Current Products and Practice

Orthodontic Banding Cements

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Introduction

Despite the advent of bonded attachments, preformed stainless steel bands are still routinely utilized in fixed appliance therapy. Banding offers superior reliability due to better resistance to occlusal interferences (Fricker, 1997). Band cements are necessary for band retention, either by assisting mechanical retention or by true adhesion. They also serve to seal a band to a tooth, filling the irregular gaps to prevent stagnation areas.

Zinc phosphate cement was widely used for band cementation for much of the last century. It has high compressive strength, but suffers from low tensile strength and high solubility, resulting in micro-leakage and demineralisation. Zinc polycarboxylate cements were introduced to orthodontics in the early 1970s and offered the advantage of chemical adherence to enamel. However, physical and handling properties were flawed, due to poor tensile bond strength, solubility, viscosity, and short working time. Both zinc phosphate and polycarboxylate cements have been superceded by new generations of adhesive cements, and are now largely obsolete as banding cements.

Glass Ionomer Cement

Glass ionomer cements (GICs; Table 1) were introduced by Wilson and Kent in 1972 as restorative materials, and subsequently became available as luting cements. The first generation of GICs consist of aluminosilicate glass powder and an alkenoate acid liquid, which undergo an acid base reaction when mixed. the second generation GICs incorporated the acid as a freeze-dried powder blended with the glass and are mixed with distilled water.

GICs offered considerable advantages in physical properties over previous banding cements. GICs capacity for adhesion to enamel and metal, combined with higher compressive and tensile strengths (Durning *et al*., 1994), provides superior clinical performance due to reduced band failure (Fricker and McLachlon, 1985, 1987; Mizrahi, 1988; Stirrups, 1991). Also there is better protection from microleakage since bond failure usually occurs at the cement band interface (Millet *et al*., 1998) and the solubility is low. Furthermore, GICs leach fluoride over prolonged periods, thus reducing the potential for demineralization.

There are, however, problems associated with the handling properties. Accurate dispensation of the liquid component is difficult, resulting in inaccurate powder:liquid/water ratios, and they are susceptible to moisture contamination during the setting reaction. These can both adversely affect the physical properties of the set material. Whilst the development of encapsulated cement has helped, these are more expensive than hand-mixed cements and wastage is likely.

Resin-modified Glass Ionomer Cement

Traditional GICs (Table 2) were modified by the incorporation of resin, and water-soluble initiators and activators, to produce dual cure hybrid cements. These set partly via an acid-base reaction and partly through a polymerisation reaction (Bourke *et al*., 1992). The advantages they offer are in improved handling characteristics, due to command setting, longer working time, and greater tolerance of moisture (Mennemeyer *et al*., 1999). The bond strength of modified GICs is reported as superior to traditional GICs (Mennemeyer *et al*., 1999), although no significant difference in failure rates was found in a clinical study (Fricker, 1997).

Acid-modified Composite Resin Cement

These compomer or composite cements (Table 3) are composed of ion-leachable glass in a polymeric matrix. They set by a light-cured resin reaction, not an acid-base reaction,

TABLE 1 *Glass ionomer band cements*

Cement	Supplier (manufacturer)	System	Kit/unit amount	Cost
Precedent™	Forestadent (Reliance)	Powder + liquid	100 g powder, 90 cm^3 liquid	£72·50
TP glass ionomer band cement	TP	Powder + liquid	50 g powder, 35 g liquid	£47·58, £7·55
Ideal Plus	T.O.C.	Powder + liquid	240 g powder, 120 ml liquid	£149·50
CX-Plus	Shofu	Powder + liquid	3 × 3 35 g powder, 3 × 17 ml liquid	£89·95
Ketac-Cem®	ESPE	Powder + liquid	3 × 33 g powder, 3 × 12 ml liquid	£71·50
Ketac-Cem®	ESPE	Capsules	50 capsules (260 mg each)	£58·50
Opuscem	Schottlander	Powder + water	30 g powder	£23·45
Intact	ORTHO-CARE	Powder + water	30 g powder 200 g powder	£18·16, £69
Glasscem	Hawley, Russell and Baker	Powder + water	30 g powder	£17·85
Watercem	T.O.C.	Powder + water	35 g powder	£24·75

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TABLE 2 *Resin modified glass ionomer band cements*

Cement	Supplier (manufacturer)	System	Type of cure	Kit/unit amount	Cost
Multi-cure band cement	3M Unitek	Powder + liquid	Dual	35 g powder, 25 g liquid	£84·62
GC Fuji ORTHO	GC Europe/Minerva	Powder + liquid	Self	40 g powder, 2 × 6·8 ml liquid	£128·60
GC Fuji ORTHO LC	GC Europe/Minerva	Powder] liquid	Light/dual	15 g powder, 6·8 ml liquid	£69·30
GC Fuji ORTHO LC Caps	GC Europe/Minerva	Capsules	Light/dual	50 capsules (mixed volume 0·1 ml)	£82·60

TABLE 3 *Acid-modified composite resin band cements*

Cement	Supplier (manufacturer)	System	Type of cure	Kit/unit amount	Cost
Band-Lok™	Forestadent (Reliance)	Two paste	Dual	4 × 6g of each paste	£67·98
Ultra Band-Lok™	Forestadent	Single paste	Light	6 × 5 g syringes	£63·44
	Hawley, Russell and Baker (Reliance)				£70·00
Python Band Tite™	TP	Single paste	Light	6 × 4 g syringes	£42·70
Transbond™ plus	3M Unitek	Single paste	Light	5 × 4 g syringes	£110
Secure™	ORTHO-CARE	Two paste	Dual	4 × 5 g of each paste	£76·70
Ideal™	T.O.C.	Two paste	Dual	48 g paste	£75·00

and rely upon water diffusion into the set polymer to allow fluoride release. The set material can take up and rerelease topical fluoride. These cements are produced both as dual paste systems, which are dual cure, and as single paste systems, which are light cured. Their handling characteristics are generally very good, with minimal mixing and command setting, but the material can be difficult to place in the bands.

These cements do not adhere chemically like GICs since they do not contain any polyacid, but the adhesion is, instead, a resin type (Fricker, 1997). Comparative laboratory investigations found that an acid-modified composite resin cement had significantly higher tensile strength and significantly lower probability of band failure than a traditional GIC (Mennemeyer *et al*., 1999; Millet *et al*., 1998). However, a clinical trial found no significant difference in failure rates between a traditional GIC, a resin-modified GIC and an acid-modified resin cement (Fricker, 1997). In contrast to GICs, these cements tend to fail at the cement/enamel interface, and there is consequently greater risk of stagnation areas, micro-leakage, and demineralization (Fricker, 1997).

Conclusions

There have been significant recent developments in banding cements and new materials are constantly appearing on the market. The properties of the cements currently in use have been compared and the latest product information available from UK suppliers is provided.

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