CLINICAL SUCCESS: Strategies for Achieving Efficient, Predictable Outcomes

Outcome-Based Preparation Design for Anterior Veneers Using Specific Depth-Cutting Burs
Robert R. Winter, DDS

Modern Concepts in Provisionalization
Greggory Kinzer, DDS

Finishing and Polishing with Modern Ceramic Systems
John A. Sorensen, DMD, PhD, FACP
THROUGHOUT OUR 36-YEAR HISTORY, Brasseler USA has strived to continually provide solutions to the needs of the restorative practice by developing innovative products and providing peer-to-peer education on their proper use within a procedure. This publication contains practical educational information from three of today’s leading clinicians and is the most recent in Brasseler USA’s commitment to our guiding principles of innovation and education.

In his article, “Modern Concepts in Provisionalization,” Dr. Gregg Kinzer reminds us that the provisional in the restorative procedure is much more than a simple “placeholder” until the final restoration is seated. A well-crafted provisional serves a number of purposes, not the least of which is contributing to the building of your practice. Dr. Kinzer then takes you step-by-step through the process of creating truly excellent provisional restorations, from trimming and finishing to final polishing.

Our second author, Dr. Robert Winter, guides you through what often proves to be a series of challenging questions: How much tooth reduction is required in veneer preparations in order to achieve the desired outcome? What considerations should be taken into account? How can the precise reduction be most readily achieved? We hope you will find Dr. Winter’s detailed, practical instructional, “Outcome-Based Preparation Design for Anterior Veneers Using Specific Depth-Cutting Burs,” very helpful in addressing these issues.

Of course, the restoration is not complete until the necessary finishing and polishing is performed. These steps can be challenging in light of recent advances in ceramic restorative materials. In his article, “Finishing and Polishing with Modern Ceramic Systems,” Dr. John Sorensen reviews data concerning the effects of material hardness and surface smoothness and wear on opposing dentition. Proper finishing and polishing of modern ceramic restorations, using the correct instrumentation, are critical, and Dr. Sorensen concludes with a review of finishing and polishing instruments designed specifically for these materials.

Our hope is that you find the content in this issue both informative and practical, and that it contributes in some positive way to both your efficiency and quality of your restorative practice.

Sincerely,
Brasseler USA
Outcome-Based Preparation Design for Anterior Veneers Using Specific Depth-Cutting Burs

Sound preparation design guidelines help clinicians achieve a highly predictable result.

By Robert R. Winter, DDS

Tooth Morphology Considerations

Whether it is a crown or veneer, 0.5 mm of space for enamel ceramic is required over the dentin or opacified layer of ceramic to mimic the depth and translucency of a natural tooth. If the underlying tooth structure is of normal color and value, a conservative preparation can be considered. If it is discolored or of low value, enough space must be created for the ceramist to correct the problem and eliminate or minimize the influence of the tooth color and the “show through” of the transition line of the preparation. Keep in mind that ceramic veneers have the highest long-term success rate when the restoration is bonded to enamel rather than dentin.1 Rellying on the color or opacity of the bonding resin cement to create the desired changes is highly variable and unpredictable, and should be undertaken only if needed to enhance the outcome.

If significant tooth morphology changes are desired, a mock-up based on a diagnostic wax-up is recommended. This preparatory stage helps to determine if a procedure such as the additive restorative technique can help minimize the actual amount of tooth that requires reduction. For example, the additive veneer technique can be used for changing tooth morphology through the use of a mock-up that is placed on the teeth at the time of preparation so that only the necessary amount of natural tooth structure is removed to accomplish the final preferred tooth shape and position. The overall depth of reduction will still be appropriate for the desired color or value changes, because the actual thickness of the restoration allows for the necessary masking while providing additional space to develop the appropriate translucency.

Preparation Design Considerations

There are several important points to consider when designing preparations. First, to have adequate space for the restorative material and conservation of natural tooth structure, the final esthetic outcome should be considered. Clinicians may need to consult with their technicians to discuss the appropriate material and amount of space needed to meet the identified outcome.

