

# Class I and Class II Silver Amalgam and Resin Composite Posterior Restorations: Teaching Approaches in Canadian Faculties of Dentistry

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## A b s t r a c t

*A 10-question survey was mailed to the 10 Canadian faculties of dentistry to determine current approaches to teaching undergraduates about silver amalgam and resin composite for posterior restorations in adults and children. Responses were received from all 10 pedodontic programs and from 8 of the 10 operative and restorative programs. The use of silver amalgam and posterior composite for restorations of primary and permanent teeth is covered in the curricula of all dental schools, but the relative emphasis on the 2 materials varies. In the operative and restorative programs, curriculum time devoted to silver amalgam is either greater than or equal to that devoted to posterior composite. Five of the 8 schools reported greater educational emphasis on silver amalgam for the permanent dentition; however, course directors noted that the preference among patients seen in clinics is tending toward composite restorations. Curricula appear designed to educate students about the optimal use of both materials. Requirements for performance of restorations during training generally do not specify the type of material; these requirements range from 60 restorations to 250 surfaces. Five of the 8 schools conduct clinical competency tests with both materials. The responses from the pedodontic programs were more diverse. The proportion of curriculum time devoted to each type of material in these programs ranged from less than 25% to more than 75%. Five schools reported more emphasis on silver amalgam, 3 schools reported equal emphasis, and 2 schools reported more emphasis on posterior composite. No clinical requirements were specified in any of the undergraduate pedodontic programs. Within some of the faculties, there were differences between the operative and restorative program and the pedodontic program with respect to emphasis on different materials for the posterior dentition.*

**MeSH Key Words:** *Canada; dental restoration, permanent/methods; schools, dental; teaching/methods*

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Improvements in resin composite and dentin bonding materials, as well as increased understanding of their optimal usage, has led to increased use of composite restorations for the posterior dentition.<sup>1</sup> At the same time, the combination of strong interest in esthetic restorations (on the part of the public and the profession) and a reduction in public confidence in the safety of silver amalgam has led to a significant decline in the use of amalgam. Clinical academics are charged with distilling current evidence so as to provide a professional education that is consistent with current science and with meeting patients' needs. Choice of restorative material requires consideration of patient-specific esthetic, functional and longevity issues. With respect to longevity, the median survival times of silver amalgam restorations are superior to those of

direct composites in cross-sectional general practice studies; however, excellent results have been achieved with current composite materials in carefully controlled clinical investigations.<sup>2</sup>

The aim of this study was to survey Canadian dental schools about current teaching practices with respect to use of silver amalgam and resin composite for posterior restorations in both adults and children. The objectives were to gain an overview of the relative curriculum time devoted to each material, clinical issues to be considered in the choice of material and educational philosophy. The original idea to conduct a Canadian survey arose from questions directed to the Canadian Dental Association concerning current teaching practices related to use of silver amalgam in Canadian universities.

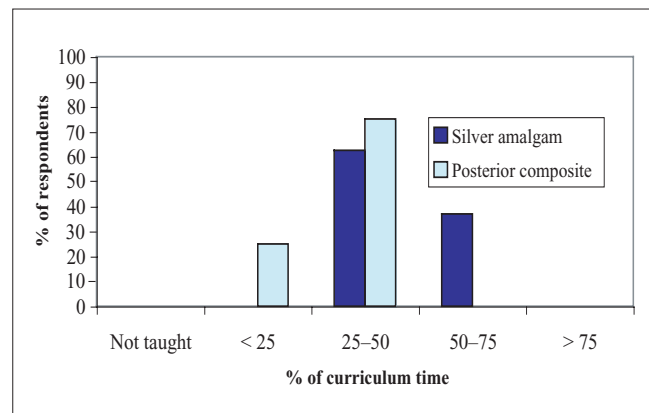
Most of the recent surveys of dental faculties concerning this subject area have focused on the teaching of posterior composites in permanent teeth. Three such surveys were conducted during 1997–98 in North America (including Canadian schools),<sup>3</sup> Europe<sup>4</sup> and Japan<sup>5</sup>; another was conducted later in Brazil.<sup>6</sup> A survey of the teaching of restorations for primary molars in North American schools has also been reported.<sup>7</sup> The responses to these surveys were diverse, but all respondents indicated that teaching time for and clinical use of composites were increasing. The responses also revealed an awareness of distinct contraindications and limitations for use of composites in Class II restorations. The authors of the North American survey noted that Canadian schools “referred to pressure to increase the use of posterior composites as a result of the Health Canada discussion of the amalgam issue.”<sup>3</sup> An overview of the Canadian educational curricula was undertaken to provide current information about the teaching of both silver amalgam and posterior composite restorations.

