

ENDO CORES FOR PREMOLARS AND MOLARS

A TECHNIQUE DISCUSSION

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The techniques described are reliant on total bonding of the final restoration. Cementation of crowns will potentially expose the core to damaging loads and lead to failure.

The techniques rely on the retention of the BioRim and the recreation of an adhesively attached compression dome to help recreate even distribution of stresses within the tooth, and avoid unnecessary stress concentrations by allowing the tooth, core and adhesive onlay function in strain harmony. The techniques for premolars and molars are quite different.

RESTORING ENDO PREMOLAR TEETH

Premolars that have reached the stage of needing endo most often have severely compromised crown structure. This exposes the core design and the remaining tooth structure to potentially damaging stresses. The goal is to retain as much remaining tooth structure as possible, and create a core system that will help distribute stresses and avoid weakening the remaining tooth.

MATERIALS



RIBBOND THIN HIGH MODULUS (THM) ULTRA 2 or 3mm

Dual-cure bonding system (Total Etch or Self Etch)

Dual cure activator for bonding resin

Dual-cure core paste or flowable bonding paste



(I wonder how long the short core on the second premolar is going to last?)

Remove all existing restorations

Remove GP 8-10mm into canals without removing any extra dentin from the walls

Air abrade all exposed dentin surfaces



Buccal cavity restored with a bonded composite prior to creating the fibre reinforced core.

NOTE: the cusps have been reduced by 1.5mm in height. No further tooth removal on the sound palatal cusp.

PREPARATION FOR FIBRE CORE RESTORATION

After cleaning the tooth, apply a self-etching bonding primer of your choice. The system you use must have a dual-cure activator option. When a canal is being used as part of a core build up, a dual cure bonding system has to be used to ensure complete polymerization of the resin within the depth of the canal. There are many on the market, so the decision as to which system to use is in the dentist's hands. Because a dual-cure system is being used, you have to be organized. Cut two lengths of 2 or 3mm wide Ribbond THM Ultra that are 2.5 times the length of the depth of the prepared canal.

After applying the SE primer and evaporating the solvent, remove any excess from the depth of the canal with a paper point.

There is one step that has to be understood when using Ribbond as part of the core build up. Ribbond is plasma etched and will establish a bond and micro-mechanical lock to unfilled resin. With dual cure bonding systems, the fibre should not be wetted with the SE primer, but with the resin B. However, this is only light cured, so just prior to wetting the fibre, a dual cure activator designed for the bonding system being used, has to be mixed with resin B, applied to the fibres to wet them, and the excess blotted off with a paper

towel. Immediately place the two lengths of fibre into a cross. A chemical reaction has now been initiated, so efficiency is needed from this stage on.

Apply the dual cure resin B into the canal and onto the tooth. The, using a fine mixing tip, inject the dual cure paste into the canal and pulp chamber, place the crossed, dual cure activated resin impregnated fibres, across the centre of the tooth and using a fine flat ended instrument, push them to the depths of the canal. Then inject more dual cure paste into the central space and allow it to cure chemically. Do not be in a hurry and force the set with a curing light. This will create high C-factor stresses in the core and possible challenge the long term stability of the seal. After 5 minutes, complete the cure with a curing light



Complete the preparation, retaining as much of the BioRim as possible and restore with an adhesively bonded restoration like e.max or a direct composite onlay



Completed preparation. Note the palatal BioRim has been retained. There is no attempt to gain further ferrule retention, that simply removes more critical tooth structure, exposing the core to increased stresses. There is a small 1mm deep roll over the edge of the palatal cusp to place the underlying tooth structure back into compression when the restoration is loaded.



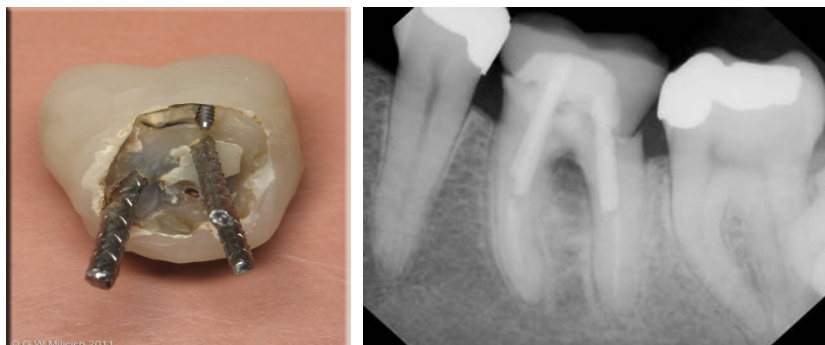
Completed CAD/CAM e.max adhesively bonded restoration.