The clinician may want to begin tooth reduction after a direct mock-up on the teeth to preserve as much tooth structure as possible. It is important to remember that the greater the color or value change, the more the tooth needs to be reduced. The next consideration is that all corners and edges must be rounded to:

- ensure precisely fitting restorations and less stress on the ceramic; sharper angles provide increased challenges for the laboratory.
- allow a smooth flow of cement for complete seating of the restoration.
- allow for complete milling or fabrication of the restoration, whether in the office or the laboratory.

Lastly, smooth and sharp preparation finish lines allow for more precisely fitting restorations at the margins, as well as more predictable clinical procedures at the time of restoration insertion.

Preparation Design Concepts

Incisal Reduction

The concept of length reduction is based on knowing the definitive incisal edge position of the final restoration. The goal is to create 2 mm to 2.5 mm of space for the restorative material. A reduction of 2 mm is adequate when there are minimal esthetic changes and minimal incisal translucency is desired. The bur that would be used for this type of procedure is RW 2.0. A reduction of 2.5 mm is recommended when there will be a framework (metal, zirconia, etc.) in the crown.

Incisal Reduction

The clinician must begin tooth reduction after a direct mock-up on the teeth to preserve as much tooth structure as possible. It is important to remember that the greater the color or value change, the more the tooth needs to be reduced. The next consideration is that all corners and edges must be rounded to:

- ensure precisely fitting restorations and less stress on the ceramic; sharper angles provide increased challenges for the laboratory.
- allow a smooth flow of cement for complete seating of the restoration.
- allow for complete milling or fabrication of the restoration, whether in the office or the laboratory.

Lastly, smooth and sharp preparation finish lines allow for more precisely fitting restorations at the margins, as well as more predictable clinical procedures at the time of restoration insertion.

Preparation Design Concepts

Incisal Reduction

The concept of length reduction is based on knowing the definitive incisal edge position of the final restoration. The goal is to create 2 mm to 2.5 mm of space for the restorative material. A reduction of 2 mm is adequate when there are minimal esthetic changes and minimal incisal translucency is desired. The bur that would be used for this type of procedure is RW 2.0. A reduction of 2.5 mm is recommended when there will be a framework (metal, zirconia, etc.) in the crown.


### BUR DESCRIPTIONS

The system described in this article is composed of five burs created for Brasseler USA. The two incisal depth-cutting burs are designed to create adequate space for the ceramist to develop natural internal characteristics and translucency in the incisal edge of the veneer restoration. This reduction is determined based on the definitive length of the final restoration. In addition, a series of three depth-cutting burs was developed so that the labial reduction is tapered and corresponds to the average enamel thickness of anterior teeth. These are used in two planes to follow the labial morphology. The average enamel thickness of anterior teeth is:

- 0.3 mm to 0.4 mm in the gingival third.
- 0.8 mm to 1.0 mm in the middle third.
- 1.3 mm to 1.2 mm in the incisal third.

#### BURS

- **RW 2.0**
  A 2.0-mm reduction bur for use as an anterior incisal edge depth guide for ceramic veneers when no core is required.

- **RW 2.5**
  A 2.5-mm reduction bur for use as an anterior incisal edge depth guide for conventional and extensive veneers or for full-crown restorations. It provides a 2-mm space for layering ceramic and a 0.5-mm space for the core material (metal, zirconia, etc.).

- **RW Min**
  A minimal labial depth-cutting bur, which provides 0.3-mm reduction in the gingival third; 0.5-mm reduction in the middle third, and 0.7-mm reduction in the incisal third.

- **RW Conv**
  A conventional labial depth-cutting bur, which provides 0.5-mm reduction in the gingival third; 0.7-mm reduction in the middle third; and 0.9-mm reduction in the incisal third.

- **RW Ext**
  An extensive labial depth-cutting bur that provides: 0.8-mm reduction in the gingival third; 1-mm reduction in the middle third; and 1.2-mm reduction in the incisal third.

#### FIG. 2

Preoperative photographs.

