

HOW TO

Reduce Demineralization and Secondary Caries

Infinix™ acts as an antimicrobial, antibacterial composite in restorative treatment to fight against caries from first steps to final curing. [by **Gregori M. Kurtzman, DDS, MAGD**; and **Yuval Wind, DMD**]



GREGORI M. KURTZMAN, DDS, MAGD



YUVAL WIND, DMD

ORAL BIOFILM is found in the periodontal sulcus, which is a difficult area for patients to maintain with home care. Even for patients without visible oral biofilm, the bacteria within the sulcus and interproximally between the papilla and tooth produce acids as they break down the carbohydrates in the food. Recurrent caries and demineralization around teeth that have had a direct restoration relate to the abundant, intraoral bacteria.

Direct resin restorations are frequent treatment for patients of all ages. Those restorations may be placed to treat slight to moderate caries, replacement of a failing amalgam or composite with sufficient tooth structure to retain a new direct restoration, root caries, or small pit/fissure caries to prevent further tooth loss. Early demineralization of the pits and fissures as well as incipient lesions have been treated with bonded sealants to limit those most common areas of caries initiation.

The Problem

Microgaps, which can result from polymerization shrinkage during resin curing in placement, may present between the tooth and direct resin. Composites across the spectrum

shrink approximately 2% following curing. This can be minimized with incremental placement but cannot currently be eliminated. That microgap may be present at the margins of the composite related to bacterial demineralization at the interface or present when the composite was placed (**Figure 1**). Unfortunately, marginal microgaps are microscopically observed and not detectable visually until a significant amount of tooth has broken down with secondary caries.

So how can we control those bacteria causing breakdown of the enamel and dentin proximal to the composites we are placing?

An Introduction to the Antibacterial Approach

Manufacturers have attempted to prevent recurrent decay with materials in various ways. Principle to that concept were fluoride-releasing resin materials that used various methods to achieve delivery, including ion exchanges in the patient's oral fluids and incorporating properties into monomers to decrease recurrent decay potential. The downside was the materials had limited lifespans before the product aiding in caries and demineralization prevention lost its effectiveness in the patient's tooth.

Infinix™ (Nobio, Inc), a next-generation antibacterial (antimicrobial) material, was introduced after receiving United States Food and Drug Administration clearance in 2019 and debuted as the first antimicrobial composite. This technology is based on a quaternary ammonium covalently bound to a silica filler (QASi), which has demonstrated in microbial

studies to be antibacterial.¹ This is incorporated into both a flowable and universal composite as well as a dentin bonding agent.

The QASi particles are insoluble and nonleaching, so nothing harmful or toxic interferes with normal flora in the oral cavity. With nothing to be recharged or replenished in the composite, it is designed to be long-lasting and has no limited life span in its antibacterial properties. These QASi particles electrostatically attract cariogenic pathogens. When the bacteria contact the resin or adhesive's surface, it electrostatically kills those microbes, eliminating them on contact by shredding the bacteria's outer membrane, removing the threat of biofilm on the restoration's surface.

No active bacteria were observed on cultures of Infinix because of the power of QASi particles (**Figure 2**). An independent study on Infinix from Clinical Oral Investigations found long-lasting antibacterial properties, demonstrating a 68% reduction in demineralization over 4 weeks (**Figure**

3).¹ Polymerization shrinkage and its microgap at the microscopic level when the composite is light cured can harbor bacteria, allowing demineralization. This can be prevented with the QASi technology of the resin.

Described as a game changer for use in direct restorations, QASi technology fights the bacteria that cause demineralization and subsequent recurrent caries. This should also limit bacterial-related inflammation with the soft tissue that is in contact with the restoration, reducing oral biofilm in the area. High-risk patients with poor home care, a dry mouth, or a high carbohydrate diet will benefit from the eliminated risk of recurrent decay on teeth with direct restorations.

Caries protection needs to begin with the bond at the dentin and enamel interface to prevent demineralization at this weak area. When an adhesive is placed on prepared dentin, the resin flows into the dentinal tubules, forming a hybrid zone. The bond retains the overlaying composite to the tooth's surface. It also acts as a barrier to bacterial-produced acids caused by carbohydrate fermentation, which demineralizes the dentin.

