

## Ceramics

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### The New Low-Fusing Porcelains (12/03)

**Question:** What's the difference between low-fusing and high-fusing porcelain?

**Answer:** The difference between low- and high-fusing porcelains is the firing temperature used to fuse the glass. A few years ago there were three classifications of porcelain: high-, medium-, and low-fusing. Now we refer to porcelain using only the terms high- and low-fusing. However, the low-fusing porcelain used a few years ago is considered high-fusing today. We now have a whole new category of low-fusing porcelain.<sup>1</sup> Today's low-fusing porcelain was developed to be less abrasive to opposing dentition by incorporating finer leucite crystals in lower concentrations. However, recent laboratory studies are equivocal, with some showing a reduction in enamel wear and others showing no difference.<sup>2-5</sup> Potential advantages to low- and high-fusing porcelain are:



#### **Low-fusing porcelain:**

- Laminate veneers may be corrected without investing in a refractory material.
- Less chance of alloy distortion due to the lower firing temperatures.<sup>6</sup>
- Less wear on porcelain ovens.
- Reportedly easier to polish.

#### **High-fusing porcelain:<sup>6</sup>**

- Superior strength.
- Superior translucency.
- Maintains form better during repeated firings.

Clinical studies are necessary to evaluate the potential reduction in wear of opposing dentition by today's low-fusing porcelains.

#### **References**

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## **Empress 2: Successor to Empress** (Originally published in May 1999)

**Question:** Last week a company representative visited our clinic and talked about a new ceramic material called Empress 2. I have had some veneers made with Empress and they turned out well; how does Empress 2 differ from Empress?

**Answer:** Introduced by the Ivoclar Vivadent Corporation in the late 1980s, Empress is described as a leucite-reinforced ceramic. Because the leucite crystals reinforce the glass matrix and impede crack propagation, the material is strong enough to be used for veneers, inlays, onlays, and full crowns. To fabricate a restoration with Empress, the lost-wax technique is used to produce a wax pattern that is then sprued and invested. A heated ceramic ingot is pressed into the mold to produce the restoration. The restoration is then surface characterized or can be cut back and veneered with porcelain. Unfortunately, although the restorations are very esthetic, Empress is not strong enough to be used for fixed partial dentures. One reason for its limited strength is that the leucite crystalline content is at most approximately 40%; a higher crystalline concentration imparts excessive opacity to Empress.

According to Ivoclar Vivadent, Empress 2 has three times the strength of Empress. There are several compositional differences between the two products that contribute to Empress 2's greater strength. Empress 2 consists of a lithium disilicate glass-ceramic that is used to form the framework of the restoration or bridge. The crystals are from 0.5 to 4 microns long and are uniformly bonded to a glass matrix. Because the index of refraction of the crystals is similar to that of the glass matrix, the crystal content can be as high as 60% without compromising the material's esthetics. As a result, Ivoclar Vivadent claims that Empress 2 exhibits much greater strength than Empress and can be used for fabricating three-unit anterior bridges (from 2nd premolar forward). Although the fabrication process for Empress 2 is similar in many respects to that used with Empress, there is one significant difference. Rather than making the wax pattern to final contour, the pattern is made for the crown or bridge framework and it is this, not the final contoured pattern, that is sprued and invested. An Empress 2 lithium disilicate ingot is then heated and pressed into the mold at a temperature of 920°C. Appropriate dentin and enamel shades of a veneering ceramic are fired in a ceramic oven, shaped to final form and contour, and glazed. Ivoclar claims that the crystals in the veneering ceramic mimic the crystalline structure of enamel and, therefore, produce a lifelike result. One final way that Empress 2 restorations differ from those made with Empress is that they may be cemented with the resin-modified cement, Pro-Tec Cem, from Ivoclar. Traditional adhesive cementation with a resin cement can also be used, as it is with Empress restorations.

These are some of the basic ways in which Ivoclar Vivadent claims that Empress 2 differs from Empress. As with any newly-marketed dental material, it is important to closely follow the published literature to ensure that the product is performing as the manufacturer claims before purchasing and using it.

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