(1 and 2) Preoperative photographs. (3) View after esthetic and functional crown lengthening but before preparation.

---

1. Winter, Robert R. Private Practice Limited to Prosthodontics. Newport Beach, California
2. Faculty, Spear Education. Scottsdale, Arizona
3. Founder, Spear Winter Laboratory. Laguna Beach, California
Labial Reduction

The three recommended reductions for the labial surface of anterior teeth are classified as minimal, conventional, and extensive, depending on the esthetic changes stipulated by the desired outcome. The minimal reduction is for zero to one shade change, the conventional reduction is for one to two shade changes, and the extensive reduction is for two to three shade changes.

The labial depth-cutting bur designed for minimal reduction measures 0.5 mm in the gingival third, 0.7 mm in the middle third, and 0.9 mm in the incisal third. The resulting reduction is mostly in enamel, except for possibly the gingival third of the preparation. For this procedure, bur RW Conv is used. When significant color or value changes are needed, or a combination of veneers and crowns will be placed or already exist, a greater reduction is required to achieve a predictable outcome. The depth-cutting bur for extensive reduction measures 0.8 mm in the gingival third, 1 mm in the middle third, and 1.2 mm in the incisal third. This results in the removal of labial enamel unless there is an additive technique planned that will change the labial position of the final restoration. The bur to be used for this procedure is the RW Ext. The suggested procedure for labial reduction is shown in the accompanying photographs and follows the following protocol:

1. Select the appropriate labial depth-cutting bur to accomplish the goals of the case.
2. The bur needs to be used in two planes to follow the curvature of the labial aspect of a natural tooth.
3. The first plane uses the 0.7 mm and 0.9 mm bands of diamonds, sinking these bands into the tooth until the shank of the bur above, in the middle, and below these bands touches the tooth. The shank typically leaves a grey line on the surface of the tooth (Figure 6).
4. The second plane uses the gingival depth-cutting diamond tip of the bur. The bur is placed into the depth of the radius of the round tip. The shank above this band of diamonds will limit the depth in this area. It is possible to over- or under-angle this aspect of the preparation. The goal is to sink the round end of the diamond tip 50% into the tooth (Figure 7).
5. Once the depth cuts have been established, reduce the labial aspect with a medium-grit tapered diamond bur (856-016 or 856-018, Brasseler USA) (Figure 8).
6. The final step in tooth preparation is finish line refinement so that a smooth and well-defined margin is created with a fine-grit tapered diamond bur (8856-016, Brasseler USA) (Figure 9).
7. Additional preparation design changes needed interproximally are outcome-dependent (Figure 10).

The long-term success of this method can be observed in the 5-year posttreatment photographs (Figure 11 and Figure 12).

Conclusion

By following the presented preparation design guidelines using the Brasserel depth-cutting burs, practitioners can produce a highly predictable result. While dentists strive to do only minimally invasive procedures, in some cases a more significant amount of tooth reduction is in the best long-term interest of the patient if the goal is to create a natural-looking restoration.

REFERENCES


ACKNOWLEDGMENT

The author wishes to thank the periodontist in this case, Dr. Edward P. Allen of Dallas, Texas, and the Spear Winter Laboratory for fabrication of the final restorations.

DISCLOSURE

The author is the developer of the five depth-cutting burs described in this article, and has received financial compensation for this article.

FIG. 1

FIG. 2

FIG. 3

FIG. 4

FIG. 5

FIG. 6

FIG. 7

FIG. 8

FIG. 9

FIG. 10

FIG. 11

FIG. 12

(4 and 5.) Bur making the incisal-depth cut and reducing the incisal edge.

(6.) Here, a conventional 0.5-mm/0.7-mm/0.9-mm bur was used directly on the labial aspect of the tooth.

(7.) The second phase utilizes the gingival depth-cutting diamond tip of the bur.

(8.) The facial aspect was reduced to the depth of the depth-cutting burs.

(9.) The finish line was refined to create a smooth, crisp, delineated margin.

