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Noteworthy Categories
CE Articles
Feature Stories
Roundtable
Viewpoint

Editorial Categories
CAD/CAM
Diagnosis & Treatment Planning
Digital Imaging
Endodontics
Implantology
Infection Control
Magnification
Materials
Occlusion
Oral Medicine
Orthodontics
Pain Management
Pediatric Dentistry
Periodontics
Practice Management
Prevention
Prosthodontics
Restorative Direct
Restorative Indirect

Veneer Case Selection Process

No- or minimal-preparation veneers offer both benefits and limitations.

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No synthetic restorative material used to reproduce natural tooth structure can match the combination of ideal qualities of functional strength and optical or esthetic display that exists in nature. Maintaining as much natural tooth structure as possible is a goal when doing restorative dentistry, especially when done for elective purposes. While less tooth reduction is a desirable goal, there are times when more reduction better serves the overall restorative agenda.

Evaluation Process for Minimum Preparation Veneer Candidates

It is critical to carefully appraise the patient's pre-existing condition, tooth position, and dentition color as well as functional envelope, phonetic components, and the patient's perceived goals of treatment before deciding the possible modalities of treatment. A comprehensive examination with a complete set of records and photographs should be taken to evaluate the interaction of function and determine the esthetic result desired. Mounted models can be compared with the facial photographs to analyze the desired changes to be made.

Additive vs Subtractive Dentistry

The functional and esthetic components of restoring teeth include planning the ideal alignment, shape and contour, surface morphology, incisal edge positions, and the opposing functional surfaces. The existing teeth can either be moved orthodontically into position or the tooth contours are modified by subtraction or addition. There has been a trend in restorative dentistry toward less invasiveness by means of tooth reduction and more common partnering with orthodontists with the goal of less tooth reduction or subtractive dentistry. Orthodontic and periodontal solutions to biologic and esthetic problems should be accomplished before planning definitive restorative solutions.

Diagnostic Wax-Up

The patient's models and photographs are used to evaluate any supplemental restorative repositioning of teeth beyond orthodontics necessary to achieve the treatment goals (Figure 1 and Figure 2). The photographs are faithfully oriented relative to the facial midline to properly assess the occlusal plane and tooth axial alignment issues. Line drawings of the proposed restorative treatment are created on the photographs (Figure 3), which assist the technician in choosing landmarks for a wax rendering of the treatment agenda. An "additive-reductive wax-up" is done (Figure 4) where contour is added in wax or removed from the stone models of the patient's existing dentition using the facial photographs to orient the procedure. This process produces a template of the ideal esthetic form for the patient, and from this an intraoral silicone matrix can be fabricated for use in provisional fabrication and intraoral mock-up evaluation. If reductive changes have to be made to reach the ideal tooth position, those areas at least will require some tooth preparation, without which the patient is forced to accept a compromised treatment outcome.

Mock-Up Evaluation of Additive-Only Esthetic Outcome

For patients who visually may be candidates for no-preparation veneers, an additive-only wax-up can be done; after a silicone matrix of this wax-up is created, the shape and position of this wax-up can be tested in the patient's mouth by filling the matrix with a material such as Luxatemp® (DMG, <http://www.dmg-dental.com>) and placing it over the existing dentition to create an intraoral mock-up (Figure 5). An intraoral mock-up may also be accomplished with direct bonding. If an esthetically pleasing outcome can be accomplished by additive procedures only, the case is one step closer to qualifying for very conservative veneers with little or no preparation.

Functional and Phonetic Evaluation of Mock-Up

If the mock-up results are esthetically pleasing, then a phonetic evaluation should be undertaken. After an evaluation of "f," "v," and "s" sounds is completed, the overall form of the teeth should be looked at. Excessive incisal thickness of maxillary anterior teeth is quite common after an additive mock-up, which may lead to the necessity of lingual preparation in some cases. Most esthetic changes in the anterior incisors will have functional ramifications as well. Canine guidance, crossover, and protrusive positions must be evaluated while the patient is wearing the mock-up. Changes in the incisal-edge positions of the maxillary incisors almost always create the need for modifications to the mandibular incisors to maintain a comfortable and atraumatic guidance.

Changing Brightness with Low-Preparation Veneers

Low-preparation veneers are not a good choice when attempting to brighten teeth. By virtue of the design of these veneers, they are thin; usually less than 0.5 mm thick. This minimal thickness will have minimal effect on the brightness unless they are made with opaque porcelain. Using opaque porcelain has its own drawbacks,



Figure 1



Figure 2



Figure 3



Figure 4



Figure 5



Figure 6



Figure 7



Figure 8



Figure 9



Figure 10



Figure 11



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mainly the lack of natural translucency and an unnatural appearance. The color of the existing dentition must be considered and balanced with the final tooth shade desired by the patient. The more change in color desired, the thicker the ceramic layer will need to be to provide adequate filtering of underlying color. If the intraoral mock-up using a translucent material has the needed thickness to achieve the desired color change, the case can proceed with no preparation or minimal preparation. If, when evaluating the mock-up, there is chromatic show-through of the underlying dentition and it is producing an undesirable color gradient, the underlying tooth structure will need to be reduced to a level that provides an adequate amount of room for the ceramist to filter out the undesired effect with the porcelain while maintaining natural vitality and translucency. The depth of preparation that is necessary completely depends on the severity of the discoloration and the amount of color change being attempted in the treatment.

