Teaching of posterior composites to dental therapists

Adapted from a *BDJ* article¹
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Introduction

In recent times, the practice of operative dentistry has been revolutionised by the development and increasing sophistication of resin composite materials and minimally invasive dental techniques. Until the late-1990s, the use of amalgam was seen as the best option for restoring posterior teeth following removal of dental caries. Some practitioners had started using composite for restoring posterior teeth at this time, but this technique was viewed with some scepticism and common problems encountered included restoration failure, caries and loss of retention. Dental students graduating from dental schools in Europe and North America at that time had very little experience at placing posterior composites.

However, over the past decade there has been a significant change in the uses, predictability and attitudes to posterior composites. Evidence from studies carried out in general dental practice indicates that where placed properly, a posterior composite restoration can last for at least as long as

a posterior amalgam restoration. This development has followed from an improved understanding and skill at placing posterior composites. Why should we be concerned about placing posterior composites rather than amalgam? Composite offers a number of important clinical advantages in comparison to amalgam:

- Cavity preparations for posterior composite restorations are minimally invasive. In contrast, amalgam requires a thickness of 2 mm to achieve sufficient strength, and requires the removal of tooth substance to create a mechanical retention (undercut). Composite does not have the same requirements. This is clinically significant in contemporary times when lesions of caries are often detected at a very early stage. Use of amalgam in a posterior tooth will require the sacrifice of healthy, caries-free tooth tissue to sacrifice the requirements of this material
- As amalgam does not bond to tooth tissue and involves undercutting of tooth substance, it weakens, rather than reinforces, a restored tooth, predisposing the restored tooth to fracture. In contrast the bonding of composite to the underlying tooth reinforces the tooth, reducing the risk of fracture
- Over time, should a posterior composite suffer from surface or marginal

deterioration or new caries, it is possible to remove some of the affected composite/composite adjacent to suspect tooth surface and to add new composite and repair and refurbish the restoration without removing it in its entirety. Such an approach is advantageous as it avoids needless loss of healthy tooth tissue that would occur during total restoration replacement, and also limits irritation to the pulp.

Considering these advantages of posterior composites in terms of avoiding unnecessary removal of tooth tissue and associated preservation of pulpal vitality, the use of posterior composites in preference to amalgam has a lot to offer patients.

Given the significant advantages of posterior composite techniques, the authors have observed the development of teaching of posterior composites over the past 20 years. Surveys of dental student training programmes demonstrate that the teaching of posterior composite restorations has increased almost two-fold during the past ten years - with the most recent survey of UK dental school programmes indicating that 55% of posterior restorations placed by dental students are of composite and 45% are amalgam. However, dental therapists have a significant role to play in delivering operative dental treatments to patients in the

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UK. Given the value and importance of the service offered by dental therapists to patients in the UK, we aimed to similarly examine the teaching of posterior composites in UK dental therapy training programmes.

The survey

An email invitation was sent to the 17 dental therapy training centres in the UK inviting them to participate in our study. Fourteen centres agreed to participate, to whom a questionnaire seeking information in relation to the teaching of direct posterior composites to dental therapy students in each centre

‘The bonding of composite to the underlying tooth reinforces the tooth, reducing the risk of fracture.’

was sent. Questions included in the survey included the amount of posterior composite teaching included in the dental therapy programme, the amount of clinical experience gained by student therapists, and the various clinical techniques taught.

The results

We received completed responses from ten of the 14 centres included in the study (response rate = 77%). These ten schools accounted for 66% of the annual graduating dental therapist workforce in the UK.

Teaching – permanent teeth

All ten centres taught the placement of preventive resin restorations and composite occlusal restorations in premolar and permanent molar teeth. Nine centres taught the placement of two and three surface occlusoproximal composite restorations in premolars and permanent molar teeth.

The respondent centres reported that the teaching of posterior composites in permanent teeth accounted for 34% of the preclinical course in operative dentistry (range = 20–60%), while the time devoted to the teaching of posterior amalgam restorations accounted for 39% of the preclinical course (range = 20–80%). It was anticipated over the next five years that the teaching of posterior composites will increase by approximately one-third to account for 45–50% of the preclinical course (range = 25–75%), while the teaching of posterior amalgams will decrease by a similar amount to account for 25–30% of the preclinical programme (range = 10–40%). Five of the ten centres reported that they taught amalgam placement prior to teaching posterior composite placement. The mean proportions of posterior restorations placed clinically in permanent teeth using amalgam and composites were 52% and 46% respectively (range: amalgam = 20–95%; composites = 5–70%). In five years’ time it is anticipated that the percentage of composite restorations placed clinically will increase from 46% to 50%, while the percentage of amalgam restorations placed clinically will decrease from 52% to approximately 40% (anticipated ranges: composites = 15–80%; amalgam 10–85%).

