Trends in Material Choice for Direct Restorations by Final Year Students from University College Cork 2004-2009

C.O. O' Sullivan*, G.J. McKenna* and F.M. Burke[†]

Abstract - Traditionally, undergraduate students in University College Cork (UCC) have been taught to use amalgam as the first choice material for direct restoration of posterior cavities. Since 2005 the use of composite resins has replaced amalgam as the first choice material. An audit was conducted of all direct restorations placed by final year students from UCC from 2004 until 2009. Results showed that over a six year period, final year UCC dental undergraduate students placed proportionately more direct composite resin restorations and significantly fewer amalgam restorations. The need for, and undergraduate exposure to, provision of amalgam restorations may have to be revisited.

KEY WORDS: Amalgam, Composite Resin, Undergraduates

INTRODUCTION

Clinicians face decisions daily when choosing the most appropriate dental material for a variety of clinical situations. When faced with restoring a cavity in a posterior tooth with a direct restoration the choice is most commonly between amalgam and composite resin. A variety of factors can influence decision making including financial considerations, preservation of tooth tissue, usability and aesthetics.

Dental amalgam is a mixture of a silver alloy with mercury first introduced in the 1800s. The material has a long, successful track record in clinical dentistry and has traditionally been considered as a strong durable material, particularly for restoring posterior teeth. Dental amalgam does not bond to tooth structure, it cannot provide a complete seal or be retained within a cavity without some form of mechanical retention¹. Recent developments have concentrated on improving bonded amalgam restorations but results are ambivalent. Amalgam can also be a useful core material, especially prior to posterior crown and bridgework. In recent years, controversy has surrounded the use of amalgam due to the mercury contained within the material. Some authors have suggested that mercury toxicity caused by amalgam restorations can contribute to a range of systemic conditions but these arguments lack credible scientific evidence. However, concerns about safe production of amalgam commercially have given rise to some countries virtually banning its use² and may be banned in the EU over the next five years.

Evidence suggests that clinicians are becoming more inclined to choose posterior composite resin restorations often due to improved aesthetics³. Advances in the production of composite resins and bonding systems have fuelled

* BDS MFDS [†] BDS MSc PhD FDSRCEd FFDRCSI the development of adhesive dentistry. Composite filling materials consist of a combination of resin and inorganic filler. The materials can be chemically cured or light cured to produce an aesthetic, durable and strong restoration⁴. Composite resin can also be bonded onto tooth structure using an adhesive system thus reducing the amount of tissue removed in cavity preparation⁵. However, composite resin materials are considered more technique sensitive than amalgam with adequate moisture control being essential⁶. Trends have indicated that the number of practitioners choosing to place composite resin in posterior cavities have increased over the last decade driven potentially by both material developments and patient demand7. In addition, it has been reported that many undergraduate training programs worldwide have moved towards teaching composite resins as a first choice material for posterior cavities⁸.

The teaching philosophy at University College Cork, Ireland had been based on teaching amalgam as the first restorative material of choice for load bearing cavities in posterior teeth. However, following a consensus meeting of the British Association of Teachers of Conservative Dentistry in 2005⁹ the teaching philosophy was changed to the use of composites as the material of first choice for load bearing cavities in posterior teeth as well as anterior teeth. This was implemented in the laboratory teaching program in 2005 for third year undergraduate students. This audit aimed to quantify the changes in patterns of direct materials used for restoration of cavities by final year students working in Restorative Dentistry. This retrospective audit compared the use of composite resin and amalgam over a six year period between 2004 and 2009.

METHODS

An audit of direct restorations placed by final year undergraduate students was conducted. The number of restorations placed was recorded over a six year period between 2004 and 2009. All restorations placed by students were logged on a computer program designed for patient billing and recording student clinical activity. There was no difference in cost for the patient between composite resin and amalgam restorations.

The results for 2004-2009 were collated by the departmental administrator. The results were tabulated using SPSS (IBM, Chicago, USA) and statistical significance was determined at a level of p<0.05.

The required target for amalgam and composite restorations can be seen in Table 1. Over the six year period the targets for composite resins remained unchanged while the target for amalgam decreased from 60 in 2008 to 50 in 2009. No differentiation was made between what tooth and tooth surface restored.

RESULTS

Over the six-year period the mean number of restorations placed per final year student decreased. The highest mean value placed was 225.09 in 2004 with the lowest average of total restorations placed falling to 179.14 in 2009 (Table 2).

Although the mean number of total restorations decreased by 20.5 % over the six year period, there was an increase in the proportion of composite resin restoration placed from 61.3% in 2004 compared with 72.57% in 2009 (p=0.37) (Figure 1). The final year class of 2007, who were third year students in 2005 when changes in teaching composite resin restorations were implemented in the laboratory, placed the highest number of composite resin restorations on average.

In comparison, the mean number of amalgam restorations placed reduced significantly (p<0.01) from an average of 87.53 amalgam restorations in 2005 to 49 in 2009. The proportion of amalgam restorations also decreased from 38.89% in 2004 to 27.35% in 2009 (Figure 1). However there was an insignificant increase of 0.6% between the class of 2007 and 2008.

Table 1.	Number of required targets of
amalgam	and composite restorations.