An adhesive that incorporates QASi technology prevents demineralization at the resin-dentin hybrid zone by bacterial inhibition, improving bond strength over time as well as effectively locking the restoration to the tooth long term. The Infinix adhesive applied to etched enamel seals the enamel with an antibacterial coating so that any microgap related to polymerization shrinkage has a decreased potential for demineralization leading to recurrent decay.



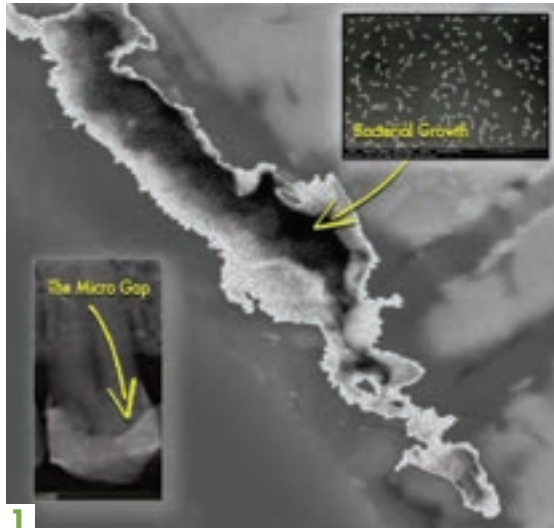
Nobio Infinix

Infinix restoratives feature antimicrobial properties that are designed to protect restored dentition from recurrent caries by reducing demineralization, allowing the composite restorations to have extended life spans. The materials feature handling and finishing properties similar to leading dental composites while adding the long-term antidemineralization properties.

