Systematic rotary instrumentation for composite restorations from preparation to polish

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Minimally invasive restorative techniques and materials are more prevalent as a philosophy and treatment modality in today’s world of modern dental restorative therapy. With the combination of early caries detection, dentin adhesives, nanomicrohybrid composites, and micro instrumentation, the days of G.V. Black’s rule of “Extraction for Prevention” are all but gone.

Today, patient comfort, with early intervention and a conservative approach to cavity instrumentation when a restoration is needed, “taking a front seat” to the old “watch and wait” approach to the treatment of dental caries. Going back to revisit dental history, we remember that pit and fissure caries often starts as a “pin point” lesion that expands in a triangular shape as it progresses toward the dentino-enamel junction (DEJ).

Once the lesion penetrates the DEJ, the caries spreads laterally and pulpotally at a much more rapid rate due to the relative “softness” of the dentin as compared to harder enamel. This needs to reason that based on the histologic progression of tooth decay, initial penetration into the lesion should conserve as much as the healthy enamel as possible while allowing sufficient access to instrument the dentin and remove the softer carious dentin while leaving healthy, mineralized dentin behind. This article will detail the use of a caries removal and preparation system that helps the dentist accomplish these goals, while limiting the use of anesthetics which has been shown to increase patient satisfaction as 15 to 22 per cent of patients in an independent study have been shown to be needle phobic.

Once the composite restoration is completed, a single instrument composite polishing system will be used to complete the procedure.

Incipient lesions in enamel only: The fissurotomy and “preventive resin” restoration

The procedure of fissurotomy allows the dentist to conservatively widen the primary grooves of a posterior tooth using specialized carbide burs designed to keep the preparation size to an absolute minimum, while creating ideal shape not to injure a divergent walls and rounded internal line angles to reduce the risk of fracturing for the composite to be placed. After caries removal, the preparation is restored using flowable composite material.

In many cases, the preparation can be confined to only the affected area of the tooth. “Extension for prevention” is not required therefore, only the diseased tooth structure and minimal surrounding hard tissue is removed. The majority of surrounding healthy tooth structure is preserved. Since the composite resin microchemically bonds to the underlying dentin and enamel, an insoluble seal of the margin is accomplished. The chances of future micro leakage and recurrent decay are greatly reduced using this minimally invasive approach and the integrity of the tooth is preserved.

Caries beyond the dentino-enamel junction

After a carious lesion penetrates the dentino-enamel junction (DEJ), it will spread laterally and pulpotally at a faster rate because of the softer nature of the dentin substrate as compared to harder enamel. Also, because of the presence of dental tubules that are fluid filled and communicate directly with the fiber nerve endings in the dentin pulp, rotary excavation of carious dentin with conventional carbide burs has a propensity to cause discomfort to the patient unless local anesthesia is used.

The “Comfortable Cavity Prep” system

The Comfortable Cavity Prep System is a kit of “task specific” rotary instruments by SS White designed to give the dentist both a conservative way to access carious lesions in tooth structure and a way to remove carious dentin only, leaving behind structurally healthy dentin substrate. Access into enamel does not elicit a pain response because there is no nervous innervation of this tissue. The diminutive tip of the fissurotomy bur allows for pinpoint access through the enamel to the carious lesion with little to no removal of healthy tooth structure.

Once the DEJ is penetrated, SmartBur II, a polymer bur, designed to discriminate between carious and carious dentin, removing only decayed tooth structure in use. According to the manufacturer, some of the other clinical benefits of SmartBur II include:

1) No trauma to the dentinal tubules, thereby in many cases, reducing or eliminating the pain response and decreasing the need for local anesthetic.

2) The minimally invasive nature of the polymer cutting instrument reduces the risk of pulp exposures when excavating deep carious lesions.

3) Carious excavation using SmartBur II leaves a greater amount of healthy tooth structure remaining after preparation to help support and retain restorative materials.

A Recent Maryland clinical study stated the use of polymer burs appears to offer a straightforward and efficient means for achieving the goal of conservative dentistry with a method for removing caries infected dentin while preserving caries-unaffected dentin and conserving healthy tooth structure, while at NYU College of Dentistry, a clinical study compared caries removal with a SmartBurs II instrument (without anesthesia) to carious excavation with a conventional carbide bur (with anesthesia).

Results showed that 84 per cent of patients preferred use of a SmartBurs II instrument compared to use of a carbide bur with no local anesthesia for the dental treatment. A major clinical benefit of this system is the systematic approach to conservative cavity preparation that the unique instrumentation provides the dentist.

Instrumenting and restoring a deep carious lesion

A patient presented with a rather extensive radiographic carious lesion on the distal aspect of tooth #4 (Fig. 1). One can clearly see the caries penetration below the proximal contact area into the distal surface of the tooth, the larger apex of the “triangle” at the surface, narrowing to a pinpoint as the lesion follows the enamel rods toward the DEJ. The caries then spreads laterally along the DEJ and pulpotally toward the centre of the tooth.

As in many of these clinical cases, another area of caries penetration is seen in the central groove of the occlusal surface as a “small, pin point” area that may or may not “tick” with an explorer (Fig. 2). The caries penetration in the central groove is “opened up” using a fissurotomy bur (Figs. 3 & 4) to gain conservative access to the active lesion below (Fig. 5).

As the lesion is opened up, it is noted that the caries spreads in the bucco-lingual direction as well. Figure 6 shows the preparation as the proximal portion of the preparation is extended to allow access for removal of the caries.

Moreover, a diode laser has been used to remove the interproximal tissue and gain better access to the gingival margin of the cavity for matrix placement. Once the convenience and access forms of the cavity are completed, the excavation of the caries with SmartBur II can begin (Figs. 7 & 8).

