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Education Research

Amalgam and Composite Posterior Restorations: Curriculum Versus Practice in Operative Dentistry at a US Dental School

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Clinical Relevance

There is an undeniable move away from amalgam towards the use of resin composite restorations in posterior teeth. The data from one dental school suggests that dental curricula are not keeping pace with the clinical shift that has occurred.

SUMMARY

This study recorded the number of preclinical lecture and simulation laboratory sessions spent teaching the preparation and placement of amalgam and resin composite posterior restorations. These data were compared to the use of both materials in the operative clinic as placed by third- and fourth-year students. The number of posterior restorations inserted by the students, expressed as a function of the number of restoration surfaces, was also evaluated. The results show that the teaching of posterior restorations pre-clinically has consistently favored amalgam 2.5 to 1 during the last three years. However, clinically, resin composite is being used for posterior restorations 2.3 times more often than amalgam. The only instance that favored amalgam over composite during the last year was in the placement of four surface posterior restorations. This shift in emphasis from amalgam to composite needs to be addressed within dental educational institutions so that newly graduated dentists are prepared to place composite restorations properly.

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INTRODUCTION

The didactic teaching and the clinical experience that students receive in the dental curriculum is limited, but it serves as the basis upon which newly graduated dentists start their own practice, work in an established practice or enter into a residency program. For decades, the curriculum in operative dentistry focused on amalgam as the predominant posterior restorative material and silicate cement as the anterior tooth-colored material. The change from silicate cement to resin based composite material as the predominant anterior restorative material occurred in the 1970s and repre-

sented a lasting change, despite the problems associated with the early composites.[1]

For decades, amalgam was the predominant material for posterior restorations, irrespective of the size of the restoration. By 1980, about 80% of all Class I and Class II restorations were amalgam restorations, while the remaining 20% were equally divided between composite restorations and indirect restorations.[2] In the mid-1990s, amalgam restorations were still used more than composite materials, and minimal teaching of posterior composite restorations occurred at dental schools.[3] However, the shift to the use of posterior composites was a reality already in the mid-1990s and has continued.[4]

Resin-based composite materials have gradually become an "all-round" restorative material, including placement of these materials in stress-bearing areas of the dentition.[5] The esthetic appearance of these materials, along with concerns for potential side effects from mercury associated with amalgam restorations, has made patients request these materials in posterior teeth, despite the fact that they were more expensive and have shorter duration.[6-7] Recent longevity data on resin-based composite restorations have shown that the quality and longevity of these restorations has increased compared to those in earlier studies.[5-9]

This study recorded the teaching volume (didactic, preclinical and clinical time) devoted to amalgam and composite posterior restorations at the University of Florida College of Dentistry (UFCD). The use of composite materials in the visible area of the dentition is indisputable, that is, for Class III, IV and V restorations in anterior teeth and premolars. Therefore, this study focused on the teaching and practice of posterior restorations in stress bearing areas at UFCD.

METHODS AND MATERIALS

For purposes of this study, information was recorded as to the teaching volume devoted to posterior amalgam and composite restorations during 2004, 2005 and 2006. The teaching volume was expressed as the number of lectures and sessions of preclinical exercises done in the operative simulation laboratory during the first two years of the undergraduate dental program. Data available for direct posterior restorations placed by third- and fourth-year students was gathered from the Quick Recovery computer software program for the same three years. The information was collected and categorized according to the American Dental Association's Code and Dental Procedures and Nomenclature for posterior amalgam restorations (codes 2140, 2150, 2160 and 2161) and for posterior resin composite restorations (codes 2391, 2392, 2393 and 2394).

These findings were placed on spreadsheets and in table formats to allow for the construction of bar graphs related to what is being taught and what is being practiced with regards to posterior amalgam and composite restorations. A comparison was also made as to the use of these two materials as a function of the number of surfaces involved in the restorations.

