Trends in the Placement of Posterior Composites in Dental Schools


Abstract: The aim of this paper is to review trends in the teaching of posterior composites in the United States, Canada, Ireland, and the United Kingdom over the last fifteen years. The authors compared the results of surveys of the teaching of posterior composites performed in 1989, 1997, and 2004-05. Historical and contemporary international trends were investigated. The amount of clinical and didactic teaching of posterior composites has increased over the past fifteen years. From a time over fifteen years ago, when very few dental students placed posterior composites in dental school, approximately one-third of posterior plastic restorations placed by U.S., Irish, and UK dental students are now composite, with the corresponding finding for Canadian dental schools being approximately 50 percent. Some variations were noted between dental schools in terms of the teaching of contraindications to placement as well as lining and basing techniques. There was some inappropriate teaching of techniques, in particular, in relation to the use of transparent matrix bands and light transmitting wedges. There was also evidence of limited student exposure to newer forms of technology, notably LED curing light units. There have been clear increases in the teaching of posterior composites in the United States, Canada, the United Kingdom, and Ireland in recent years; however, the proportion of posterior composite restorations placed by dental students relative to dental amalgams does not yet match the typical situation in contemporary clinical practice. Dental schools have a responsibility to ensure that their curricula are evidence-based to best prepare their students to meet the needs and expectations of their future patients.

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Dental school programs are frequently criticized on the grounds that they do not reflect everyday clinical practice. The purported reasons for this criticism include the following: there is a lack of evidence to support techniques used in practice; educators are slower than practitioners to adopt new materials and techniques; concepts of dental care guiding curriculum decisions are outdated; the dental care skills assessed on regional and national qualifying examinations have failed to evolve with changes in clinical practice; and dental schools lack resources to introduce new materials and techniques. As a consequence of dental schools’ failing to keep the curriculum contemporary, graduates of such schools may not be competent to deliver aspects of modern oral health care to their future patients.

One aspect of modern oral health care in which new dental graduates may lack the necessary knowledge and understanding, let alone clinical competencies, is the use of tooth-colored restorative systems for the restoration of posterior teeth. This difficulty is presently considered to be most pressing in respect to the use of resin composites, but also extends to other tooth-colored systems, including all-ceramic alternatives. As recently as eight years ago, it was reported that resin composite “was suitable for placement only in small occlusal and occlusoproximal cavities, preferably in premolar teeth, with little, if any, occlusal function.” This has not, however, been the reality in general dental practice, where there has been a significant increase in the placement of composites in posterior teeth. This has occurred as a consequence of improved physical properties of commercially available composites and bonding technologies, an increased demand from patients for aesthetic restorations, and a developing evidence base to support the use of composites in the restoration of posterior teeth.
A recent survey of general dental practitioners in the United Kingdom found that 50 percent of participating dentists placed direct composites in load-bearing situations in molar teeth.\(^8\) Information from the United States also indicates increased use of resin-based composites in occlusal and occlusoproximal cavities in posterior teeth.\(^9\) These developments pose the question: to what extent has the teaching of posterior composites in dental schools increased in response to the increasing placement of composites in posterior teeth in clinical practice?

Previous investigations found limited teaching of posterior composites in the UK, Ireland, and North America.\(^10-12\) In 1997, it was noted that most dental school graduates in the United States and Canada had “limited clinical experience in the placement of Class I and Class II composites.”\(^12\) A similar study in Europe found while “most dental schools teach the use of composite in selected posterior cavities, there was considerable variation in the principles taught, and in the clinical experience gained by undergraduate students.”\(^11\) In late 2004/early 2005, we reexamined the teaching of posterior composites in the United States, Canada, Ireland, and United Kingdom.\(^3,13,14\) This article brings together and reviews the findings of the recent follow-up surveys and compares these results with the findings from the previous surveys.

The primary aim of this article is to provide an overview of trends in the teaching of posterior composites as observed in the United States, Canada, Ireland, and UK. We also aim to challenge researchers and educators to resolve key areas of different thinking in the interest of more commonality in presenting students with an evidence-based approach to the use of composites in the restoration of posterior teeth.