The appropriate size diameter SmartBur II is chosen and the excavation is completed with slow speed instrumentation. The major advantage of using the polymer bur is that it will easily remove decayed dentin, but it is not able to cut healthy dentin, which is always removed when using round carbide burs for this procedure. Figure 9 shows the completed preparation after isolation with holetite (Isolite Systems) and placement of a sectional matrix (Composi-tight 5D, Garrison/Dental Solutions). Owing to the close proximity to the dental pulp, a bioactive cavity liner (TheraCal, Bisco) is placed on the cavity floor (Fig. 10). TheraCal is a light cured resin modified calcium silicate pulp protectant/liner designed to perform as a barrier and to protect the dental pulp complex. Its alkaline pH helps promote pulp healing and apatite formation.

Once the liner is light cured, a self-etching dentin bonding resin is applied to the enamel and dentin (All Bond Universal, Bisco) per manufacturer’s instructions and light cured. Next, the first increment of composite material (Arte, Bisco) is placed into the cavity preparation and light cured (Fig. 11). This increment fills the proximal box and pulpal floor of the cavity to a point just apical to the proximal contact area. The final increments are then placed, light cured, and finished. Figures 12 and 13 respectively show radiographic and clinical views of the completed composite restoration on tooth #4 after instrumentation with the Comfortable Cavity Prep System.

A simplified and systematic approach to finishing composite restorations

Once a composite restoration is placed, it must be trimmed/finished and polished so that the
surface is smooth like natural tooth structure and the margins of the tooth/restoration are confluent and imperceptible to the time of an explorer. Many composite finishing systems require two or three successive diamond or carbide instruments to refine or prepare the composite surface for the final luster, which is placed with rubber abrasives.

Trimming and Finishing Burs (SS White) are manufactured in both 12 and 20 blade configurations. These posterior composite burs are designed for two-step contouring and pre-polishing all posterior composite restorations. The 12 blade burs are engineered to finish and contour composite restorations directly after placement. Anatomical features such as grooves, pits and fissures can be easily placed into the composite surface by removing any striations or scratches, and blending the cavo-surface margin in a natural seamless form. These burs are non-invasive and create an ultra-smooth surface on all composite materials, ideal for final polishing. These burs are used in a high spered handpiece with water spray to optimise the finished surface.

Once the trimming/finishing step is completed, the occlusal contacts on the restoration are checked with articulating paper (Accufil II, Parkell) and further adjusted with the appropriate 20 blade trimming/finishing bur as needed. Once the occlusion has been properly adjusted, the final luster or polish can be imparted to the restoration. Again, for many polishing systems, two or three grits of rubber abrasives are required to finish the process and end with a high luster on the surface of the restoration. Jazz Supreme Single Step Composite Polishers (SS White) are designed to use low speed and low pressure with water to create a beautiful luster on the surface of composite restorations. The water creates a slurry with the diamond particles and the silicone in the polisher to impart a high surface gloss on the composite material. According to the manufacturer, some of the benefits of the Jazz Supreme system are:

1) The combined technology of diamond particles and silicone impregnated in the rubber abrasive help create the highest possible surface luster.
2) A single step system saves the operator time and helps create an optimal shine much faster.
3) The shanks of the instruments are made of stainless steel and are surface refined with gold flashing making these instruments ideal for multiple use.
4) The Jazz Supreme Polishers are compatible with all aesthetic composite materials, eliminating the need for multiple polishing systems.

**Figure 14** is an occlusal view of a maxillary molar that has an existing amalgam restoration and occlusal decay. A 550 carbide fissure bur (88 White) is used to remove the existing amalgam while a Fissurotomy Bur (SS White) is used to remove marginal decay while conserving as much healthy tooth structure as possible (Figs. 15d 16). Once the cavity preparation is complete, the adhesive procedure is completed and the composite material placed in the cavity preparation and light cured.

The first step in the finishing/polishing procedure is to use a 12 blade finishing carbide (88 White) to accomplish anatomical contouring and marginal refinement (Figs. 17d 18). When instrumenting the margins of the composite, make sure the flutes of the bur are either moving away from the restorative material toward the tooth, or moving across the margin contacting tooth and restorative material simultaneously. This way the cutting instrument will not dislodge the margin of the restorative material, which is not as hard as the adjacent enamel. Next, the 20 blade finishing carbide is going to pre-polish the surface of the composite material and further refine the marginal interface. Once the trimming and finishing step is complete, polishing is accomplished with a Jazz Supreme flame shaped rubber abrasive polishing point (Fig. 19). Notice how when used with water spray, a slurry develops on the surface of the restorative material that will help to increase the final luster of the restorative material (Fig. 20). The completed composite restoration on the occlusal surface of the maxillary first molar is shown in Figure 21. In addition, a highly reflective surface is created while the number of steps and instruments used to create the end result is significantly reduced.

**Conclusion**

In this article, a total instrument system by SS White called “The Comfortable Cavity Prep” system along with finishing and polishing armamentarium has been demonstrated from conservative cavity preparation to finishing of the final restorative material in two clinical cases. Use of this system can help the dentist achieve conservative, comfortable, and expedient cavity preparation as well as finishing and polishing of today’s nano-microhybrid composite restorative materials. SmartBurs II and Fissurotomy Burs are an essential part of the caries treatment regimen. They help to create great patient experiences by reducing the pain and fear associated with cavity preparations. SmartBurs II make a positive impact on practice management and are a contributing factor to increased patient care and referral rates.

**Editorial note:** Dr Lowe has received honoraria from SS White.