RESULTS

The volume of teaching related to posterior restorations at UFCD given to first- and second-year students, with respect to lectures and preclinical laboratory exer-

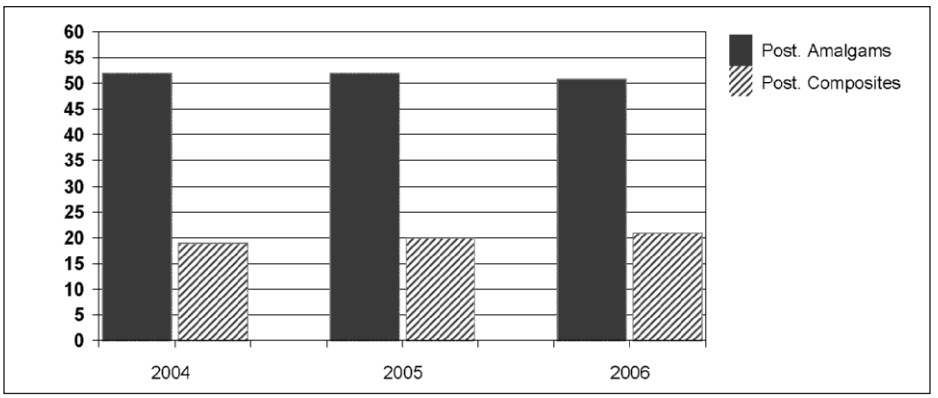

Figure 1. *Bar graphs showing the total preclinical teaching time devoted to posterior amalgam and composite restorations over the three-year period 2004–2006.*

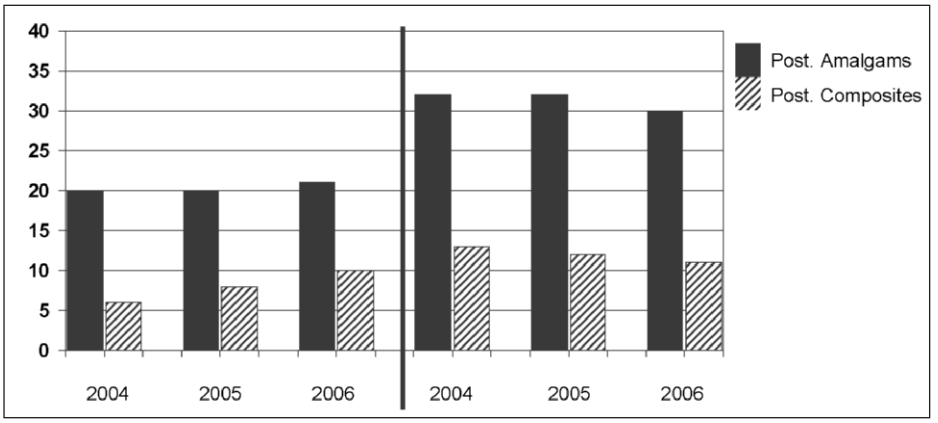

Figure 2. *Bar graphs showing the number of lectures (left) and number of laboratory sessions (right) applied to the teaching of posterior amalgam and composite restorations in the first two years of the dental curriculum during 2004-2006.*

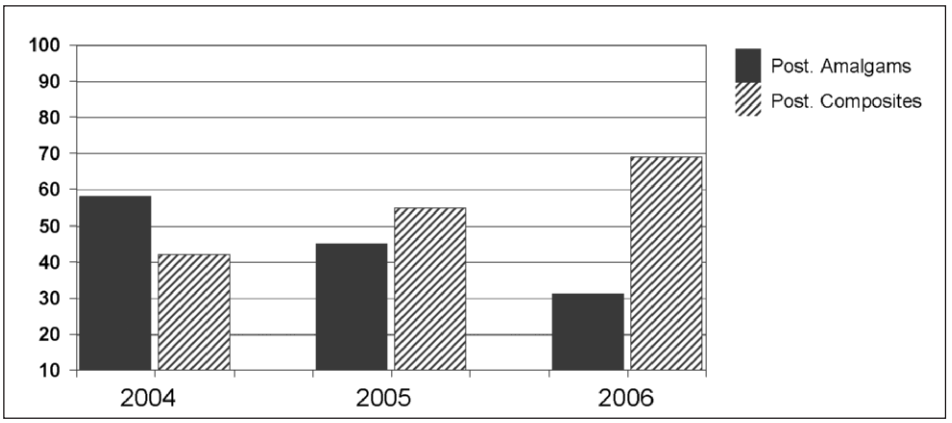

Figure 3. *Bar graphs showing the percentage of posterior amalgam and composite restorations inserted by dental students in the undergraduate operative clinic in 2004-2006.*

