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EDITORIAL

Prescribing a dental ceramic material: Zirconia vs lithium-disilicate

From teeth made of ivory and implanted in the jaw during historical times to modern day, high-strength ceramic restorations, the goal has always been to restore a person's ability to chew food and to enhance physical appearance. Charles Henry Land described the porcelain jacket crown more than 100 years ago; however, this type of crown never became particularly popular because of problems with strength and marginal adaptation. The metal–ceramic crown, introduced in the 1960s, revolutionized the methods by which crowns were made. Because of the ability of the ceramics to mimic natural tooth structure combined with the strength and marginal fit of the bonded, metal–alloy substructure, this restoration became the gold standard for restoring anterior teeth.

More recently there has been an increased consciousness among the general public concerning their dental health and esthetics. This growing awareness combined with the continuous demand for new and better materials has changed the dentist's and the patient's perception of the metal–ceramic crown, prompting dental manufacturers to develop more durable and life-like appearing restorative materials.

Strength and longevity

There are numerous all-ceramic systems available on the market, and two of the most popular systems are zirconia-based or lithium disilicate-based. The question becomes, which system should be chosen and when? Strength and longevity become important parameters when making the choice. Lithium disilicate crowns are monolithic. Zirconia-based crowns are veneered with a relatively weak ceramic material. Because of this fundamental difference in composition, the behavior of these crowns could be quite different over time. Flexural strengths of zirconia and lithium disilicate are approximately 1000 and 400 MPa, respectively. While zirconia, per se, is more than twice as strong in flexural strength, its weakness lies in the veneering ceramics, which has a flexural strength that is approximately 100 MPa. When comparing these two systems, some studies have reported that lithium disilicate crowns performed better with fatigue testing.

There is also the question of the type of restoration—single crown vs fixed partial denture (FPD), anterior restoration vs posterior restoration. Zirconia is a very strong material that can support an FPD. Nevertheless, chipping of the veneering ceramics has been reported, especially with FPDs in the molar region. Is this type of restoration in the posterior region really better than a traditional metal–ceramic FPD? Only time can give us the answer to this question as new information becomes available through long-term clinical studies.

Ability to match natural teeth

Objects are perceived as esthetic for a multitude of reasons. Concepts such as "ideal" proportions or a particular color that pleases the eye are embedded references in the brain that help to judge, by comparison, what is beautiful and what is not. This same concept applies to teeth. Artificial teeth not only must have the dimensions, texture and contours of the teeth to be replaced, but also should have similar light behavior. The three factors that play a role in light behavior are translucency, metamerism, and opalescence. An area where the zirconia-based and lithium disilicate crowns differ substantially is translucency. Different zirconia materials posses different levels of translucency; nevertheless, because of its higher crystalline content, it is considerably less translucent when compared with lithium disilicate. When of equal thicknesses, the most translucent zirconia is only 73% as translucent as conventional lithium disilicate. Higher translucency will let more light into the restoration, and if used in conjunction with a clear cement, a more life-like appearance can often be achieved.

High translucency, however, is not always desirable. There are instances were ceramic materials with lower translucency

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are beneficial. Discolored teeth or teeth restored with grayish metal posts-and-cores require a ceramic material that can mask the underlying discoloration or metal core material. Although zirconia's relative opacity is advantageous when masking is desired, lithium disilicate has the potential to produce similar results when using medium opacity (MO) and high opacity (HO) formulations of the material.

Indications for use

Although complete-contour zirconia crowns are available on the market, this material is primarily used as a substructure that is veneered with feldspathic ceramics. On the other hand, lithium disilicate can be pressed to produce a complete-contour crown, a substructure that will later be veneered, or a partial coverage restoration. This versatility could render the system to be a favorite among dental laboratory technicians.

Clinical handling

Because of zirconia's high strength, a zirconia-based restoration can be cemented with any type of luting cement. Traditional cements are far less expensive when compared with modern resin-based cements, and are far less technique sensitive. For lithium disilicate restorations, bonding with a resin-based cement is recommended. The material is readily etchable, and bonding the restoration to the supporting tooth structure will increase the strength of the crown. Nevertheless, resin cements are expensive and technique sensitive, with many steps involved in the bonding process, and removal of excess cement is more difficult.

Summary

Because we do not have the "perfect" material that can be applied universally to all clinical situations, such as making a crown for a peg-shaped lateral or restoring a tooth with a grayish post-and-core, knowledge and clinical judgment must guide the clinician in the choice of material, and it is the sole responsibility of the dentist, not the dental laboratory technician, to make that judgment. Sometimes several different materials can produce similar results, while in other circumstances, a particular material stands out as the optimal choice.

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