Indirect Bonding In Orthodontics- A Review

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Abstract
The difference between different techniques of indirect bonding is basically related to the adhesive which is used for bonding on the working models, transfer trays, and enamel surfaces. Indirect bonding technique is applicable for both labial and lingual surfaces. Many kinds of indirect bonding adhesives and techniques are present which increase the patient comfort, decrease operators chair side time and provide accuracy of bracket placement. The disadvantages are complex laboratory steps, cost and no appropriate resin directly designed for indirect-bonding. For indirect bonding there were questions about bond strength but studies have shown that there is no significant difference between direct and indirect bonding technique on bond strength. The purpose of this article is to review the different techniques of indirect bonding and how beneficial each technique can be.

Keywords
Adhesive; Bond; Indirect Bonding; Tray

Introduction
Indirect Bonding is technique in which orthodontic brackets and other attachments are transferred from dental casts (working models) and placed on to the dentition using a transfer device [1]. Traditional bracket placement involves placing each bracket directly on to the tooth by operator. Accurate direct bracket placement is very difficult for an Orthodontist. Indirect bonding has been an exciting advancement in orthodontics. It beholds great comfort to the patient and operators because it provides the accuracy of bracket placement and reduces chair side time [2]. Silverman and Cohen [3] in 1972 introduced the first indirect bonding. They used methyl-methacrylate adhesive to attach plastic brackets to model cast in the laboratory. In 1979 Thomas introduced a simple and efficient way of bonding the bracket indirectly.

Indirectly bonded brackets have been shown to have better bond strengths and lesser bond failure rates as compared to those of directly bonded brackets. Indirect bonding technique is been predicted for many years. Guenthner has used this technique for 25 years while Larson has used it for 15 years, and over these years the technique has gradually improved. This is due to recent advances in bonding materials techniques [4].

Indirect Bonding Technique - Labial Technique
Labial Indirect bonding technique steps-
1. Laboratory Method
2. Clinical Method

Laboratory Method
The indirect bonding technique starts by taking impressions of the dentition. These impressions are used to make a working model of the patient. The brackets are secured to the working stone model with hydrophilic glue.
Wax is used to block and prevent adapting light tray in to the bracket part. The light tray is placed over the brackets and then on the patient cast from facial to lingual side. Excess tray material is trimmed with a wax knife. The tray is light cured and the working model is soaked with the custom tray in water for minimum of one hour to dissolve hydrophilic glue from the bracket base and for the release of the custom tray from the model (Figure 1).

**Figure 1**: Indirect Bonding Technique Tray Fabrication

![Figure 1](image1)

**Clinical Method**

Bonding agent and light cure material is applied on the brackets base in the special transfer tray. After etching the teeth the bonding agent is applied. A dry field is maintained and then the tray is placed in the mouth and the adhesive part of the tray is adapted on to the teeth with help of the fingers. Light curing of each bracket is done for 20 seconds. The tray is removed and each bracket is cured again for 20 seconds. Any excess adhesive from the teeth surface is removed (Figure 2) [5].

**Figure 2**: Indirect Bonding of Transfer Tray

![Figure 2](image2)
Various Indirect Bonding Techniques

Thomas Technique[6]

B.G. Thomas developed a method of bonding brackets which is based upon the tray holding the brackets and positioning them by relating the tray to the occlusal surface of teeth. It is similar to the technique developed by Silverman and Cohen.

Silicone Tray Technique [7]

Stone models are made and brackets for each tooth are selected. A small portion of hydrophilic adhesive is applied on each base and tooth. The brackets are then positioned on the model. For fabrication of the silicone tray the material is mixed and made into putty form and then placed onto the brackets to form a tray allowing for sufficient thickness and strength. After silicone has set, the whole working stone model & tray are immersed in hot water to release the brackets from stone. The tray is then trimmed and midlines are marked. The patients teeth are prepared as for direct bonding. The adhesive is mixed and loaded in a syringe. After applying a sufficient portion to bonding bases the tray is placed on prepared arch and held firmly with steady pressure for about 3 minutes. The tray is removed after 10 minutes. The tray may be cut transversely or longitudinally to decrease the risk of bracket debonding when being peeled off. The bonding is complete after careful removal of excessive flash is done.

Moin & Dogon Technique [8]

Impressions are made by polyether material and the casts are poured in stone.

A drop of sticky wax is placed on to the tooth surfaces of the cast where the brackets are to be placed. The tray is separated from cast but brackets remain inside. Brackets are removed from the cast and are heated to remove remaining wax material. They are then placed into the impression. Teeth are prepared, etched and isolated. Enamel layer is sealed with mixture of universal catalyst and sealant. Bracket base is covered with the adhesive material and tray is adapted. In this technique wax has been used for sticking materials to working model. It has following advantages:

- Easy to correct and readily be made until optimum bracket positioning is achieved.

