

Considering tooth-colored inlays and onlays versus crowns

It has been estimated that about 40 million crowns are placed in patients each year in the United States (J. Schuck, vice president, sales and marketing, Glidewell Laboratories, oral communication, Jan. 9, 2008). This number commonly inspires frustration in conservative dentists, who complain about the large numbers of crowns placed each year, stating that many of the teeth that were crowned could have been restored with less aggressive restorations. I agree.

Reasons other than dental caries motivate dentists and patients to want crowns, including obtaining an optimum esthetic appearance, periodontal splinting, cracked teeth and the necessity of making major changes in occlusion. Since the late 1950s, porcelain-fused-to-

metal (PFM) crowns have dominated.

I have placed and observed PFM crowns since they were introduced into the profession, and my observations have shown me that they have certain clinical characteristics. These restorations can provide excellent esthetic results when initially placed. As years pass, unavoidable gingival recession occurs naturally or is exacerbated by aggressive oral hygiene, and the crown margins show either gray metallic color or opacity related to the opaquers used to block the metal color. The superficial stains placed on the crowns to characterize them wear off, or they are dissolved by the many acidic beverages consumed by typical dental patients. Thus, the esthetic longevity of PFM

crowns ranges from relatively short (a few years) to long (many years), depending on a multitude of factors.

Because of the gross amount of tooth structure required for full crowns, every dental practitioner has been frustrated with the decision to make crown preparations on teeth that have large intracoronal restorations. When the previously placed intracoronal restoration is removed to make the crown preparation, the only sound tooth structure remaining is on the facial and lingual surfaces. Of necessity, that sound tooth structure must be removed to provide space for the crown restoration. The result is a crown preparation with two narrow pieces of tooth structure sticking up on the facial and lingual surfaces, no tooth structure on the mesial and distal surfaces and nothing in the intracoronal portion of the tooth.

Making tooth preparations for

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crowns is relatively easy; undoubtedly, that is one of the reasons that crowns are used more often than the slightly more difficult onlay or inlay. Are we performing the wrong procedure for many patients with the previously described conditions by recommending and making crown preparations and placing crowns? I contend that the profession is placing too many crowns.

Tooth-colored inlays and onlays have proven themselves to serve as well as other restorations for a significant number of years.¹⁻⁶ Perhaps it is time to take a fresh look at tooth restorations that are more conservative than full crowns.

This article supports the alternative of placing inlay and onlay restorations for many of the teeth that now receive crowns.

TOOTH-COLORED INLAYS

What is an inlay? Recently, there appears to be a consensus of opinion on that subject from the group representing most third-party payment companies, the American Association of Dental Consultants (AADC). The following definition is from the AADC's position paper "Defining and Differentiating Inlays and Onlays":

An inlay is an indirect restoration constructed of cast metal, porcelain/ceramic, or composite/resin that neither supports nor replaces a cusp or cusps of a tooth. The inlay restoration is nothing more than a centric stop in that it provides no protection for the cusp tip as concerns lateral and/or protrusive masticatory excursionary forces. The onlay component replaces the cusp tip or tips. The onlay most often entirely replaces the cusp tip so as to maintain and/or restore the vertical dimension in the preparation. When the cusp tips are sound,

the original vertical dimension is not altered.^{7(p3)}

Inlays are not placed commonly in the United States, for what appear to be some identifiable reasons (Tom Limoli, president, Atlanta Dental Consultants, oral communication, March 4, 2008). Third-party payment companies do not always provide good coverage for intracoronal, ceramic or polymer restorations. The logic appears to be that if the restoration needed is of the intracoronal size, and the patient wants a tooth-colored restoration, directly placed resin-based composite should be used. I agree with that. If the intracoronal tooth cut is no more than one-third to one-half of the distance from cusp tip to cusp tip, dentin remains to support the remaining facial and lingual tooth structure and there are no horizontal cracks in the remaining facial and lingual tooth structure, direct resin-based composite restorations are excellent if placed carefully. The quality characteristics desired for Class II resin-based composite restorations include tight contact areas, intact margins, adequate occlusion, smooth surfaces without overhangs, adequate esthetics if in an observable location and optimum desensitization of the tooth before restoration placement to preclude postoperative tooth sensitivity.

To assist readers in determining how to identify and report the tooth-colored restorations they are placing, I have summarized the most commonly used American Dental Association⁸ procedure codes in the table. There are codes for inlays, but it may be futile to inform patients of potential payment

knowing that the expected level of payment for inlays is not likely to be made by benefit companies. Often, companies will pay for an inlay at the level of payment for a resin-based composite or an amalgam restoration.

I suggest that clinicians should become competent in placement of direct resin-based composite restorations for small to moderate-sized intracoronal restorations for most teeth needing this level of treatment. If the clinician makes indirect restorations, he or she should inform the patient of the minimal expectations in terms of benefits coverage.

TOOTH-COLORED ONLAYS

What is an onlay? This subject has been debated for years. There has been significant confusion about the subject among practitioners. The official definition of the AADC⁷ is as follows:

An onlay is an indirect restoration (fabricated outside the oral cavity) that covers one or more cusps, extending through and beyond the cusp tip to the facial/lingual and proximal slopes of the covered cusps. It may be fabricated from any of the materials used for inlay restorations. It is implicit in this type of restoration that occlusion in all functional positions is supported by restorative material rather than the tooth structure of the covered cusps.

