FUNCTION MEETS AESTHETICS

Advanced Materials for Posterior Restorations

by Stephanie Huth, DDS

Material science advancements have enabled dental professionals to design and fabricate highly customized restorations that meet patients' aesthetic and functional requirements. Such advancements are especially helpful when replacing failing or defective restorations. Especially with large defects in the molar region, where direct restorative therapy reaches its limits, both anatomy and aesthetics can be restored by all-ceramic restorations.

In the past, posterior restoration guidelines dictated that function and strength be the most important characteristics of restorative materials. Although all-ceramic systems were produced from the late nineteenth century, their indications have been limited due to their poor mechanical properties and the associated failure rates. Therefore, cast gold or other porcelain-fused-to-metal (PFM) restorations with a higher fracture toughness and flexural strength were generally employed for posterior restorations, where respective forces of mastication occur. With the introduction of all-ceramic systems, which could be improved by structural reinforcement and defect-minimizing production process, the range of indications could be expanded. Another breakthrough was achieved by adhesive cementation, thus increasing the mechanical strength and improving the longevity of a ceramic.

However, development of new materials in recent years has allowed clinicians a reprieve from deciding between function and aesthetics. Materials such as lithium disilicate (IPS e.max, Ivoclar Vivadent) and universal cementation systems (Multilink Automix Next Generation, Ivoclar Vivadent) have expanded opportunities for dental professionals to offer the highest quality metal-free, durable and aesthetic restorations for all clinical indications, regardless of their location in the mouth.

Lithium Disilicate

IPS e.max is a ceramic material composed primarily of fine-grained Lithium Disilicate Crystals (LDC) that are embedded in a glassy matrix consisting of silica, potassium oxide, phosphorous oxide, zirconia, zinc oxide, alumina, magnesium oxide, and coloring components. The amount of 70 Vol-% needle-like crystals in the matrix leads to a microstructure that effectively controls the optical, physical and mechanical properties of the material, allowing for an overall stable and strong structure. The material itself is highly translucent due to its adjusted refractive indices between glassy matrix and LDC, making it an optimal choice for aesthetic restorations. However, the material's monolithic nature also results in an extremely durable restorative option, boasting a flexural strength of 360-400 MPa, according to the manufacturer. This unique combination of strength and aesthetics indicates lithium disilicate for effective use for a wide

variety of restorations, including anterior and posterior crowns, inlays, onlays, veneers and implant restorations.

A Universal Cementation System

To maximize the potential of such capable materials as lithium disilicate, an equally efficient bonding system can be employed to guarantee clinical long-term success. Multiple steps are typically required in the cementation process, such as pre-treatment of the ceramic and the prepared tooth surface, to ensure that complete bonding is achieved. As such, an ideal cementation system would address all of these needs, with all system elements working seamlessly together to provide the most efficient bonding mechanism.

Multilink Automix Next Generation (Ivoclar Vivadent) is such a system, providing exceptional restorative bonding while simultaneously enhancing aesthetics. The self-curing luting composite with light-curing option is indicated for placing indirect restorations fabricated from a variety of materials, including silicate and oxide ceramics, composites and metals. According to the manufacturer, the Multilink Automix system achieves optimal bonding when used in conjunction with lithium disilicate (IPS e.max) restorations.

The Multilink Automix System enables an efficient clinical workflow. The pre-treatment of the tooth surface can be conducted with the timesaving application of the mixed, self-etching Multilink Primer A/B onto the entire bonding surface. In addition, Multilink Automix is dispensed from the automix syringe, and the desired amount can be directly applied to the restoration. There is no need for the use of manual mixing or activating capsules. Moreover, a constant mixing ration is guaranteed.

The enhanced cement formula also promotes easier cleanup; the material can be light-cured in quarter segments (e.g., mesio-oral, disto-oral, mesio-buccal, disto-buccal) for one to three seconds per quarter surface to achieve a gel-like consistency that can be easily removed with a scaler. The light exposure interval depends on the light intensity of the polymerization lamp, the distance between optical conductor and excess cement, and the number of cemented abutments.