### Materials and Methods

We compared the results of surveys on the teaching of posterior composites performed in 1989, 1997, and 2004-05.\(^3,10-14\) We drew potential historical and contemporary international trends from the findings of these surveys. We did not undertake direct comparisons and detailed statistical analysis, given differences in the investigations undertaken over the sixteen-year period.

### Results

The findings of the 1989, 1997, and 2004-05 surveys are presented in terms of the content and amount of teaching and the teaching of techniques for posterior composites. Information on the numbers of schools replying to each survey is outlined in Table 1. The 2004-05 surveys of Canadian, UK, and Irish schools achieved a 100 percent response rate;\(^3,14\) the 2004-05 survey of U.S. dental schools achieved a 90 percent response rate.\(^3\)

The 1989 survey\(^10\) reported limited teaching of posterior composites in Europe and North America. Teaching was mainly didactic in nature; in less than 10 percent of schools, students gained preclinical, and some clinical experience, in the placement of posterior composites. The 1997 European\(^11\) and North American\(^12\) surveys found increased teaching of posterior composites. The European survey found that most dental students had “some experience” of placing posterior composites; some schools in 1997 had clinical requirements for posterior composites. The North American survey\(^12\) found that graduates had “minimal clinical experience” in the placement of such restorations; and, in common with the situation in Europe, few schools had clinical requirements.

The 2004-05 surveys\(^3,13,14\) found dramatic increases in the amount and content of relevant teaching. It was found that 30 percent of posterior restorations placed by U.S., Irish, and UK dental students are composites; based on this finding, it was anticipated that this percentage would rise to more than 50 percent over the next five years.\(^3,13\) In Canadian schools, 50 percent of posterior restorations placed by students in 2004-05 were composites, and it was anticipated that this percentage would rise to greater than 55 percent in five years.\(^14\) All U.S., Irish, UK, and Canadian dental schools teach the placement of occlusal composites in posterior teeth; however, there is variation between countries in the teaching of two-surface and three-surface occlusoproximal composites (Table 2). Respondents in the United States and Canada estimate that the amount of preclinical teaching of posterior composites will increase by 150 percent over the next five years. Respondents in UK and Irish dental schools estimate this increase will be in the region of 200 percent.

### Table 1. Numbers of dental schools from each region replying to each survey

<table>
<thead>
<tr>
<th></th>
<th>United States and Canada</th>
<th>Ireland and UK</th>
</tr>
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<tbody>
<tr>
<td>1989 survey</td>
<td>63</td>
<td>15</td>
</tr>
<tr>
<td>1997 surveys</td>
<td>54</td>
<td>15</td>
</tr>
<tr>
<td>2004-05 surveys</td>
<td>57</td>
<td>15</td>
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</table>
of posterior composites, there has been an increasing diversity in the placement techniques taught. The 1989 survey \(^1\) reported consistency within the limited teaching that occurred. In terms of teaching techniques for lining and basing cavities, there was disagreement between European and North American dental schools in 1997 and again in 2004-05 in relation to the management of operatively exposed dentine in “moderately” deep cavities. In 1997 \(^1\) and 2004 \(^3,13,14\) approximately 60 percent of European, Irish, and UK schools taught the placement of a glass-ionomer cement base in this situation, with the remainder teaching the technique of “total-etching.” In contrast, in 1997 \(^12\) and in 2004 \(^3,14\) almost 60 percent of North American schools taught “total-etching” when restoring “moderately” deep cavities. There was clear agreement (>90 percent of all schools) that “total-etching” should be used when restoring “shallow” cavities and that a glass-ionomer cement base, with or without a calcium hydroxide liner, should be used when restoring “deep” cavities.

The contraindications to placement of posterior composites taught in 1997 \(^11,12\) and 2004-05 \(^3,13,14\) on which more than half of the schools agreed are outlined in Table 3. In relation to moisture control during placement, all schools agreed that a rubber dam was necessary in “most” (>75 percent) cases.

