

# INDIRECT BONDING: AN OVERVIEW

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## Abstract

Indirect bonding technique that helps in precise positioning of orthodontic brackets and reduces clinical time needed for bonding. The precise location of bracket placement on the teeth is a goal in order to individualize and optimize the treatment outcome. The article will present an overview of the techniques of indirect bonding. It helps the clinician to choose and analyze the indirect bonding technique.

**Key Words** Indirect bonding, advantages, disadvantages, different methods

## INTRODUCTION

Indirect bonding is a technique, in which orthodontic brackets and other attachments are transferred from dental casts (working models) and bonded onto dentition using a transfer device. It was first described in detail by Silverman and Cohen in 1972. Initially Candy was used as a means of attaching the brackets to the working models before transfer tray fabrication. Water-soluble adhesives and even sticky wax also used to attach the brackets to the models. Silverman and Cohen first used cements for bonding brackets onto working models. They also prepared a thermoplastic transfer tray. In following years, different resins (methymetacrylate, Nuva-Fil bis-GMA etc.) were introduced in this technique. In 1975, they used light cured adhesive<sup>1</sup>. As early as 1974, Newman discussed the use of acrylic-based adhesives to direct and indirect bond plastic and mesh base brackets. Thomas discussed a modification of the Silverman and Cohen technique in which Concise® or Dyna-bond® were used to form a custom base. This technique first described the construction of these custom composite bases and utilized a clear vacuum-formed transfer tray<sup>2</sup>.

At the beginning of 1980s, thermally cured adhesives were started to use<sup>1</sup>. The working models with brackets were heated to 250-300 °F for approximately 15 to 20 minutes to cure the resin. But, in this procedure, brackets were drifting from ideal places and these high temperatures were not appropriate for some materials such as ceramic esthetic brackets<sup>3</sup>.

Fried and Newman discussed the use of a no-mix adhesive in indirect bonding in 1983.

In 1990, Read and O'Brien used a visible light-cured adhesive in indirect bonding on foil mesh-based brackets. Hamula discussed the advantages of using light-cured adhesives for indirect bonding in 1991. He listed several advantages including unlimited working time during bracket placement, less bracket drift on the working models, and less patient discomfort because of the acceleration of bracket bonding. After the introduction of Adhesive Precoated Brackets, Cooper and coworkers described the use of these precoated brackets in indirect bonding and

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listed the benefits such as consistency of coating, ease of cleanup, and elimination of waste.

In 2002, flowable composite was incorporated into indirect bonding by Miles. Thus, this material reduced void risks under bracket base, and good handling of composite was achieved<sup>2</sup>.

**The advantages of indirect bonding:**

1. Accurate bracket placement.
2. Reducing chair-side time
3. Elimination of the need for separators and bands<sup>4</sup>.
4. Improved ability to bond posterior teeth
5. Mandatory mode of placement, especially in lingual cases<sup>2</sup>.

Thomas observed that indirect bonding takes less chair time and is more accurate because, “it stands to reason when you are holding teeth in your hand, looking at them from every angle, from posterior, occlusal, buccal, lingual, etc., you can place the bracket more precisely than doing it in a direct manner.”

**The disadvantages of indirect bonding**

1. Technique sensitive
2. Additional set of impressions needed
3. Posterior attachments has chance to brake if patient chews ice, etc.
4. Needs more laboratory time and educated staffs for laboratory steps
5. Most of the resins used in market designed for direct bonding; therefore, there is almost no appropriate resins directly designed for indirect bonding.
6. The indirect bonding onto short clinical crowns and extremely rotated teeth are difficult

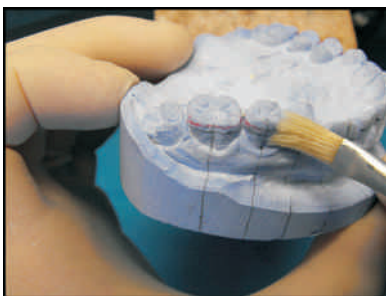
**Indirect bonding steps:**

There are many kinds of indirect bonding technique. The differences between all kinds of indirect bondings are basically related with adhesives used for bonding onto working models, transfer trays, and adhesives used for bonding to enamel.

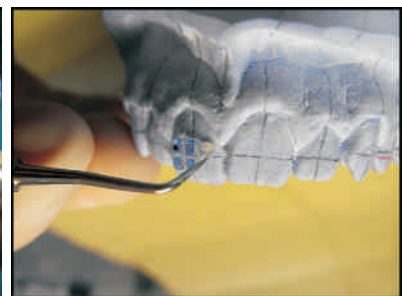
The laboratory steps of conventional indirect bonding technique.



