes, president of the International Association of Healthcare and Dentistry, reports that he has been using and teaching this restorative technique for more than a decade. He reports that after doing some research of his own, he quickly realized the problem with dual-winged designs was the fact that they suffered from rigidity. Although a rigid design is often associated with strength, in the case of resin bonded bridges it has the opposite effect. This rigidity does not allow for natural tooth movement and therefore, a two-winged design will usually de-bond at one end, causing a hidden opening where lingual demineralization and decay begins. Dr. Holmes admits that this concept initially sounds counterintuitive, but it is not until the actual physics and stresses involved are considered that the true advantage of a single-winged Maryland bridge becomes evident.

BONDING TO ZIRCONIA

Zirconia, with its superior strength and exceptional monolithic esthetics, is widely seen as the best option for Maryland bridges. Unfortunately, material strength and natural aesthetics are worthless properties without a dependable way to securely bond the prosthesis to the tooth structure. In some circles, it is still believed that zirconia cannot be bonded effectively, and therefore, this material is simply not suitable for this application.

Dr. Markus Blatz and his team wrote an exceptional research piece on bonding zirconia in the October 2016 issue of Compendium magazine. They coined the term "APC" to describe their technique of bonding zirconia.[5] This technique teaches three very practical steps. Below is a short summary pulled from their article describing the APC process:

A – Air particle abrasion

After restoration cleaning, zirconia should be air-particle abraded (APC-Step A) with alumina or silica-coated alumina particles; some call this procedure sandblasting or microetching. A chair-side microetcher using small particles (50 µm to 60 µm) at a low pressure (below 2 bar) is sufficient.

Figure 3
Monolithic zirconia color customized by applying MiYO liquid ceramics.

Figure 4
Digital design is verified and finalized on analog printed model from IO scan. Fabrication can be fully modeless.

Figure 5
Retracted anterior view. Day of delivery.

Figure 6
Material strength reduces required lingual coverage of retainers.

Figure 7
Final smile

P – Zirconia primer

The subsequent step includes application of a special ceramic primer (APC-Step P), which typically contains special adhesive phosphate monomers, onto the zirconia bonding surfaces.

C – Adhesive composite resin

Dual- or self-cure composites (APC-Step C) should be used to ensure adequate polymerization/conversion beneath the zirconia restoration, which reduces light transmission.

This above quoted article is an exceptional resource and offers a detailed and in-depth look into zirconia bonding techniques. The Absolute Lab team regularly refers to and supplies their customers with this information when questions arise regarding bonding of zirconia.

CASE STUDY

The article photos feature a case study that shows the lifelike esthetic and highly functional results achievable with this full digital workflow. This case was processed by Jack Marrano and the Absolute Dental Lab ART team. This was processed in collaboration with Dr. Keri Chen, Graduate Prosthodontic Clinic, University of Illinois Chicago.

CONCLUSION

It is generally agreed that an implant retained prosthesis is a more predictable restorative solution than a Maryland bridge. There are, however, cases where a resin bonded bridge offers the patient a good alternative in lieu of a more invasive, three-unit bridge option.

After restoring multiple patients with single-winged bridges, it has become evident that, although counterintuitive, a single winged-bridge does offer a better chance at success than a traditional dual-winged bridge!

ABOUT THE AUTHORS

Conrad J. Rensburg, N.H & N.H.D is the CEO and owner of Absolute Dental Laboratory and leads the implant and NavaGation Precision Guidance® surgical divisions. Jack Marrano, CDT is Director of the Signature Prosthetics team and leads the Absolute Dental ART Team (Advanced Restorative Team). They are authors of multiple peer-reviewed articles and have presented at, and are members of, the Academy of Osseointegration, the American College of Prosthodontists, the PEERS prosthodontic association and many other societies. They continue to play an integral part in the research and development of many of today's restorative materials and development of digital clinical workflows. Supported by their exceptional Absolute and NavaGation teams, they offer comprehensive, high quality, prosthetic, and surgical solutions to clinicians across the United States. Conrad and Jack can be reached at www.absolutedentallab.com.

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By Aaron Roux

DENTAL 3D PRINTING WITH Multi-Materials and a Small Footprint

Dental 3D printing has proven to be a successful tool for labs as the industry shifts to a more digital workflow. What used to require a lab full of highly-skilled technicians is now possible in a smaller footprint with modern technology.

3D PRINTING HAS CHANGED THE WAY LABS OPERATE WITH EXCELLENT RESULTS.

The goal of a digital workflow is to provide services quickly and efficiently without sacrificing the precision and accuracy dental professionals have come to expect. When implemented correctly, tools like 3D printers can be a game changer for labs, but choosing the right equipment and partners is critical.

To learn more about the current state of dental 3D printing, it's important to understand how we got here.

In its infancy, 3D printing for the dental industry was an experiment to see if existing commercial technology had a place in the dental world. The industry started experimenting by printing dental implants in the late 1990s, but the first application to make waves was mass dental model production for clear aligners.

3D-printed aligner model by Stratasys

Companies were taking scan data from a patient's mouth to 3D print a highly-accurate model of the teeth. These models were then used as a mold to form the clear aligners. As the treatment progressed, 3D printers created new models for each stage, and new aligners were made until the treatment cycle was complete.

This reduced patient chair time and allowed dental professionals to see more patients, which increased revenue. Also, labs no longer needed to keep an inventory of models as they could be printed on demand. Before long, clear aligner companies were purchasing multiple 3D printers and running them day and night.