(10.) In this case, the final preparation finish line extended interproximally to the palatal aspect of the tooth to accomplish the tooth morphology changes that were required to achieve the desired final outcome.

Mock-up for enamel preservation with porcelain laminate veneers.

Dental aesthetics and aesthetic restorative dentistry.

Winter
Modern Concepts in Provisionalization
Trimming and polishing techniques to create natural, esthetic provisionals.

By Gregory Kinzer, DDS, MSD

The use of provisionals in a restorative practice is a common everyday occurrence, but often the purpose of the provisionals gets lost. Rather than being thought of as “just a temporary” provisionals provide many benefits. They help eliminate tooth sensitivity through fit and seal. They maintain gingival health and contour, and they maintain tooth position through proper occlusal and interproximal contact—both of which help to ensure efficient delivery of the definitive restorations. Anterior provisional restorations are also used as a “blueprint” for the definitive restorations, helping to communicate the contour, shade, and arrangement to the technician. And lastly, provisionals can be a huge practice builder. Patients often have a negative image in their head of provisionals because these “temporaries” are quickly fabricated and often look and feel un-natural. However, offering provisionals that can be mistaken as definitive restorations is sure to have a positive impact on patient satisfaction (Figure 1 through Figure 3).

Materials and Techniques
Among the many material options available for provisional fabrication are methyl methacrylate, ethyl methacrylate, bis-acryl composite, and light-cured resin. Although each material has its own advantages and disadvantages, they can all be used successfully to accomplish the goals of provisionalization. It is typically not the material that makes the difference, but rather the provisionalization technique and how the restorations are trimmed and polished.

There are three main techniques for fabricating provisionals. The first and most common technique is “direct in the mouth.” The overwhelming majority of provisionals are fabricated in this manner using a matrix from a diagnostic model or wax-up, filling it with provisional material, seating it over the preparations in the mouth, and then removing to trim and polish. Another technique is “indirect on a model.” The same type of matrix is used, but the provisional is made on a silicone or stone model of the preparations. This can be beneficial with a larger number of units, as it is easier to control the fit, form, and esthetics. The last technique would be a combination of the previous two techniques, where a “preformed shell” is then relined over the preparations directly in the mouth.

Trimming and Polishing Provisionals
By far the most important part of fabricating provisionals is the process of trimming and polishing. The techniques of trimming provisional restorations is linear and consistently follows the same sequence. That trimming sequence is buccal/palatal margins, interproximal embrasures, facial/incisal embrasures, facial surface, and incisal edges.

Buccal/Palatal Margins
The starting point when trimming provisional restorations is to identify and trim the buccal and palatal margins. Prior to any trimming of the provisionals (bisacryl), it is advisable to clean the provisionals with alcohol (Figure 4 and Figure 5). The purpose of this is to remove the sticky air-inhibited layer. If this is not done, the burs and discs will immediately stick to the preparation (Figure 6). The key to using diamond discs is to run them at a fairly slow speed. If the speed is too high, there is a loss of tactile sensation and the discs will cut too aggressively. It is important when carving gingival embrasures to always keep the disc parallel to the tooth being worked on, to allow the proper emergence profile to be created from the preparation to the restoration, and helps the interproximal embrasure flow into the facial embrasure (Figure 12 and Figure 13). Orienting the disc “straight” into the embrasure should be avoided, as this does not allow the large acrylic bur (H79DE) (Figure 6). However, it is not uncommon for acrylic burs to “chatter” and possibly gouge margins. For a more refined removal of material at the marginal areas, the clinician can use a fine acrylic bur (H79WE) (Figure 7) or a silicone polishing wheel (RWGPP green (Figure 8). This benefit of the silicone wheel is that it creates a very smooth, polished margin with no risk of chatter (Figure 9).

