



Myths vs. **REALITIES**

State-of-the-Art Indirect Posterior Tooth-Colored Restorations

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The time of the porcelain-fused-to-metal (PFM) crown being the primary esthetic posterior indirect restoration is coming to an end, as many dentists are adopting all-ceramic restoration options. However, there are mixed results with the new materials. There are two main options for all-ceramic posterior indirect restorations: full-coverage crowns and partial-coverage bonded onlays. Here, Drs. Jose-Luis Ruiz and Gordon Christensen respond to some myths related to partial-coverage bonded onlays and full-coverage all-ceramic crowns.



Figure 1: PFM crowns needing precise taper, significant tooth structure removal, and subgingival margins, which require retraction cord placement.

Dr. Ruiz's Stance Regarding Partial-Coverage Bonded Inlays and Onlays

Supragingival partial-coverage bonded onlays and inlay/onlays are the most minimally invasive and biocompatible option for indirect restorations. The profession's first attempt at this alternative had challenges; however, over time, with increased knowledge about the specific tooth preparation required, and better understanding and use of materials, these restorations are serving well.¹⁻³ When properly placed, tooth-colored onlays can be as predictable as full-coverage restorative options.

Myths and Realities

Myth

PFM crowns are more predictable and easier than bonded onlays.

Reality

Because most clinicians are more familiar with the PFM full-crown technique, familiarity sometimes is confused with simplicity. Many clinicians do not use partial-coverage bonded onlays due to their unfamiliarity with them, leading to the belief that these restorations are more technique-sensitive and difficult than PFM crowns. This author does not believe this is true. Let us consider the potential complexity of a PFM crown preparation. Subgingival margins are required for acceptable esthetics; full-crown preparations can be difficult, requiring correct taper and cord placement (Fig 1); impressions for restorations are more difficult, as observed by the number of poor impressions sent to laboratories. Major laboratories report that 85-90% of the impressions they receive have poor margin definition.⁴ Managing soft tissues during cementation is difficult; removal of subgingival cement is also difficult (Fig 2). It is the author's experience that partial-coverage bonded onlays are easier than full crowns if supragingival preparations are used.⁵ The preparation of an adhesively retained restoration is easy, since a perfect taper is not important and retentive features are not needed. Excellent onlay preparations usually require five minutes (Figs 3 & 4). With the use of translucent pressed porcelain, the margins of the restoration can be positioned supragingivally, making the entire procedure easier, including impressions, provisional restoration, and bonded cementation (Fig 5). When specific situations require slight subgingival margins due to existing restorations or caries, tooth preparation and cementation is easier than when the entire restoration has subgingival margins.



Figure 2: Radiograph showing subgingival cement and poor marginal fit on a subgingival PFM fixed partial denture.



Figure 3: Onlay preparation of an endodontically treated tooth with supragingival margins, showing the tooth preservation and no need for retraction cord. Note that the impression and bonded cementation will not be affected by gingiva.



Figure 4: Supragingival preparation showing minimally invasive tooth preservation.



Figure 5: Observe the excellent margin blending achieved with translucent pressed porcelain, which allows for supragingival margin placement and tooth preservation.

Myth

PFM or full-zirconia crowns will last longer than a bonded porcelain onlay.

Reality

Although PFM crowns have served the profession for more than 50 years and there are anecdotal reports of restorations lasting for decades, the author believes that the average longevity of a PFM crown is much shorter. However, any full-crown preparations, including strong all-zirconia crowns, are destructive procedures requiring the removal of significant amounts of healthy tooth structure⁶ to achieve the mechanical-retentive features and subgingival margins needed for optimal esthetics (Fig 1). This excessive tooth removal can lead to pulp trauma and, in some cases, endodontic treatment, shortening the tooth's life.⁷ As mentioned above, bonded onlays have proven their longevity, with the added benefit of less tooth destruction and supragingival margins. When patients ask about longevity, it is important to clarify whether the question is regarding the longevity of the restoration only, or the longevity