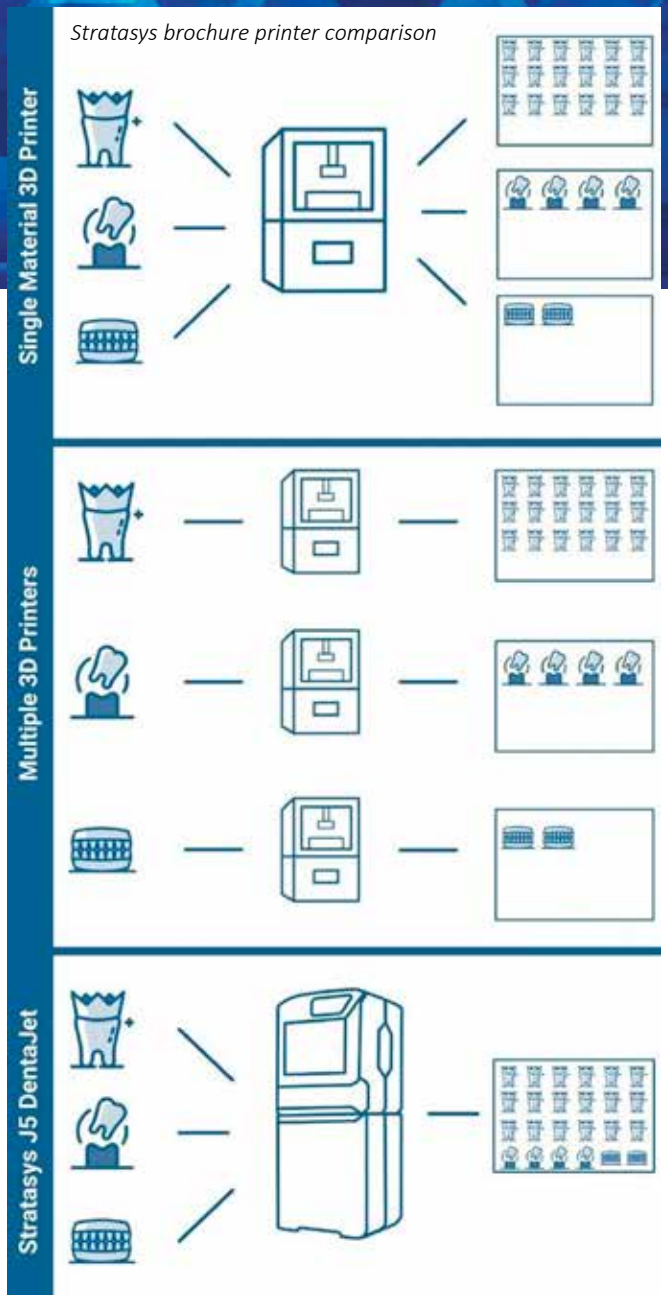
This early success caught the interest of some of the world's top 3D printing companies and led to significant R&D efforts to produce dental-specific 3D printers. Since then, dental 3D printing has changed the way labs operate with excellent results.

The global dental 3D printing market was worth around USD 3.25 billion in 2021 and is estimated to grow to about USD 8.29 billion by 2028. (source: Zion Market Research)

The Importance of 3D Printer Selection

Because labs need to produce models for a wide range of applications, adaptability is key, and that's why choosing the right tools is so important. If a lab has only one 3D printer and receives an order for transparent surgical guides, rigid implant models, and soft gingiva masks,

Stratasys J5 DentaJet



Stratasys brochure printer comparison

that would require multiple print jobs and material changes. Every manual interaction with a printer extends the total time-to-part, so this process isn't ideal.

If a lab purchases multiple printers and dedicates each to specific materials, it reduces material changes but includes its own challenges. For example, there is a more significant initial investment, they will use more floor space, and more time and resources are required to maintain multiple printers.

Also, if an order calls for a large quantity of one material and only a few of another, the second system would sit idle unless another material change takes place.

Each option benefits the lab, but neither solution is perfect for creating an efficient workflow. After several years of R&D and collaboration with labs, Stratasys introduced a new solution.

The Stratasys J5 DentaJet 3D Printer

The Stratasys J5 DentaJet, supported by GoEngineer, is like having three or more printers in one. The user is able to print several biocompatible materials simultaneously in a single print job. The mixed tray capability eliminates the need to change materials between jobs so a lab can print more parts without interruption or manual interaction.

With the J5 DentaJet, labs can produce parts based on demand versus capacity. So, for example, if a job calls for 15 implant models, 15 surgical guides, and 25 gingiva masks, the

J5 DentaJet multi material full build tray (models, surgical guides, soft tissue gingiva masks)

3D-printed color model by Stratasys

3D-printed dental orthodontic model retainer fabrication example by Stratasys

Print to cast RPD frameworks by Stratasys

J5 DentaJet multi-material 3D printing (model, surgical guide, soft tissue gingiva mask)

printer software optimizes the placement of each part, and the user can assign the proper material to it. From there, the printing process begins.

The J5 DentaJet can produce as many as 46 complete implant cases in one day of unattended 3D printing. Once the printing is completed, the parts are 100 percent fully cured and ready to be cleaned, with minimal post-processing requirements. All that is needed is to print and remove the support material with a waterjet or an automated support removal system, which can be done in minutes.

Here are some ways the printer can be used for various applications.

Orthodontics

3D print indirect bonding trays, clear aligner models, orthodontic models with brackets, and separator DM models for producing acrylic devices.

Crown and Bridge

Produce a large volume of precise full arch and quadrant models with removable dies and full-color study models. Print as many as 87 crown and bridge cases daily in only three trays (one case equals a quadrant model, opposing model, and removable die).