Patients and dentists alike will also benefit from other recent updates to the Multilink Automix Next Generation system. Shading has been expanded to include a new shade, white, that demonstrates a medium translucency and is excellently suited for glass-ceramic restorations. Try-in pastes are also now available for determining the appropriate shade of Multilink Automix with respect to the restoration.

The following case demonstrates how the use of advanced materials such as lithium disilicate and an advanced universal cementation system enables clinicians to meet patient demands for functional yet highly aesthetic restorations, regardless of the location in the mouth.

Case Presentation

A patient presented with a failing restoration in the posterior region (Fig. 1). After discussing several restorative options with the patient, it was ultimately decided that the treatment plan would consist of an IPS e.max lithium disilicate inlay restoration, cemented with Multilink Automix Next Generation. Though the restoration was located in the posterior region, the patient expressed a desire for a natural looking restoration, leading to the selection of a pressed lithium disilicate restoration.

Clinical Protocol

To facilitate the development and fabrication of the provisional and final restorations, an impression was taken first. The patient was then anesthetized with 3% mepivacaine and the tooth prepared. After preparation was complete, final and opposing impressions, shade photographs and a bite registration were taken to provide the laboratory with necessary diagnostic information.

A bisacryl provisional restoration (Telio CAD, Ivoclar Vivadent) was then fabricated and cemented with provisional cement (Telio CS Link, Ivoclar Vivadent) to permit the patient to function while the definitive restoration was designed and fabricated (Fig. 2). The Telio CAD system was chosen for long-term provisionalization due to the material's high flexural strength and high homogeneity.

Restoration Seating

Upon completion of the lithium disilicate restoration fabrication, the patient returned to the practice for seating. The patient was first anesthetized with 3% mepivacaine, and the provisional restoration removed. The preparations were then cleaned (Fig. 3) and thoroughly rinsed to remove any remaining cement (Fig. 4).

Fig. 1: The patient presented with a failing posterior restoration.
Fig. 2: A provisional restoration was placed.
Fig. 3: The provisional restoration was removed and the preparation was cleaned.
Fig. 4: The tooth was prepared for placement of the definitive restoration.

continued on page 80

 continued from page 79

Fig. 5: The restoration was prepared for try-in with Multilink Automix Try-In Paste (Ivoclar Vivadent).
Fig. 6: The restoration was evaluated for shade matching and appropriate marginal contacts.
Fig. 7: The restoration was pretreated with IPS Ceramic Etching Gel (Ivoclar Vivadent) to ensure an adequate bonding surface.
Fig. 8: The restoration can optionally be pretreated with IvoClean (Ivoclar Vivadent) to eliminate salivary contamination.
Fig. 9: Monobond Plus (Ivoclar Vivadent) was applied to the restoration as a primer.
Fig. 10: Multilink Automix (Ivoclar Vivadent) was applied to the restoration.

The final restorations had been prepared for try-in using Multilink Automix Try-In Paste (Ivoclar Vivadent), and margins, occlusal, proximal contacts, and shades were verified (Figs. 5, 6). Once approved by the patient and dentist, the restorations were prepared for final seating.

The restoration was then pretreated with IPS Ceramic Etching Gel (Ivoclar Vivadent), 5% hydrofluoric acid, to ensure an adequate bonding surface would be achieved (Fig. 7). If the restoration is already treated with ceramic etching gel in the dental lab, it can be cleaned after try-in with a cleaning paste (Ivoclean, Ivoclar Vivadent) to ensure salivary contamination would not occur (Fig. 8). An additional treatment with etching gel is then not necessary. A universal single-component restorative primer (Monobond Plus, Ivoclar Vivadent) was then applied to the internal surface of the restoration (Fig. 9), allowed to sit for 60 seconds, and then air-dried.