of both the restoration and the tooth. If considering the longevity of the restoration only, strong materials such as gold alloy, PFM, or full zirconia are likely to last longer, but these restorations disguise secondary caries that may be present without the dentist's knowledge. We have all experienced removing PFM or gold-alloy crowns only to find that the tooth had significant secondary caries under the restoration (Fig 6). An important question is, should we consider the longevity of the restoration, the longevity of the tooth, or both? The translucent metal-free, tooth-colored restorations have the advantage of showing new caries more readily because they are translucent and not opaque. Additionally, if we consider the benefits of less tooth reduction, supragingival margins, and thus healthier gums, bonded onlays are probably the best choice for the long-term conservation of the natural dentition.

Myth

Stronger lithium disilicate is needed for durability with bonded onlays.

Reality

As previously mentioned, leucite-reinforced porcelain onlays and inlay/onlay restorations have proven to be effective and durable, both in the author's personal experience, as well as recorded in available literature for well over 15 years.⁸⁻¹⁰ Land and Hopp¹⁰ show a 10% failure rate at 10 years, in an extensive Medline literature review of bonded inlay and onlay articles from 1993 to 2008. Lithium disilicate inlays and onlays have shown impressive short-term success and promise.^{11,12} Success with bonded ceramic restorations is dependent on technique, including adequate supragingival tooth preparations, correct use of bonding materials, adequate cements, and correct occlusal adjustment. In the author's experience, considering the three "golden rules" of occlusion (equal occlusal contacts, posterior disclusion, and an unobstructed envelope of function) is very important during occlusal adjustment.¹³ Having esthetic restoration margins supragingival preserves tooth structure, and the superb translucency of the restorative material can provide overall excellent esthetics. Although lithium disilicate is available in a translucent option, the author's opinion is that its translucency does not match that of a highly translucent, leucite-reinforced pressed porcelain restoration (Figs 7-9). The author's experience with leucite-reinforced onlays is extensive, having placed thousands of restorations for more a decade with impressive success. Although he has used lithium disilicate for full crowns with excellent short-term results, he does not feel the need to switch to lithium disilicate until more of the possible problems are discovered. The author has some skepticism about strong ceramics, such as full-lithium disilicate or full-zirconia restorations, because they are excessively hard, not similar to nature, and difficult to remove, when necessary. In the future, dentists will have to deal with replacing these almost



indestructible, difficult-to-remove materials, which will be a major challenge to the dental professional and patients. In the author's opinion, strong materials such as gold alloy, zirconia, and lithium disilicate are preferred primarily because they usually do not break, even if occlusal interferences are present (Fig 10). Unfortunately, the patient may pay the price in one way or another, with chronic tooth sensitivity, defective interferences, muscle pain, or any of the other signs or symptoms of occlusal disease. This author's opinion is that it is preferable to utilize more biocompatible materials, used with correct occlusion.

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Figure 6: Secondary caries under old gold-alloy restoration, evidently leaking for years.



Figure 7: Compare levels of translucency, from the least translucent full zirconia.



Figure 8: A more translucent monolithic lithium disilicate.



Figure 9: Maximum translucency with leucite-reinforced feldspathic pressed porcelain.



Figure 10: A recent dental graduate had complained of tooth sensitivity since a gold alloy onlay was placed a year earlier. Sensitivity almost disappeared the day after interference was removed.

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Figure 1: Zirconia crowns, coping, and veneering ceramic are nearly the same color, allowing for maximum esthetics.

Dr. Christensen's Position on Full-Coverage All-Ceramic Crowns

PFM crowns have some undesirable characteristics, including the need for significant tooth structure removal, the desirability for subgingival margins, potential ceramic fracture, and often unesthetic results. Nevertheless, PFM crowns comprised approximately one-half of the indirect crowns placed in the U.S. in 2010, and most dentists use them with significant success. They have served the profession well for decades. All-ceramic crown options have some advantages over PFM crowns. Tooth preparation for some forms, such as all full-zirconia, can be less aggressive. Additionally, most dentists agree that they can provide better esthetics. There is less need for subgingival margins. However, because some all-ceramic crowns are new, and there are several options, some clinicians may be less aware of each restoration's specific requirements and the different techniques needed for predictable success with each of these materials.