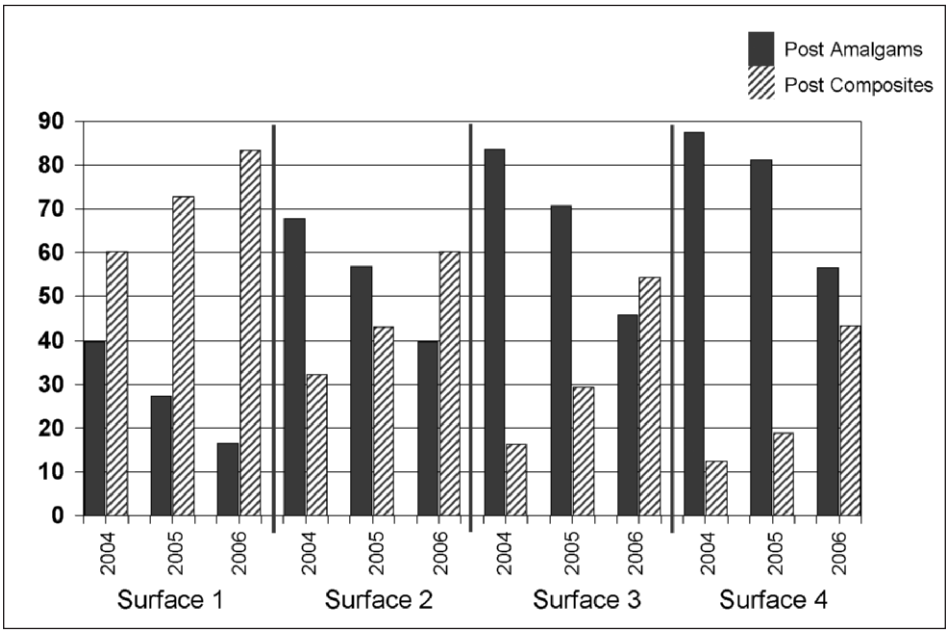

Figure 4. *The percentage of posterior amalgam and composite restorations inserted by dental students in the undergraduate operative clinic in 2004-2006 expressed as a function of the number of restoration surfaces. Note that the bar graphs for all sizes of restorations show an increase in the relative number of composite restorations compared to amalgam restorations and that more composite restorations than amalgam restorations are inserted in 2006 for all sizes of restorations except four-surface restorations.*

cises, is illustrated in Figure 1. The majority of both the didactic teaching and the laboratory exercises for posterior restorations focus on amalgam (Figure 2). When the students reach the clinical part of the curriculum during the third and fourth years of study, it was apparent that a change in the most commonly placed posterior restorations had occurred in 2005 (Figure 3). A marked increase in the relative use of composite materials for posterior restorations was recorded in 2006.

The change from amalgam to composite restorations was most prevalent for one-surface restorations. However, in 2006, the majority of two- and three-surface restorations were also composite restorations (Figure 4). Amalgam was still the predominant material for four-surface restorations, but the trend towards an increased use of multi-surface composite restorations was apparent (Figure 4).

DISCUSSION

Although the current teaching of posterior composite restorations has increased in North American dental schools,[10] compared to previous years,[3] there is still a discrepancy between what is being taught and what is being practiced. In earlier surveys of the curriculum related to Class I and Class II restorations, the reluctance to teach the use of composite materials in stress-bearing areas was related to the lack of clinical research to establish guidelines for these restorations.[3] Recent clinical research has shown that the longevity of posterior composites is comparable to amalgams,[5,8-9] which substantiates what is seen in dental school clinics, as well as in dental private practices.