Before the application of the universal resin cement (Multilink Automix) to the internal surface of the restoration (Fig. 10), the surface of the tooth was pretreated. The preparation was isolated and thoroughly cleaned with a fluoride-free paste (Proxyt RDA 36, medium, Ivoclar Vivadent) (Fig. 11). A self-etching primer (Multilink A/B) was then dispensed, mixed and evenly applied to the preparation surfaces for 30 seconds, starting with the enamel surface. The excess was dispersed with blown air until the mobile liquid film was no longer visible. As the primer is solely self-curing, light-curing is not necessary (Figs. 12, 13). The restoration was seated and stabilized (Fig. 14).

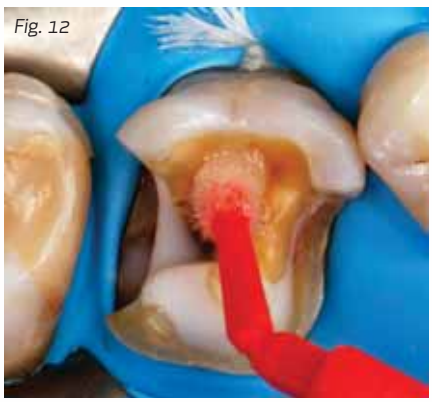

Fig. 11: The preparation was isolated and cleaned with Proxyt medium fluoride-free (Ivoclar Vivadent).
Fig. 12: A mixture of Multilink Primer A/B (Ivoclar Vivadent) was applied to the preparation.
Fig. 13: The primer was evenly dispersed with a strong stream of air.
Fig. 14: The restoration was seated.


Fig. 15


Fig. 16


Fig. 17


Fig. 18


Fig. 19


Fig. 20


Fig. 21

Fig. 15: The restoration was light-cured in quarter segments according to the manufacturer's instructions.
Fig. 16: Excess cement was removed using a scaler.
Fig. 17: An Air Block Liquid Strip (Ivoclar Vivadent) was placed to limit oxygen exposure.
Fig. 18: The restorations were light-cured according to the manufacturer's instructions.
Fig. 19: OptraPol Next Generation (Ivoclar Vivadent) was used to polish the restoration margins.
Fig. 20: Fluor Protector S (Ivoclar Vivadent) was applied to the restoration to prevent hypersensitivity and caries development.
Fig. 21: Image of the final restoration.

The restoration was then partially light-cured in quarter segments (e.g., mesio-oral, disto-oral, mesio-buccal, disto-buccal) according to the manufacturer's instructions (Fig. 15). After that, excess cement was removed using a scaler (Fig. 16). A liquid strip (Air Block Liquid Strip, Ivoclar Vivadent) was placed to protect the cement line from oxygen exposure during the curing process (Fig. 17). This prevented the formation of an inhibition layer, assuring the clinician of excellent restoration margins. Final light-curing was completed according to the manufacturer's instructions (Fig. 18).

The restoration margin was polished with a silicone polishing system (OptraPol Next Generation, Ivoclar Vivadent) (Fig. 19). After, the restoration was coated with a fluoride varnish (Fluor Protector S, Ivoclar Vivadent) and allowed to dry for 60 seconds to further protect the tooth structure after chemical and mechanical treatment (Fig. 20). Occlusion and aesthetics were then verified, and both the patient and dentist were pleased with the new restoration (Fig. 21).

Conclusion

Advanced materials such as IPS e.max and Multilink Automix Next Generation enable clinicians to provide long-lasting, highly aesthetic restorations for a variety of indications. These materials also eliminate previous restrictions on where certain materials can be used, as they are designed to address all issues surrounding restoration fabrication and placement. Thus, patients can benefit from these advancements in restorative dentistry when they request or require treatments that are both functional and aesthetic. ■

What has been your experience with restorative dentistry? Comment online at Dentaltown.com.

Author's Bio

Dr. Stephanie Huth is research associate in the internal clinic of Ivoclar Vivadent's research and development department. She is responsible for clinical studies concerning restorative dentistry and prosthodontics, particularly adhesives and zirconia restorations. She started her career at the Julius-Maximilians-University in Würzburg, Germany (2005-2010), where she passed the examination with distinctions and earned a doctorate in the department for functional materials in medicine and dentistry.