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The Burton Approach to Indirect Bonding

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Abstract. *There has been a resurgence of interest in the indirect bonding technique for orthodontics. The procedure is not often used in the UK and the reasons for this, as well as the renewal of interest, are explored. A costing exercise suggests that the cost-effectiveness of the technique may be improved by the described Burton technique and, in the light of current manpower considerations, the implications for its use in the future are also discussed.*

Index words: Cost-effectiveness, Indirect bonding, Manpower, Orthodontics.

Introduction

In order to gain maximum benefit from a pre-adjusted fixed appliance system (Andrews, 1979) it is mandatory to position every bracket correctly. Bracket placement may be carried out either directly or indirectly.

Direct bonding to teeth *in vivo* has been the preferred technique for most UK orthodontists since the advent of the acid etch bonding technique (Reynolds and Fraunhofer, 1976). The popularity of the technique may stem partly from its relative simplicity. Before the introduction of light-cured composites, a major disadvantage of the direct technique was the short working time before the chemically-cured resin set, which allowed little opportunity for accurate bracket location. However, since the advent of light-cured adhesive systems the only major disadvantage of the direct technique is the increased chair-side time required to carry out a full bond-up in this manner.

Indirect bonding (IDB) requires that brackets are positioned on dental casts in the laboratory prior to being attached to the patient's teeth (Silverman and Cohen, 1972). The clinician then transfers the brackets to the teeth using a transportation device. It has been suggested that this technique may allow more precise bracket location (Hickman, 1993) due to the improved access and time availability in the laboratory. Unfortunately, research has not always supported such claims. For example, Aguirre *et al.* (1982) found that the technique improved vertical placement of brackets on maxillary canines, and the angulation of maxillary and mandibular canine brackets, whereas Koo *et al.* (1999) noted improvements only in the vertical plane and then only on certain teeth.

Whilst the indirect technique allows the operator to reduce clinical chair-side time at the bond-up visit, this saving is offset by extra laboratory time and the cost of additional materials. It has also been suggested that removal of cement is more difficult and time consuming following an indirect bond-up (Zachrisson and Brobakken, 1978).

It is, perhaps, not surprising then that the largely unproven 'benefits' of indirect bonding have so far failed to impress and motivate UK orthodontists into adopting the technique. However, there has been a recent resurgence of interest in the indirect technique, particularly in the USA, due largely to technological improvements, which include:

1. The availability of transfer trays made from transparent material (Read and O'Brien, 1990; Read and Pearson, 1998) that allow the use of light-cured composite resins, rather than the self-cure composites, which have been found to be particularly difficult to remove from around the brackets after setting (Kasrovi *et al.*, 1997).
2. The use of bracket placement jigs, in place of a transfer tray, linked via a cold cured acrylic splint moulded into the occlusal rests of the bracket height jigs (Reichheld *et al.*, 1990).
3. A 'dual-tray' transfer system with chemically-cured composite (Hickman, 1993).
4. The development of adhesive pre-coated brackets (APC; Cooper and Sorenson, 1993; Kalange, 1999; Sondhi, 1999).
5. The use of a thermally-cured, fluoride-releasing indirect bonding system (Sinha *et al.*, 1995).
6. The use of a thermally-cured adhesive system with APC brackets (Moskowitz *et al.*, 1996).
7. The use of a dual-temperature hot-glue gun to form the matrix of the transfer tray for use with an indirect technique using chemically-cured composite (White, 1999).

Aims and objectives

The aim of this paper is to evaluate the cost-effectiveness of indirect bonding and to describe a possible technique.

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Materials and methods

At Queens Hospital, Burton-on-Trent, UK, the indirect bonding technique has been used for the past 10 years. Figure 1 outlines the procedure that found to be most effective and currently recommended.

In order to evaluate the cost-effectiveness of indirect bonding the costs associated with the Burton method were compared with estimates derived from other established laboratories. In addition, the costs associated with in-house indirect bonding were also investigated by obtaining estimates for the equipment and materials involved.

Results

Costings (obtained in December 2000) are presented in Table 1.

1. Impressions are taken for study models poured in stone.
2. Appropriate pre-adjusted edgewise brackets are selected for each tooth.
3. A small amount of 3M Unitek™ laboratory adhesive is applied to each bracket base.
4. The brackets are carefully placed in their correct positions on the model by the clinician.
5. An appropriately sized blank of transparent tray material, such as Drufolen-W™ (distributed for Panadent Ltd), is selected, and draped over the dry models and brackets. Under a dry heat source the tray material is then adapted closely to the model using a vacuum-forming apparatus.
6. After cooling, the tray is trimmed with a hot instrument before being removed from the model, along with the brackets. The tray is then trimmed with scissors 1–2 mm away from the clinical crowns of the teeth and just over the lingual cusps, with vertical slits being introduced from the edge of the tray to the gingival wings of the brackets to allow for clean removal of the tray at the time of bracket placement. (Figure 2).
7. In the clinic, the teeth are then etched in preparation for bracket placement, and bonding agent applied.
8. Sufficient light-cured composite resin is now applied to the bases of the brackets in the tray.
9. The tray is then seated on the prepared arch and held firm with steady pressure. Curing is achieved with a standard light source held over each bracket in turn.
10. The tray is removed and all excess adhesive flash is cleaned away.

FIG. 1 The Burton 'Ten-Point' Indirect Bonding Technique.

Discussion

A survey of specialist orthodontists has revealed that 90% of specialists in the UK do not use the indirect technique although over 40% would be willing to consider adopting the technique if it conferred advantages (T. M. Hodge and A. A. Dhopatkar, personal communication).