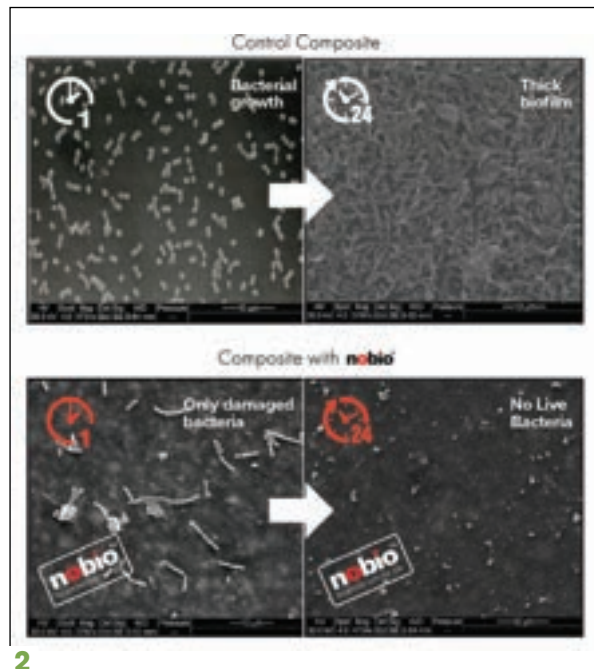
Nobio, Inc

844-463-4649 | infinix.com

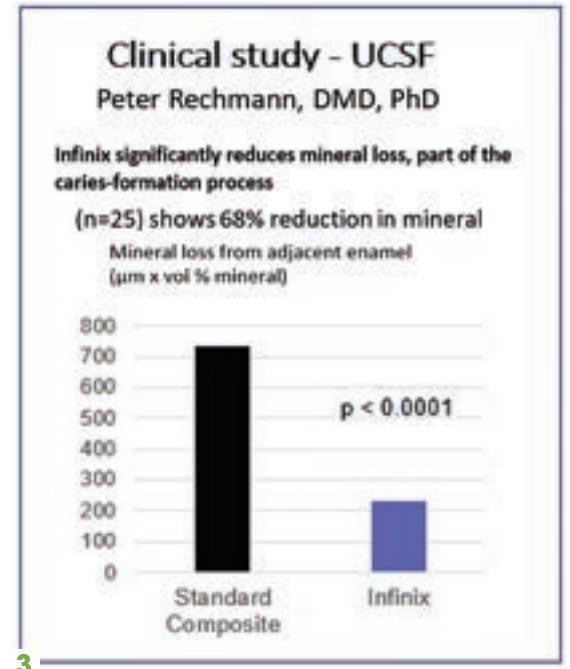
CIRCLE RS #25



1



2



3



4



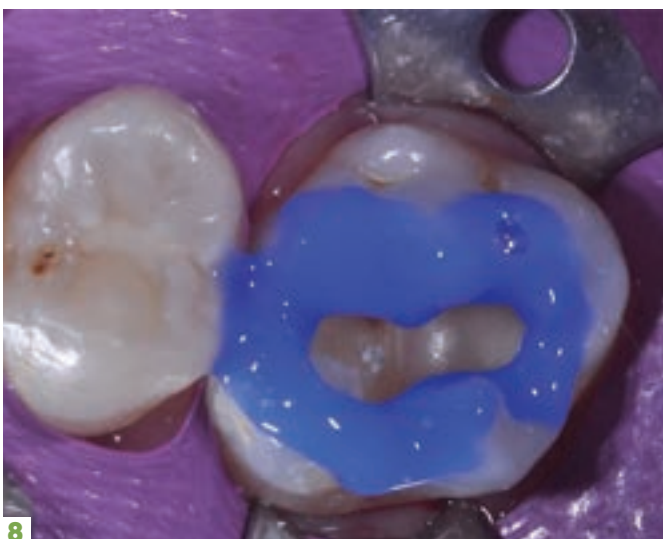
5



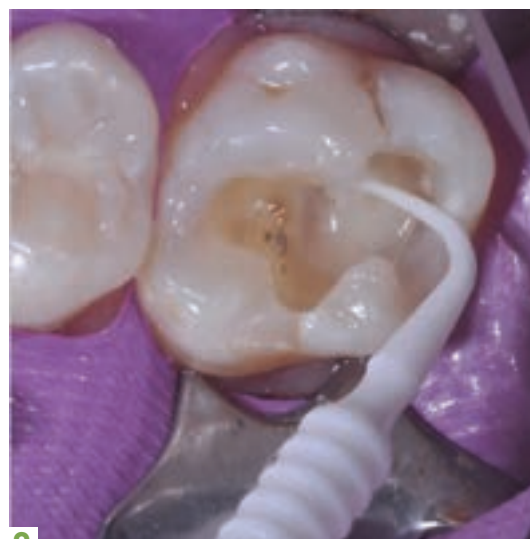
6



7



8



9

AT A GLANCE

1. A microgap between the direct resin and tooth structure that harbors bacteria is not cleansable with home care.¹

2. This comparison of bacteria (*Streptococcus mutans*) on a control composite and Infinix demonstrates a large culture of bacteria on the control and an absence on the Infinix.

3. A study from the University of San Francisco California demonstrating a significant reduction in demineralization related to a decrease in caries-causing bacteria on the composites surface.²

4. Following excavation of the old restorative material and decay, a deep area was present on the distal portion of the occlusal floor.

5. Infinix Universal Bond was applied to only the deep portion of the occlusal floor, and Infinix Flowable Composite was placed as a base and light cured.

6. Extensive caries are present on the facial cervical and interproximals of the lower anterior, as well as lingual incisal wear on the maxillary incisors.

7. Restoration of the affected anterior areas with Infinix Universal Bond and Universal Composite returns tooth contour and improves esthetics.

8. Selective etching was performed of the enamel.

9. Infinix Universal Bond primer was applied to all surfaces with brushing motion for 20 seconds and then air thinned.



10



11



12

The preparation may be filled with Infinix™ Flowable Composite—used as a base—with the remainder of the restoration incrementally filled with Infinix™ Universal Composite (Figures 4 and 5) or with the universal composite placed as the sole filling material (Figures 6 and 7). The flowable combined with the Infinix adhesive provides a sealant with antibacterial properties in pediatric and adult patients to help preserve healthy tooth structure.

The authors' preference when treating abfractions is to use a flowable composite versus a universal or hybrid resin due to flexure of the tooth that led to the cervical abfraction "notch." A flowable composite in this clinical situation will flex with the tooth and is less likely to "pop" off or re-abract than the stiffer universal or hybrid composite.

Treatment

Infinix™ Universal Bond consists of a self-etch primer and a light-cured bonding agent containing QASi par-

ticles. Bond strengths of greater than 18 MPa to enamel and greater than 20 MPa for dentin can be achieved. Additionally, a bond to zirconia of 26.7 MPa improves retention of zirconia crowns and onlays to the resin cement used.

