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CREATING CERTAINTY AND CONFIDENCE WITH INDIRECT BONDING

Indirect bonding offers a superior method of adhering brackets to teeth, but few orthodontists use it. The neglect of this procedure has many origins, including expense, lack of expertise, and inconsistent results. This paper presents an indirect-bonding method that can be used to expedite bonding appointments and make them more pleasant for patients and clinicians alike. World J Orthod 2009;10:117–122.

Although most orthodontists will admit that they can place brackets more accurately using indirect bonding, fewer than 20% routinely use this method.[1] Orthodontists justify this decision by citing material expense, high laboratory utilization, costly training of personnel, difficulties in achieving consistent and predictable bracket adhesion, and more.

Many clinicians feel that insufficient pressure between teeth and brackets causes indirect-bonding failure. Polyvinyl siloxane and vacuum transfer trays often have excessive flexibility that prevents tight contact between brackets and teeth. Two previous articles[2,3] described alternative indirect bonding methods that use a transfer tray made from a polymer of ethylene vinyl acetate applied with a hot glue gun. This material has FDA approval, is nontoxic and noncarcinogenic, and has enough rigidity to keep the brackets close to the teeth, but also has enough flexibility to permit easy removal after polymerization of the composite. The Surebonder DT 200 (Fig 1) uses miniglue sticks and allows adjusting the heat according to the particular task. With the low heat, technicians can control the flow of the liquid glue. In contrast, high temperatures will produce bubbles and a molten matrix that can be difficult to manage.

Indirect bonding with the Surebonder has the advantage of accuracy and certainty and allows clinicians to develop the necessary confidence to make indirect bonding a simple, predictable procedure.

IMPRESSION TECHNIQUE

Orthodontists should spend time at the first treatment equilibrating the teeth before taking impressions. This avoids having to guess where and how to compensate for chipped and damaged teeth when placing the brackets on the models. A good impression forms the basis of any successful indirect bonding technique. Although polyvinyl siloxane impressions are still the gold standard for precision reproduction, an alternative alginate has recently been developed that rivals this more expensive material. ImprESSIX (Dentsply, York, Pennsylvania, USA) fast-set alginate mixed in the TurboMax (Dentsply) auto alginate mixer gives clinicians a homogeneous, smooth mixture of alginate (Figs 2 and 3). Before impressions are made, teeth should be clean and plaque-free. The best impressions result from a thick mixture that resembles putty, but clinicians will need to vary the water and powder ratio for their own preferences. By using rigid trays of hard plastic or metal, distortions that occur with softer disposable trays can be avoided.

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Fig 1 Surebonder DT-200 dual-temperature hot glue gun.

Fig 2 Cross-section of hand-mixed alginate.

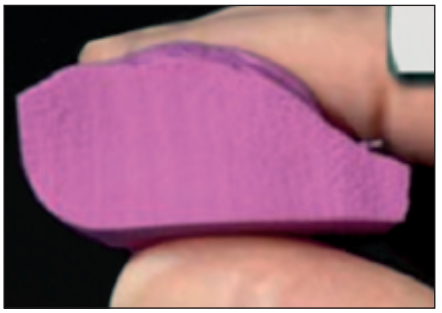

Fig 3 Cross-section of alginate processed in the TurboMax.

MODEL PREPARATION

Fast-set white stone with high compressive strength offers the best choice for model fabrication. After the stone has set, the models should be checked for any defects before they are marked for bracket placement. A fine-tipped colored pencil (0.5 mm or smaller) is best because black lead markings sometimes transfer from the model to the teeth. Draw vertical lines to represent the long axes of the teeth (Fig 4). Next, connect the mesial and distal marginal ridges of each tooth with a line (Fig 5).

Orthodontists have traditionally used measurements from the incisal edges and buccal cusp tips to the center of the clinical crown. Because the cusps of the first molars are often already worn, this approach will lead to an overeruption of the molars during leveling. Alignment of the marginal ridges rather than crown centers holds the key to good posterior occlusion.[4] Select a point on the first premolar for the position of the bracket slot, and using an Ormco Boone Bracket Gauge with a colored lead tip (Ormco, Orange, California, USA) or an ordinary Boone Gauge, make a mark and draw a line parallel to that of the marginal ridge line of the first premolar (Fig 6). Using a compass with a lead point or one with two styluses, measure the distance from the first premolar marginal ridge line to the line representing the bracket slot and transfer that measurement to all of the remaining posterior teeth (Figs 7 and 8). From these points, draw lines parallel to the aforementioned marginal ridge lines (Fig 9).