MOLAR ENDO CORE

All cusps should be overlaid.



Failure to do so can lead to catastrophic failure.



Cores on endo molars do not have to extend into the canals using posts. This leads to stress concentration and long term failure

There is sufficient tooth structure to provide an effective energy sink and retention without using the root canals for retention. The case being demonstrated is a complex one involving a missing wall in the pulp chamber.

MATERIALS



RIBBOND THM OR THM ULTRA. Two or three pieces

RIBBOND WETTING RESIN (do not use this in premolar Ribbond posts – it is only light cured)

RIBBOND STICKY FLOW (do not use this in premolar Ribbond posts – it is only light cured)

SE DENTIN BONDING SYSTEM. This does not have to be dual cure because light can reach to the depths of the pulp chamber on molars with this technique

Gaenial Bond, Scotchbond Universal, Optibond FL(total etch), Clearfil SE Bond 2, Clearfil SE Protect, PQ1 to name a few, are all suitable.

POSTERIOR COMPOSITE. GC everX posterior. A fibre reinforced composite, or any high strength posterior composite like Clearfil APX.

TOOTH PREPARATION

Following endo, remove all remaining restorations. Reduce all cusps by 1.5mm, with a slight 1mm rolled chamfer margin.

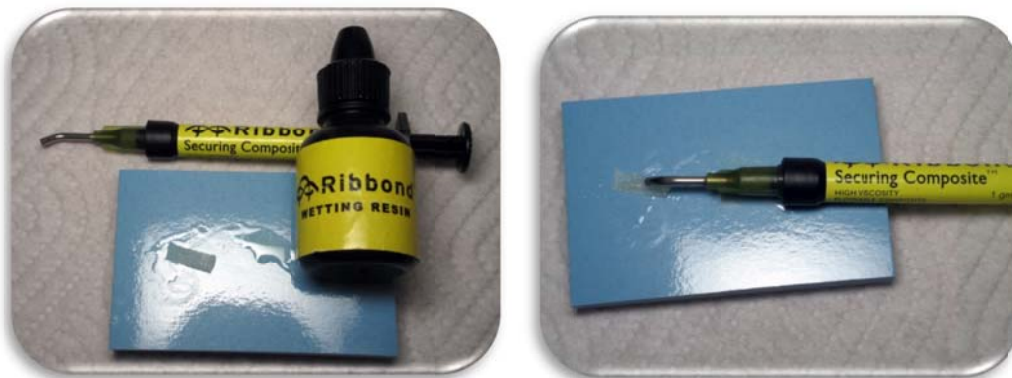


Ensure there is a slight mechanical undercut in the internal pulp chamber shape. This is generally present anyway. In this case, the mesial wall of the pulp chamber is missing and needs to be restored. The goal is to create a fibre reinforced torsion box in the pulp

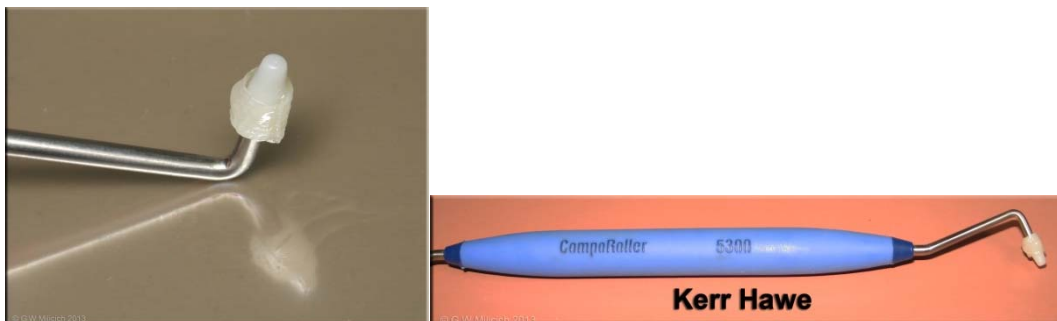
chamber to help distribute stresses evenly throughout the tooth and avoid stress concentrations. We are trying to create strain harmony between the core system and the remaining tooth.

