Understanding e.max as the ideal material for indirect posterior and anterior restorations

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Posterior restorations are among the most frequently performed treatments in dentistry today, yet various challenges and limitations still exist in their execution. Whether for cases involving full coverage, partial, implant-supported, or aesthetic restorations, the process of selecting the appropriate material for indirect posterior treatments can be wrought with confusing information because the requisite demands may seem contradictory.

Among the considerations for posterior restorations are establishing proper isolation for adhesive cementation, ensuring fracture resistance of the selected material for long-term function, and achieving proper anatomical form and marginal integrity. Superior fit contributes to the best possible outcome and functional longevity for the patient, while strength of the selected restorative material helps to ensure resistance against the masticatory force exerted on posterior denition. Combined, ideal anatomical form, marginal adaptation, and appropriate proximal contact and contour are required of materials and resulting restorations used in posterior treatments.

Additionally, aesthetics in posterior restorations has become an increasingly important consideration for both patient and clinician despite their location in less visible areas of the mouth. Shade and colour matching between the restorative material and natural tooth structure is necessary for creating lifelike restorations.

Not surprisingly, considering the multiple requirements for posterior restorations, it can be challenging for clinicians to determine the most appropriate material for various indications. High-strength all-ceramic materials are recommended for posterior restorations based on their strength. However, some have lacked aesthetics. Recently, non-ceramic materials have evolved to compete with ceramic in posterior restorations. The numerous indirect resin composites now available may perform well in certain clinical situations, but they still require further research to determine whether they are viable for long-term success.

The advent of new materials and the expanding use of CAD/CAM have ushered in improvements in ceramic materials. The result has been increased use of durable metal-free materials that are more aesthetic for successful treatments. Investment in terms of education, purchasing of the systems, and skills enhancement is required for proper and predictable use.

Among these advancements is lithium disilicate (IPS e.max), a universal all-ceramic material for indirect restorations. Because this material combines strength with high aesthetics, its durability, predictability, and longevity make it an ideal material for indirect posterior restorations.

Lithium disilicate
Lithium disilicate (e.max) is categorised as a glass-based ceramic. It is generally composed of quartz, lithium disilicate, phosphorus oxide, alumina, potassium oxide, and other components. These powders are combined to make a glass melt that is moulded and then formed into blocks or ingots. The manufacturing process creates a highly thermal shock-resistant glass-ceramic due to the low thermal expansion that results during manufacturing. Within the material, needle-like crystals form and comprise about two-thirds of the volume.

The ingots can be processed using the lost-wax hot pressing technique, whereas blocks are milled using the CAD/CAM technique. Lithium disilicate can be cemented using adhesive bonding (such as Multilink N/Automix, Ivoclar Vivident) or conventional cementation techniques.

The monolithic property of e.max contributes to the strength and aesthetics of the restoration. The traditional use of a high-strength core material made of zirconia or alumina decreased aesthetics owing to the high value and increased opacity compared with glass-ceramic materials. Even though these high-strength core materials demonstrated excellent mechanical properties, the added layers of veneered ceramic, which have a much lower strength, caused the overall strength of the restoration to decrease. Lithium disilicate circumvents these problems and offers both strength and high aesthetics for an expanded range of indications.
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Unless other ceramics, e.max offers 560 MPa in strength, which is twice the strength of other ceramics.12–14 Another advantage is that e.max can be finished thinner without chipping owing to its higher edge strength.15,16 Additionally, e.max provides exceptional aesthetics without requiring a veneering ceramic when processed in its monolithic form. This allows restorations to maintain their structural integrity.17

The material is available in four translucencies, including high opacity, medium opacity, low translucency, and high translucency.11 In a five-year study conducted by Ivoclar Vivadent, 97 per cent of the pressed e.max restorations studied received an excellent rating in aesthetics.17

Research continues to examine the efficacy of lithium disilicate restorations. Fasbinder et al., for example, investigated the longevity of lithium disilicate crowns, following 52 restorations over two years. The researchers found no identified cases of crown fracture or surface chipping. Over the two-year period, the patients were checked three times and none reported any sign of sensitivity.11

Guess et al. examined the fatigue behaviour and reliability of CAD/CAM-processed lithium disilicate compared with zirconia all-ceramic crowns veneered using the hand-laying technique. They concluded that the lithium disilicate crowns were superior in fatigue-resistant crowns compared with the zirconia crowns, which were subject to fatigue susceptibility to early veneer failure.16

Further, e.max can be used for a variety of indications, as demonstrated by Sorensen et al., in whose study e.max was used for the fabrication of three-unit bridges. The researchers concluded that by using e.max they achieved an acceptable clinical success rate.10 Other indications include posterior partial- and full-crown, as well as implant-supported restorations.18

**Case studies**

IPs e.max can be used for a wide range of universal anterior and posterior indications. In addition to its proven regard- ing aesthetics are pleased after receiving their restorations, and clinicians can be assured of functional predictability. Posterior restorations fabricated from e.max demonstrate the requisite strength, aesthetics, and durability. Whether full or partial coverage, e.max restorations provide function and fit to ensure satisfaction of both clinician and patient. The following cases demonstrate the material’s versatility for a number of everyday restorative cases.

**Case 1**

The patient presented with a maxillary incisor (Fig. 1a). Three anterior full-crown all-ceramic restorations were fabricated from e.max in order to enhance aesthetics and function, and were cemented with Multilink N adhesive cement (Fig. 1b).