Interproximal Gingival Embrasures
In order to open and adjust the interproximal gingival embrasure, the use of a thin, flexible diamond disc is necessary (Vision Flex 934 or Hyper Flex 911H) (Figure 10 and Figure 11). The key to using diamond discs is to run them at a fairly slow speed. If the speed is too high, there is a loss of tactile sensation and the discs will cut too aggressively. It is important when carving gingival embrasures to always keep the disc parallel to the tooth being worked on, to allow the proper emergence profile to be created from the preparation to the restoration, and helps the interproximal embrasure flow into the facial embrasure (Figure 12 and Figure 13). Orienting the disc “straight” into the embrasure should be avoided, as this does not allow the
proper emergence profile to be created and does not create adequate room for hygiene. In order to carve the embrasure for the midline, the clinicians should start by “notching” the gingival embrasure halfway between each preparation and then angling the disc from each preparation into this area. This allows the adjustment to end up dividing the space equally between the teeth.

It is always desirable to leave the gingival embrasures slightly open when carving them, because the provisionals are typically made after some sort of gingival displacement is performed to get the impressions. If they are kept too closed, the tissue has no room to rebound after it having been displaced. As a result, inflammation of the tissue will be present due to inadequate room for hygiene.

**Facial/Incisal Embrasures**

To address the facial/incisal embrasures, the practitioner should start by determining the appropriate width desired for the incisal edge and use a disc to carve (Vision Flex 934 or Hyper Flex 911H). The facial embrasure is then a direct extension between the gingival and incisal embrasures. Leaving the facial embrasures more closed will give the perceived appearance of a wider tooth, as the line angles will be pushed out toward the lateral aspects of the tooth thereby creating more surface for light reflection. A more open facial embrasure will move the line angles toward the middle of the tooth, giving the perception of a narrower tooth.

**Facial Surface/Incisal Edge**

In conjunction with carving the facial embrasures, the next step in the process is to adjust the facial surfaces and incisal edge. The facial surface can be adjusted with either a silicone polishing wheel (RWGPP green) (Figure 14) or a fine acrylic bur (H79EF) (Figure 15), depending on how much adjustment is necessary. For anterior teeth, it must be remembered that the facial surface is composed of three planes (cervical, middle, incisal) and typically has surface anatomy to help break up the light. The incisal edge can easily be adjusted with the same green silicone. Any minor refinements to the contour can then be accomplished with a fine silicone wheel (RWPPP pink).

**Polishing**

Traditional polishing techniques using pumice on a wet rag wheel (slow speed) followed by a high shine polishing paste on a dry rag wheel (high speed) still produces the best surface finish. However, use of the aluminum-oxide-impregnated felt wheels (SWR22M and SWR22F) is a quick way to produce a very nice surface chairside (Figure 17 and Figure 18).

**Conclusion**

In summary, the key to fabricating natural, esthetic provisionals is “time” and “attention to details” with the trimming and polishing techniques, as can be seen in the completed provisional restorations after finishing and polishing (Figure 19).

**REFERENCES**


(10. and 11.) The gingival embrasures were opened first using a thin, flexible disc that was run at a slower speed.

(12. and 13.) The same discs could be used to carve the facial and incisal embrasures to create the line angles.

(14. and 15.) After opening the embrasures, the facial surfaces were adjusted using fine carbide burs or silicone wheels.

(16.) The provisional restoration after adjustment but before the final polish.

(17. and 18.) Using the felt wheels allowed the restorations to achieve a high luster and shine. (Note the difference in the surface of the centrals, as one has been polished and one has not).

(19.) The completed provisional restorations after finishing and polishing.
Finishing and Polishing with Modern Ceramic Systems

Advanced ceramic polishing instruments simplify finishing and polishing and provide superior results.

By John A. Sorensen, DMD, PhD, FACP

Today’s all-ceramic systems facilitate novel restoration designs and increased restorative options along with greater clinical longevity. The evolution of modern ceramic materials as minimal antagonist tooth structure wear and sufficient strength—even for second molars in bruxers—have moved these systems into the realm of routine clinical practice. A factor critical to the strength and abrasiveness of ceramic materials is how the clinician adjusts, grinds, and polishes the ceramic restoration on delivery and cementation. The clinician’s goal in finishing and polishing modern ceramic systems is clinical expediency and efficiency—that is, to achieve the most rapid adjustment and polishing while inducing the least amount of damage with the fewest bur changes.