J5 DentaJet 3D-printed dental models

Implantology

Print biocompatible and transparent surgical guides, implant models where the analog will precisely fit into, and soft gingiva masks - all in one tray. Also, print All-On-X try-ins. Print as many as 46 implant cases per day with only two trays (one case equals a full arch model, opposite side, surgical guide, and gingiva mask).

Removables

Replace hand wax-ups and automate the process of cast chrome partials with the Print to Cast technique; print the models and the corresponding RPD frameworks on a single, mixed-tray. Also, print custom trays and denture try-ins. Print as many as 45 cases per day with only four trays (one case equals RPD framework and model).

The J5 DentaJet is a solution for common problems both small and large dental labs face, and allows for growth into new revenue-generating applications while keeping customers satisfied.

Stratasys and GoEngineer have built a reputation for listening to their customers and providing them with the necessary tools and support. To learn more about the Stratasys J5 DentaJet or dental 3D printing in general, visit https://www.goengineer.com/3d-printing/dental and keep an eye out for exciting new materials and updates, such as digital dentures, temporaries, color models from a color digital impression, and more.

About the Author

Aaron Roux has been in the dental laboratory industry for 20 years and is the Dental Lead Specialist at GoEngineer. His focus is working with dental laboratories to identify and provide additive manufacturing solutions and support that fulfill the production needs of laboratories within the digital dental landscape. He can be reached at aroux@goengineer.com.

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Photo Courtesy of Przemek Seweryniak, DTG

"Our switch from milling PMMA to printing Trusana for our provisional All-On-X cases has been a game changer for our lab. We have been able to increase our production, and the esthetics and strength we are getting from Trusana exceed anything we've seen from milled PMMA."

—Jay Collins, CEO, Cornerstone Dental Lab

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Monolithic Restorations Made of Zirconium Oxide: HOW TO MAXIMIZE RESULTS

By Aiham Farah

Surface matters

Modern zirconium oxide materials incorporate a wide range of light-optical properties that impart an inherent natural appearance to restorations. In spite of these high-performing material characteristics, it is in the hands of the technician to use these materials to their best advantage. Results that are virtually indistinguishable from the original, the beautiful natural dentition, can be achieved by creating suitable textural and morphological features and, in some cases, by adding external shade effects. Here, the author uses a monolithic anterior restoration to introduce his technique to create beautiful zirconia restorations. A state-of-the-art zirconium oxide (IPS e.max ZirCAD Prime, Ivoclar), skilled craftsmanship and a well-rounded range of stains and glazes (IPS Ivocolor, Ivoclar) help him achieve highly esthetic restorations.

Nature's perfection is reflected in intricate details, such as the pattern of incident light on the surfaces of natural teeth. The typical appearance of "naturalness" arises from their richly faceted surfaces on which even the smallest rays of light create specific patterns. While nature does not produce perfectly straight lines, CAD/CAM milling machines do. So, is the CAD/CAM fabrication of monolithic restorations incompatible with natural esthetics? No, this is not the case, because there is a remedy: if CAD/CAM technology and monolithic materials are used to generate as perfect a copy of the natural tooth as possible, the resulting restoration should be finalized by hand. This gives the dental technician an opportunity to refine the secondary anatomy with craftsmanship and skill. Think surface texture! Morphological details can be created with the aid of fine diamonds that have a geometrical configuration that is amenable to surface contouring. While the morphological details are being created, the tooth is gradually "springing to life" (**Fig. 1**).

Figure 1
Surface textures (left) are contoured by hand to impart a natural appearance to the restoration.

Monolithic CAD/CAM zirconia restorations can be given an additional touch of individuality and natural beauty by applying external shade effects to refine the surface texture (secondary anatomy). When the staining technique was introduced in the 1980s, it revolutionized the manufacture of ceramic restorations. Its success was based on its user-friendly technique and reliability. In recent years, the layering technique has experienced a revival in response to the increase in esthetic expectations. At the same time, polychromatic ceramic materials have begun to compete successfully with conventional layering methods due to their efficiency. Inno-

vative restorative materials have outperformed the layering ceramics in a number of areas. So, what could be more tempting than creating monolithic restorations and customizing them with the staining technique?

Ivoclar has been aware of this change in expectations from an early stage. The company's product developers realized that a skillful combination of framework material with a matching staining system had the potential to achieve enhanced results in terms of esthetics, reliability and economic efficiency. Today, this combination of materials is available to dental laboratories: it consists of the high-strength IPS e.max ZirCAD Prime and the versatile IPS Ivocolor range of stains and glazes.

Looking at the materials science of a contemporary innovative zirconium oxide material

The zirconium oxide material IPS e.max ZirCAD Prime is based on a unique manufacturing technology which, among other things, produces discs that offer an internal progression of shade and translucency (**Fig. 2**). This zirconium oxide features a continuous seamless progression of shade and translucency and combines two zirconium raw materials into one product. In the dentin zone, the high-strength zirconium oxide 3Y-TZP (flexural strength of around 1,200 MPa) endows the material with stability. This attribute enables the fabrication of restorations with a reduced wall thickness and a minimally invasive preparation technique. Given its high strength, IPS e.max ZirCAD Prime is suitable for bridges with up to 14 units. In the incisal area, the disc contains the highly translucent zirconium oxide 5Y-TZP. This zirconium oxide compound features a lower flexural strength, which has no limiting effect in the incisal area and in areas away from the connectors. Its high translucency is an advantage, as it is optimally coordinated with the incisal area. The optical properties give monolithic restorations a naturally vibrant appearance, even without additional characterization work. IPS e.max ZirCAD Prime delivers an accurate shade match and yet, it leaves all options open. If desired, the restorations can be customized using the infiltration, staining or layering technique. This is especially advantageous in the anterior region, where the already high potential can be maxed out.