Vertical and horizontal lines are drawn on the teeth of the working model



Separating medium is applied on the working model



Bracket is positioned on the model



Transfer tray is fabricated



Etchant is applied on the teeth



Primer is applied on the teeth



Transfer tray is fabricated



Etchant is applied on the teeth



Primer is applied on the teeth

1. Prophylaxis the facial surfaces of the teeth with a rubber cup and pumice.
2. Take alginate impressions with either perforated or rim-lock metal trays and pour the impressions immediately in a hard stone.
4. After set, separate the casts from the impression trays.
6. The long axis and the mesiodistal center points of the teeth as well as the preferred inciso-gingival positions of the bracket slots to be bonded should be marked with a pencil
7. Apply 1 or 2 coats of liquid separating medium to the facial surfaces of the teeth on the cast and it is allowed to dry.
8. The resin is placed on the pad of each bracket.
9. Place the brackets on each of the cast teeth with firm pressure and position them according to the pencil marks
10. The orthodontist should check bracket positions, occlusal interferences and if there is any excess adhesive around the bracket and molar attachments.
11. The composite is now ready to cure.
13. The transfer tray is fabricated for transferring the brackets to the teeth.
14. Soak the models with trays in warm water allow the release of the tray from the model.
14. The rough and irregular sides of the transfer trays should be trimmed and corrected. Bracket bases are micro etched with aluminum oxide particles.
15. The transfer tray and teeth should be clean and dry before bonding.
16. Etching gel is applied on the teeth. The teeth should be rinsed with water and air dried to ensure complete desiccation.
17. Apply the resins to the bracket bases and/ or teeth
18. The transfer trays should be seated over the teeth with equal pressure to the occlusal, labial, and buccal surfaces to ensure full contact between teeth and brackets. The bonding should be performed by appropriate curing type (chemically or lightly).

19. After bonding, the transfer trays should be removed with fingers and scaler.

20. Excessive resins can be removed with scaler or tungsten-carbide bur. The contact surfaces of the teeth should be checked with a dental floss.

**Difference between various indirect bonding techniques from conventional technique:**

**The sondhi technique:** In this technique, the researchers developed a resin designed for indirect bonding. The viscosity of the new resins was increased with a fine particle fumed silica filler (approximately 5%), so, it had an ability of filling any voids. Further, the resin had a quick set time of 30 seconds, which significantly decreases the time needed to hold the bonding tray. According to them, APC (3M/Unitek) Adhesive coated brackets or noncoated brackets with Transbond XT Light Cure Adhesive was the material of choice. For the transfer trays, they used biostat unit. It consisted of 1 mm thick layer of Bioplast overlaid with a 1 mm thick layer of Biocryl. The bonding tray's hard outer shell was trimmed away from all heights of contour for patient comfort and fitted closely because it only permits firm seating and rigidity to the soft tray. If a Biostar unit is not available, they recommended a bonding tray made with a suitable silicone transfer material. Indirect bonding Resin A is painted onto the tooth surface with a brush, and Resin B is painted on the resin pads in the indirect bonding tray<sup>5</sup>.

**The Vashi technique:** The researchers modified the transfer trays in this technique. The impression compound which is a thermoplastic material was used with thermoplastic glue to prepare transfer trays. Impression compound was warmed with a flame torch and placed onto the occlusal and lingual surfaces of the teeth of the working models. After that, the brackets were placed and the glue was flowed from glue gun, adhered to the impression compound, and covered the brackets on all sides. Care was taken so that the glue flowed only partly under the gingival and occlusal wings of the brackets. If it flowed fully then it might be difficult to remove the tray after bonding in the mouth. The glue cooled



Adhesive coated bracket are placed on the teeth



Transfer tray is fabricated on the biostar unit



Transfer tray is fabricated with polyvinyl siloxane



Glue gun



Impression compound



Marking made on the model for bracket positions and impression compound is placed



Glue is flowed on the teeth and removal of the transfer tray



Transfer tray made with impression compound and glue

down for about 5 minutes. After that the tray was taken out with a probe or a hand scaler.

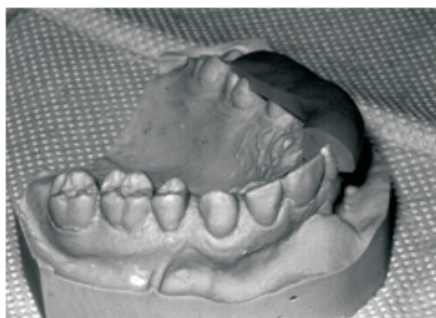
Transfer tray for a single tooth and for a group of teeth can be fabricated in this technique. Tubes can be bonded precisely onto the second molars with these trays when second molars erupt after starting orthodontic treatment or if they have not been bonded earlier. Partial impressions can be made of these teeth without removing arch wires<sup>6</sup>.

