Surface treatment of ceramics

In modern prosthodontic dentistry, metal-free ceramics are widely used materials, and knowledge of their unique cementation procedures is paramount for a modern dentist. In order to achieve optimal adhesion between teeth and ceramics, knowing the composition and properties of adhesives is not enough. It is important to know how dental tissue and the different ceramics interact with them, and how these substrates can be treated beforehand in order to achieve optimal results.

As technology has progressed, different types of ceramics have been introduced, such as feldspathic porcelain, leucite-reinforced ceramics, lithium disilicate and zirconia. These materials have similar esthetic properties, but different mechanical and chemical properties. The difference in properties between ceramics is directly related to their structural differences: The presence or absence of leucite crystals, the radically different shape of lithium disilicate crystals and zirconium oxide particles, and other features of ceramics directly influence the type of surface treatment needed to obtain an optimal chemical adhesion. Each material needs to be treated in a certain way before cementation, and knowing this could yield overall better clinical results.

Nowadays, sandblasting glass-ceramic surfaces (feldspathic, leucite and lithium disilicate) is not advised, because this kind of treatment could flatten them and create microfractures in the glossy matrix, leading to future failure of the restoration. A tribochemical treatment on zirconia using aluminum oxide particles, however, is advised; it increases surface roughness and augments chemical adhesion owing to the particles embedded in the zirconia’s surface.

The gold standard for treating glass-ceramic surfaces is etching; however, for different ceramics, different etching times must be applied:
- For feldspathic ceramics, etching with 5% hydrofluoric acid for 120 s is advised.
- For leucite-reinforced ceramics, etching with 5% hydrofluoric acid for 60 s is advised.
- For lithium disilicate, etching with 5% hydrofluoric acid for 20 s is advised.

For zirconia, etching is not advised, as it has been demonstrated that its surface is rendered chemically inert by this treatment.

In conclusion, clinicians should feel compelled to research and study this subject in order to combine their knowledge of adhesive materials with the knowledge of chemical characteristics and best surface treatments for both the dental substrate and the restoration substrate.

Dr. Giacomo Derchi
Board of reviewers

Dr. Vincenzo Marchio