INCREASED USE OF INLAYS AND ONLAYS

Sirona Dental Systems estimates that there are about 22,000 of its CEREC computer-aided design/computer-aided manufacturing (CAD/CAM) devices in offices around the world, including 8,000 in the United States (E. Hansen, Sirona Dental Systems, Charlotte, N.C., oral communication,

November 2007). The growing popularity of clinical CAD/CAM machines has stimulated dentists to provide more conservative restorations than in the past. In my opinion, this is a good change. In addition, the recent introduction of another clinical CAD/CAM device, the E4D (D4D Technologies, Richardson, Texas) will increase use of conservative indirect restorations. I predict that clinical CAD/CAM activity will continue to increase.

There is growing interest in gold alloy inlay and onlay restorations, stimulated primarily by a group of dentists who believe strongly that these restorations still are the best long-term restoration in dentistry. The Richard V. Tucker Study Clubs, affiliated clubs throughout the world that teach Dr. Tucker's well-known techniques for placing conservative cast gold restorations and that now have 501 members internationally (A. Chinn, membership roster editor, The Academy of Richard V. Tucker Study Clubs, written communication, March 10, 2008), have provided major stimulation to this movement.

In my opinion, inlays and onlays will continue to increase in use, especially tooth-colored ones.

WHEN TO USE AN INLAY OR AN ONLAY

The literature offers little information regarding the decision about when to treat a patient with an inlay or onlay. As a result, the following information is based on my own observations and opinions developed through many years as I have experienced success and failure in my own practice and in clinical study clubs and dental schools.

TABLE

American Dental Association procedure codes* for tooth-colored indirect non-metal-containing restorations.

RESTORATION TYPE	CODE
Porcelain/Ceramic	
Inlay, porcelain/ceramic, two surfaces	D2620
Onlay, porcelain/ceramic, two surfaces	D2642
Onlay, porcelain/ceramic, three surfaces	D2643
Onlay, porcelain/ceramic, four or more surfaces	D2644
Crown, three-quarters porcelain/ceramic	D2783
Crown, porcelain/ceramic substrate	D2740
Resin-Based Composite	
Inlay, resin-based composite, two surfaces	D2651
Onlay, resin-based composite, two surfaces	D2662
Onlay, resin-based composite, three surfaces	D2663
Onlay, resin-based composite, four or more surfaces	D2664
Crown, three-quarters resin-based composite	D2712
Crown, resin-based composite (indirect)	D2710

* Source: American Dental Association.⁸

We need more research on each of the following topics, because the use of inlays and onlays appears to be increasing. I have written numerous articles expressing my views on the desirability of providing minimally invasive dentistry whenever possible.⁹⁻¹²

Factors involved in the decision regarding onlays.

The clinician needs to consider a few factors when deciding to leave a cusp uncovered by an onlay.

Width of the removed intracoronar tooth structure. If the intracoronar cut is less than one-third of the distance from cusp tip to cusp tip, my preference is to place a direct resin-based composite or, for those using it, an amalgam. As the cut approaches the halfway point of the distance from cusp tip to cusp tip, composite or amalgam can be used, but any experienced practitioner can testify to the frequent fracture of cusps

that occurs during service when this much tooth structure has been removed.

In this situation, the clinician should consider an onlay or crown to support the weakened cusps. Some dentists support use of inlays in teeth with intracoronar cuts from one-third to one-half of the distance from cusp tip to cusp tip, and I have accomplished many of these myself with success. However, in my opinion, the wider the intracoronar cut, the more successful are onlays versus inlays.

Horizontal cracks in the tooth structure. If a cusp has visible horizontal cracks, it is best to remove it.

Lack of supporting dentin under the cusp. If the cusp is almost entirely enamel, the most predictable treatment is to remove it or cover it.

Heavy occlusion. In the case of bruxism or clenching and in the presence of questionable cusps, I suggest making onlays

or crowns.

Highly discolored cusps in esthetically important areas. For esthetic reasons, such cusps should be covered with a veneer portion of the restoration or removed.

Aggressive eating of hard foods. Many patients eat especially tough or hard foods such as hard candy, tough dehydrated meat, nuts or ice. If a patient who has a history of eating such foods is in need of a new restoration, the clinician should consider placing an onlay, with its superior strength, instead of leaving questionable cusps. If I have any question in my mind about the strength of the remaining tooth structure, I remove it.

Teeth with short clinical crowns. If the amount of tooth structure coronal to the gingival tissue is short, and the retention of an onlay would be questionable, either inlays or crowns would be preferable for retention purposes.

SUMMARY

Useful definitions for inlays and onlays now exist,⁷ and they should help dentists understand the various conditions that relate to naming a restoration an inlay or an onlay. Making the right clinical decision about placing inlays and onlays versus crowns is important relative to the restoration's long-term service. This article expresses reasons to use inlays and onlays whenever possible instead of the more aggressive crown restoration. ■

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