No information was supplied in the 1989 \(^10\) or 1997 \(^11,12\) surveys on the teaching of restoration of the proximal contour of posterior composites or on the use of curing lights. The 2004-05 \(^3,13,14\) investigations found that 21 percent of all schools taught the use of transparent matrix bands and light-transmitting wedges, either solely or in combination with metal matrix bands and wooden wedges. In 2004-05, 29 percent of U.S., Irish, and UK dental schools taught the use of LED curing lights, either solely or in combination with “traditional” quartz halogen curing lights. \(^3,13\) However, no Canadian dental schools taught the use of LED light-curing technologies. \(^14\)

### Discussion

It is evident that there have been clear increases in the teaching of posterior composites in dental schools in the United States, Canada, Ireland, and United Kingdom over the last fifteen years. It seems that this increase was more marked in the interval between the 1997 and the 2004-05 surveys than in the interval between the 1989 and 1997 surveys. \(^3,10-14\) The substantial amounts of contemporary teaching and increased clinical experience of dental students in the placement of posterior composites will help address the increased demands for this form of restorative oral health care. It is, however, incumbent on

### Table 2. Current teaching of occlusoproximal composites in various countries (expressed as a percentage of schools in each region)

<table>
<thead>
<tr>
<th></th>
<th>U.S. (n=47)</th>
<th>Canada (n=10)</th>
<th>Ireland and UK (n=15)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2-surface (premolars)</td>
<td>100</td>
<td>100</td>
<td>93</td>
</tr>
<tr>
<td>2-surface (molars)</td>
<td>98</td>
<td>100</td>
<td>93</td>
</tr>
<tr>
<td>3-surface (premolars)</td>
<td>89</td>
<td>90</td>
<td>60</td>
</tr>
<tr>
<td>3-surface (2 molars)</td>
<td>68</td>
<td>90</td>
<td>60</td>
</tr>
</tbody>
</table>

### Table 3. Contraindications to the placement of posterior composites taught in dental schools in 1997 and 2004 on which more than 50 percent of schools in each region agreed

<table>
<thead>
<tr>
<th></th>
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<tbody>
<tr>
<td>Unable to place rubber dam</td>
<td>Unable to place rubber dam</td>
<td>Unable to place rubber dam</td>
<td>Unable to place rubber dam</td>
</tr>
<tr>
<td>Allergy to composite materials</td>
<td>Allergy to composite materials</td>
<td>Allergy to composite materials</td>
<td>Allergy to composite materials</td>
</tr>
<tr>
<td>Replacement of large amalgam</td>
<td>Poor cooperation</td>
<td>Replacement of large amalgam</td>
<td>Replacement of large amalgam</td>
</tr>
<tr>
<td>Poor enamel</td>
<td>Subgingival margins</td>
<td>Poor enamel</td>
<td>Subgingival margins</td>
</tr>
<tr>
<td>Parafunctional activity</td>
<td>Buccolingual width of the occlusal portion is &gt;2/3 of the intercuspal width</td>
<td>Parafunctional activity</td>
<td>Buccolingual width of the occlusal portion is &gt;2/3 of the intercuspal width</td>
</tr>
<tr>
<td>Poor oral hygiene</td>
<td>Poor oral hygiene</td>
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</tbody>
</table>
dental school teachers and leaders that their curricula do not continue to lag behind developments in this aspect of modern clinical practice. Indeed, it could be argued that dental school curricula should instead lead the way in the development of new skills and techniques for the ever-expanding use of composite systems. It is sobering to reflect that the graduating dental school class of 2006 may continue to practice dentistry until the late 2040s. Hopefully, these new members of the dental team will be competent to address the demands of their patients and to deliver contemporary forms of oral health care, including the optimum use of composites in the restoration of posterior teeth. Regrettably, the findings of the 2004-05 surveys indicate that this may not be the case.\(^3,13,14\) Accordingly, early action is indicated to ensure that a similar situation does not occur in 2007 and thereafter.