Teaching – deciduous teeth

All ten centres taught the placement of preventive resin restorations in deciduous molar teeth. Nine of the ten centres taught the placement of composite restorations in occlusal cavities in deciduous teeth, four schools taught composite placement in two-surface occlusoproximal cavities, and two

schools taught resin composite placement in three-surface occlusoproximal cavities in deciduous molars. Many schools commented that they rely heavily on the use of a range of materials and procedures for the restoration of deciduous molar teeth, in particular in multi-surface scenarios. The materials taught included, amalgam, glass-ionomer cements and resin modified glass-ionomer cements, together with stainless steel crown techniques.

Cavity preparation

In contrast to cavity preparations for posterior amalgam restorations, the design features taught for posterior composite restoration cavities included:

- Minimal cavity preparations, with no ‘extension for prevention’ – eight centres (80%)
- ‘Slot type’ cavities (ie no occlusal component) – seven centres (70%)
- Rounded internal line angles – six centres (60%)
- Beveled occlusal margins – four centres (40%)
- Beveled proximal box margins – three centres (30%).

Contraindications

The contraindications taught to the placement of posterior composites in permanent and deciduous teeth are summarised in Table 1. The most common contraindications to the placement of posterior composites were a history of allergy to resin-based composite materials (ten centres), poor oral hygiene (ten centres when placing occlusoproximal restorations) and poor patient cooperation (ten centres when placing occlusoproximal restorations).

Moisture control

All ten schools reported that they taught the placement of a rubber dam when placing posterior composites. However, other forms of moisture control were taught also, including cotton wool rolls (ten centres), the use of a dry guard (ten centres) and the use of gauze (two centres).

Bases and liners

Techniques taught for the protection of operatively exposed dentine, including the use of liners and bases under posterior composites are reported in Table 2. ‘Total-etch’ techniques were favoured for cavities involving the outer one-third of dentine only (nine centres). Such techniques were not included in any of the programmes for deeper cavities involving the middle or inner-third of dentine. In such situations the placement of glass-ionomer

cement with or without a calcium hydroxide lining was preferred.

Matrices and wedges

Five centres taught the use of a transparent (cellulose-acetate) matrix bands and light-transmitting plastic wedges when placing occlusoproximal restorations. The other five schools taught the use of circumferential and sectional metal matrices with either wooden or flexible plastic wedges.

Composites and bonding systems

Nine centres taught the use of hybrid composites for posterior composites. In

addition the teaching at two centres included the use of macrofilled and microfilled composites. The teaching at one centre included the use of a nanohybrid composite. The brands of composites most commonly taught were 'Spectrum TPH' (Dentsply DeTrey GmbH, Konstanz, Germany - six centres), 'Filtek Supreme' (3M ESPE, St Paul, MN, USA - four centres), and 'Z100' (3M ESPE, St Paul, MN, USA - two centres). The brands of bonding system most commonly taught were 'Prime & Bond NT' (Dentsply DeTrey GmbH, Konstanz, Germany) - six centres and 'Scotchbond' (3M ESPE, St Paul, MN, USA) - three centres.

Light curing

Five centres taught the use of quartz-tungsten halogen light curing units (QTH) for the photoactivation of composites. Three centres taught the use of light emitting diode (LED) light curing units. Two centres taught both QTH and LED light curing technologies. No centres taught the use of plasma arc based light curing units.

Techniques

In our studies of dental student programmes, we often find examples of techniques being taught which are not in keeping with current best evidence. We found some examples of

