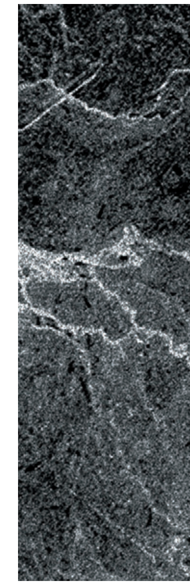
Contemporary Issues



BONDING TO ZIRCONIA

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Zirconia is densely sintered and does not contain a glass phase. Therefore, it cannot be etched with hydrofluoric acid to create a microretentive etching pattern. In addition, because zirconia does not contain any silica, silanes cannot be used to promote bonding.

So what are the alternatives for resin bonding to zirconia? Numerous long-term laboratory studies have shown that resin bonding to zirconia surfaces created by computer-aided design and computer-aided manufacturing (CAD/CAM) machining and dense sintering is not durable, independent of the use of primers or specific luting agents. Scientifically proven methods for long-term durable bonding to zirconia ceramics require first cleaning, roughening, and chemical activation through airborne particle abrasion using pure alumina or silica-coated alumina particles (Rocatec, 3M ESPE, Seefeld, Germany). Although some clinicians question the effectiveness of air abrasion on zirconia, recent studies have shown that air abrasion with 50-μm alumina at a reduced pressure of 0.05 MPa (7 psi) is able to do the job.

In addition to air abrasion, chemical coupling agents such as phosphate monomers for conventionally air-abraded zirconia or silanes for silica-coated zirconia can be used. Bonding with phosphate monomer containing systems is more reliable than bonding to silica-coated and silanated zirconia. Therefore, phosphate monomer luting cements (e.g., Panavia [Kuraray, Tokyo, Japan]), or phosphate monomer primers such as Clearfil Ceramic Primer (Kuraray) or Monobond Plus (Ivoclar Vivadent, Schaan, Liechtenstein) on freshly air-abraded zirconia are the most reliable bonding methods today. However, it must be stressed that contamination of the air-abraded zirconia with saliva or other contaminants will prevent the formation of chemical bonds and therefore must be avoided.

Although zirconia crowns can be bonded with resins, they also can be luted with conventional cements because an adequate crown preparation provides sufficient retention without adhesive bonding. Thus,

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DOI 10.1111/j.1708-8240.2011.00403.x

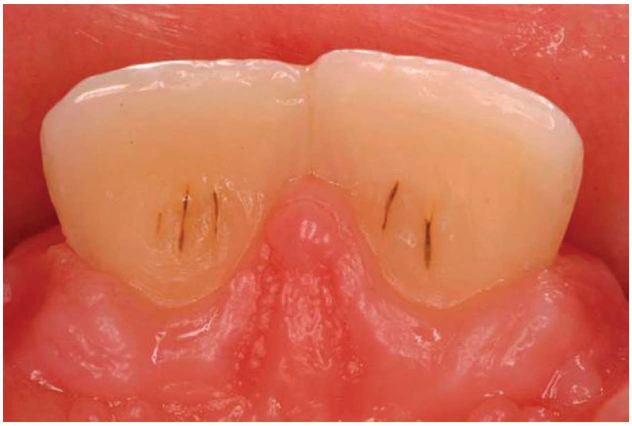

Figure 1. Minimally invasive nonretentive preparation for lingual retainers.

Figure 2. Resin-bonded, single-retainer FPDs as a clinical test system for reliable zirconia bonding.

when bonding zirconia crowns with resins it is nearly impossible to differentiate between truly effective bonding (i.e., no microleakage will occur) and basic cementation (i.e., microleakage will occur over long term, but the crown does not dislodge because of its mechanical retention).

Therefore, the best method to show that a bonding system is able to promote durable bonding to zirconia is to use it for bonding nonretentive restorations such as Maryland type resin-bonded fixed partial dentures (FPDs; Figures 1 and 2). In an ongoing study in our department at the University at Kiel, such nonretentive restorations are bonded randomly with different materials that have had promising results in the laboratory. The outcome of such studies will provide the best scientific evidence for reliable clinical bonding to zirconia.

It should be mentioned that several alternative surface conditioning methods, such as the application of a low-fusing porcelain pearl layer, selective infiltration etching, zirconia ceramic powder coating, and nanostructured alumina coating, have been developed to eliminate air abrasion of zirconia. However, these methods are rather complicated and time-consuming and cannot be applied chairside. In addition, contamination during clinical try-in of the treated restorations might adversely affect resin bonding.

In summary, in my opinion, the simplest and most effective way for luting zirconia restorations today is the use of phosphate monomer luting systems on freshly air-abraded zirconia, as air abrasion can be done chairside within seconds.

SUGGESTED READING

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