Background

Lithium disilicate ceramics layered with veneering ceramics have shown excellent results in clinical studies up to 10 years in duration with the e.max® Press system (Ivoclar Vivadent). Five clinical studies with nearly 500 crowns demonstrated a 98.4% survival rate with a mean observation period of 4 years. Chipping occurred in 1.4% of the restorations; however, all of the cases could be repaired intraorally. The vast majority of fractures and chipping of ceramic restorations occur in molar restorations. A literature review of all types of ceramic restorations showed fracture rates of 6.7% for molars after 2.5 years; however, the fracture rate of the e.max CAD molar restorations was 1%. This compares quite favorably to that of metal-ceramics and other ceramics.

While the zirconia substructure is nearly indestructible—even for posterior 3- and 4-unit bridges—at the beginning, chipping of the veneering porcelain was a persistent problem. Improvements made in substructure design, processing protocols, and layering materials for zirconia ceramics have significantly reduced chipping of the veneering porcelain. New design strategies using traditionally layered zirconia substructure systems to replace the lower-strength veneering ceramic create a nearly indestructible full-contour zirconia crown. Restoration fabrication is greatly simplified by making only effective polishing necessary. The monolithic zirconia crown reliably restores even second molars in bruxers (Figure 1 through Figure 3). The author has routinely used this approach for more than 9 years with no failures.

An in vitro wear study measured loss of human tooth structure against a variety of full-crown materials. The enamel wear from antagonist polished Lava® zirconia (3M ESPE) was similar to a gold-platinum alloy (Aquarius, Ivoclar Vivadent). Similarly, enamel wear from a lithium disilicate ceramic (Empress® 2, Ivoclar Vivadent) was not different from the gold alloy. Given the advantageous wear characteristics of these modern ceramics, it is important for clinicians to understand how to best optimize the antagonist restoration surfaces by proper adjustment and polishing during delivery.

The Principles of Tooth Wear and Ceramic Polishing

The OHSU Oral Wear Simulator (OWS), an in vitro, three-body, wear-testing machine for composite resin filling materials developed by Condon and Ferracane, has demonstrated a strong correlation with clinical trials (R² = 0.94). The author and colleagues modified the testing system by replacing the composite with a ceramic tile to measure wear against a 10-mm diameter human enamel cusp. Running a variety of new ceramics and older porcelains, it was demonstrated that several new fine-grain ceramic systems, such as lithium disilicates, exhibited enamel wear similar to the enamel-enamel control. A clinical trial using 3-D surface profilometry on a lithium disilicate ceramic system (Empress 2) revealed little or no wear of opposing enamel surfaces at 1 year and confirmed the validity of the in vitro OHSU OWS.

Contrary to many clinicians’ beliefs, there is no correlation between the hardness of a ceramic and the potential abrasion of natural tooth structure. Potential abrasion of tooth structure all comes down to the microscopic surface roughness of the ceramic. Measurement of surface roughness demonstrates that finer grain size of the ceramic, the lower the wear against tooth structure, and, incidentally, the finer the grain size of the ceramic, the more machinable and more polishable the ceramic. Mean crystalline particle size of zirconia ceramics is approximately 0.5 µm, creating a situation where the zirconia can be polished smoother than the veneering ceramic (Figure 4).

The clinician should remember that, in function over time, the surface of even highly polished porcelain restorations wear, exposing the native internal structure of crystalline particles, voids, and flaws, which are abrasive to antagonist tooth structure. Hence, a significant advantage of the new generation of ceramics, such as zirconia or lithium disilicates, is their finer grain structure, high crystalline content, and considerably reduced glossy phase, as well as their higher quality (substantially reduced flaw distribution). However, the resulting ceramic surface after clinical adjustment with diamond burs and subsequent level of polishing has a much greater impact by far on antagonist tooth wear than grain structure size of the ceramic. Therefore, the roughness of a ceramic surface created by diamond bur occlusal adjustment can potentially abrade the opposing enamel surface by several orders of magnitude greater than that created by the inherent material roughness.

