

INDIRECT BONDING

AUTHOR

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The advantages of indirect bonding have been recognised for more than twenty years. However the technique has not gained widespread acceptance as an alternative to conventional direct bonding. Reports of difficulty in achieving adequate isolation of posterior teeth and problems with resin flash and low bond strength may explain the reluctance of the profession to make use of the technique. This paper describes an improved indirect technique which uses a heat cured bonding resin in a way that appears to overcome the reported problems.

Indirect Bonding

The bonding of orthodontic attachments to teeth using a template constructed in the laboratory was described by Silverman *et al* in 1972.¹ The technique involves the temporary attachment of the brackets to a plaster model of the teeth and the construction of a custom-made tray to carry the brackets to the mouth. Various media have been suggested for attachment of the brackets to the model, with some early reports recommending water soluble confectionery.^{2,4} Sticky wax³ and water soluble Laboratory Adhesive* have also been used.

Removal of the temporary adhesive medium after template construction results in a gap of variable thickness between bracket base and tooth surface. To compensate when bonding a significant amount of bonding resin must be used. The resulting lack of control over the flow of the bonding resin has been associated with problems of excessive flash and voids. It has been reported that the resin flash causes gingival irritation and that voids in the adhesive result in decreased bond strength.⁴

An improvement in technique was suggested by Thomas.⁶ Instead of using a temporary medium to attach the brackets to the model, Concise Orthodontic Bonding Resin* was used. This provided a custom fitting base for each tooth. The attachments were subsequently bonded to the teeth using chemically cured unfilled resin, thereby reducing the thickness of the flash and making its removal easier. The integrity of the bond between the aged resin base and the resin used to bond the attachments to the teeth has been proved in recent studies.^{7,8}

Recently, the use of visible light cured resin to bond the brackets to the

plaster models has also been advocated.⁹

¹¹ The main advantage of the light cured resins over the chemically cured is that some control of polymerisation is available. The orthodontist can delegate the setting up of the attachments and check their positions before the adhesive is cured. There is, however, a limited time during which attachments can be adjusted because curing is initiated as soon as the adhesive is removed from its container and exposed to ambient light.

The following method, to be described in detail, offers a further improvement by using heat cured resin. Heat cured resins are stable in light at room temperature for an unlimited time, thereby permitting a true "command cure". A dental chairside assistant is able to set up several cases leaving the orthodontist to finalise the positions of the attachments on the model at a convenient time.

Method

Accurate alginate impressions are taken of the teeth to be bonded. If extractions have been carried out these are taken not more than seven days prior to bonding. If the case is non-extraction or if extractions have been deferred a thirty day delay is acceptable. Alteration to tooth morphology associated with restorative dentistry or fissure sealants must be avoided between impression taking and bonding.

Laboratory Procedure

The impressions are poured in orthodontic stone, preferably vacuum mixed, and trimmed. The models must not be hand articulated at any stage because loss of plaster detail will lead to an incomplete seating of the template when bonding. If possible, the models are left to dry overnight; or, if

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Fig. 1. Positioning of incisor bracket using Boone Gauge.

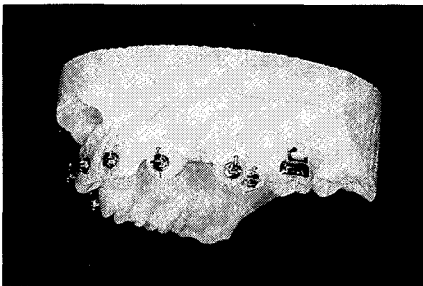


Fig. 2. Attachments on model immediately prior to template construction.

necessary, they are dried in a warm oven for four hours.

The long axes of the teeth are marked with a lead pencil and a single coat of separating medium is painted on the facial surfaces of the teeth and left for one hour to dry.

Thermacure Resin Paste[†] is applied to each bracket and gently pushed into the base with a spatula. Any material flowing beyond the base is removed and the attachment placed on the appropriate tooth on the model. Sufficient pressure is applied to force material from under the base until contact is made between the bracket base and plaster tooth. The excess material is removed and the bracket accurately positioned. A Boone Gauge[‡] (Fig. 1), Torque Angulation Reference Guide (T.A.R.G.^{||}) or Slot Machine[¶] may be used to finalise angulation, height and torque.

The models are placed in an oven preheated to 120°C for fifteen minutes to cure the adhesive. Figure 2 shows a case with attachments in place prior to template construction. Following ten minutes of bench cooling, a template is constructed using Optosil Plus[™] which is

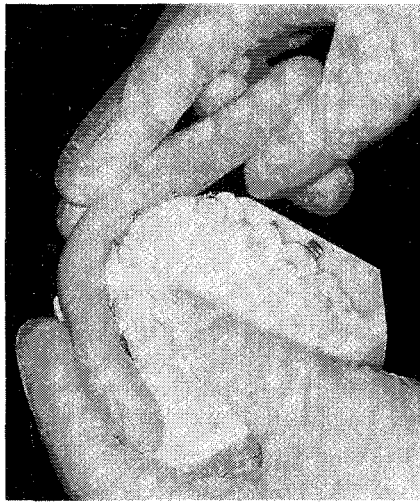


Fig. 3. Correct method of application of Optosil Plus material.