Zirconia restorations can be given an additional touch of individuality and natural beauty by applying external shade effects.

Figure 2
IPS e.max ZirCAD features a continuous and smooth progression of shade and translucency. The material combines two zirconium oxide raw materials (5Y-TZP and 3Y-TZP) in one product.

Processing the restoration after CAD/CAM milling and sintering

This report focuses on the process to finalize a monolithic zirconium oxide restorations, create the restoration's secondary anatomy and apply external shade effects. Full-contour anterior crowns milled from IPS e.max ZirCAD Prime are used to demonstrate a proven approach. Once the crowns are sintered, fitted on the working model and their contact points adjusted, the attention is turned to the restoration's surface texture.

Figure 3
Grinding over the entire surface with a long diamond bur

Figure 4
Polychromic zirconium oxide with subtle progression of shade and translucency

Applying secondary anatomical features to the monolithic framework

In the first step, a long diamond bur (usually coded with a red ring) is used to grind over the entire restoration lightly, without applying pressure (**Fig. 3**). By slightly roughening the surface, the actual shade of the zirconium material can be seen more accurately. After sintering, zirconium oxide surfaces tend to have a mirror-like reflective appearance. Because of this, their shade tends to be slightly distorted. By removing the reflective layer, the proper shade comes to the fore. If this step is performed correctly, the real base shade of the zirconium oxide is revealed. Additionally, the subtle natural progression of shade and translucency can be observed, without having to illuminate the restoration with a light source from any particular angle (**Fig. 4**).

In the next step, the tooth shape is checked to make sure that the milling machine has faithfully translated all the details of the technician's design to the restoration. A diamond rubber is a good choice for applying any necessary corrections and for surface contouring (**Fig. 5**). When fine-tuning the shape of anterior crowns, it is essential to bear in mind that the gradation in translucency (from cervical to incisal) is more visible if there is a vestibular curvature. This makes the translucency of the incisal third appear more clearly.

In the third step, the transition lines are accentuated and then the surfaces are checked to see if they are symmetrical. This check can be carried out with the help of a pencil or a direct light

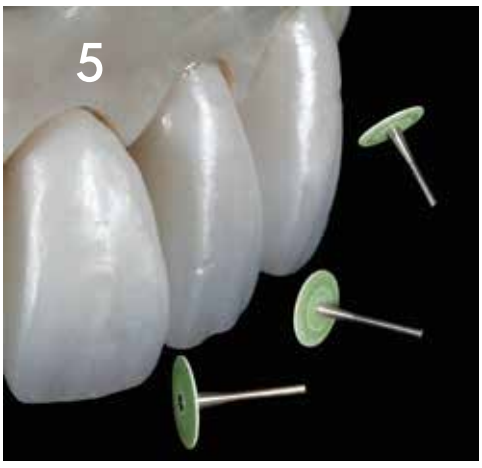

Figure 5
Contouring the surface using a diamond rubber

Figure 6
Creating natural textural features using stone burs

source. Attention is now turned to creating the macrotexture. This step is essential to reproduce the three-dimensional features typical of natural teeth. Eroded green stone burs, applied at low rpm, have been shown to provide good results here. The natural texture of the teeth can be emulated in a targeted fashion using the tip of the stone (**Fig. 6**).

Now the vertical microstructure is applied. Diamond burs are again very useful here. In the case shown, a bur that looks a bit like a football (**Fig. 7**) produces a delicate texture without leaving aggressive grooves. The tip of the bur creates a fine pattern of micro grooves that gradually and softly open out, resembling very closely the natural tooth structure. A direct light source is ideal for visualizing these fine details. In the absence of an adequate light source, the intensity of the texture can be visualized with an auxiliary method, such as dusting the surface with silver powder or passing over the surface with articulating paper. Visualizing the textures assists in observing the differences between highly reflective zones (e.g. prominent areas such as angle lines or strong contours) and shaded zones (e.g. depressions or fine grooves).

Lens- or ball-shaped diamond burs are used for creating the horizontal microtexture (**Fig. 8**). Important rule for creating a natural surface texture: when creating perikymata and grooves, make sure that vertical lines run parallel to the long axis of the tooth and horizontal lines run perpendicular to the long axis. After that, any sharp angles created while texturing the surface are softened using a rubber wheel (small diameter). Excessively textured areas are slightly smoothed over. Subsequently, the restoration is blasted with aluminium oxide (50 µm, 1.5 bar) to remove any contamination or deposits left by the diamond-coated burs or rubber wheels.

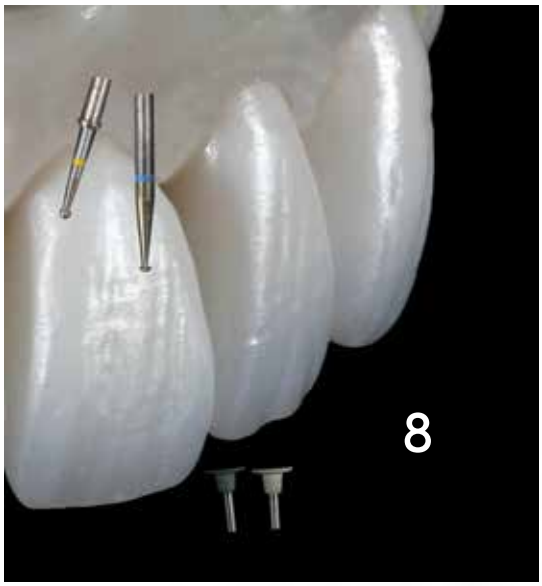

Figure 7
Applying vertical microtextures using a diamond bur with a tip in the shape of a football

Figure 8
Creating the horizontal microtexture

A direct light source is ideal for visualizing these fine details.