Using the Ormco Boone Gauge or an ordinary Boone Gauge, transfer the measurement from the cusp tip of the first premolar to its slot line to the incisors. The maxillary lateral incisors should be a pencil width more incisal than the central incisors (0.25 mm). The mandibular incisors should all have the same measurement. Mark the maxillary and mandibular canines about 0.75 mm more gingival than the incisors (Fig 10).

INTEGRATING THE VTO WITH INDIRECT BONDING

The brackets on the maxillary anterior teeth (canine to canine) should be positioned so a pleasant smile arc results at the completion of treatment. Clinicians can use the visualized treatment objective (VTO) to help them decide where to position the brackets for those teeth. Burstone[5] has suggested that the occlusal plane for adults should lie 3 mm inferior to the lip embrasure. However, when treating adolescents, clinicians should compensate for patient immaturity and place the occlusal plane 5 to 6 mm below the lip embrasure. This will allow a pleasant display of the teeth as the patient ages and the lips turn flaccid.

After the construction of the VTO occlusal plane, clinicians need to reposition the maxillary and mandibular incisors anteroposteriorly and place the maxillary incisors exactly on the new occlusal plane. The mandibular incisors will extend 1 mm above the new occlusal plane and occlude with the lingual of the maxillary incisors. The VTO will ordinarily

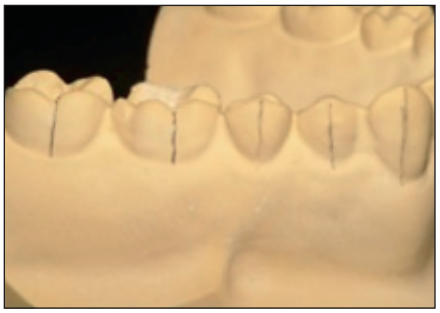

Fig 4 Long axes of the teeth marked by vertical lines on the cast.

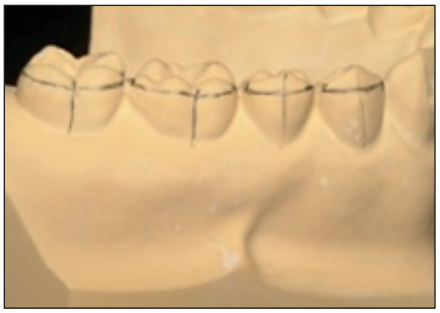

Fig 5 Posterior marginal ridge lines drawn on the cast.

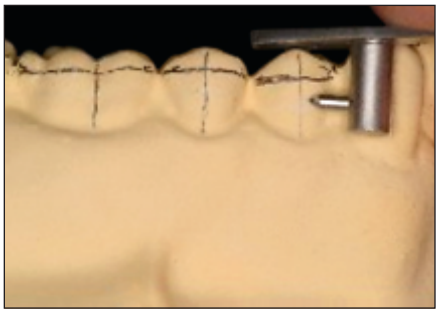

Fig 6 Marking the ideal slot position of a first premolar with a Boone gauge.

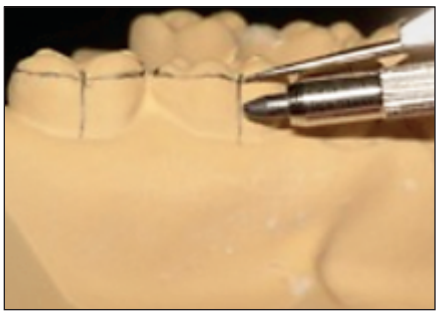

Fig 7 Transferring the distance from the marginal ridge line to the ideal slot position from the first premolar to the first molar.

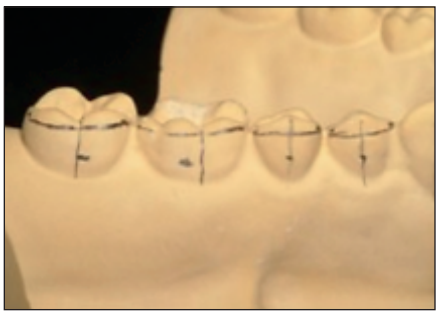

Fig 8 Ideal slot position marked on all posterior teeth.

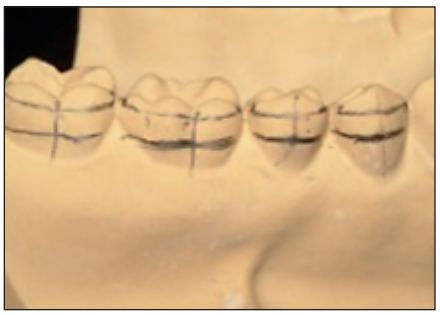

Fig 9 Lines drawn parallel to the marginal ridge line on all posterior teeth.

Fig 10 Cast completed with all slot lines.

