Direct posterior bonded restorations - an outline of a clinical technique

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In this study, the authors explore current concepts in direct posterior bonded restorations.

Modern dentistry has experienced a major shift on patients’ demands from health and function to cosmetics. Materials and techniques are constantly evolving to adapt to these ever-changing needs. One major purpose of modern dentistry is not only to deliver this type of care with excellence but the preservation of healthy tooth structure is just as essential. This article describes current concepts to help consistently obtain an excellent, predictable and long-lasting restoration with the direct posterior bonded restoration.

Research has shown that the direct posterior composite fits all of these criteria while also strengthening a tooth that has lost its integrity (Joynt et al, 1987; Eakle, 1986; Segura & Riggins, 1999; Reel & Mitchell, 1989; Sheth, Fuller & Jensen, 1988; Simonsen, Barouch & Gelb, 1983; Landy & Simonsen, 1984).

When either decay or removal of a previous restoration weakens a tooth, the direct posterior composite is the most conservative technique that can restore the original contours and colour.

While any restorative technique requires meticulous steps to achieve success, the intermediate steps during bonding are sensitive and critical. Furthermore, we recognise that if we do not control the shrinkage of the composite during its polymerisation it can create stress, microleakage, marginal breakdown, fractures and secondary caries. All of these could lead to the failure of the restoration and might necessitate endodontic therapy (Davidson, 1997; Jensen & Chan, 1985; Bausch et al, 1982; Eick & Welch, 1986; Kemp-Shoulte & Davidson, 1988; Torstenson & Oden, 1989; Asmussen, 1975).

It is the Class I direct occlusal composite restoration that carries the highest stress due to the lack of free surface areas within the cavity (Kanka, 2001). Therefore, the ratio between the bonded and free restoration surfaces (C-factor) (Roulet, 1997) is high, creating shrinkage stresses that are higher than the bond strength (Jackson & Morgan, 2000).

**TECHNIQUE**

Once clinical or radiographic examination determines that the old restoration or decay must be removed, it should be done carefully to preserve tooth structure (Rubinstein & Nidetz, 1995) (Figures 1a & 1b). A decision then must be taken if unsupported tooth structure is to be kept or removed if the composite restoration is to be used as a build-up for a future onlay or crown. A more conservative approach is acceptable if the direct...
composite is the final restoration and small undercuts are present. When an indirect restoration is the treatment of choice, it will require the removal of healthy but unsupported tooth structure to establish a path of insertion of the restoration, hence weakening the tooth. The placement of a small bevel on all margins is one step that extends bondable enamel surface area and helps prevent a white micro fracture line around its enamel margin (Kanka, 2001).

**DECONTAMINATION**

The rubber dam is placed for proper isolation (Rubinstein & Nidetz, 1995; Leinfelder, 1991) and the deepest decay is removed with a slow speed round bur. The tooth is disinfected (Gwinnett, 1992) using an Intracoronal Brush (Figure 2) with a mixture of pumice and 2% Cavity Cleanser containing chlorhexidine digluconate (Rubinstein & Nidetz, 1995). This step insures the removal of the saliva pellicle. Grease contamination from the hand piece can hamper proper bonding without being obvious to the dentist; therefore, the tooth is cleaned with a small cotton pellet soaked in 70% isopropyl alcohol (Kanka, 2001) (Figure 3).

**ETCHING, WETTING**

If needed, a foam pellet with Cavity Cleanser is used again to manually eliminate any debris left on the tooth that may prevent proper etching. After thorough rinsing and drying, the enamel (Figure 4) and dentin (Figure 5) of the tooth are now ready for etching (Rubinstein & Nidetz, 1995; Kanka, 1991; Suh, 1991; Fusayama et al, 1979; Kanka, 1990; Kanka, 1990; Bertolotti, 1991; Bertolotti, 1990; Gwinnett, 1971; Bowen, Cobb & Rapson, 1982; Bowen et al, 1984) with Uni-Etch 32% phosphoric acid and benzalkonium chloride. It is first placed on the enamel, then on the dentin for a maximum of 20 seconds. The tooth is thoroughly rinsed for at least 5-10 seconds and gently dried to remove any excess water while the dentin is left moist. Regardless of how deep the preparation is, the same technique is always applied as biocompatibility of resins to the pulp has been demonstrated (Cox et al, 1987; Kurosaki et al, 1990; Fusayama, 1981; Cox, 1987). Aqua Prep F or Tubulicid Red is placed on the tooth with a foam pellet for 10 to 60 seconds (depending on the size of the cavity) (Figure 6) followed by a very light stream of air, again leaving the dentin slightly moist (Johnson, Algart & Brannstrom, 1973; Brannstrom, Linden & Astrom, 1967; Brannstrom, Linden & Johnson, 1968) to avoid irreversible pulpitis (Brannstrom, 1963). These steps have created the best clinical environment to seal the tooth (Suh, 1991; Fusayama, 1987; Pashley, Michelich & Kiehl, 1981) and

