Indirect Bonding with Light-Cured Adhesive and a Hybrid Transfer Tray

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Indirect bonding has evolved concurrent with the improvements in dental materials. Light-cured adhesives allow additional time for tray placement, and adequate bond strength that allows for rapid tray removal and immediate archwire placement. Flowable restorative composite resins have proven to be an ideal indirect bonding adhesive. The tray system combines clear vinyl polysiloxane to capture the brackets and a thin thermoplastic outer tray. The primary advantage of this technique is the reduction in laboratory time needed to fabricate the hard outer tray. (Semin Orthod 2007; 13:64-68.) © 2007 Elsevier Inc. All rights reserved.

On beginning practice in 1981 the technique used by the author involved placing the brackets on working models with toffee. The transfer trays were then made from silicone putty, and the adhesive was a two-paste composite resin. A problem with this technique involved the possibility of adhesive flash remaining around the base of the brackets, which required removal with a round bur and a hand piece. Another problem involved the requirement of waiting long enough for the adhesive to gain enough bond strength to allow tray removal.

With the advent of lingual orthodontics came the custom base indirect bonding technique. The brackets were placed on the model with a heat-cured composite resin and the flash removed. After the bracket position was adjusted, the model was placed in an oven to cure the resin.

After the tray was made and the model was placed in warm water to dissolve the separating medium and release the brackets from the model, the cured composite resin had formed a custom base on the brackets. This custom base would adapt so closely to the tooth that it was only necessary to use a thin film of self-cured composite resin to act as the adhesive between the custom base resin and the etched enamel. Initially, Concise (3M Unitek, Monrovia, CA) restorative unfilled enamel sealant was used as the adhesive. Some clinicians preferred to simply place part A of the sealant on the custom base and part B on the enamel. When the tray was placed on the prepared teeth, the two parts would meet and cure. This became known as the “A-B custom base” technique.

Specific indirect bonding adhesives were developed for the A-B technique. Improvements included adding fillers for increased viscosity and bond strength, as well as adding accelerators to decrease the setting time and to decrease the time the trays had to be held in place before they could be removed from the bonded brackets.

At approximately the same time that light-cured restorative composite resins were introduced, orthodontists began experimenting with clear transfer trays. These trays are made in the same manner that mouth guards are made on the Biostar® (Great Lakes Orthodontics, Tonawanda, NY). The clear trays allowed the use of light-cured, nonfilled resins to be used as an adhesive. The main advantage of the use of light-cured adhesives versus chemically cured adhesives was the relatively high initial bond strength present at the critical time of tray placement.
Another advantage was the increased working time available to ensure that the tray was fully seated. Subsequently, the “double tray technique” was introduced, which used an outer hard acrylic tray in addition to the soft inner tray. This increased stability in the tray system.

The next step in the evolution of this process involved adding a filler to the resin in order to increase the viscosity, as well as the bond strength. Fluorobond™ (Ormco, Sybron Dental Specialties, Orange, CA) was a lightly filled, light-cured orthodontic sealant used by the author as an indirect bonding adhesive. This was replaced by Ortho Solo™ (Ormco, Sybron Dental Specialties, Orange, CA) which added some moisture tolerance to the system. Halogen lights became stronger, and curing times decreased. When the argon laser was introduced, it decreased curing time and provided a smaller and lighter wand. The use of

Figure 1. (A) Affinity Crystal Clear vinyl polysiloxane (VPS). (B) Application of VPS over brackets. (C) Model with VPS. (Color version of figure is available online.)

Figure 2. Micro-etching of the custom bases. (Color version of figure is available online.)

Figure 3. Completed tray. (Color version of figure is available online.)
an argon laser also decreases enamel demineralization.\(^1\)

Filtek™ Supreme Plus Flowable Restorative (3M ESPE, St. Paul, MN) acts as an intermediary resin in our indirect bonding process. The use of a flowable light-cured adhesive with indirect bonding was first described by Miles.\(^2\) Filtek is viscous enough so that it stays where it is placed on the custom base; however, it flows under the pressure of seating the tray down to 10 microns, which is considered an ideal cement line thickness. Very little flash is present after bonding, if care is taken to place a minimal amount of Filtek on the custom base.

