A combined direct dowel and indirect core technique

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The dowel-and-core restoration is indicated when inadequate tooth structure remains to retain an extra-coronal restoration. A modified technique for fabricating the dowel and core combines the direct technique of forming the dowel in the actual channel with the indirect technique of creating an ideal core contour in the laboratory. This technique allows the operator to create an accurate and passive fit of the dowel pattern in the canal preparation. The technique also introduces the option of retrieving the dowel portion by utilizing a polyvinyl siloxane cast or liner. Further advantages of the technique are reduced chairside time and the ability to capitalize on the preparation of multiple teeth. The technique focuses efforts on achieving an accurate and passive fit of the dowel clinically while delegating the formation of the core to the laboratory. (Quintessence Int 2000;31:19-23)

Key words: direct technique, dowel and core, endodontically treated tooth, fixed partial denture, indirect technique, vacuum-adapted matrix

Endodontically treated teeth present unique challenges to the restorative dentist. Whenever possible, conservative restorative techniques that avoid endodontic treatment are highly desirable. If endodontic therapy is unavoidable, conservation of tooth structure is of paramount importance to provide a stable foundation for restorative treatment. The necessity of dowel-and-core restorations for endodontically treated teeth has been well demonstrated. Dowels do not reinforce endodontically treated teeth but are indicated when there is inadequate tooth structure to retain a core for a coronal restoration.

There are numerous methods for the fabrication of cast dowel and cores for endodontically treated teeth, including custom-cast metal dowel and core or commercially prefabricated dowels, which retain core reconstructions consisting of silver amalgam, resin composite, or glass-ionomer materials. Moreover, a variety of dowel compositions can be selected, such as metals of various types, fiber-reinforced resin composite, carbon fibers held together with epoxy resin, ceramic fibers, and zirconium oxide posts. There is no single dowel-and-core system or technique to fit all clinical situations. For many restorative dentists, the custom-cast metal dowel and core remains the treatment of choice because of its rigid physical properties.

The two most commonly used modalities for fabricating dowel-and-core patterns are indirect impression techniques and direct pattern fabrication techniques. For the indirect technique, an impression of the dowel-and-core preparation and adjacent structures is obtained with elastomeric impression material. A dental stone cast is made from the impression; from this cast, the dowel and core is waxed, retrieved from the die, invested, cast, and finished for cementation. With this technique, an intact wax or acrylic resin pattern can be difficult to retrieve from a narrow canal, and an incomplete or fractured wax pattern typically results. Also, the accuracy of the cast dowel and core is dependent on an impression of the canal, which may not reflect the subtleties of the canal preparation, leading to poor adaptation and a "loose" fit.

In the direct technique, the dowel is made directly in the canal of an endodontically treated tooth. The pattern is fabricated by inserting a plastic dowel or a stain-
less steel wire in the canal and making the dowel and core buildup in wax or acrylic resin. With this technique, dimensional changes of both the wax and acrylic resin can be difficult to control. In addition, the dowel portion should be fabricated first, and then the core portion should be allowed to solidify. Finally, the core is prepared with a handpiece to create correct contours and proper clearance for the opposing dentition. The chairside time required to achieve these goals may be excessive.

This article describes a method of fabricating cast dowel and cores that combines the advantages of the direct technique for making a dowel pattern and the advantages of the indirect technique for making a core pattern.

**TECHNIQUE**

An irreversible hydrocolloid impression is made for fabrication of diagnostic casts. A diagnostic waxup of the tooth to be restored is fabricated (Fig 1).

The tooth and its canal (Fig 2) are prepared, the preparation is lubricated with a water-soluble lubricant, and then a plastic dowel is selected and positioned. Acrylic resin is applied to the preparation and plastic dowel (Fig 3). It is important to avoid covering the outer surface of the prepared tooth, which could create undercuts that hinder removal of the dowel pattern from the tooth. The pattern must fit the preparation passively.
Some mechanical locks are created by adding acrylic resin lobules to the pattern while it is in the mouth (Fig 4). The mechanical lock is painted with polyether adhesive, and the dowel pattern is returned to the canal. A polyether impression of the prepared tooth with the acrylic resin dowel in its canal (Fig 5) is made and removed from the mouth. (The preparation should be provisionalized with a stainless steel post and provisional restoration for sufficient but temporary retention.)

A small amount of light-body polyvinyl siloxane impression material is injected around the dowel pattern in the impression (to ensure retrievability of the dowel pattern), and then a working cast is poured in a dental stone (Figs 6 and 7).

A stone cast of the diagnostic waxup is fabricated and used to form a vacuum-adapted matrix (Temporary splint material, Patterson Dental).

The clear matrix is placed on the preparation in the working cast and used as a guide for waxing the core pattern (Fig 8). Enough space must exist between the core and the matrix for desirable esthetics and occlusal clearance for the final restoration. The dowel and core is waxed, sprued, cast, and finished in the traditional manner (Figs 9 and 10).

**DISCUSSION**

A basic requirement of custom-cast dowel is an accurate reproduction of the form of the prepared canal. The wax dowel pattern can be retrieved easily from minor undercuts in the canal wall. The same difficulty can be overcome with a pattern made from autopolymerizing acrylic resin. By patterning custom dowels in acrylic resin directly in the prepared canal, errors created by the indirect method of using a working cast can be avoided. Minor undercuts in the canal wall are bypassed carefully by moving the pattern in and out of the canal until the acrylic resin sets completely.
Heilman suggested the use of a needle tube, inserted to the depth of the prepared canal. This technique involved injection of the resin while the needle is slowly withdrawn, until the canal is full of acrylic resin. He also commented that flowing acrylic resin into the canal with a paintbrush sometimes results in air entrapment, which yields voids and an incomplete pattern. The inability to accurately control the monomer-polymer ratio may yield a pattern containing partially cured resin, leading to possible distortion or fracture of the pattern.

Direct dowel-and-core fabrication can be a time-consuming chairside clinical procedure. By transferring the steps for making the core pattern introrally to the laboratory, valuable chairside time can be saved. In addition, it is more difficult to create the core introrally with acrylic resin and prepare the core while stabilizing the pattern than it is to form the core in the laboratory with wax.

The direct technique is an effective method for a single tooth, and the indirect method is better suited for multiple teeth. Recently, the use of a flexible cast for indirect fabrication of multiple cast dowel-and-core restorations or multiple cast dowel-coping restorations for overdentures has been introduced. Boberick and Wyke used a direct-indirect method by directly fabricating dowel patterns in the prepared canals and completing the margins and contour of multiple coping restorations on a flexible cast made by a polyvinyl siloxane die system (Mach 2 Die Silicone, Parkell). The use of a flexible cast was first developed for the indirect composite inlay with the purpose of chairside fabrication. This technique facilitates retrieval of the restoration and pattern and may be used as an alternative to a stone cast.

Contemporary esthetic dentistry has promoted the development of carbon fiber and ceramic fiber dowels for meeting the trends of “metal-free” dentistry. However, cast dowels and cores still have a sound place in restorative dentistry and may provide a firm foundation for building a strong, functional rehabilitation.

**CONCLUSION**

When a direct acrylic resin dowel pattern technique is combined with an indirect waxup core pattern technique, there are several advantages:

1. Accurate and passive fit of the dowel pattern is achieved in the canal preparation.
2. Chair time is reduced because the core pattern is made in the laboratory.
3. Excellent contour can be established for the core by using a clear index matrix as a guide.
4. The technique can be used with single or multiple teeth.

The combined direct dowel and indirect core technique will allow the clinician to restore endodontically treated teeth with efficiency and predictability.
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