Figures 9a and b
Comparison of various differently textured teeth. Note: The more texture, the more reflection.

Ideally, the incisal third of the crown is not too heavily textured. This is because the more textured the surface, the more reflective it is. **Figures 9a-b** show a selection of differently textured surfaces next to each other. To take the picture, the restorations were illuminated from behind to better visualize their textures. One set of crowns has been textured as described in the procedure above, and the others have not been. Clearly noticeable: The more pronounced the texture, the more light is reflected. This also has an effect on translucency. For this reason, surface textures should be kept light; especially in the incisal third, where a high degree of translucency is essential for the monolithic crown to look natural.

The shade is checked one more time before proceeding to applying the external shade effects. There is, however, a problem when evaluating the shade using a conventional shade guide and this problem needs to be addressed.

To start with, shade guides and zirconia restorations are made from different materials with a different surface behavior (light reflection, etc.). What is more, the tabs of the shade guide have a high gloss finish, while the zirconia crowns have a matte finish after having been blasted. To create a level playing field, the shade guide is first sandblasted and then, together with the crowns, moistened with glazing material (**Figs. 10a-c**). This enables an accurate evaluation of the shade match. In the clinical case shown here, the shade of the crowns (IPS e.max ZirCAD Prime) harmonizes with the target shade on the shade guide (BL2 Bleach). Additional shade adaptations are not a must. In principle, the crowns could now be simply glazed and finished. In the mouth, their shade would look beautiful and natural. Additional customizations – such as a youthful opalescence and mamelons – can be created at this stage by applying external shade effects using the staining technique.

Figures 10a-c
The shade match is assessed after the shade tabs (shade guide) have been given a matte finish (by sandblasting) and both the restorations and shade tabs have been moistened with glaze paste.

External shading and characterization

The middle area of the monolithic crowns shows a shade that matches the IPS Ivocolor Shade Incisal 2 (SI2). In principle, this would be the shade that is used to create the desired translucency according to the shade guide to achieve a progression of shade. The crowns have been made, however, from a polychromatic material, with the translucency incorporated into the incisal edge. So there is no need for painting a translucent effect onto the restoration and the focus can be placed on creating the opalescent effect. For this purpose, Shade Incisal 3 (SI3) is used. The bluish hue of this ceramic material provides natural-looking illusions of opalescence, which can hardly be attained with other stains, especially not in Bleach areas. The mesial and incisal edges are characterized using SI3. The technician should not be shy to move the brush slightly down (toward the dentin) to achieve a soft transition. After that, a small line of interrupted dashes is applied horizontally under the incisal edge with the tip of the brush using Shade Incisal 1 (SI1). The shades applied to the restoration are now fired at a low temperature (e.g. 700 °C) to fix them in place (**Fig. 11a**). Subsequently, the mamelon and halo effects can be applied. Mamelon effects can be produced by applying one of the light-reflecting bright stains of the Essence kit. To create an additional "true-to-life" three-dimensional effect, the shade is mixed with 10 percent layering material, such as IPS e.max Ceram Opal Effect 4 (OE4). As a Bleach shade is used in the case shown here, this "thin veneering layer" is applied. The blend consists of IPS e.max Ceram OE4 and IPS Ivocolor Essence white, mixed together with IPS e.max ZirCAD Zirliner liquid. In my opinion, the IPS e.max ZirCAD Zirliner features a better consistency for mixing the materials than the Build-up Liquid. When applied to the surface, the mixture stays in place and can be placed exactly where wanted (**Fig. 11b**).

The opacity of the monolithic crown is optimally coordinated, especially in the cervical third, and makes for an impressive result (**Fig. 12**). In spite of the dark shade of the preparation, the restoration accurately matches the shade of the BL2 shade guide. Finally, glaze material is applied

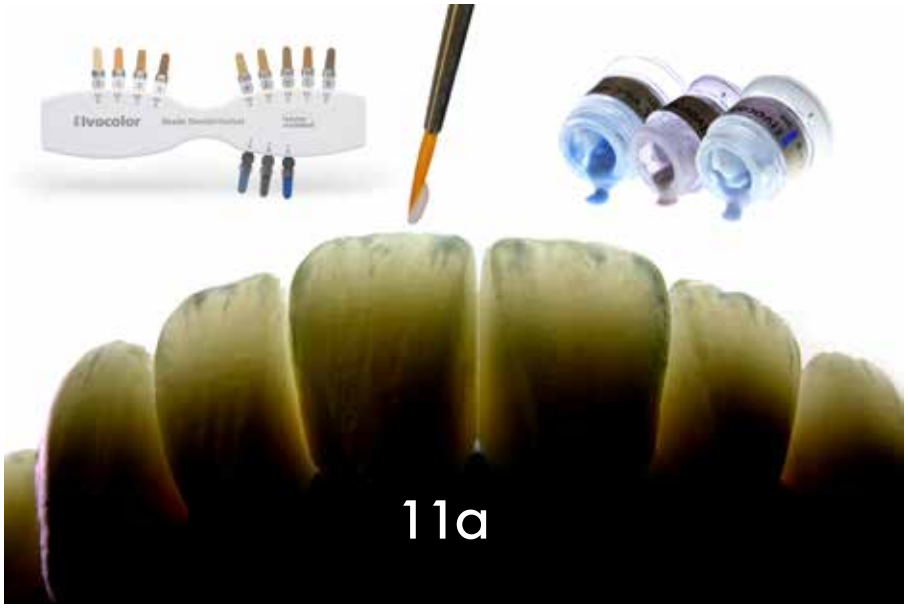

Figure 11a
Characterizing the incisal area using IPS Ivocolor Shade Incisal

Figure 11b
Applying a thin veneering layer using the materials of the IPS e.max Ceram range