- Sticky wax is easy to remove for the bracket base.

Sondhi’s Method [9]

In this technique, the researchers have taken an effort to develop a resin designed for indirect bonding. It commercially available as “Sondhi’s Indirect Bonding Kit”. An effective indirect bonding procedure has been developed after many attempts and experiments. The viscosity of the new resin was increased which lead to the complete filling any voids. They used a separate resin material for the tooth surface and for the bracket base. For the transfer trays, they used two different layer, first inner layer (Bioplast) is softer than the outer layer (Biocryl). The outer layer provides rigidity to the tray (Figure 3).

Figure 3: Sondhi’s Indirect Bonding Kit

Vashi Method [10]

In this technique, combination of thermoplastic glue and impression compound was used to prepare special transfer trays. Impression compound is a thermoplastic material which also is used in prosthodontics. Glue includes copolymer ethylene-vinyl acetate, which is, non-cariogenic, non-toxic. To make special transfer tray, impression compound is warmed with a flame torch and seated onto the occlusal and lingual surfaces of the teeth of the working models after which the brackets are seated onto the working stone models. The glue is flowed from glue gun and it adheres to the impression compound, and covers the brackets on all sides.

Indirect Bonding with a Thermal Cured Composite [11]

The use of thermally cured composite material has the advantage of increase unlimited working time. Therefore placement of the bracket can be performed in proper stress-free environment and can increase accuracy along with precise positioning or seating of brackets. Working stone models with the brackets are placed in oven for curing at 325°F for 15 minutes. For the special transfer trays, the poly-vinyl siloxane impression material
is applied over the thermally cured brackets. Vacuum form thermoplastic material is used over the working cast, brackets, and impression material complex.

**Thermal-Cured, Fluoride-Releasing Indirect Bonding System[12]**

In this technique the casts are heated with the brackets by placing it in a countertop toaster-oven with a set temperature of 325°F, for 20 minutes. This method will cure the composite resin material. The model is removed from the oven and allowed to cool. Special transfer tray is made from silicone impression material or a vacuum-formed plastic sheet. The silicone material, is preferred as it can be manipulated to encapsulate the brackets and make an impression of model. This helps all the brackets to be bonded simultaneously in their proper positions.

**A Indirect Bonding Technique for Precision and Efficiency by Guenthner and Larson[13]**

In this technique two type of composites are used for bonding brackets onto the working stone models; thermally cured adhesive and adhesive pre-coated system. In this technique there is a different transfer tray fabrication method. They use a two part vinyl-poly-siloxane putty material that is mixed manually. Once the material is mixed, it becomes very fluid and it flows easily to capture the undercuts of the brackets. This holds the brackets securely in the trays. The tray should have minimum thickness of about 5 mm. This thickness of the tray provides enough support and rigidity. The trays are divided into segments for the four quadrant of the jaws and trimmed away from each other in the midline.

**Indirect Bonding with Light Cure Adhesive Material and a Hybrid Transfer Tray [14]**

Indirect bonding has evolved concurrently with the improvement in dental materials. Light-cured adhesive allows additional time for tray placement, and adequate bond strength that allows for proper tray removal and immediate arch wire placement. Flowable restorative composite resin has proven to be an ideal adhesive for indirect bonding. The tray system combines clear vinyl poly-siloxane to capture the brackets and thin thermoplastic outer tray. The primary advantage of this technique is that it reduces the laboratory time.

**Indirect Bonding Technique in Lingual Orthodontics**

In lingual orthodontics, the indirect bonding technique is preferred. The difference in morphology on the lingual tooth structures complicates the fabrication of a standard and suitable bracket. To obtain an ideal view for bonding is very important, if there is a mistake in bracket positioning, it is also difficult to bend the arch wire for correction of malocclusion. The clinicians are not well versed to the lingual tooth structures. There are several indirect bonding method for lingual orthodontics. With the recently designed Orapix system. It is a the three dimensional construction system established to achieve very accurate bracket positioning on the special transfer trays. In the Incognito system, working stone models are created on the computers. The brackets and wires are fabricated, designed, and customized using CAD-CAM programs. Therefore, there is decrease in risk of bond failure as each bracket is custom made for each individual tooth. In this system the finishing can be done easily and there is good patient adaptation especially when speaking. [15]

**Recent Advances in Indirect Bonding Techniques**

**Labial /Buccal Indirect Bonding- A New Manual Method [16]**

This new technique uses the Torque and Angulation Device (TAD) and the Bracket Positioning Device (BPD) technology for improved accuracy. The difference with the other techniques is that precision equipments are used to determine accurately the position of the slot with relation to the tooth. Using direct bonding or indirect bonding via “eye and hand” lab techniques, we cannot be sure that the bracket we have placed will be delivering the required slot values stated on the given system. Using the TAD and BPD these errors can be eliminated and the brackets can be placed at the highest accuracy levels for best results.

