Kalange (1999) described a bracket position guide in indirect bonding with reference to the posterior teeth. In his technique, horizontal lines were drawn on the model in molars and premolars connecting the mesial and distal marginal ridges (marginal ridge line). Next, a second line (slot line) parallel to and 2 mm below the marginal ridge line was marked. On the second molar, the measurement was decreased by 0.5 mm. In some cases, where the teeth were large, we could increase the measurement by 0.5 to 1 mm and would place the brackets slightly away from the occlusion. The distance from the cusp tip on the first premolar to the slot line was then measured and transferred to the incisors. The level of the maxillary lateral incisors needed to be decreased by 0.5 mm and the canines should be increased by 0.5 mm. When brackets were placed along this slot line, the marginal ridges of the posterior teeth and the anterior teeth would align on a plane with the same level.

Although the above-mentioned method of bracket placement could minimise the need of finishing when a pre-adjusted appliance was used, none of them could complete the orthodontic treatment ideally by a piece of straight wire. Even sophisticated devices were developed to help the accuracy of bracket placement in indirect bonding, like the Ray Set (Melsen and Biaggini, 2002) or Slot Machine (Creekmore, 1996). It still could not eliminated the finishing wire bending since the manufactured brackets were standardised. It did not take the individual morphologic variation of the teeth into consideration. Miethke and Melsen (1999) studied the influence of vertical bracket displacement on 1st and 3rd order corrections of 28 cases using stone models. They found that inter-tooth variation was extreme, and concluded that the intra-individual variation in tooth morphology was larger than the variation between the different types of preadjusted appliances. Thus, if the straight wire approach should be followed, the bracket would have to be custom made. To overcome the variations in tooth contour, size and shape, diagnostic setup of the malocclusion model into an ideal occlusion was used to customise the bracket position (Takeshita et al., 1983; Hoffman, 1988; Kyung, 1989; Hong and Soh, 1996).

Transfer tray construction

Thermoplastic material is the most commonly used in forming the indirect bonding tray. Newman (1974) used 1½ to 2½ inches thick polyethylene plastic placing over the working model and then softening it with a Bunsen burner flame. The softened plastic was then closely adapted around the working model using moist tissue paper with finger pressure to embed the brackets and form the transfer tray. Similar to this, softened polymer of ethylene vinyl acetate by hot glue gun was used to form the transfer tray (White, 1999; White, 2001; Kothari, 2006).

Vacuum forming machine was widely described to construct the transfer tray as it could make the manufacturing process easier and faster. It was used as early as 70's and still the most commonly used method for transfer tray construction in indirect bonding (Gottlieb et al., 1974; Moshiri and Hayward, 1979; Thomas, 1979; Fried and Newman, 1983; Gerkhardt and Schopf, 1987; Collins, 2000; Rajagopal et al., 2004). A two-layer vacuum-formed transfer tray construction was used by several authors (Cooper and Sorenson, 1993; Hickham, 1993; Sondhi, 1999; Sondhi, 2001; Sondhi, 2007). It had a softer material vacuum-formed over the brackets and the model first, followed by a harder material over it. The outer layer of the tray provided rigidity, and the inner layer offered flexibility to permit easy removal of the tray.
Silicone impression was also used widely in transfer tray construction. Many authors described the fabrication of transfer tray by silicone putty, as it provided enough rigidity during tray seating and some flexibility to allow tray removal (Simmons, 1978; Scholz, 1983; Aguirre, 1984; Sinha et al., 1995; Kalange, 1999; Sondhi, 2001; Guenthner and Larson, 2007; Kalange, 2007; Sondhi, 2007). A clear silicone impression material (Memosil 2) was used to construct a transparent transfer tray for a light-cure adhesive (Read and Pearson, 1998; McCrostie, 2003). Higgins (2007) described as a double silicone transfer tray construction, whereas soft silicone was injected onto the brackets followed by immediate injection of hard silicone on top. A mixture of silicone impression material and vacuum forming transfer tray was also used (Moskowitz et al., 1996; Higgins, 2007; Moskowitz, 2007). They first applied a soft silicone impression material over the brackets and the occlusal surface of the model. After setting, a more rigid vacuum form plastic was formed over it. This transfer tray had a hard outer shell for rigidity and soft lining for flexibility. Similar to this, Matsuno and co-workers (2003) described an individual transfer tray called "Hybrid Core". It was made by a soft silicone inner layer and hard acrylic resin outer layer.

Hoffman (1988) described a technique that used an individual transfer tray made by rectangular wire and inlay pattern resin. L-shaped full-size rectangular wires were tied onto the brackets, which were placed on a diagnostic setup model with an ideal occlusion. Small pieces of Duralay resin were then placed over the occlusal surfaces of the teeth individually and embedded the occlusal portion of the transfer wires to make the transfer index. Brackets with the transfer index were removed from the setup model and put back on the malocclusion model. The bonding tray was now made by joining the transfer indexes with semi-rigid silicone impression material (Xantopren Blue and Optosil). A similar transfer tray design was described by Reichheld and co-workers (1990), also by Kasrovi and co-workers (1997). They used brackets with preformed, friction-gripped height gauges