**Case 2**

A patient presented with a maxillary left lateral incisor (Fig. 2a). Due to its high susceptibility to early veneer failure, this tooth was restored with a lithium disilicate crown. No further restorations were needed after one-year recall (Fig. 2b).

**Case 3**

A female patient presented with worn dentition, a closed vertical dimension of occlusion, and poor esthetics, particularly on the left side (Fig. 3a). She expressed great concern about what she perceived as unacceptable aesthetics. The teeth were prepared for full-coverage restorations owing to the extensive fillings and need to change occlusion radically (Fig. 1b). All of the maxillary teeth were restored with full-crown coverage restorations fabricated with e.max. This material was selected based on its strength and durability, which would be necessary to establish a new and comfortable occlusion and desirable aesthetic outcome (Fig. 4a).

**Case 4**

The patient presented with mesial decay on a maxillary molar (Figs. 4a & b). A minimally invasive mesio-occlusal inlay preparation was performed in anticipation of a lithium disili- cate restoration. The preparation maintained the enamel on all of the peripheral margins. The mesio-occlusal inlay was placed and adhesively bonded to the enamel along all of the margins (Fig. 4c). Once placed, superior aesthetics and mar- ginal fit were confirmed. The lithium disilicate restoration decreased the chance of the tooth dramatically, which pos- sibly decreased the risk of future fracture.

**Case 5**

A patient presented requesting a complex reconstruction involving individual tooth restorations and implants, as well as periodontal therapy. Fig. 11 illustrates one approach to treat the patient’s previous restorations. Fig. 12a: The patient presented with periodontal disease and significant decay. Fig. 12b: A metal-ceramic implant prosthesis was placed in the maxillary left quadrant, and all of the individual lithium disilicate crowns were fabricated to create a more functional and aesthetic reconstruction. — Fig. 13: Chart documenting the author’s clinical success using lithium disilicate restorations.

**Case 6**

A patient presented needing an implant abutment. A stock titanium abutment (Bio-Horizons) with Laser-Lok was used to wax and press an e.max implant abutment, which would be cemented on to the titanium abutment (Figs. 5a & c). Since all-ceramic restorations can be subject to failure from the insidete, the stiffness of the core material is another consideration.

A titanium abutment with a high elastic modulus minimises failure when lithium disilicate or zirconia is used. The pressed e.max was cemented to the titani- um abutment in the mouth using Multilink Implant cement (Ivoclar Vivadent; Figs. 6a & d). This represents an entirely dif- ferent method of implant re- storation that is easier and less expensive (Figs. 6g & h).

A patient presented with minimal enamel that was chipping off the maxillary anterior teeth (Fig. 5a). There was insufficient enamel to support a veneer restoration, so the teeth were prepared for full-cover- age restorations. Because e.max reflects light in a manner simil- lar to natural enamel and has the same wear coefficient, it was the ideal material in this case. The maxillary recon- struction using e.max restora- tions demonstrated improved aesthetics and predictable function (Fig. 5b).

**Case 7**

The patient presented needing a complex reconstruction involving individual tooth and implant restorations, as well as periodontal therapy. The implants were placed, the teeth prepared, and a ceramic core crown was fabricated with VitaLum (Fig. 7a). The crown was finished to all of the necessary aspects of the tooth and finished all of the margins on the enamel. The enamel was adhesively bond- ed entirely to the enamel with Vitabond (Fig. 7b). This procedure was minimally invasive, and the ceramic mate- rial is known to have a successful long-term result.

**Case 8**

The patient presented needing an implant abutment. A titanium abutment (Bio-Horizons) with Laser-Lok was used to wax and press an e.max implant abutment, which would be cemented on to the titanium abutment (Fig. 5a & c). Since all-ceramic restorations can be subject to failure from the inside out, the stiffness of the core material is another consideration.

A titanium abutment with a high elastic modulus minimises failure when lithium disilicate or zirconia is used. The pressed e.max was cemented to the titanium abutment in the mouth using Multilink Implant cement (Ivoclar Vivadent; Figs. 6a & d). This represents an entirely dif- ferent method of implant re- storation that is easier and less expensive (Figs. 6g & h).

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A patient presented with periodontal disease and significant decay (Fig. 10a), resulting in the need to extract some of the teeth in the maxillary left quadrant and place implants. Additionally, there was a signif- icant problem concerning the vertical dimension of occlusion and lack of anterior guidance. In addition, the patient was very unhappy with the appearance of his teeth. A metal–ceramic im- plant prosthesis was placed in the maxillary left lateral incisor and all of the individual lithium di- silicate crowns were fabricated to realise a more functional and aesthetic reconstruction. By using lithium disilicate prin- cipally as a monolithic material in this case, the laboratory time to fabricate these restorations was two-thirds less than when a metal core is made and a ce- ramic layered over it (Fig. 10b).

**Conclusion**

I have maintained a database for the last 50 years of different confounding variables and pa- tients on the long-term survival rates of ceramic materials and the conditions that promote fail- ure. Previously, the best long- term survival of a restoration that has been studied was the monolithic leucite-reinforced glass-ceramic (IPS Empress, Ivoclar Vivadent). It has been demonstrated that e.max can be used universally and effectively in all systems, including the posterior region, making it suitable for a range of indica- tions. It has been studied repea- tedly to confirm its strength and functionality, and my research confirms that lithium disilicate has been used with impressive long-term success (Fig. 11).