**Gum and Gun: A New Indirect Bonding Technique[17]**

A method which is more simplified and routinely employed in orthodontics is the application of erkogum (transparent blocking wax) as an adhesive and glue gun material as transfer tray to obtain a precise indirect bonding (Figure 4).

**Advantages of Indirect Bonding**

- Permits more accurate placement of brackets.
- Decreases chair time of appliance placement.
- Less patient discomfort, since bonding time is reduced.
Disadvantages of Indirect Bonding

• Teeth with crowns, large buccal restorations or acrylic restorations will not bond.

• Cost of the inventory is high.

• Sometimes difficult to bond on very short clinical crowns.

• It is very technique sensitive and all procedures must be followed closely.

How to Avoid Lab Problems in Bracket Tray Preparation

• Work on dry models. (very important)

• Keep models small. Avoid sharp points of stone when model is to be used in vacuum former.

• Use diluted modern foil. Undiluted will inhibit adequate attachment to the stone allowing brackets to be displaced during vacuum forming.

• No build up of separator should be evident after it dries on model if the model has been painted, it will feel slick to a moistened finger.

• Trim bracket bases that are too large with a stone. Keep bases short of gingival.

• If the bonding material starts to reach its initial set prior to its final positioning of bracket, remove and start over. It will not adhere to the model.

• Allow the bonding material to set at least ten minutes before forming tray.

• Make sure bracket wings and band side slots are kept clear of bonding material.

• Good adaptation of bases to tooth contours is essential.

Figure 4: Gum and Gun Technique
• Extent tray labially and buccally only enough to cover brackets after material is heated and it sags. Otherwise it will be forced into the undercuts and be difficult to remove from the models.

• The tray material must be thick enough to grip teeth contours firmly. This can be ensured if the tray material is not overheated and the rubber dam is not too tightly stretched over the vacuum former. Adequate tightness of rubber dam is achieved by only stretching it until wrinkles are removed then tightening the remaining clamp.

• Soak models in water before tray removal until models are saturated.

• Spray the material and vacuum former rubber dam with silicon lubricant. Do not contaminate the inside of the tray (bracket backs) with the silicon lubricant or bonding will not occur.

• Clean tray and model in warm water to rid both of the separators using a soft toothbrush. Do not use hot water or tray distortion will occur.

• Do not contaminate tray with soap or other agent that might inhibit chemical reaction with the sealant.

How to Avoid Clinical Problem in Indirect Bonding Techniques

• Avoid and contamination of the tooth surface after tooth conditioning (etching) has been achieved. Teeth must be dry and free of contamination.

• Brackets inside of the tray must be lightly abraded and clean before they are painted with the catalyst liquid.

• Place the appliances into the mouth within; at most, two weeks after the impression have been made. (preferably one week) Extractions should be delayed until brackets have been placed; to ensure best bonding result and avoid errors caused by minor tooth movements; or brackets should be placed within one week following extraction.

• Restorative work should not be done following the impressions until after bracket placement, or the tray likely will not fit.

• The impressions must be accurate and of clean teeth. Be sure and fill all holes in the model prior to tray formation.

• Hyper fluorosis and tetracycline stained teeth will require more conditioning time (up to two minutes).

• The surface of the teeth should have a chalky appearance before attempting to bond. If an area still appears “shiny”, recondition!

• Be sure and use the proper liquid in the proper place, universal on the teeth and catalyst on the bracket tray.

• The teeth must be absolutely clean prior to the conditioning process. Use a medium or coarse grit pumice and water only. Do not use prepared prophy paste.

• When painting the teeth with the universal liquid, start at the most distal tooth to be bonded on one side, then the other side and work forward. This will place a coat of raisin over those teeth most likely to be contaminated with saliva first.

• Don’t take shortcuts unless your intentions are for experimentation. Bonding is a precise technique.

Conclusion

Indirect bonding is an advancement in orthodontics over the last few years. Once orthodontic treatment has been planned the brackets need to be placed accurately on the teeth for best possible results. This should be done before any orthodontic arch wire is selected and placed. The accurate placement of brackets is the foundation on which all subsequent orthodontic treatment is undertaken. Therefore, keys to efficient clinical treatment of the cases, whether routine or complex, is accurate bracket placement.

Reference