ADHESIVE APPLICATION

Two coats of One-Step Plus are applied on the tooth with a brush (Figure 7) and the resin is air-dried with the air syringe to evaporate the acetone solvent. One-Step Plus is reapplied, thoroughly air dried again and thinned down until there is no visible excess of resin. It is then light cured for 20 seconds at 600 mW/cm², thus creating the hybrid layer (Kanaka, 1991; Nakabayashi, Kojima & Masuhara, 1982; Nakabayashi, Nakamura & Yasuda, 1991; Kanka, 1992a; Kanka, 1992b).

PACKING AND POLYMERISATION

While different philosophies exist in regards to how a direct composite must be polymerised, it has been demonstrated that a low-intensity curing regimen reduces shrinkage stress without compromising the mechanical stability of the restoration (Feilzer et al, 1995; Uno & Asmussen, 1991). Such a stress can be significantly reduced during polymerisation by a reduced initial conversion rate of the resin material (monomer molecules turned into a polymer network) and improving the adaptation of the resin material to its previously cured walls.

The tooth is rebuilt in incremental layers using Aelite LS. For the first layer, the packing of the composite must be done carefully in order not to incorporate any air bubbles while creating proper adaptation of the material to the pulpal floor and axial walls.The first layer of polymerised composite to dentin is the ‘dentin gel cure stage’ which is initially light cured for six seconds at 600 mW/cm² and after three minutes fully cured for 20 seconds. For the next layer the material is segmented to allow for it to cure only to its corresponding walls and respective cusp (Wieczkowski et al, 1988) (Figure 8). These steps reduce the possible sensitivity and cracks caused by contraction polymerisation of the composite (Qullet, 1995) approximating buccal and lingual cusps (Baratieri & Ritter, 2001; Davidson, de Gee & Feilzer, 1984).

The last layer is with Pyramid Neutral, which is adapted and burnished against the tooth. Glycerine is applied over the tooth/composite interface to prevent oxygen inhibition (Figure 9) and is pulse delay light cured for three seconds at 200 mW/cm². This step initiates the chain reaction on the photo initiators to start polymerising the final layer of the composite with the least possible stress (Suh et al, 1999).
After three to five minutes, the composite is polished with rubber points (Figures 10 & 11), followed by a composite Polishing Brush. The tooth is rinsed, dried, re-etched and finally sealed with Fortify Plus and light cured for 20 seconds for each rebuilt surface. The use of such a surface sealant has been shown to reduce the wear rate of posterior composite restorations (Dickinson & Leinfelder, 1993). The rubber dam is removed to verify that the occlusion does not need any further adjustments in centric occlusion as well as on lateral movements (Figures 12 & 13). If any adjustments were made, those areas should be readjusted.

**CONCLUSION**

Predictability and longevity of direct posterior bonded restorations can be obtained by meticulous application of current composite placement techniques. Controlling shrinkage stress using a low shrinkage composite significantly reduces the strain placed on the enamel margins, thereby enhancing the integrity of the restoration. The addition of the ‘dentine gel cure stage’ is intended to reduce internal stresses on the tooth during its rebuilding steps. Following a consistent regimen from preparation to polymerisation allows for the delivery of excellence in restorative treatment.

**REFERENCES**


Smear layer: removal and bonding considerations. Oper Dent 3(suppl): 30-34


Yin R et al (2002). Low shrinkage composite. 2002 IADR Abstract 0514, San Diego, CA Meeting

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MATERIALS

Intracoronal Brush, Polishing Brush. Ultradent Products, Inc. South Jordan, Utah 84095. Tel: (001)800-552-5512


Tubulicid Red. Global Dental Products, North Bellmore, New York 11710. Tel: (001)516-221-8844