Path of Insertion

If after evaluating for position, form, function, phonetics, and color, the patient is still a candidate for no- or minimal-preparation veneers, the path of insertion and potential undercuts that may limit access to the areas of the teeth requiring augmentation now needs to be determined. The stone models and the additive diagnostic wax-up should be used to determine which areas of the teeth are going to be involved in the restorations. All areas covered in wax will need to be covered with the restorations, and will need a common path of insertion. A study model of the patient's pre-existing dentition can be placed on a surveyor in the laboratory and each restoration can be checked for path of insertion to all surfaces restoratively involved, and undercuts can be identified and marked. If a surveyor seems excessive, a simple visual check to identify undercuts on the stone model can work well for skilled operators. All areas that are identified as being undercut will need to be addressed with additive bonding or tooth reduction. If at this time there are no apparent undercuts, or they can be solved with additive bonding to allow a path of insertion, the patient is a candidate for "no-prep veneers."

Minimal Preparation Philosophy

There are many attractive reasons why the practitioner would want a case to be minimal preparation. When minimal tooth reduction is done, there is less preparation time and, thus, a shorter appointment. Anesthetic is either not needed or it is used sparingly. The fact that no or limited tooth structure is removed means intermediate provisional restorations are not required. Although accurate impressions are just as critical with minimal-preparation techniques, the invasiveness and difficulty of the impression technique is diminished. With less preparation, there is a likelihood of retaining more enamel, which increases bond strength and the long-term integrity of the margins. This adds to the durability and longevity of the final restorations. If, after completion of the evaluation steps above, there are a few areas of limitation that are not global in nature, this is where minimal preparation comes into play.

Illusions of Reversibility

The patient was highly motivated to have as little tooth reduction done as possible while achieving as many of his treatment goals as possible. Not knowing initially if he would like the added length and changed shapes of his planned restorations, the patient gained comfort from the possibility of full reversibility if the underlying teeth were untouched. The patient acknowledged that the treatment was being done mainly for vanity or cosmetic reasons. If, after completion, it was determined this was all a mistake or the result failed to live up to expectations, then it would be a highly desirable option to go back to the way he was initially. While true in theory, it is not exactly true in practice, as it is very difficult to remove bonded veneers cleanly. The layers of porcelain, bonding material, and tooth structure are difficult to distinguish when using rotary instruments at high speed and with a water spray. Unintentionally, some tooth structure would be lost, and surface texture and morphology would be forever changed. Although this is definitely not a reversible procedure, the likelihood of losing only a minimal amount of tooth structure was still very attractive to the patient (Figure 6).

Preparation Benefits

Small areas of tooth preparation are accomplished to eliminate the problems with path of insertion, color, and function while maintaining an overall philosophy that is very conservative of the existing natural dentition. This allows the completion of treatment that delivers an uncompromised esthetic and functional result for the patient and maximizes the amount of retained natural dentition. If the limitations seem to be of a more global extent, then traditional veneer or crown preparation may be necessary to treat that particular patient.

There are significant benefits to be gained with tooth preparation. Because of the lower flexural strength of porcelain, wrapping porcelain around sharp corners creates a greater likelihood of crack propagation. Simply rounding out the sharp corners and edges of the underlying teeth will improve the durability of the restorations.

Rough surfaces on teeth tend to attract stains and debris. The margins of the newer porcelains used for veneers have minimal thicknesses that are measured in tenths of millimeters, but adaptation to the underlying tooth structure (the fit) must still be accurate to minimize the resin component at the margin interface. Small undercuts in marginal areas which result in overhanging ceramic that is not well-adapted to existing tooth structure can create significant resin thickness at the margin. In microscopic and microbiotic terms, this can create huge areas that are difficult to clean. The thicker the margin is, the more it will stain. These visible and undesirable stains can appear within 6 weeks or less of delivery. This will happen sooner if the margin is not well-sealed with luting material. A large percentage of patients have gingival recession over time, leaving the staining margins even more visible and unattractive. Just a shallow chamfer preparation at the planned margins of the restoration allows a smooth marginal transition, healthy tissue, and decreased likelihood of marginal staining (Figure 7, Figure 8, Figure 9).