PREPARATION FOR FIBRE CORE RESTORATION

If the core of the tooth is intact, two lengths are needed. If a wall has to be rebuilt, three lengths of Ribbond will be needed, one of sufficient length to wrap right around the pulp chamber walls. Depending on the size of the pulp chamber, either 3mm or 4mm Ribbond THM is needed.



The Ribbond is wetted with normal resin, blotted dry with tissue paper and then sticky flow is applied to the upper surface.

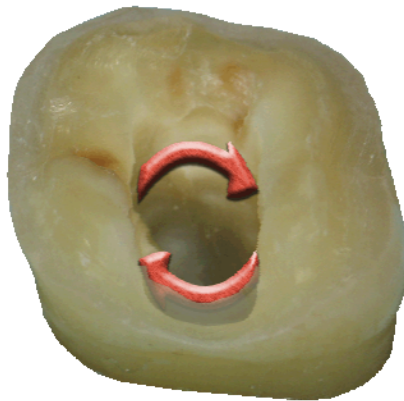


If a circumferential wrap is being used in the case of a missing wall, the Ribbond can be wrapped around a composite roller and sticky resin applied. Leave the Ribbond on the roller and use this to place it inside the pulp chamber. Cover with a light proof lid until needed.

TOOTH PREPARATION

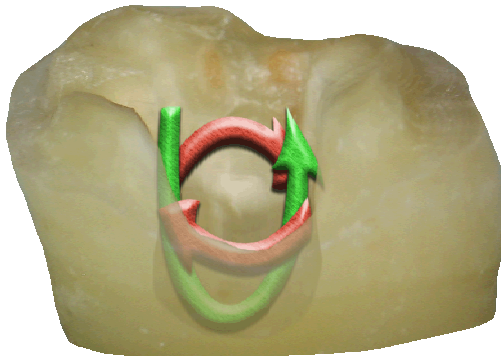


Remove GP 1.5mm into the canals and seal with glass ionomer. Once set, remove any excess GIC from the pulp chamber walls and floor to expose clean dentin. Air abrade all exposed dentin surfaces.

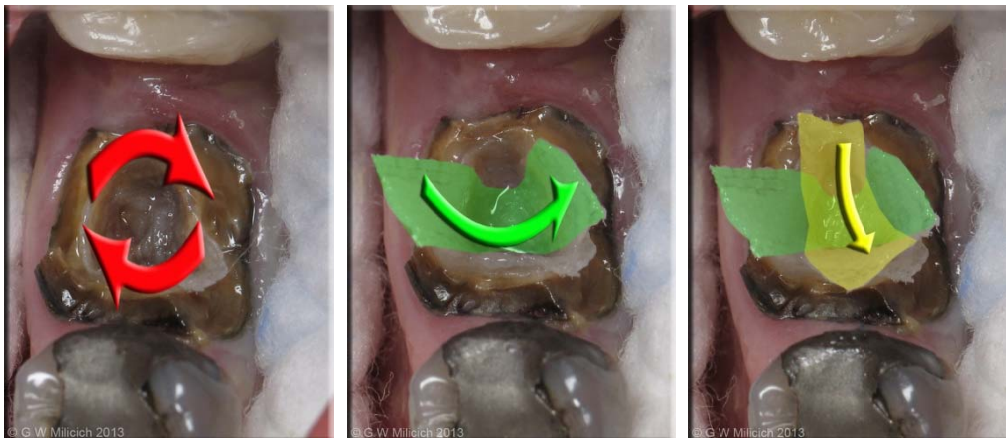


If a direct bonded composite is used to restore the tooth, selectively acid etch all enamel margins, rinse and then apply SE bond to all surfaces as per manufacturer's instructions, air thin and cure. Then apply the first circumferential wrap of Ribbond, ensuring it is closely adapted to the chamber walls. Close adaptation of Ribbond to the underlying dentin is most desirable because this provides the greatest reinforcing effects to the underlying tooth structure.