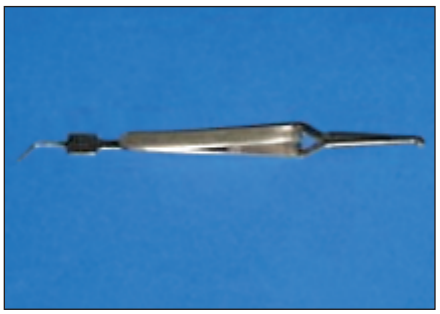

Fig 11 Bracket holding instrument with mirror and probe at the left end.

Fig 12 Intraoral use of probe end for measuring bracket height and removing excess composite.

show that any bite opening will require intrusion of the mandibular and maxillary incisors to stay in place vertically or extrude a small amount. If the VTO shows that the maxillary incisors should not move vertically, clinicians can place the bracket at the same level as the maxillary first premolar. If, on the other hand, the VTO displays maxillary incisors that require extrusion, then clinicians should move the brackets gingivally to achieve that goal. On rare occasions, the VTO will suggest maxillary incisor intrusion, and this will require placing the brackets more incisally to attain that objective.

Opening the bite by intrusion of the maxillary incisors carries the risk of making the smile less attractive as the patient ages and the upper lip begins to sag. By middle age, these patients will show barely any teeth even when smiling largely. This contributes to a premature aging of the face and distracts from a youthful and pleasing appearance.

Fig 13 Trimming of excess glue with scissors.

After drawing all of the lines on the models, two coats of separating agent are applied to the casts and allowed to dry. After the separating medium has dried, the laboratory technician can attach the brackets to the model with a small amount of tacky glue (Aleene's, Buellton, California, USA), an inexpensive, water-soluble adhesive often used by hobbyists. The glue sets rapidly, so technicians will need to position the brackets quickly. The orthodontist has to review all bracket positions before the transfer trays are made. Incorrectly placed brackets can easily be removed and reglued. The best device for placing brackets is a special holding instrument: One end has the holding pinchers, while the other has a mirror with or without a crosshair and a millimeter-marked probe (Fig 11). The probe can serve to remove excess composite or measure the bracket-slot distance from the incisal edge/cusp tip. This bracket holder is useful intraorally or in the laboratory (Fig 12).

TRANSFER TRAY FABRICATION

Before fabricating the transfer trays with molten glue, paint the brackets with mineral oil. This is the best lubricant to ease the removal of the transfer trays after composite polymerization.

Tray construction begins by applying the molten glue to the occlusal margins of the brackets, being careful not to extend the glue under the gingival tie wings. Such an extension, while not completely detrimental, will make tray removal more difficult. The glue gun is used to form a molten matrix over the entire lingual and occlusal surfaces of the stone teeth and the remaining bracket aspects. An additional amount of glue is added to the center of the brackets so as to add bulk to the part of the tray responsible for holding the brackets close to the teeth. Also, whenever possible, the trays should be extended distally one tooth beyond the last bracket or tube placed. This will help to secure and stabilize the tray.

The technician can smooth the surface of the tray by patting the still-soft glue with a wet finger (the moisture lubricates and protects the fingers and smooths the glue before it hardens). After the glue has hardened, the models are submerged in water for 30 to 60 minutes to dissolve the tacky glue so the transfer tray with the brackets can be smoothly separated from the cast. Additional soaking of the separated tray will allow easy removal of the remaining glue with a soft-bristled brush. This could also be accomplished with a small ultrasonic denture cleaner. The excess glue is trimmed from the transfer tray with scissors (Fig 13), and the midline is marked with a magic marker. Microetching will increase the surface area of the bracket mesh and subsequently increase the bond strength slightly.[6,7] However, technicians must exercise extreme care to remove all of the aluminum oxide powder from the bracket mesh, because any remaining particles will weaken the bond strength.

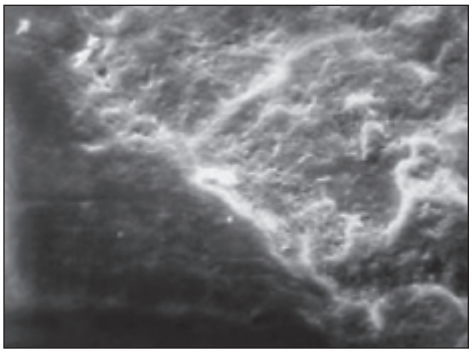

Fig 14 Fluorosed enamel surface.

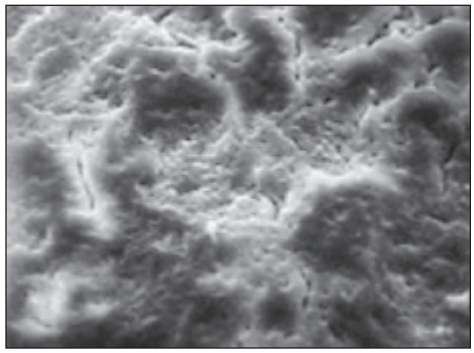

Fig 15 Fluorosed enamel surface after etching with 37% phosphoric acid.