Laboratory Perspectives

The restorations used for this type of treatment require special skills and the use of specific material in the laboratory. From a laboratory perspective, ease of fabrication is directly proportional to the amount of tooth reduction achieved by the dentist; the more reduction, the more material options available and the easier the fabrication of the restorations. The most difficult cases are the "no-prep" cases; although a minimal-preparation treatment approach can be easier than a no-preparation approach, the minimal thickness of material still makes these cases much more difficult to fabricate than a traditionally prepared veneer case that is prepared to transition smoothly from a minimum thickness of 0.5 mm to maximum thicknesses in the range of 1.5 mm.¹ Minimal-preparation veneer porcelain can have thicknesses as little as 0.1 mm in some areas and

over 1 mm thick on the same restoration with more abrupt transitions from thin to thick areas, requiring careful selection of ceramic material to deal with the underlying color and translucency levels of the preparations.²

Materials

There are two traditional porcelain options for making veneers. A long-standing technique that can yield beautiful results is to stack feldspathic porcelain on either a platinum foil or refractory die. Advantages include the ability to vary the opacity and chroma levels in different parts of each individual restoration as needed. The main limitation to these restorations is the very fragile nature of thin feldspathic veneers, which can crack easily during fabrication and placement and exhibit a flexural strength in the range of 85 MPa.³ Today, it is possible to fabricate very thin pressed veneers using high-translucency lithium-disilicate ceramic material, which has a flexural strength of 400 MPa, thus eliminating the delicate handling necessary with feldspathic material.⁴ This material can be pressed more thinly than usual feldspathic veneers can be fabricated (to 0.1 mm), which works well over desirably colored tooth structure.

Lab Fabrication

Lithium disilicate was selected for this case because of its ability to be pressed into very thin restorations; in this case, 0.2 mm in many areas of the facial portions of the veneers. The 400 MPa flexural strength of this material also decreases the risk of fracture during insertion with the complex path of insertion necessary with these very thin veneers.⁵ High-translucency, enamel-like ingots were used in the lost-wax pressing process, which eliminated the need for layering in the gingival third. The incisal third was cut back slightly from the facial to allow layering of incisal effects (Figure 10, Figure 11, Figure 12).

Arguments for More Preparation

A presumption made earlier in this article was that it is easier for the dentist to do minimal-preparation veneers. There is a good argument for the preparation of low-preparation veneers being more technique-sensitive than normal-preparation veneers.⁶ This is especially true when the dental alignment is not perfect, diastemas exist, or there is a lot of gingival recession with large interproximal embrasures (interproximal space devoid of tissue).⁷ With well-aligned teeth that have tissue filling the interproximals, there is less wrap required to hide the margins. The porcelain can be more uniform in thickness and the anatomy of the teeth is only changed a little (buccal and incisal embrasures tend to be smaller). When teeth are misaligned or when more interproximal cavosurface is exposed, the porcelain needs to wrap more interproximally to fill the space so that all interproximal margins are tucked out of view. Many of these surfaces bend around more than 180° of the circumference, thus yielding undercuts and line-of-draw issues during fabrication and placement of the restorations. Laboratory fabrication issues escalate substantially. Trying to treat cases that exhibit path of insertion problems related to diastemas or rotations without adequate preparation can leave the ceramist in the undesirable situation where undercuts prevent adequate interproximal path of insertion and leave the ceramist with a choice of having to move the proximal contacts too far to the facial, resulting in a bulky appearance, or blocking out the undercut and extending the margins interproximally to allow ideal contour, but resulting in an open margin where the undercut was blocked out.

Advantages of Normal Preparation Over Low Preparation

- Subtractive capabilities allow for more natural tooth contours
- More control of buccal/lingual placement of incisal edges
- Better control of midline alignment
- Shade change without creating unnatural opacity
- Less bulky emergence contours, especially on the cuspids
- Easier placement with multiple line of draws
- Less technique-sensitive for the dentist and technician
- Easier to hide margins
- Decreased tendency toward more closed/smaller buccal and incisal embrasures
- More symmetrical shapes, especially of lateral incisors
- Nicer surface textures
- Nicer incisal characterization

The Ideal Patient

The ideal candidate for very conservative treatment is one with a slightly underfilled buccal corridor; slightly lingualized, small maxillary anterior teeth; closed or almost closed contacts; relatively even spacing of teeth; no gingival recession with gingival tissue filling interproximal areas; and no severe discoloration. Patients with full, slightly overdominant teeth are not good candidates, neither are severely tetracycline-stained cases.⁸ Patients exhibiting loss of interproximal soft tissue, crowding, and rotations require careful screening described earlier and usually require orthodontics before veneering.⁹ Patients exhibiting excessive spacing require orthodontic treatment before veneering as well.¹⁰ The patient population that has all of these characteristics is small.⁸

Conclusion

The amount of tooth reduction should be matched to the goals and priorities of the patient. There are positives and negatives with both heavy and light tooth preparation that significantly affect the quality of outcome. Low-preparation veneers are a good choice when modest improvement in symmetry and tooth alignment is desired as well as making a more uniform surface morphology. The best cases for the minimal-preparation design are those with properly aligned teeth without diastemas, gingival recession, or papillae loss. The minimal-preparation veneer is not a good choice when the goal is to greatly change value or brightness.

If the case selection is not ideal, minimal-preparation veneers can be more technically challenging for the practitioner and the technician than conventional veneer designs. The practitioner is responsible for controlling undercuts, creating a line of draw, and hiding margins. Significant improvements in outcome can be achieved with small amounts of tooth preparation to create a margin, open buccal and incisal embrasures, ensure a line of draw, and round out sharp edges.

The philosophy of doing conservative dentistry is a noble goal but it should be noted that conservative does not mean limited preparation but, rather, preparing the least amount of tooth structure needed to achieve the goals of the case.

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