Note the missing mesial wall is now replaced by a layer of Ribbond. Remove excess sticky flow from the occlusal surface and cure.



The second piece of Ribbon is placed buccolingually and closely adapted to the first layer and cured. If a direct composite is going to be placed, keep the Ribbon within the height of the pulp chamber. If an indirect restoration is being placed, it doesn't matter, it will be reduced during final contouring of the onlay preparation. If the volume of the pulp chamber is significant, or there has been significant loss of tooth structure, a third mesiodistal strip of Ribbon can be placed.

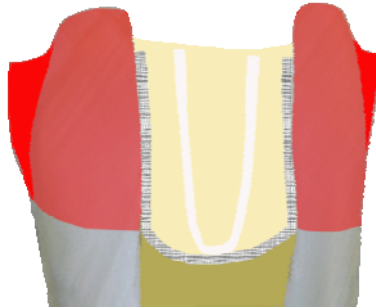


Example: **Circumferential wrap**, followed by **buccolingual layer**, followed by **mesiodistal layer**.

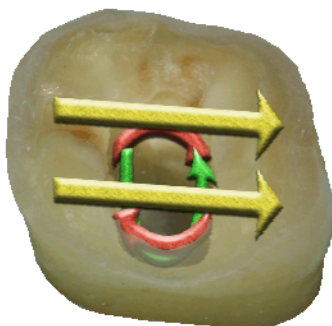


The centre of the core is then filled with layers of everX Posterior (a Fibre reinforced composite from GC) or posterior composite until filled, then contoured for the final adhesive restoration.

Continuing with the initial case. The core can then be filled with layers of everX Posterior or other posterior composite and then contoured for an adhesive onlay restoration, retaining as much of the BioRim as possible.

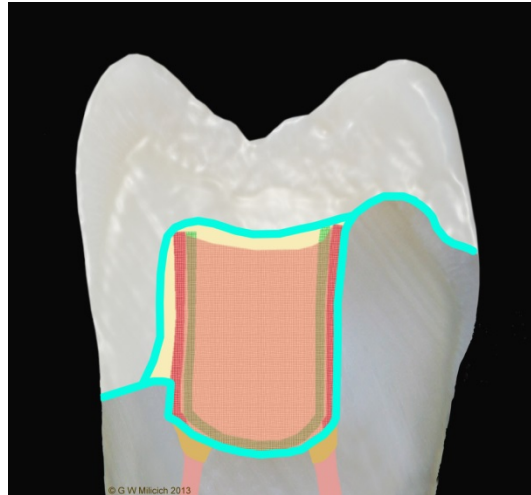


Note the overlay contours that put the retained Biorim (red) back into compression when the onlay is loaded. This design is also retaining as much enamel on the margins as is possible. The bonded fibre reinforced core provides a large volume that helps dissipate loads and stresses throughout the tooth in all directions, minimizing damaging stress concentrations.



If a direct composite is going to be placed, two further strips of Ribbond are laid buccolingually across the tooth to tie the cusps together.

Then the composite restoration is completed with posterior composite using incremental layers. This restoration can be viewed as an interim stabilization of the tooth and allows for the placement of an adhesive indirect onlay at a later stage without having to go back and readdress the core status. Removal of the overlying composite takes you back to the original onlay design and a bonded e.max onlay can be placed. If a bonded e.max onlay is being placed straight away, the horizontal layers of Ribbond are not required.