Figure 2: Failed alumina all-ceramic posterior crown.

Myths and Realities

Myth

Lithium disilicate is becoming more popular than zirconia.

Reality

At this time, the largest laboratory in the U.S., Glidewell, reports that full zirconia and zirconia-based crowns comprise approximately 35% of indirect units, and lithium disilicate is about 12%.¹ Zirconia-based crowns (zirconia coping + external ceramic) have been used in the profession for about 10 years. Clinical usage has allowed the profession the opportunity to observe the challenges associated with these restorations.²⁻⁴ At their introduction, the failure rate of zirconia-based restorations was higher than PFM crowns. Over the past decade, most of the weaknesses of zirconia-based restorations have been identified and overcome by the respective manufacturers and researchers.⁵ Zirconia-based crowns, when fabricated by knowledgeable and competent technicians, can have excellent translucency and better esthetics than PFM and full-zirconia restorations (Fig 1). Full or monolithic zirconia and lithium-disilicate crowns are newer options, and both are growing at a very fast rate. Full lithium-disilicate monolithic crowns have been used longer than full-zirco-

nia crowns, and they have been accepted with optimism by the dental community. They have shown good short-term clinical results and in vitro studies show promise.⁶⁻⁹ Dentistry has had a significant number of tooth-colored crowns that have come on the market with great promotions, only to fail after a few years (Fig 2). To avoid expensive failures, it is desirable to observe any new

concepts, including new all-ceramic restorations, for a period of at least five years before substituting them for clinically successful techniques.

Myth

Full-contour zirconia crowns will replace the zirconia-based crown concept.

Reality

Full-zirconia crowns have been received with much excitement and are growing at a rapid pace. Full-zirconia restorations without the placement of external ceramics appear to be very strong. This increased strength makes clinicians feel more comfortable when using full-zirconia in areas of high stress. Additionally, research related to wear of both full-zirconia restorations and opposing tooth structure is promising. Full-zirconia restorations are newer than zirconia-based crowns, which have been used long enough to allow some of their problems to be identified and improved. Currently the main problem with full-zirconia restorations is the lack of esthetics, as the material is opaque, and most characterization is accomplished with external staining, which may be temporary (Fig 3). Significant research and development is ongoing to improve this problem, and it is promising. A major challenge that exists is removal of the restoration when

failure occurs or making endodontic access. At this time, because of current esthetic concerns about full zirconia, zirconia-based crowns should be used in any area requiring optimum esthetics (Figs 4-6). It is anticipated that significant improvements in full-zirconia restorations are forthcoming.

Myth

The PFM concept is dead.

Reality

Although great improvements have been achieved with all-ceramic restorations, and they have significant advantages when used correctly, PFM crowns are well-proven and used routinely. They are still important for any restorative practice. Let us not forget that the PFM crown has been proven for over 50 years.¹⁰ The percentage of failure is very low, and is often estimated to be just 1 or 2% over many years. That has certainly been this author's experience. The long-term esthetic acceptability of PFM crowns is less than perfect, after a period of service (Figs 7 & 8). The gingival tissues recede, exposing tooth structure that is a different color than the crown, making them esthetically challenged. This author suggests that PFM restorations should be considered when fixed-partial dentures are needed, or in any areas where the long-term success of PFM restorations makes them more appropriate than the still-to-be-proven newer materials.

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Figure 3: Opacous zirconia margins exposed after gingival recession.



Figure 4: Before; patient with alumina-based restorations wanting to replace them.



Figure 5: After; zirconia-based restorations showing improved translucency and esthetics.



Figure 6: Zirconia-based translucent restorations.



Figure 7: Clinically functional 10-year-old PFM crown. Although in good clinical condition, the patient wanted it replaced due to the unesthetic dark margin.



Figure 8: This patient reported that the #30 PFM crown, which is in good clinical condition, has been in her mouth for 30 years.

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