All factors considered, to capitalize on the advantageous qualities of modern ceramics, clinicians must ensure that they properly finish and polish the occlusal surfaces after making adjustments.

Potential Damage to Ceramics from Grinding

A significant cause of chipping of veneering porcelain was theorized to occur from grinding damage during adjustment procedures with diamond burs. Surface and subsurface damage from grinding on porcelain is well documented. The induced damage can cause crack propagation and failure at the time of grinding or delayed failure under functional cyclic loading.

Chang et al evaluated porcelain cracking from three grits of finishing diamonds grinding on four different all-ceramic veneering porcelains. They theorized that the 46-µm grit diamond caused heat-generated thermal shock, damaging porcelains. While interesting findings, their results must be questioned because they used a handpiece speed of 340,000 RPM. This is contrary to the “Cardinal Rule in Adjustment and Polishing of Ceramics”—that is, always use low speed and low pressure to minimize heat generation and damage induction.

John A. Sorensen, DMD, PhD, FACP
Acting Professor, Department of Restorative Dentistry, University of Washington
Seattle, Washington
Former Director, Pacific Dental Institute
Portland, Oregon
Advances in Rotary Instrument Technology
Recent rotary instrument technology advances have optimized finishing and polishing of modern all-ceramic systems. Brasseler USA has developed a new multi-layer chromium nitride coating for diamond burs that better bonds diamond particles to the bur and increases the useable life of the bur. For sharper-tip diamond burs, the coating reduces the chances of wearing off the diamond particles and leaving dark metal marks.

The Brasseler red-band Fine Finishing Diamond (mean particle size 30 µm) has been the author’s favorite rotary instrument for adjusting and refining the occlusion. The new Dialite finishing diamond with football shape is ideal for occlusal adjustment (Figure 5) and grinding in anatomy of full-contour zirconia crowns (Figure 6 and Figure 7). Fine contouring, grooves, and refining secondary anatomy are rapidly achieved with a small, round Dialite finishing diamond bur (Figure 8). Used at relatively low RPM and low pressure, the finishing diamond is effective for material removal, yet is not traumatic to the ceramic. This is critical for avoiding damage to the ceramic, incurring flaws, which may later propagate into cracks, causing failure in function or parafunction. Besides preventing damage to the ceramic, another concern is avoiding heat spike generation, which can cause thermal shock damage and phase changes in the ceramic.7

The zirconia used in dentistry has metal oxides added to create the metastable tetragonal phase, which enables the structure to undergo transformation toughening; this unique property of zirconia ceramics arrests crack formation. Excessive heat generation can cause the zirconia to shift back to its thermodynamically preferred monoclinic state, rendering the ceramic unable to undergo transformation toughening.8

The objective in designing efficient polishing instruments is to achieve rapid removal of material, progressively replacing bigger scratches with smaller scratches while minimizing heat generation. Optimization of new polishing systems is achieved by the abrasive particle size, the particle concentration, and the binder used to form the polishing shapes.

The Dialite System by Brasseler was the original benchmark for diamond-impregnated porcelain polishing systems that revolutionized polishing of all types of porcelain and ceramic surfaces. Surface profilometry research showed that the Dialite Kit could polish surfaces to be smoother than overglazed porcelain.9 The Dialite System uses a three-step process that varies the grain size, grain loading, and binder.

New Frontiers in Ceramic Polishing Technologies
Understanding the unique properties of modern ceramic systems such as lithium disilicate (e.max) and Y-TZP zirconia, Brasseler USA has made revolutionary developments resulting in new polishing systems. These polishing systems have been optimized to: reduce the number of polishing steps (bur changes); polish more efficiently; and achieve an overall higher quality polish and luster. Additionally, the new polishing systems consider the unique properties of lithium disilicate and zirconia ceramics to minimize damage and diminish potential deleterious effects on ceramic strength. The results are polishing instruments that are easy to use and that reduce restoration failure with the right combination of physical and chemical properties of the different ceramics.10 Therefore, two specialized polishing systems specific to their ceramic structure have been developed.