We have found the Burton technique clinically efficient and to have the following advantages:

1. Using a light-cured adhesive material confers the benefits of command setting, while allowing the transfer tray to be removed and the initial aligning wire to be fully ligated immediately after curing is complete.
2. The tray material is rigid, but thin and begins turning inside out as it is pulled away from the teeth, thus facilitating easy removal.
3. Vertical slits in the transfer tray (Figure 2) allow the splint to be easily removed in stages without bracket dislodgement.

It is a great advantage to have laboratory services available on site; however, the basic technique could be used in the practice setting by applying one of the following modifications:

1. An experienced technician positions the brackets on study models in the laboratory prior to sending the set up back to the practice.
2. By marking the study models the clinician indicates to the technician the precise bracket positions required. The models are then returned to the laboratory for tray construction. The markings also serve as a 'double check' when the trays are returned to the practice. Whilst this technique requires an extra step, the additional time spent by the clinician is minimal and has the benefit of allowing the orthodontist to maintain control over bracket positions.
3. Certain laboratories offer to position brackets with the aid of bracket placement guides. This technique is thought to be more accurate than visual location alone and eliminates the need for the clinician to indicate bracket positions.

FIG. 2 Removal of the transparent transfer tray at the time of bracket placement.

TABLE 1 *Sample costings*

Laboratory	Technique employed	Cost
Queens Hospital Laboratory, Burton-on-Trent	Brackets placed by experienced technician in positions marked by clinician on study models	£8·00* (13·19 EURO) per arch
Hot Wire Orthodontic Laboratory, East Grinstead, London	Brackets placed by experienced technician 'with or without' direction by clinician	£10·00* (16·48 EURO) per arch for silicone putty transfer tray (chemically-cured technique) £16·00* (26·37 EURO) per arch for clear trays (for use with light-cured technique)
Optident™ Laboratory, Ripon, Yorkshire	Brackets placed by technician using bracket placement guides	£85 (140 EURO) plus VAT for bond-up using Mini 2000 brackets (provided) £150 (247 EURO) plus VAT using Orthos brackets (provided) £300 (494 EURO) plus VAT using Inspire brackets (provided)
DRUFOMAT manufactured by Dentamid	In-house positioning of brackets and construction of transfer trays	£1800 (2,967 EURO)initial cost for purchase of vacuum forming apparatus Plus £1·00* (1·65) per bond-up for lab adhesive/tray blanks

*Not including brackets.

4. If vacuum-forming apparatus is available in the practice then the bracket placement and tray forming procedures can be carried out 'in-house'. This reduces overall laboratory costs in the long term, as well as limiting the associated postage costs or delays.

Cost-benefit

One of the disadvantages of the indirect technique (Table 1) is the additional cost involved in placing brackets. Although there are laboratory fabrication steps associated with indirect bonding, cost analysis suggests that the technique may be more financially viable than it appears.

Much of the recent literature on indirect bonding originates from America, where the technique is widely practised with APC brackets (Cooper and Sorenson, 1993; Kalange, 1999; Sondhi, 1999). The cost of these brackets is greater than non-coated brackets, for example, as of October 2000 3M Unitek™ MBT non-coated brackets cost £3·62 (5·97 EURO) each compared with £4·68 (7·71 EURO) for their pre-coated counterparts. Yet the technique itself can readily be used with standard non-coated brackets. Importantly, Sunna and Rock (1998) showed no significant differences between these two bracket types in terms of bond failure rates.

Laboratory costs are, of course, greater for the indirect technique. However, the savings associated with a reduction in clinical time offsets these costs. The authors estimate that use of the indirect technique can halve the clinical time required to carry out a fixed appliance bond up. This represents a considerable financial saving. If an average time for a full bond-up appointment were in the region of 40 minutes, then a practice using the Burton indirect technique would save approximately 20 minutes for an extra cost of £16 (26·37 EURO; Table 1). Prices are slightly greater in London, as expected (Hot Wire laboratory), but still competitive.

Further savings are possible if molars are routinely bonded, due to a reduction in size of the band inventory required and fewer appointments as a result of an elimination of the need for separation.

The most cost-efficient method of indirect bonding, however, after the initial outlay to buy the machine, may well be to have available the vacuum-forming apparatus used to prepare the trays. The orthodontist would, again, mark the models to indicate the desired bracket positions, and it should be possible to train one of the existing auxiliary members of staff in the practice (hygienist or nurse) to carry out the bracket placement, tray forming, and trimming procedures.

Implications for the Future

Currently in the UK there is a shortage of specialist orthodontists, which has been aggravated by the uneven geographic distribution of those practitioners that are available. One response to this problem has been for the General Dental Council to set up a 'Dental Auxiliaries Committee' to review the implementation of auxiliary personnel in orthodontics.

Included in the list of the clinical procedures recommended in the report of the 'Auxiliaries Review Group' (Report of the General Dental Council Dental Auxiliaries Report Group, 1998) was the placement of direct bonded attachments. Although Atack *et al*. (1999) found hygienists to be satisfactory at bracket placement, many specialists feel this stage of patient management, because of its importance to the final result, should stay within their overall control.

In this context, the indirect bonding technique represents a manageable and cost-effective technique by which the orthodontist could accurately supervise a large number of patients, whilst maintaining the high quality of service that they provide.

Conclusions

The majority of fixed appliance bond-ups in the UK are carried out using the direct bonding technique. Advances in material technology and orthodontic science, however, have meant that the indirect technique for bonding orthodontic brackets is more attractive than ever before. Using a

simple cost analysis it appears that there is a need for a thorough re-evaluation of the technique and its application in the modern orthodontic practice setting. Furthermore, in view of the current manpower situation and potential future political developments, the technique offers the orthodontic clinician a possible route to increased productivity, whilst ensuring that quality is not compromised.

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