Resin composite is as viable an option as amalgam in posterior teeth and is a superior option in many circumstances.[8,9-11] The guidelines for the use of composites in posterior teeth are now well established, and, in most instances, composite restorations are being done in larger numbers than amalgams. A close relationship should exist between what is being taught and what is being employed in the student operative clinics and in general dental practices. If posterior composite restorations occupied a relatively larger part of the curriculum, it is quite possible that their acceptance by the dental school faculty would increase and the students would become as adept at using composites as they are at using amalgam. In addition, the quality of composite restorations in general dental practice might increase.

One explanation for the short longevity of Class I and Class II composite restorations noted in earlier studies[12] may be that the teaching of Class II restorations

was lacking or that it was slow in developing.[3,13] A common clinical procedure that is not taught well in dental schools is likely to have a negative effect, especially if the clinical procedure is as technique-sensitive as it is for composite materials. The early composite materials were of inferior quality, and it took several years after their introduction before the materials were of satisfactory quality. Now, it is time for the teaching in dental schools to catch up with the frequent use of posterior composites in student clinics and in general dental practices. The increased quality of composite restorative materials on the market today justifies an increased use of these materials, and it is expected that the increasing use of these materials as "all-round" restorative materials, including large, multisurface restorations, will continue. This calls for more attention to the teaching of multi-surface composite restorations in North American dental schools.

Dental schools are grappling with ways to approach the shift from posterior amalgam restorations to posterior resin composite restorations. Currently, a much discussed topic within the dental education community is how best to introduce and teach dental students the preparation and restoration of posterior resin composites versus amalgams. We have, for decades, followed the principles of GV Black to guide the preparations for the use of amalgam. These parameters have allowed us to measure the progress of dental students in fractions of millimeters to determine how their skills are developing. We now have a group of composite materials that generally do not require any specific preparation guidelines, other than allowing for conservative access (convenience form) to remove carious tissue. Gauging dental students' motor skills with a dental handpiece becomes harder to monitor without the parameters of outline form, retention form and resistance form. It must be recognized that the preparation of a cavity for an amalgam restoration generally is more demanding than for a composite restoration. In addition, Class II amalgam preparation and restoration is also currently a requirement for some state board examinations, including the Florida State Dental Board Examination.

While the ability of students to acquire finely tuned motor skills is still important, the area where these skills come into play has shifted from the preparation of a tooth to its restoration due to the different requirements of resin composites. Amalgam is technique-sensitive related to how the preparation is done and how it is condensed. The shift towards resin composite materials makes the preparation less important, while the placement of the resin composite restoration becomes more important. This is the area that now requires the focus of our operative dental curriculum and pre-clinical laboratory sessions. However, as shown in this study, the curriculum is not developing quickly enough to keep pace with what is done in practice. The bulk of the teaching time at our dental school is still spent on amalgam instruction pre-clinically, but clinically, the bulk of the time is being spent on placing posterior resin composite restorations. It is time to face up to the reality that changes are necessary.

CONCLUDING REMARKS

There are several ways to approach teaching dental students how to prepare and place resin composite and amalgam restorations in posterior teeth. Currently, the transition to more emphasis on resin-based composite restorations within the curriculum and pre-clinical simulation laboratory in our dental school is imminent. The move towards tooth-colored restorations is led by the desires of dental patients and the confidence that dental practitioners have acquired through experience with resin composite materials. This is born out both through clinical observation and through more and more positive results as seen in laboratory research and in clinical and practice-based studies.

It is important to remember that students must be taught the proper techniques for placing composite materials, including proper isolation, wedging, incremental placement, curing and finishing.

This shift in emphasis from amalgam to resin composite restorations within the UFCD clinics is probably not unique. Plans for a survey of the teaching and practice of composite and amalgam restorations at dental schools in North America are in progress so as to provide information on changes in other dental schools. It appears that many dental schools in the United States are starting to move towards this change[10] but data are lacking. UFCD and other dental schools are starting to realize that these changes are needed, and they should make the necessary adjustments in curriculum, including pre-clinical teaching. It is time to escalate the pace with which the training of dental students in the art and science of placing resin composite restorations is fully implemented to assure that students, upon graduation, are ready for the demands placed on them by patients and the profession.

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