Performance esthetics from a high-strength material - the versatility of lithium disilicate

John C Schwartz[1]

Depending on the clinical situation and the location of teeth, materials with different mechanical properties need to be employed when restoring teeth with fixed porcelain veneer crowns. This is pivotal in full-mouth rehabilitation, for example. However, the use of many different materials may entail difficulties in achieving harmonious shading or even render a uniform outcome impossible. The exceptional properties of lithium disilicate glassceramic enable dental professionals to create natural-looking restorations which fulfil the different requirements – without having to make concessions with regard to shading.

Typically, strength values of dental porcelains are relied on to indicate porcelain crown performance. However, strength is a conditional, rather than an inherent, property of dental porcelains. In vitro strength data alone cannot be used to assume a material's long-term performance in vivo. In two-phase porcelain systems consisting of a framework and veneering material, the design of the substructure has a decisive influence on the overall strength. It is therefore logical to consider fabrication design as a factor in the overall strength performance of an all-ceramic crown in vivo. Apart from the physical properties of the materials, the correct dimensional relation between the veneer and the substructure is a prerequisite for the success of twophase porcelain systems. While the substructure functions primarily as the system's strength, the veneering porcelain provides its esthetics. Examples of two-phase porcelain systems include porcelain-fused-to-metal crowns, zirconia crowns and veneered lithium disilicate crowns. Increasing the strength function of the system would imply thickening the substructure. Thickening the substructure creates less

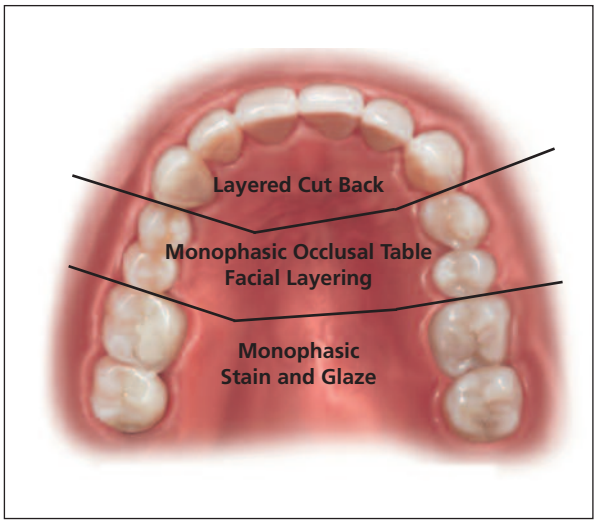

Figure 1: Different indications require different fabrication and layering techniques: IPS e.max® lithium disilicate allows uniform results to be achieved.

[1] *John C Schwartz, DDS, Metairie, LA/USA*
Director Integra Institute, Assistant Clinical Professor, Louisiana State University School of Dentistry, Department of Prosthodontics

Corresponding Author:
337 Metairie Road, Suite 200, Metairie, LA 7005, USA
johnschwartz@johnschwartz.com

Figure 2: Preoperative frontal view of the patient's condition: The areas of heavy wear are clearly visible. Clinical crown loss was estimated to be between 20 and 70 percent.

Figure 3: Preoperative occlusal view of the patient's maxillary arch.

room for the outer phase to perform its esthetic function.

Traditionally, creating a structural design to maximize esthetics has reduced the strength value of biphase systems due to small dimensions of the substructure. An example is limiting a substructure to a coping form. While esthetic, the coping design leaves the veneering porcelain unsupported in cusp-to-fossa function and vulnerable to long-term stress fracture. Possessing a high-strength substructure that has considerable esthetic advantages over other substrates can improve the strength of a system without compromising esthetic values.

A hybrid substructure design, which supports a cusp-to-fossa relationship, increases the strength of the system. Refractive index values increase when the substructure thickens; increasing the thickness of the substructure results in a crown of higher value. By acknowledging the individual strengths and weaknesses of the components of the biphase porcelain systems, it is possible to engineer structural stabilization factors in esthetic crown design. The material that most closely fits these ideal synergistic criteria is lithium disilicate.

Applications of lithium disilicate glass-ceramic

Monophasic lithium disilicate crowns can be used on molars, for which strength is a desirable trait. For anterior reconstructions, however, veneered lithium disilicate should be used to emphasize esthetics. A synergy between the strength of the lithium disilicate substructure and the esthetics of the veneering material can be attained with IPS e.max® System. This product allows all-ceramic restorations to compete with traditional restorations in terms of in vitro strength. At the same time, the esthetic value expected from all-ceramic crowns is not compromised.

Monophasic lithium disilicate restorations can be used in posterior areas, where strength is most important. When used in the bicuspid region of the mouth, the facial aspect (visible portion) should be layered using IPS e.max® Ceram. As a result, esthetics are improved without compromising the core integrity strength. In the fabrication of anterior crowns, the artistic skills of dental technicians are utilized to achieve high esthetics. When creating full-contour, monophasic IPS e.max LS2 crowns, the cusp-to-fossa relationship should be studied first. Proper "waxing" in cusp-to-fossa physiology limits compression and shearing forces. Monophasic construction also allows higher resistance to fracture. The ideology behind the monophasic lithium disilicate crown is similar to that of full cast gold crowns (Figure 1).