**An Indirect Bonding Technique for Precision and Efficiency by Guenther and Larson:**

The researchers proposed two type of composites i.e thermally cured adhesive or APC (adhesive pre-coated) system. Two part vinylpolysiloxane putty material was used as transfer tray material. The tray was about 5 mm thick. This

thickness provided enough support and rigidity. The trays were separately prepared into segments for the 4 quadrant of the jaws. Success with the technique requires attention to detail, but it does not require excessive complexity<sup>7</sup>.

Prescription-based precision full arch indirect bonding: The reference for bracket placement in the anterior region in this technique is the incisal edge. The researchers cared firstly about vertical and horizontal lines on the working models. They offered the smallest diameter pencils ( 0.03 mm black lead pencil, and a 0.05 mm red pencil) for drawing lines. They draw vertical long axis lines and horizontal lines connecting the mesial and distal marginal ridges on the molars and bicuspid on working models. With a bow divider, they measured the slot line (it is usually 4.5 mm) on the first bicuspid and it was same



Completed tray on the model



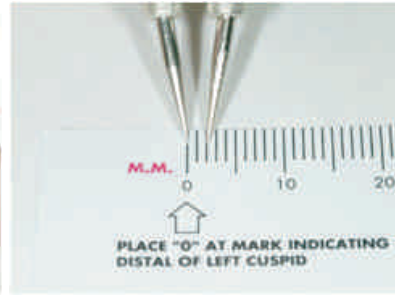
Both trays on the model show material trimmed away from midline to enable easier evaluation of seating of the trays.



Vertical lines are drawn on the teeth of the model



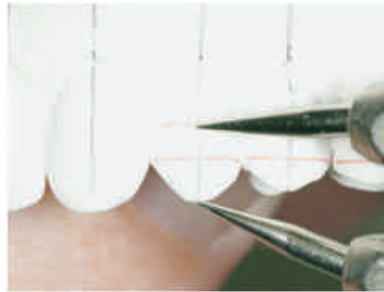
Horizontal lines are drawn on the teeth of the model



Bow divider is used to measure the slot line



The measurement is placed on the Premolar



Slot line of canine is measured



Slot line of central incisor is measured Premolar

as the upper central incisors slot lines. For the lateral incisors, the measurement was decreased by 0.5 mm and it was same as central incisors for the upper canines. For the lower arch, the slot line on the first bicuspid determined the mandibular central and laterals incisors' slot lines. For the lower canines, this measurement was increased by 0.5 mm. By placing these lines on the working models, a truly customized prescription was created<sup>8</sup>.

**A modified technique for improved efficiency and precision:** In this technique, a bracket placement marker gauge was used to determine the slot height of incisors and canines on the models. According to the researcher, reference tables can be used to determine bracket height of anterior teeth. Canine bracket was placed at the same height as the first premolar and for lateral incisors, 1 mm was subtracted. For central incisors, 0.5 mm was added to lateral incisors height<sup>9</sup>.

**Computer-aided indirect bonding:** There are different indirect bonding techniques which utilize high technology computer-driven systems. One of these systems, SureSmile® system is based on intraoral scanner that captures in vivo images of the dentition. The 3D digital diagnostic setups are obtained. Therefore, bracket positions are established, archwire geometry is configured, and custom indirect bonding transfer trays are constructed<sup>1</sup>. In another system, OrthoCAD iQ, a system designed to select bracket positions digitally and then reproduce those positions intraorally using an indirect bonding technique. Based on the orthodontist's treatment plan, OrthoCAD produces a virtual diagnostic set-up with the teeth positioned in an ideal alignment. Bracket positions are then selected using these simulated post-treatment models. OrthoCAD iQ then uses a pensized "wand," consisting of a tip, a miniature video camera, and eight LEDs, to transfer the brackets to the targeted tooth location on the plaster models. By accurately



Vertical and horizontal lines are Drawn



Bracket position is measured with a measuring gauge

and reliably directing the brackets to their specified locations, OrthoCAD claims to reduce the frequency and number of wire bending and repositioning appointments, thus improving practice efficiency<sup>10</sup>.

### **Indirect bonding in lingual orthodontics**

In lingual orthodontics, the indirect bonding is preferred because;

The variations on the lingual tooth structures complicate to fabricate a standard and suitable bracket

To obtain an ideal view for bonding is very compelling

If there is a mistake on bracket positions, it is also difficult to bend the arch wire for correction.

The clinicians are not familiar to the lingual tooth morphologies.

### **CONCLUSION**

The indirect bonding technique is a better method when it comes to precision in placing brackets. In a meeting about indirect bonding, the researchers were questioned about indirect bonding. Thomas stated that indirect bonding takes less clinical time (chair time) and is more accurate, he also reported 98% success rate. In the same discussion, Zachrisson confirmed that it is better to position brackets on models. With any new development, there will be some trepidation. There is a natural fear of unknown. In indirect bonding, there were doubts about bond failures. However, 25 years of relaxed results have showed that it is suitable to pass to indirect bonding.

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