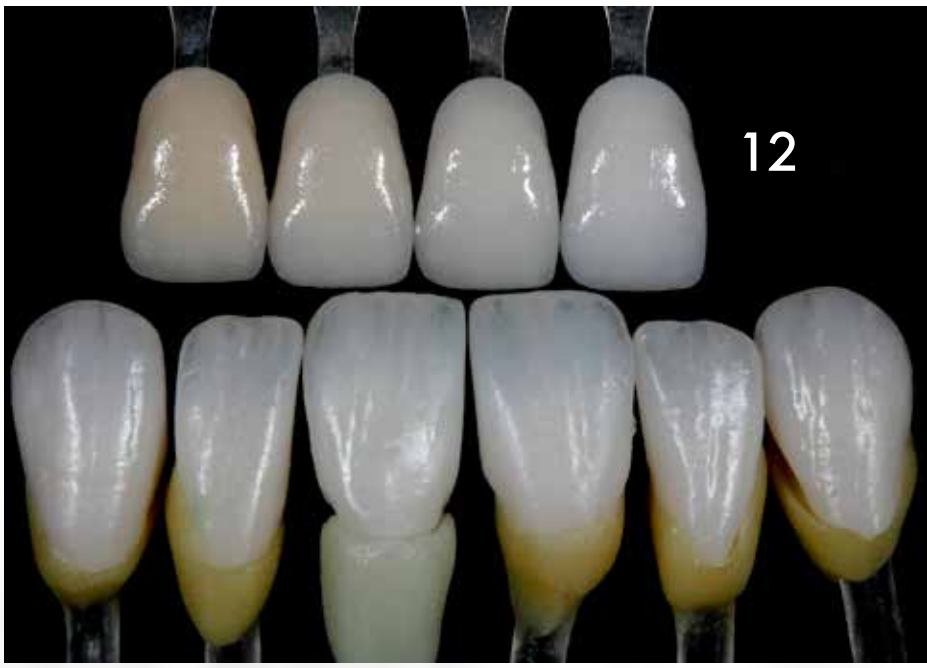

Figure 12
Optimally coordinated opacity of monolithic CAD/CAM crowns

Figure 13
Completed zirconia restorations on the model

to smooth out any uneven areas created between the layered 3D mamelon structures. This is done with a fluorescent glaze material (IPS Ivocolor Glaze FLUO). Fluorescent glazes are generally recommended for monolithic zirconia surfaces. The restoration is fired using the standard glaze firing program. After that, the entire surface is coated with a second, extremely thin layer of fluorescent glaze material. This time, the material is applied in a slightly thinner consistency to make sure that the textural features are retained (Fig. 13).

Figures 14a and b
Inserted restorations offering natural-looking shade effects and a natural surface texture

Conclusion

Monolithic zirconia restorations can be "brought to life" by manually creating surface textures and, as an option, by applying external shade effects. To do so successfully, the skilled craftsmanship and creativity of the dental technician are required in addition to a coordinated range of materials. The procedure presented in this report involves clearly less work than the conventional layering method; the result, however, comes very close to the high benchmark set by layered restorations. It is possible to create monolithic restorations with brilliant esthetics that are a near perfect representation of the natural tooth – even in the anterior region (**Figs. 14a-b**).

About the Author

Aiham Farah is a cosmetic trainer, ceramist, and materials consultant. Since 2009 he has been a materials consultant for Ivoclar in the Near East and Orient.