Dialite LD System
Specific to lithium disilicate ceramics, a system was created that consists of a grinder for contouring and then only two steps for polishing instead of three steps like the original Dialite system. This provides for reduced chairtime in the delivery of e.max restorations, yet enhanced quality of finish, polish, and luster.

Dialite LD Grinder
This epoxy-based diamond impregnated grinder with medium coarse grain efficiently and rapidly removes large amounts of ceramic, yet due to the grain size and binder, minimizes potential damage to the internal ceramic structure (Figure 9).

Red Pre-Polish
This polyurethane-bound fine polisher with high diamond
BRASSELER USA

Sorensen

FIG. 9

FIG. 10

FIG. 11

FIG. 12

FIG. 13

FIG. 14

FIG. 15

FIG. 16

FIG. 17

FIG. 18

FIG. 19

FIG. 20

FIG. 21

FIG. 22

FIG. 23

FIG. 24

FIG. 25

particle concentration facilitates aggressive removal of ceramic structure and smoothing to a brilliant surface roughness—all with a light touch to minimize heat generation (Figure 10 and Figure 11).

Yellow Fine Polisher
With a smaller diamond grit size than Original Dialite Fine (Grey) polisher, this polisher enables the system to cut and remove structure for superior shine and ultra-high luster (Figure 12). Completed finishing and polishing of a crown is shown in Figure 13.

Dialite ZR System
Specifically designed for zirconia, the Dialite ZR System also reduces the number of steps to involve two rubber wheels instead of three.

Dialite ZR Grinder (Green)
This epoxy-based, high-performance grinder has a high diamond concentration and is optimized for bulk material removal at low speed and low pressure. A major improvement over standard diamond-imregnated stones, its design makes it possible to keep the zirconia below 800 °C, even with dry grinding. No water cooling or special equipment is needed (Figure 14).

Dialite ZR Medium Grinder (Pink)
This medium grinder system has similar characteristics to the ZR Grinder abrasive only would be an intermediary step between green coarse grinder and polishing instruments (Figure 15).

Green Medium Fine Polish
This very soft, polyurethane-matrix-bound, high-concentration, medium-fine grain diamond polisher allows a soft touch, with a high material removal rate to achieve a brilliant surface structure with a wheel on the broad surfaces (Figure 16) and points with high polish, even with Medium (Figure 17).

Orange Fine Polish
A polyurethane binder with super-high loading of fine diamond particles, this super-soft matrix instrument promotes achievement of ultra-high polish and luster with minimum heat generation, using a fine polishing point for high shine in the occlusal grooves (Figure 18), a fine polishing wheel for creating high shine and luster on the broad surfaces (Figure 19), and a narrow fine polishing disk for high shine in broader grooves (Figure 20).

The Dialite polishing instruments help to achieve a durable high-luster finish intraorally (Figure 21) and Figure 22).

Dialite and Lava
3M ESPE recently introduced the Lava Plus All-Zirconia Monolithic System, a highly esthetic system that comes in a wide selection of shades matched to the Vita Classic Shade guide with 16 shades and two bleaching shades (Figure 23). This highly translucent monolithic zirconia works perfectly with the Brasseler Dialite ZR polishing kit to produce an extremely esthetic full-contour crown despite being all zirconia. Studies show that Lava Plus is more translucent when shaded than other full zirconia systems.* Note the enhanced appearance of a Lava Plus crown polished with the Brasserel system versus a zirconia crown stained and glazed (Figure 24 and Figure 25).

ACKNOWLEDGMENT
The author would like to thank Burbank Dental Lab for fabrication of the zir-MAX® monolithic zirconia crowns and the e.max Press® crowns used in this article.

DISCLOSURE
Dr. Sorensen is a consultant for Brasseler USA and has received material support for this manuscript.

REFERENCES
The new Lava Plus All-Zirconia Monolithic system...
C4
Ad