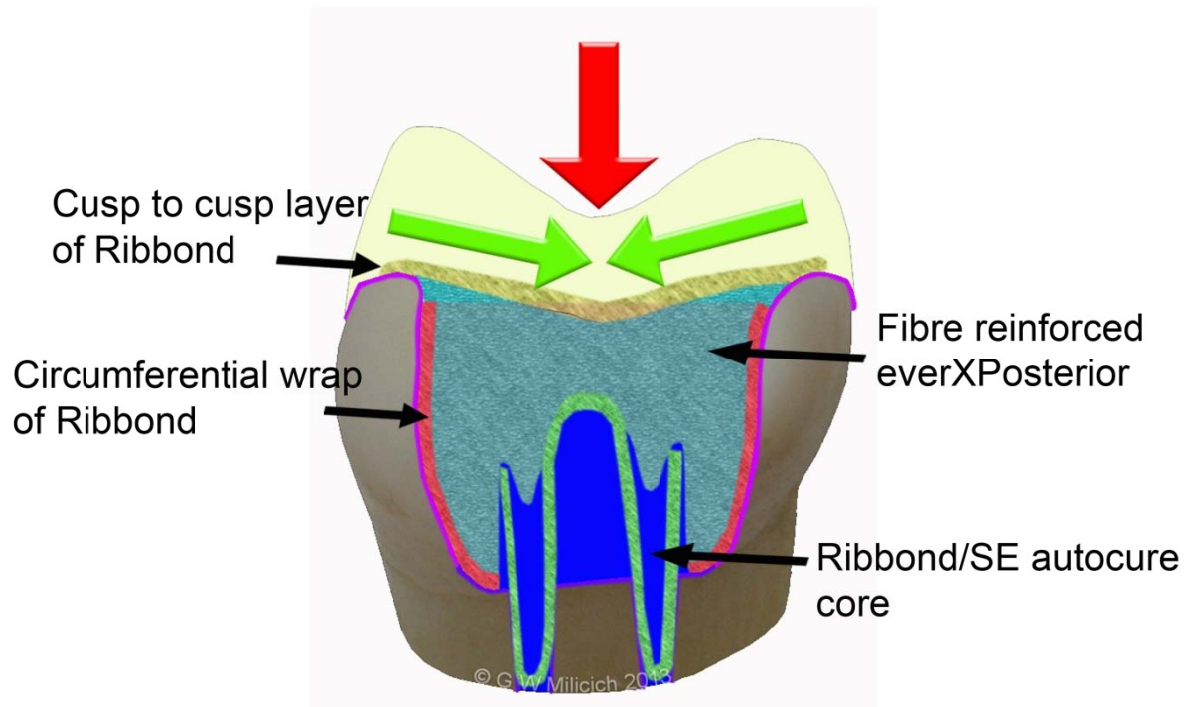


The use of a circumferential wrap and then buccolingual and mesiodistal layer of Ribbond create a stable, bonded core that is strongly attached to the tooth. Ensure the Ribbond is as closely adapted to the tooth as possible. By then adhesively bonding (Blue lines) an onlay over the bonded core, all the components become connected into a biomechanically functional unit. Cementation, even with self-etch resin cements does not provide adequate strength and exposes the core to unnecessary stresses that can lead to failure. Do not use SE cements.

The technique described can also be used if there is a mesio-distal fracture in the tooth that has led to irreversible pulpitis. If the fracture **does not involve the pulp chamber floor**, the tooth can be root filled and then internally reinforced with this core technique, ensuring the Ribbond is closely adapted to the tooth over the cracks in the chamber walls, and an adhesive e.max onlay placed. The criteria for potential success are that there is no interproximal bone loss (indicates a crack extending well onto the root face) and pre-treatment, the tooth is not tender to percussion (indicating ligament inflammation possibly associated with a more extensive crack). Also warn the patient that teeth like this are seriously compromised and there is an increased chance of long term failure.

DIRECT BUILDUP OF A VERY DAMAGED ENDO PREMOLAR

This is a graphic of a very compromised premolar that had a shell of enamel left. A core and full crown prep, or even an onlay, would have left the tooth in a very unstable state. Ribbond was placed into each of the canals as shown. After recreating the lost distal wall with 1mm of composite, a circumferential wrap of Ribbond was placed. The core was filled with fibre reinforced composite (everXPosterior, GCA). A layer of Ribbond was then placed from cusp tip to cusp tip followed by a final occlusal layer of composite.



Under occlusal loading (**red arrow**) the occlusal buccolingual layer of Ribbond acts to pull the two cusps together (**green arrows**), helping to protect the underlying reconstruction from the damaging effects of compressive distortion (Poisson's effect)



Completed restoration showing how the protective effects of Ribbond have prevented any C-Factor related stress causing fracturing of the thin enamel walls due to uncontrolled composite polymerization stresses associated with large volume restorations.

Disclaimer: This is not a complete discussion on all the applications of Ribbond, and the science behind these techniques has not been included. It is meant as a simple technique document to back up the lecture discussions and act as a procedure reminder to help you put these new techniques into practice.