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By Bryan Johnson

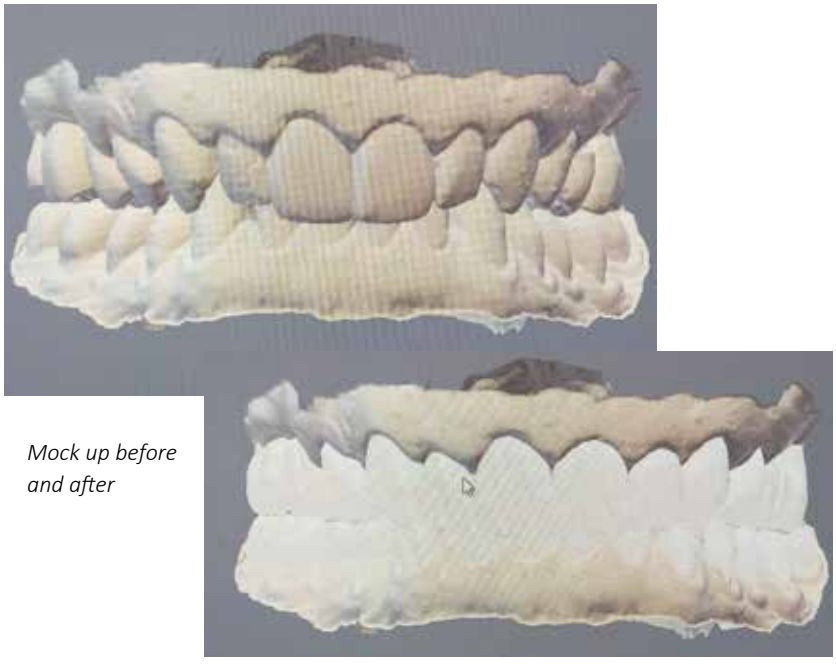
DIAGNOSTIC, A Different Perspective

Digital mock up

Having done enough of these, I know the pitfalls. Being able to work with clients who understand the problems allow for a great relationship builder and a great outcome. I am sure we have all had clients who prepped a full upper and lower and gave a mush blue bite. Sometimes, results far exceeded the patient's expectations, but the fact is, there were likely countless try-ins, becoming an overall pain for the technician. Most patients prefer to see the outcome as soon as possible. I am usually blessed to consult, so I can achieve this before the handpiece is picked up. We can do most of the design legwork by simply asking questions showing pictures of the certain shapes and incisal characteristics, and even a simple card of denture teeth to move and alter chairside. Everything is then narrowed down, and a large part of the patient's vision and multiple try-ins of biotemps is eliminated, which saves time and money for everyone. Multiple photos of rest facial and profile pictures are taken to have handy while designing for an even better outcome.

With the matrix made right from print, endless amounts of temps can be made.

So, where are we when we do the consult? Sometimes it's on the fly. For instance, maybe the lowers are prepped and we all have to bend to what we are working with and formulate which direction to go with the diagnostic or try-in diagnostic. A traditional full-mouth wax up might have taken four to six hours, but with digital and printing we can design something in one quarter of the time. Speaking of design and plans, how we approach this can vary, but there are several ways. First, is the virtual prep or eggshell temps, which is usually good for singles or small bridges with ample tooth length and short-time design. Process negotiations interproximal relief usually requires seating issues.



Mock up before and after

Second, manual prep from pre-op usually gets the job done and an aggressive prep is required. Negatively taking time and soft tissue seating causes problems with a lot of re-lining and multiple checks needed to get the temps to fit in the path of reduction.

Third, digital mockups or overlay is probably the best option for the first temps. A slightly larger tooth with the form of the tooth just overlaying the existing, can show the design and the required changes can be made to give thickness for the chairside temp constructed with the matrix from your print. The diagnostic benefits are shown to the patients for evaluation before placing the temps for changes. With the matrix made right from print, endless amounts of temps can be made. This enables freedom for

the doctor to prep how they normally would, without the worry of over-reduction. The patient leaves the same day with a great temp close to final. Most of our rehabs include raising the incisal pin a few millimeters to bring back the normal void and plane correction. If the occlusal scheme room is maximized or corrected, it can sometimes make larger mold changes on tooth length and rotation. Profile corrections are sometimes required.

Fourth, diagnostic try-ins, including bridges and veneers, are already prepped and the current temps are satisfactory. The temporary close to final can be printed to help identify issues, and I have found the incisal length and profile are best indicated. The print temp can be worn that day for the patient to take home, evaluate, and make a final decision. Multiple prints or duplicates can be delivered on the first day as back-up. This is a great time saver for the lab, as all we have to do is change the material on the case, reduce thickness a touch, and mill the final once approval is given. Let's be honest, printed veneer bridges, doing single veneers on the front six, takes time. To save it, I usually print a bridge veneer a little thicker, especially interproximal with thicker lobes, to get it to print and to make the bridge survive post-processing reduction of the thickness. I perform after-processing and finishing on a solid model to prevent torque and possible breakage. Super fine burs and rubber wheels on a slow speed usually get me to where I need to be. The shape is already there, so it goes pretty quick, and I also recommend a glazing appliance to help add strength, making a combo case even easier. These diagnostic techniques are just a few areas you may be able to apply to your workflow. While I may find a few things to be a must for success, I understand there are different strokes for different folks. There are, however, some things that need to be applied.

Devote a material that is specific to printing temps, an adequate cement gap, and for accuracy, remove the bur compensation application in printing. Why wait — just export and go. It's right in the folder, and is easy to change the design,

Above: Second print temps delivery..same form just refined and streamlined

Virtual prep

export it to print quick design changes, and multiple copies look good. The best thing is we can charge for it.

Process your cures with the recommended times and system to be compliant. This achieves a predictable outcome and increases the longevity of your printed temp and accuracy of your models. Being a cowboy and subjecting your lab to possible FDA issues just isn't worth it.

Use the print software to your advantage. Our exports are usually hollow and in need of some modeling to make more solid. Some have the ability to quickly cut and make nice bases so we can get right into the print.

Don't go skimpy on the resins. Use your C&B resin for preventing a specific resin that can be seen and evaluated by the patient.

Thanks for reading this article. I am really blessed to be given this opportunity and hopefully gave some helpful tips that have helped me complete some successful cases with these techniques. We don't need some fancy smile design program; as technicians we know what is within us to bring the passion and knowledge to change someone's life. No program can do that. Thanks again – be well!

About the Author

Bryan Johnson is a highly skilled dental laboratory technician with 25 years of hands-on experience in fixed, removable, and CAD/CAM technologies. He is the laboratory manager and vice president of his family-owned dental lab, Sterling Dental Arts in Merritt Island, Florida. His general passion and thirst for knowledge gives him a unique perspective that has lead him to specialize their removable department in flexible and hybrid partials.

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At the 2022 Southern States Symposium & Expo, FDLA joined together with the Foundation for Dental Laboratory Technology (FDLT) to increase awareness of the opportunities for enhancing education in the industry. Members and vendors were encouraged to donate to the FDLT. A check in the amount of $1,100 was given to the Foundation for Dental Laboratory Technology.