Having demonstrated increased teaching of posterior composites in dental schools, it is important to consider possible barriers to further enhancement of teaching of this technique. In the course of our investigations, we received anecdotal evidence from U.S. dental schools that they felt limited in their future expansion of teaching by the requirements of the National Board Examinations, which still focus heavily on amalgam restorations.\(^3\) On a related theme, in the UK, much patient care is contracted under the terms of the General Dental Services Act/National Health Service. This remunerative scheme has previously failed to encourage an evidence-based approach to the use of composites in the restoration of posterior teeth. Some UK dental schools reported that while they would like to increase their teaching of posterior composites, it was considered that this would be inappropriate preparation for independent practice by their students given the existing remunerative schemes.\(^3\) A further limitation was the amount of time available in the dental school curriculum. There are ever-increasing demands on the dental school curricula, with many new materials and techniques to be taught, together with a reluctance among faculty to discontinue certain teaching that no longer forms an important aspect of clinical practice.\(^1\) It is also noteworthy that dental education is expensive and may suffer certain limitations through financial restrictions. While dental schools should strive to provide high-quality learning and teaching for their students, irrespective of financial costs, budgetary containment imposes limitations in the real world of dental education. Most schools also report that they are experiencing difficulty recruiting suitably qual-

A further difficulty highlighted in this study is the lack of consistency in teaching among dental schools, with some evidence of inappropriate teaching. These include:

- teaching of techniques that have been associated with inappropriate clinical outcomes; for example, the use of transparent matrix bands and light-transmitting wedges, despite current evidence that suggests that this technique is associated with inappropriate clinical outcomes;\(^15\)
- differences between dental schools in the teaching of contraindications to the placement of posterior composites; one of the few contraindications on which there is much agreement is a history of allergy to composite materials, despite there being little information in the literature that describes true allergy to composite materials;\(^12\)
- disagreement on the management of operatively exposed dentine in moderately deep cavities, involving the middle third of the dentine; this perhaps is a reflection of the lack of research consensus on the best management for this form of cavity. It is suggested that this issue gives rise to widespread confusion amongst dental students and dental practitioners, with inappropriate application of certain clinical techniques;
- limited student exposure to new technologies such as LED curing lights. Recent evidence suggests that LED curing lights are at least as effective as quartz halogen lights.\(^16\) Student exposure to such new technologies should be expanded.

It is clear that there has been increased teaching of posterior composites in dental schools in the United States, Canada, Ireland, and United Kingdom. Such teaching should be based on best evidence and should avoid leaving dental students confused. While some variation in teaching is unavoidable in areas where there is insufficient research consensus, this article has highlighted some areas of inappropriate teaching. Confusion amongst students may lead to a lack of confidence amongst new graduates, difficulties for the dental team in adapting and appraising new materials and technologies, and problematic interactions with members of the dental trade. Regrettably, the consequence of such confusion and difficulties will be a reduction in the quality of treatments offered to certain patients. Dental schools need to be proactive and suitably resourced to develop and deliver teaching programs that will prepare their students to provide high-quality modern care to
patients. However, as certain budgetary limitations are inevitable, difficult decisions need to be taken as to what to develop and what to exclude in the dental curriculum. In this regard, predictions of future patterns of disease, trends in the use of different materials, and, very importantly, ever-growing patients’ expectations should be taken into account.

Conclusion

This article reports a marked increase in the amount and content of teaching of posterior composites in the United States, Canada, Ireland, and United Kingdom, with special emphasis on the seven years from 1997 to 2004. This is important, as there has been a substantial increase in the placement of posterior composites in general dental practice. It is incumbent on dental schools to ensure that their graduates are best prepared to deliver quality contemporary care to their future patients. With regard to the use of composites in the restoration of posterior teeth, there still appears to be a shortfall in teaching relative to the use of this technique in clinical practice. Survey responses indicate inconsistencies in instruction among dental schools and some inappropriate teaching of clinical techniques.

REFERENCES