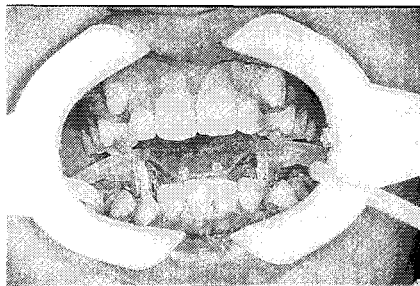


Fig. 4. Patient ready for bonding with Dry Field Retractor^{††} in place.

formed into a roll and applied to the attachments in a lingual direction and adapted onto the occlusal surfaces of the teeth (Fig 3). When the Optosil Plus has set (approximately 60 to 90 seconds), the models are soaked in cold water for twenty minutes before the template is peeled off. If any brackets remain attached to the model they are removed and placed into the template.

Any adherent separating medium is removed from the cured resin bases by rinsing under cold water, gently scrubbing with cotton wool pellets or a tooth brush. The template is dried, trimmed to the desired shape and the midline marked. The best method of storage for the completed templates is to wrap them in tissue paper; this prevents contamination and permits further drying of the Optosil.

Clinical Procedure

Immediately prior to bonding, the templates are unwrapped and the cured resin bases are lightly ground with a clean green abrasive stone to ensure a fresh surface for bonding. Plastic Bracket Primer[™] is then painted onto each base and allowed to evaporate.

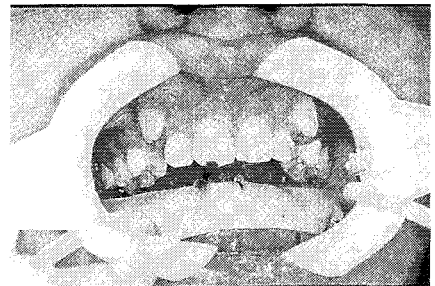


Fig. 5. Application of Maxicure[™] Liquid mixture to upper teeth.

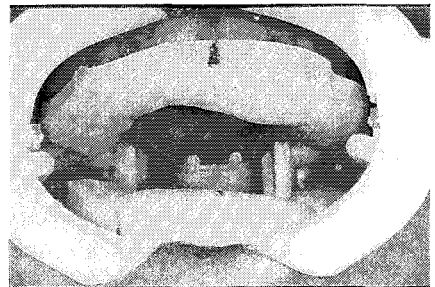


Fig. 6. Upper and lower templates in place.

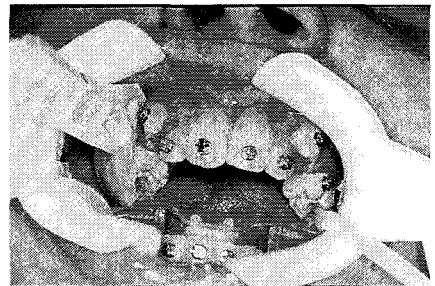


Fig. 7. Removal of upper template.

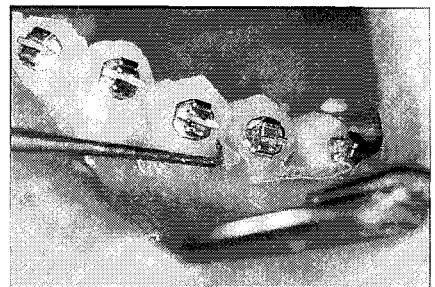


Fig. 8. Removal of resin flash.

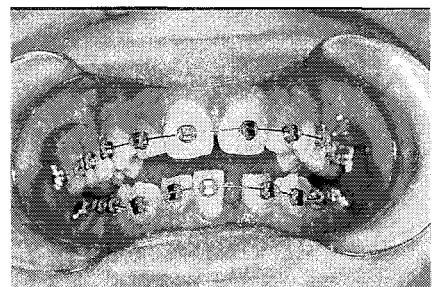


Fig. 9. Completed bonding with archwires in place (not same as Figs. 4-8).

The patient is seated and the Dry Field Retractor^{††} is positioned in the mouth (Fig 4). All upper and lower teeth to be bonded are pumiced, washed and dried, etched for fifteen seconds with Monoloc Etching Solution[§] (38% phosphoric acid) and then washed and dried.