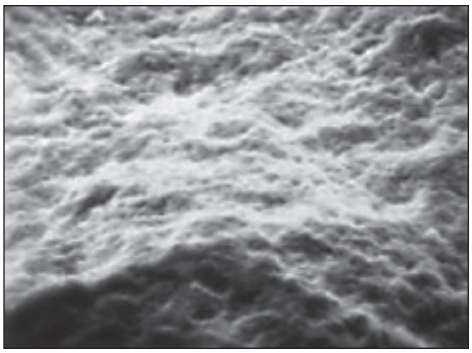

Fig 16 Fluorosed enamel after microetching.

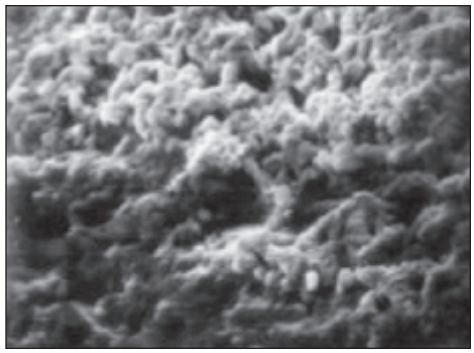

Fig 17 Fluorosed enamel after microetching and acid-etching.

CLINICAL APPLICATION

If clinicians feel that patients' teeth contain excessive concentrations of fluoride (Fig 14), they should microetch the enamel before acid-etching. Etching or microetching alone has little clinical effect (Figs 15 and 16),[8] but microetching followed by chemical etching greatly enlarges the bondable surface area of fluorosed enamel[9] (Fig 17).

Hot glue transfer trays permit the use of multiple composites, including auto-cure, light-cure, no mix, and sealant combinations. However, clinicians may prefer to use light-curing composites to achieve a faster and more thorough polymerization than with auto-curing materials.[10] Light-curing products are less compromised by environmental conditions such as heat and humidity. Clinicians should select indirect-bonding composites on the basis of flow, as well as strength. Some of the more reliable light-curing materials are Transbond (3M Unitek, Monrovia, California, USA), Enlight (Ormco, Orange, California, USA), and Light-Cure (Reliance Orthodontic Products, Itasca, Illinois, USA).

Chairside assistants should carefully load the mesh of each bracket with a minute amount of the respective composite and place it under an amber-protective plate to prevent premature polymerization by ambient light. Composite flash remains the one large disadvantage of any indirect technique that uses flowable composite.

The orthodontist and assistants will clean the teeth and microetch them if necessary before isolating them with retractors, cotton rolls, or triangular saliva absorbers. Although orthodontists can use a water-based, all-in-one adhesive,[2] a recent study has shown that the traditional etch-and-bond technique offers stronger bond strength.[11] After etching and rinsing, clinicians may prefer to dry the teeth with warm dry air (a modified hair dryer), particularly if the compressed air supply has oil or water in the lines.

Fig 18 Use of a Schure instrument to remove the transfer tray.

Once the teeth are sealed, the tray is placed over them using the midline mark for guidance. The tray is held in place with light pressure while the light source cures the composite. Regular visible light-curing units will require 20 to 30 seconds per tooth for complete polymerization, whereas a Power Slot tip (Reliance, Itasca, Illinois, USA) will require only 15 to 20 seconds per tooth. The curing time is even further reduced with the new LED lights (Reliance, Itasca, Illinois, USA) that require only 10 seconds per tooth.

Once the composite is cured, the transfer tray is removed with a Schure instrument. If this proves difficult or the brackets are in danger of being torn off, the glue should be softened with a hot-air gun until the tray can be simply peeled from the brackets (Fig 18).

Clinicians can tie in an active wire immediately, or they may choose to place separators to prepare the molars for banding and use an annealed initial wire. Doctors should wait until after bonding before placing separators since their placement will move the teeth and the trays will not fit. Any extractions have to be postponed until after the indirect bonding is completed.

CONCLUSION

Many orthodontists prefer direct-bracket placement, though the previously described indirect method offers several advantages:

1. More accurate bracket placement
2. More efficient use of clinical bonding time
3. Maximum assistant efficiency
4. Relatively low costs
5. Tight adherence of the brackets to the teeth
6. Delegation of certain bonding steps
7. Superior patient comfort and shorter appointments
8. Short learning curve

No clinical technique offers an unalloyed blessing, and clinicians will probably find some features of indirect bonding they will not like. But if used for at least a short time, indirect bonding proves to be pleasant for both patients and orthodontists.

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