**Laboratory Technique**

The indirect bonding technique combining a clear double transfer tray with an APC™ II (3M Unitek, Monrovia, CA) custom base has been previously described by Sondhi.\(^3\) The following are the modifications that the author has made:

1. Use a resin-reinforced model stone such as GC Fujirock® EP (GC America Inc., Alsip, IL).
2. Use a separating medium and place the brackets on the models. A technique for precision bracket placement using marginal ridges, and functional and esthetic surfaces as a reference point, has been previously described by Kalange.\(^4\)
3. Cure the custom base resin in a Triad 2000™ Visible Light Curing Unit (Dentsply International, York, PA) for 10 minutes from the occlusal and 10 minutes from the gingival.
4. Lay down a bead of Affinity™ Crystal Clear transparent vinyl polysiloxane or VPS (Clinicians Choice, Inc., New Milford, CT) to capture the brackets (Fig 1A-C). Use a small, yellow (4.2 mm) mixing tip. The bead should be approximately the diameter of a pencil so that it can be removed in one piece in the mouth. Hold the mixing tip at a 45 degree angle to the bracket

**Figure 4.** Isolation and etching using the Nola Dry Field System. (Color version of figure is available online.)

**Figure 5.** (A) Dry Tips. (B) Dri-Angle. (Color version of figure is available online.)
face. Keep the VPS flowing ahead of the tip to surround the brackets.

5. Using a Biostar® machine (Great Lakes Orthodontics, Tonawanda, NY) and 0.5 mm clear Splint Biocryl (Great Lakes Orthodontics, Tonawanda, NY; item #021-023) make an outer tray over the VPS using the lead pellet technique.

6. Soak the working model with the custom transfer tray in warm water for a minimum of one hour to dissolve the separating medium, and release the custom bases from the model. Remove the tray from the model in one piece. Do not separate the VPS from the outer tray.

7. Return the tray to the curing unit for one minute to cure any “soft spots”.

8. Trim the tray with scissors or a scalpel.

9. Micro-etch the custom bases with Ortho Prophy™ SA-85 abrasive (Danville Engineering, San Ramon, CA). This will clean the custom bases without removing a significant amount of the resin (Fig 2).

10. Rinse the tray well to remove all abrasive. Shake off the excess water and allow to air dry (Fig 3).

**Clinical Procedure**

1. Apply the smallest amount of Filtek that will cover the custom base of each bracket, and spread the adhesive with the end of the syringe (Fig 6). Place the trays in the dark.

2. Isolate the oral cavity using a Nola Dry Field System (Great Lakes Orthodontics, Tonawanda, NY) (Fig 4). Use Dry Tips® (Molnlyke Health Care, Goteborg, Sweden) for maximum moisture control or the more rigid Dry Angles (Dental Health Products, Inc., Youngstown, NY) to hold the cheek away from the second molars (Fig 5A and B).

3. Etch the facial surface of all teeth to be bonded on one arch, rinse well, and dry with a tooth dryer.

4. Apply a thin layer of Ortho Solo to the etched enamel.

5. Seat the tray and cure each tooth for 10 seconds with either a high intensity halogen or LED curing light or 5 to 10 seconds with an argon laser (Fig 7).

6. Repeat the procedure for the opposite arch.

7. Remove the outer trays.

8. Remove the VPS.

9. Remove any interproximal adhesive flash. The patient is now ready for archwire placement.
Summary

Indirect bonding has undergone many improvements since its introduction in the 1970s and the interest in this technique has increased; however, it does not enjoy the popularity that it deserves. Opponents of the technique equate the complexity with crown and bridge fabrication. The technique described in this article serves to simplify tray fabrication. This is accomplished by combining clear vinyl polysiloxane to capture the brackets, with a thin thermoplastic outer tray. The resulting tray is easier to trim and less bulky than other types.

Figure 9. Removal of the VPS. (Color version of figure is available online.)

Figure 10. Outer tray and VPS. (Color version of figure is available online.)

References