The bonding agent is similar in application technique to other 2-bottle adhesive systems, so no new techniques are needed to incorporate it into the treatment regime. Total-etch or selective-etch techniques may be utilized (Figure 8). The primer is applied to prepared dentin and enamel, simultaneously treating both surfaces. Following preparation, the primer is applied to the tooth surfaces with a microapplicator and allowed to sit for 20 seconds. Then a mild air stream is applied to the treated surface to dry the area prior to application of the bonding agent (Figure 9). Next, the bonding agent is placed, followed by a mild airflow applied over the surface to ensure even coverage of the adhesive, which is then light

AT A GLANCE

10. Infinix bonding agent was then applied to all surfaces, lightly air thinned and light cured.

11. Infinix Universal Composite was incrementally placed, light curing between portions and sculpted to full contour.

12. The completed direct resin restoration utilized Infinix Universal Bond, Flowable Composite, and Universal Composite.

cured for 10 seconds (Figure 10). The preparation is then completed with Infinix Universal Composite (Figures 11 and 12).

An Elevated Solution

In dental implant cases, the flowable composite is used to seal the screw access hole in an abutment or screw-retained restoration. Following placement of either a piece of cotton pellet or polytetrafluoroethylene tape over the screw head, the area is filled with Infinix Flowable Composite. This will aid in preventing bacterial invasion that may contribute to peri-implantitis into the implant platform area.

Infinix Universal Bond has good handling properties, good adaption to tooth structure, and good body so that anatomy can be built prior to light curing. Based on the authors' experience, it may be warmed to 50 oC/122 oF to improve flow and adaption in a deep proximal box, which eliminates any potential voids at the gingival aspect of the proximal preparation. The bonding agent may be utilized with other composites should the practitioner prefer or need to use a shade not available from Infinix. Due to its high bond strength to zirconia, the Universal Composite may be applied to the interior of the restoration and the prepared tooth and can then be combined with a dual-cure resin cement to elevate that product with the QASi antibacterial technology. ●

REFERENCES

1. Reis A, Carrilho M, Breschi L, Loguercio AD. Oper Dent. 2013;38(4):E1-E25. doi: 10.2341/12-258-LIT
2. Rechmann P, Le CQ, Chaffee BW, Rechmann BMT. Demineralization prevention with a new antibacterial restorative composite containing QASi nanoparticles: an in situ study. Clin Oral Investig. 2021;25(9):5293-5305. doi:10.1007/s00784-021-03837-4

ABOUT THE AUTHORS

Gregori Kurtzman, DDS, MAGD, is in private general dental practice in Silver Spring, Maryland. He is a former assistant clinical professor in the Department of Restorative Dentistry and Endodontics at University of Maryland School of Dentistry and a former American Academy of Implant Dentistry Maxi-Course assistant program director at Howard University College of Dentistry. He has lectured internationally on the topics of restorative dentistry, endodontics, implant surgery, removable and fixed prosthetics, and periodontics and has more than 790 published articles globally and several e-books and textbook chapters. He has earned fellowship in the Academy of General Dentistry (AGD), American College of Dentists, International Congress of Oral Implantology (ICOI), Pierre Fauchard Academy, Academy of Dentistry International, as well as mastership in the AGD, ICOI, and International Academy of Dental-Facial Esthetics and diplomat status in the ICOI, American Dental Implant Association, and International Dental Implant Association. He is also a consultant and evaluator for multiple dental companies. Dr Kurtzman has been honored to be included in the Top Leaders in Continuing Education by Dentistry Today annually since 2006 and was also featured on the June 2012 cover. He can be reached at dr_kurtzman@maryland-implants.com.

Yuval Wind, DMD, is in practice in Tel Aviv, Israel. He is a graduate of the The Maurice and Gabriela Goldschleger School of Dental Medicine at Tel Aviv University and a member of the Department of Oral Rehabilitation at The Maurice and Gabriela Goldschleger School of Dental Medicine and the Sackler Faculty of Medicine at Tel Aviv University. He is a former director of the Advanced Aesthetics Program at The Ronald E. Goldstein Research Center for Aesthetics in Dentistry at Hebrew University-Hadassah School of Dental Medicine in Jerusalem, Israel. He is a well-known lecturer in the field of esthetic dentistry, minimal intervention dentistry, prosthodontics, adhesive dentistry, and composite materials.