Year	Amalgam Target	Composite Target
2004	60	80
2005	60	80
2006	60	80
2007	60	80
2008	60	80
2009	50	80

Over the six-year period only four students failed to meet the required target of 80 composite resin restorations. However, the numbers failing to reach sufficient amalgam restorations increased from three in 2005 to eighteen in 2009 with just over half the class of 2008 (51.3 %) failing to reach their requirements. This is despite the fact that from 2004 until 2008 the required target for amalgam restorations was 60 but this was reduced to 50 restorations in 2009 (Figure 2). Restoration requirements contributed to 25% of the overall mark for the restorative module. Over the six year period no student had to repeat final year exams on the basis of requirements alone.

DISCUSSION

Improvements in adhesive dentistry have radically changed the management of restoring posterior teeth. The concept of minimal intervention dentistry has evolved as a consequence of our increased understanding of the caries process and the development of adhesive restorative materials. It is now recognised that demineralised but noncavitated enamel and dentine can be "healed" 10 and techniques such as "extension for prevention" as proposed by GV Black is no longer tenable. Minimal intervention techniques cause less destruction of tooth substance than conventional techniques, with reduced risk of tooth structure and pulpal problems¹¹. These advances coupled with aesthetic requirements and patient preference has led to a substantial increase in the teaching of posterior composites in European and North America dental schools¹². The increased demand for composite has also been driven by public concern regarding mercury content in amalgam restorations. Calls for increased controls on amalgam usage have been fuelled by speculation that mercury content can lead to harmful neurological side effects and impaired kidney function, particularly in pregnant woman and children¹³. There are no valid scientific studies to show that dental amalgam poses a health hazard to patients, to dentists or the environment¹⁴.

The development of guidelines for teaching posterior composite resin restorations to dental undergraduates was the focus of the 2005 annual conference of the British Association of the Teachers of Conservative Dentistry in Birmingham. Following this conference, changes in teaching composite resins as the material of first choice were implemented in the teaching laboratory in Cork Dental School. This audit demonstrates that following these changes, there was a proportionate increase in the placement of composites by final year students over a six year period.

Table 2. Average restorations placed by final year students 2004-2009

Year	Number of Final Year Students (n)	Average Total Restorations (n)	Average Composite Resins (n)	Average Amalgams (n)
2004	32	225.09	137.56	87.53
2005	38	195.82	120.00	76.26
2006	34	204.00	133.03	70.97
2007	30	202.83	138.00	65.00
2008	37	180.73	121.00	59.00
2009	35	179.14	130.00	49.00



Figure 1. Proportion of Composite Resin & Amalgam Restorations 2004 - 2009



Figure 2. Number of students unable to reach amalgam restoration requirements.

From the results, it can be seen that there was an increase in the proportion of composite placed from 61.1 % in 2004 to 68.3% in 2007. The final year undergraduates of 2007 were the first group to be taught composite restorations as material of first choice in the teaching laboratory in 2005 and therefore one may have expected this figure for 2007 to be higher. Diversity in teaching and variation of clinical techniques amongst staff in UCC may be responsible for this and indeed for the overall insignificant increase of composites placed over the six year period. Dental educators have a responsibility to ensure that students receive suitable exposure to the use of resin composites so that new graduates will be competent to treat patients in a modern clinical practice setting. Educational guidelines by the General Dental Council and the Association for Dental Education Europe support this view¹⁵.

The results demonstrate a significant decrease in the placement of amalgam restorations from 38.89% in 2004 to 27.35% in 2009, with 51.42% of final year students in 2009 failing to meet their targeted amalgam requirements. Yet there is still an obligation to ensure students are competent in the placement of amalgam restorations. Amalgam has proven to be a safe and cost effective restorative material providing good longevity¹⁶. With recent economic and budgetary concerns patients may opt for less expensive options such as amalgam when considering a restoration.

The reduced cost and time involved in placing amalgam restorations may also influence dental practitioners. Also in certain clinical situations there is a clear indication to use amalgam as the material of choice over the placement of composite such as restoring Class 2 cavities where moisture control is poor.

However it is clear that there are limitations of this audit regarding the data collection. All restorations placed by final year students were logged on a computer programme designed for patient billing and recording student clinical activity. Data was broken down according to student year group, year of placement and type of restoration. However no differentiation was made regarding the tooth notation or the number of surfaces restored. As a result it is unclear whether the restorations placed were on anterior or posterior teeth. These shortcomings may have influenced the results of the proportion of composite placed over the six year period as the vast majority of anterior restorations were composite resins. Furthermore no differentiation what made between the indications for the type of restoration, for example replacement of failed restorations or treatment of a new carious lesion. Recently, changes have been implemented regarding cavity classification and tooth position when recording undergraduate clinical activity.

While there has been an increase in the use of composite resins for the restoration of posterior teeth in recent years¹⁷, surveys of dental practices indicate that dental amalgam still predominates as the 'material of choice' for the restoration of posterior teeth within UK dental practice¹⁸. This may frustrate dental graduates emerging into the dental workforce in the coming years. It is clear from this audit that students struggled to meet the required targets for amalgam restorations. Just over half of the class of 2009 failing to meet their requirements despite the fact that these requirements dropped from 60 in 2008 to 50 in 2009. Perhaps then, there lies a challenge to the dental profession both in the UK and Ireland to encourage more of a shift towards increasing the use of composite systems in the restoration of posterior teeth, in particular among established practitioners and also to revisit the requirements targeted for posterior amalgams in undergraduate teaching.

CONCLUSION

Over the six-year period recorded, final year undergraduate students in UCC have placed proportionately more direct composite resin restorations and significantly fewer amalgam restorations. The need for, and undergraduate exposure to, provision of amalgam restorations may have to be revisited.

ADDRESS FOR CORRESPONDENCE

Clare.osullivan80@gmail.com

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