The Foundation Celebrates Eight Great Years

Thirty-one sponsors, numerous individual donors, seven racers, a handful of spectators, and over $77,000 later – the Foundation for Dental Laboratory Technology (Foundation) successfully pulls off its eighth Race for the Future, which was recently held in conjunction with the Chicago Triathlon in Chicago, Ill.

There were two relay teams, which consisted of the Foundation's Executive Director Lindsey Rowan, Foundation's Educator Representative Nicole Jackson, CDT, TE, and Nicole's husband, Derek Jackson; and NADL's Supplier Representative Shawn Nowak, Foundation's Vice Chair Sean Siegel, and NADL's Executive Director Bennett Napier, CAE. The only one brave enough to take on all three events of the triathlon individually was sponsor and NBC Trustee Barbara Warner, CDT. Not to be overlooked were those ringing cowbells from the sideline.

As a non-profit 501(c)(3) organization, donors are the true lifeblood of the Foundation. Because of donors and the consistent success of the Race for the Future, the Foundation was able to launch the CDT Hardship Grant for 2020 and 2021, bring back the NADL University Grant, and host its first-ever Foundation Education Day. The Foundation thanks the countless individuals, dental laboratories, manufacturers, and suppliers who recognize the good the Foundation brings to the dental laboratory technology industry and will continue to bring with support from donors like you.

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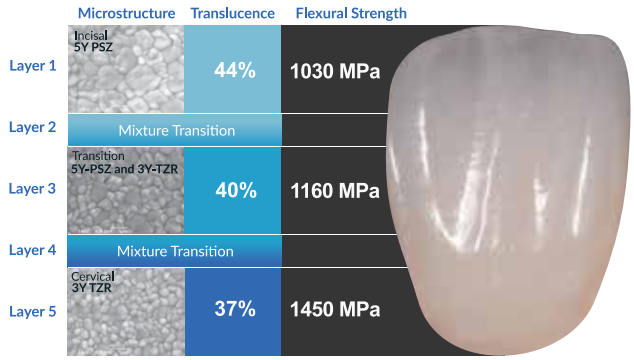

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Stay Ahead of the Curve

Lisa Fleming *is the digital dentistry manager at Benco Dental, located in Pittston, Pa. Benco Dental recently decided to support FDLA as a business partner and she shares more about the importance of industry support.*

We expect to see a significant increase in digital and cloud-based interactions.

How does Benco Dental help dental laboratories be successful?

We love labs, we only serve the dental market, and we've been doing it since 1930. Unlike our publicly traded competitors, we're fiercely independent, so we think in terms of decades, not quarters. That means we're focused on our customers, not short-term profit targets or satisfying investors. Perhaps more importantly, we're the best of both worlds for today's labs in terms of delivering the latest technology as well as everyday consumables. You can choose from a broad selection of open technology solutions that tie together your complete workflow, backed by tech support from people who understand our customers. Our print catalog of lab products stretches across 364 pages, but whether you're looking for CAD/CAM or gypsum, we've got you covered—and shop.benco.com lets you manage all of your supply needs.

Where do you see the industry headed in the next five years?

Our chairman and chief customer advocate, Larry Cohen, joined the business in 1959 when gold and teeth made up a big chunk of customers' invoices. Between then and now, Benco has transformed into an innovation and technology company that pioneered industry firsts like Painless® electronic ordering, automated supply management, CenterPoint showrooms and digital dentistry open architecture CAD/CAM. So, we have a good sense of where things are headed. We expect to see a significant increase in digital and cloud-based interactions. In addition, we expect a greater 3D printing presence, especially with emerging printing material technologies. One can also anticipate an increase in automation and AI to streamline and optimize dental practices; we're heavily invested in AI ourselves for business operations. I think what excites us most is innovating on delivering these advances to customers in ways that prioritize choice, convenience, compatibility, cost effectiveness and usability.

How can lab owners differentiate themselves in today's environment?

By being on the cutting edge of technology. Being innovative, easily accessible, and providing high-quality work with a quick turnaround to customers. Having a varied and wide reach in the market. Partnering with a distributor that will meet their needs. If you do all of that, you'll create a recognizable brand in your market. We actually offer branding and marketing services, so we can even help labs craft a unique visual and brand identity to stand apart.

Why is being an FDLA Business Partner valuable to you?

The lab business is equal parts art and science. As a family company, we feel a deep connection to our lab customers across the country and being an FDLA Business Partner only enriches our longtime passion and enthusiasm for helping customers stay ahead of the curve. Our doors are always open to labs, so come visit us and test drive the latest innovations at our CenterPoint showrooms in Texas, California and Pennsylvania. We'd love to show you what we call The Benco Difference when it comes to our products, service, and most importantly, support.

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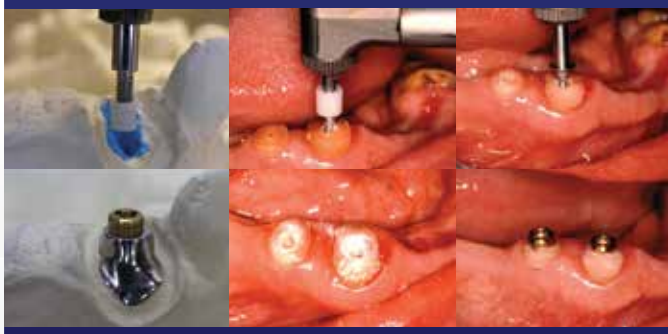

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