Case presentation

In this particular case, a 59-year-old male complained about his unattractive smile and wanted one that was more esthetically pleasing. At the time of presentation, the patient had a long dental history of missing posterior teeth, root canal therapy, tooth mobility issues, sensitive teeth, full metal crowns, PFM crowns, amalgam fillings, discolored teeth and difficulty in chewing (Figures 2 and 3). Additionally, the clinical and radiographic examination revealed clicking and popping upon opening of the mouth in both temporomandibular joints (TMJs). Upon palpation, there was also a slight discomfort of the posterior capsule of the right TMJ, but the left posterior and lateral capsules were within normal limits.

Figure 4: The diagnostic wax-up should be created with care as it forms the basis for the restoration.

Figure 5: Lithium disilicate substructures for the anterior crowns.

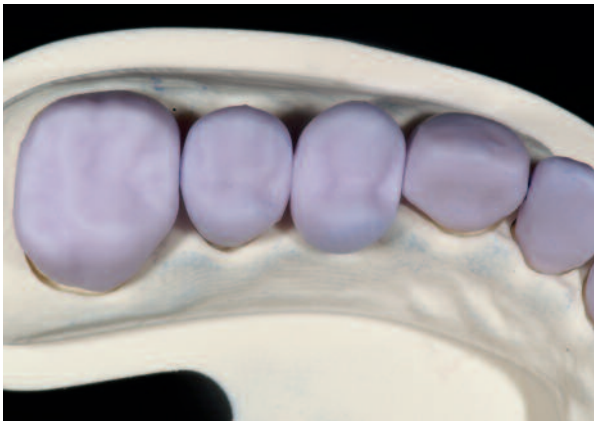

Figure 6: The lithium disilicate CAD/CAM restorations (IPS e.max CAD) were placed on the model in their "blue" phase after milling.

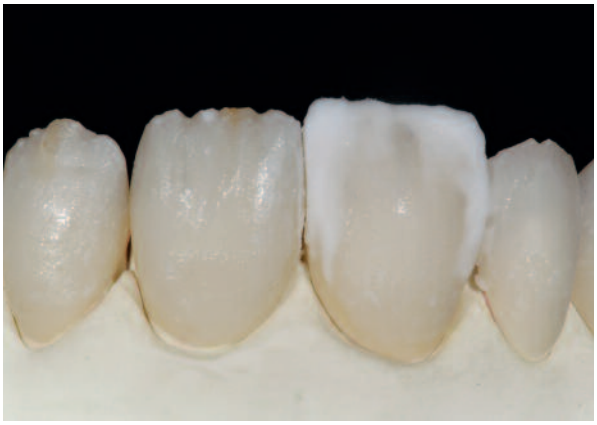

Figure 7: Customized build-up of the anterior crowns.

Diagnosis: Occlusion

The patient's maxillary and mandibular midlines were aligned but demonstrated tracking to the right upon opening. There was a Class III occlusal relationship, with a deep overbite that approached an edge-to-edge overjet anterior position, with a lack of anterior guiding patterns.

Diagnosis: Gingiva

A periodontal examination revealed generalized pocketing of 1 to 3 mm, with isolated pocketing of 4 mm. Additionally, anterior and posterior isolated gingival recession was noted, with associated isolated thinning of keratinized gingiva. Other issues, such as wide keratinized gingival banding, blunted papillae and uneven periodontal outline form also were observed during the examination. The gingiva was irritated and demonstrated isolated bleeding upon probing.

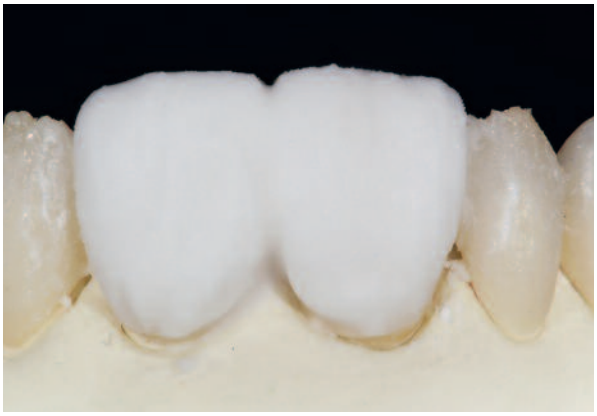

Figure 8: A porcelain enamel layer was applied to the layered crowns.

Figs 9 and 10 View of the completed restorations on the model

Figures 11 and 12: View of the IPS e.max lithium disilicate restorations after seating – the completed full-mouth rehabilitation has a natural and harmonious appearance, even though different fabrication procedures were employed.

Diagnosis: Dental hard tissue

During the dental evaluation, missing teeth, crowns, amalgam fillings, composite fillings, heavy wear facets, exposed dentin surfaces, enamel splintering and clinical crown loss, estimated between 20 and 70 percent, were revealed.

Treatment plan

The diagnosis from this evaluation encompassed worn dentition, collapsed occlusion, generalized chronic mild gingivitis, generalized chronic mild periodontitis and mild MPDS/TMD. Based on this diagnosis, it was necessary to develop an extensive treatment plan that would not only increase the esthetic value of the patient's teeth, but also their functionality. The treatment plan included opening the bite and establishing a vertical dimension of occlusion, establishing anterior guidance patterns and restoring the dentition. It also was decided that a diagnostic wax-up, based on photographic analysis, would be used in this treatment plan (Figure 4), which allowed the planned restoration to be built up in a precise and detailed manner. The wax-up was used to establish the length-to-width parameters of the natural teeth, the incisal plane, occlusal plane and the fixed arch parameters. These steps were all necessary to provide an outcome that was both esthetically pleasing to the patient and, more importantly, functional.

Reprinted with permission from REFLECT 3/10