The lower teeth are bonded before the upper because they are more likely to become contaminated during the procedure. Two drops each of Maxicure Liquid A^{||} and Maxicure Liquid B^{||} are mixed in a dappen dish. The clinician paints a small amount of the mixture on the facial surface of each tooth in the lower arch while the assistant paints a small amount on each bracket base in the lower template. As the template is seated, gentle pressure is applied with the fingers in a gingival, lingual direction and held until the mixture has set in the dappen dish. The upper teeth are redried and 2 drops each of Maxicure Liquid A and B mixed and applied as before (Fig 5). The upper template is held in place (Fig 6.) with gentle pressure applied gingivally and until the Maxicure has set in the dappen dish (Fig 6). The lower template is then forcibly removed so that any inadequate bonds are detected. Any flash is removed with a scaler and the upper template is forcibly removed. If there are any bond failures they are rebonded directly with Transbond[™] without further preparation (Fig. 7.) and any flash lifted off with a scaler (Fig 8). The archwires are fitted immediately (Fig 9).

Discussion

According to a survey in 1991,¹² indirect bonding was used routinely by less than 10 per cent of the respondents. This represented only a slight increase in use of the technique when compared with a previous survey in 1986.¹³ From the data, it could be inferred either: that the procedure has disadvantages that outweigh the advantages, or, conversely, that the profession is misinformed.

The disadvantages claimed by Zachrisson and Brobakken⁴ with respect to excessive flash, and increased bond failure with indirect bonding, have been eliminated with improvements in technique and adhesives.

Many advantages have been claimed for indirect bonding, including: reduced clinical time, improved accuracy of bracket placement, reduced patient stress and discomfort and reduced operator stress.^{9,10} The reduction in chair-side time is indisputable with procedure

times claimed to range from 20 to 45 minutes. Accuracy of bracket placement was examined in one study and could not be substantiated as a real advantage when compared with direct bonding². Any reduction in stress levels for operator and patient is difficult to quantify and has not been proven in any study.

At the 3m Unitek Forum on Orthodontic Bonding held in Orlando USA in April this year, Dr Randal Adam, a 3M Chemist, discussed the advantages of Transbond Light Cured Resin for direct bonding.

He stated that: "if an orthodontic attachment is repositioned when the bonding resin is at an advanced stage of polymerisation, the cured resin will have reduced strength. The light cured resin therefore, has an advantage in that it is possible to adjust the attachment position, when bonding directly, before polymerisation is initiated with the curling light."

It may be reasonable to suggest from Dr Adam's comments, that indirect bonding could also provide superior bond strength because the attachments are held rigidly as the resin polymerises. It is possible that this benefit may be greater in the posterior segments where repeated revision of bracket position is likely because of difficult access.

A further advantage of indirect bonding generally - and in particular with heat cured resins - is that the increase in working time during attachment placement allows for careful and, if necessary, prolonged consideration of bracket type and position. It is possible to truly customise the appliance and avoid the "one size fits all" philosophy that prevails in the world of pre-adjusted orthodontic appliances. Inventory can be reduced to a minimum with brackets on standard bases so that they can be placed conventionally or upside down where negative torque is required, as suggested by Hocesvar with the Beddtiot Technique.¹⁴

Conclusion

The described indirect technique has been developed over a fourteen year period with a progression from the temporary attachment of brackets to the model with sticky wax and, later, Laboratory Adhesive, to custom-made bases of visible light cured resin. The heat cured resin technique has been used routinely for the last two years by the author to bond from first molar to first molar in both dental arches. The

entire procedure - including the fitting of archwires - takes approximately fifteen minutes with bond failures seemingly far less frequent than with previous techniques. For these reasons, it is suggested that indirect bonding as described is a viable technique worthy of consideration.

Appendix Notes

1. The oven used is a small bench type available from most department stores. It is necessary to purchase an oven thermometer because the temperature control is not sufficiently accurate. An oven with a cut off timer is recommended so that it can be set and left without the risk of cracking the models if they are left in the oven too long.
2. The Dry Field System is strongly recommended because it provides excellent isolation of posterior teeth.

Acknowledgement

The assistance of Mrs Maria Hinde, Dental Therapist, in the development of the technique presented in this paper is acknowledged.

Product List

- Unitek, 3M Corporation
Monrovia CA. USA
- + Unitek 3M Corporation
Monrovia CA. USA
- † Reliance Orthodontic Products
Itasca IL. USA
- § Unitek, 3M Corporation
Monrovia CA. USA
- || Ormco Corporation
Glendora CA. USA
- ¶ Creekmore Enterprises
Houston TX. USA
- ** Bayer Dental
Leverkusen. Germany
- ++ Reliance Orthodontic Products
Itasca IL. USA
- †† Nola Orthodontic Specialties
Kenner LA. USA
- §§ Rocky Mountain Orthodontics
Denver Co. USA
- ||| Reliance Orthodontic Products
Itasca IL. USA
- ¶¶ Reliance Orthodontic Products
Itasca IL. USA
- *** Unitek 3M Corporation
Monrovia CA. USA

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