Table 1 Contraindications taught to the placement of posterior composites

Contraindications	Permanent teeth			Deciduous teeth		
	Occlusal cavities premolars	Occlusal cavities molars	Occl-prox cavities premolars	Occl-prox cavities molars	Occlusal cavities molars	Occl-prox cavities molars
	Number of training centres					
Inability to place rubber dam	2	2	5	5	2	2
Parafunctional activity	1	1	2	2	1	1
Pathological wear	0	1	0	1	1	1
Poor oral hygiene	5	5	10	10	3	5
Replacement of a large amalgam restoration	2	3	3	4	1	1
History of allergy to composite materials	10	10	10	10	9	9
Atypical diet	1	1	1	1	1	1
Large pulp	0	0	0	0	0	0
Proximity to the pulp	1	1	1	1	1	1
Denture abutment	0	0	1	1	0	0
Subgingival margins			9	9		5
Temporomandibular dysfunction	0	0	0	0	0	0
No valid aesthetic requirement	0	0	0	0	1	1
Endodontically treated tooth	2	2	3	4	2	2
Opposing composite restoration	0	0	0	0	0	0
Susceptibility to caries	6	6	6	6	6	6
Poor patient cooperation	8	9	9	10	8	9
History of postoperative pain with posterior composite restorations	4	4	4	4	2	2
Poor enamel quality	3	3	4	4	3	3
Buccolingual width of occlusal portion is <1/3 of the intercuspal width	0	0	0	0	0	0
Buccolingual width of occlusal portion is 1/2 of the intercuspal width	0	0	0	0	0	0
Buccolingual width of occlusal portion is >2/3 of the intercuspal width	2	2	3	3	0	0
Buccolingual width of proximal box > 1/2 intercuspal width	1	1	2	2	1	1

these in our present survey of dental therapy programmes and we bring these to the reader's attention with the aim of assisting them in the delivery of quality dental care. Such examples include:

Bevelling

Four centres indicated that their trainee therapists were taught bevelling of occlusal cavosurface margins and three centres were found to teach bevelling of the proximal box margins. Neither of these techniques are regarded as being appropriate. Bevelling of the occlusal cavosurface margin results in the incorporation of thin extensions of composite in the completed restoration which extends over the occlusal surfaces. These extensions of composite are at risk of fracture under occlusal loading. These extensions also create difficulties during replacement of the restoration, with difficulty in identifying where the restoration ends, with the risks of healthy tooth tissue removal. Also, bevelling of the proximal box margins results in the unnecessary loss of enamel that would have been very useful in creating a reliable bond. This is especially problematical along the gingival margin, where the loss of enamel caused by bevelling can result in the exposure of dentine and cementum, neither of which create reliable bonding and marginal seal.

Bonding or basing?

As noted in teaching programmes of dental students as well as trends in dental practice, there is often confusion in relation to the management of operatively exposed dentine and the decision to either bond the restoration in place or to place a base first. Avoiding the use of a base offers several attractions when placing posterior resin composites, including an increased surface area for bonding and an increased thickness of composite which limits the subsequent risk of bulk fracture. While the use of bases under deep amalgam restorations is desirable given the risk of thermal conduction through amalgam resulting in pulpal pain, composites do not conduct heat in a manner similar to amalgam. The evidence for placing bases under composite restorations is limited, except in situations in very deep cavities in which it may be necessary to place a base to protect an indirect or direct pulp cap. A recent clinical study has indicated that post-operative sensitivity arising from posterior composites was not linked to the presence – or absence – of a cement base.

Restoring proximal contacts and contours

Five centres indicated teaching the use of transparent matrix bands and rigid light transmitting wedges. The use of these

Table 2 Teaching in respect of the management of operatively exposed dentine prior to the placement of posterior composites			
	None ('total-etch')	Calcium hydroxide + Glass ionomer Cement	Glass-ionomer cement only
	Number of training centres		
Shallow cavities (outer third of dentine)	9	0	1
Moderate cavities (middle third of dentine)	1	3	7
Deep cavities (Inner third of dentine)	0	10	4

techniques has been discredited due to the bands being stiffer and thicker than their metal counterparts, thereby increasing the risks of open and unfavourably proximal contours and contacts. Also, rigid light-transmitting wedges do not adapt to the curved gingival margin of the proximal box and as a consequence are associated with an increased risk of overhang production. Transparent matrix bands and light transmitting wedges were introduced at a time when it was considered that composites contracted in the direction of the polymerising light, but this has been disproven. Metal matrices, sectional or circumferential, used together with wooden wedges or elastic wedging systems, are the technique of choice when placing occlusoproximal composite restorations.

Conclusion

Based on the results of this study, it is evident that the teaching of posterior

composites, in at least permanent teeth, is a well-established part of most teaching programmes for trainee dental therapists in the UK. Some variation was noted between the various centres in respect of the amounts of clinical experience gained in the placement of posterior composites and in certain clinical techniques. In further developing the teaching of posterior composites to dental therapists, training centres should continue to focus on best available evidence and look to relevant consensus documents on this aspect of the teaching of operative dentistry, such as those of the British Association of the Teachers of Conservative Dentistry (BATCD).

1. Lynch C D, Wilson N H F. Teaching of direct posterior resin composite restorations in UK dental therapy training programmes. *Br Dent J* 2010; **208**: 415-421.