## Materials and Methods

A questionnaire (see **Appendix 1**) was developed to elicit an overview of relative teaching times, clinical requirements and educational philosophy concerning the use of silver amalgam and resin composite in the posterior dentition. Many of the questions were adapted, with permission, from the survey of North American and European schools developed by Mjör and Wilson.<sup>3,4</sup> A section concerning contraindications to either material was also adapted from the previous survey. No information about specific proprietary materials or techniques was sought. Two identical survey forms were mailed in July 2003 to the deans of all 10 Canadian dental faculties, with a request that the forms be directed to the faculty members with primary responsibility for the content of undergraduate pedodontic and operative and restorative programs. Recipients were asked to complete the 4-page survey within 2 months. Follow-up requests were sent in late 2003 and again in early 2004 to schools that had not responded.

The survey consisted of 10 questions, some in multiple-choice format, some requiring provision of specific information and some with opportunity for written comment or additional faculty-specific information. The following topics were covered:

- Proportion of curriculum time for direct posterior restorations devoted to teaching the use of silver amalgam and posterior composites.
- Preclinical and clinical requirements for direct posterior restorations.
- Contraindications to the placement of silver amalgam or posterior composite.
- Tests of clinical competency in performing direct posterior restorations.



**Figure 1:** Proportion of curriculum time for direct posterior restorations spent on silver amalgam and composite materials within operative and restorative departments.

- Educational philosophy regarding teaching of restorations with silver amalgam and posterior composite, including factors involved in the clinical choice of material.
- Anticipated future changes to the curriculum in the area of direct posterior restorations.

## Results

Responses were received from all 10 Canadian pedodontic programs and from 8 of the 10 operative and restorative programs. Each of the responding course directors answered almost all of the questions. For responses to multiple-choice questions, the percentage of responses in each category was calculated.

The responses from operative and restorative departments concerning the percentage of curriculum time for direct posterior restorations that was devoted to each type of restorative material for the adult dentition were consistent and fell into 2 major categories (**Fig. 1**): either the curriculum time devoted to amalgam was greater than that for posterior composite or equal curriculum time was devoted to the 2 materials. Five of the 8 schools reported greater emphasis on silver amalgam in their curricula. It was commonly noted that even though silver amalgam is still the primary restorative material, the preference among patients seen in the clinics is tending toward composite restorations. It appears that curricula within all dental faculties are designed to educate students about the optimal use of both materials. Comments included “There is a place for all restorative materials” and “Both materials have their place.” Many course directors stated that they provide guidelines on choosing the most appropriate material according to the particular clinical circumstances, with the patient making the ultimate (informed) choice in the faculty clinics.

Respondents from 5 of the 8 schools stated that students are required to perform specific numbers of adult restorations, ranging from 60 restorations to 250 surfaces. These

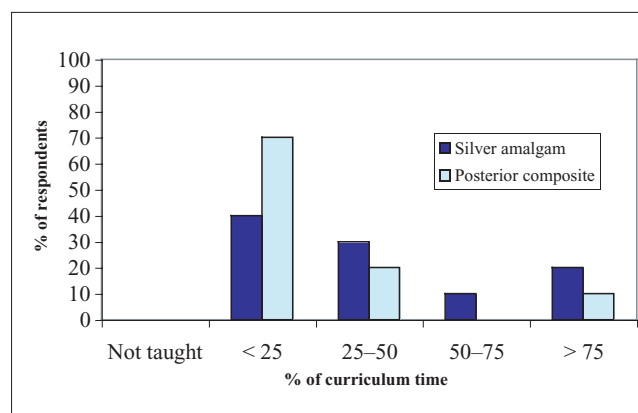
**Table 1 Agreement with suggested contraindications for Class II restorations with either composite or amalgam (operative and restorative departments)<sup>a</sup>**

Contraindication	Composite	Amalgam
Poor oral hygiene or high risk of caries	8	0
Gingival margin on root structure	6 (2-partial)	0
Inability to place rubber dam	7 (1-partial)	0
Parafunctional activity or heavy occlusion	6	0
Cavity size > half to two-thirds of intercuspal width	7	0
Large pulps	2	0
Direct or indirect pulp cap	0	0
Core buildup (vital teeth)	3	0
Abutment for removable partial denture	3	0
Patient's health problems	0	1
Patient's concerns about mercury	0	7
Contact with dissimilar metal	0	3
Pregnancy	0	5

<sup>a</sup>Data are presented as number of programs indicating that the specified problem or condition is taught as a relative contraindication for restoration

programs specify required numbers of surfaces for each material. One program specifies a minimal number of either type of restoration as “minimum core experience” and expects the student to gain further clinical experience from the provision of comprehensive patient care. Two programs have eliminated requirements for a specific number of restorations in the move to comprehensive care, but they clearly expect that students will achieve clinical competency in direct restorations. Six of the 8 responding schools have tests of clinical competency in performing Class II restorations, and 5 of these include testing of Class II competency with both types of direct restorative materials.

Didactic teaching in all programs includes provision of information to students concerning advantages and limitations of the restorative materials. Of the possible contraindications listed on the questionnaire, 5 were identified by most or all respondents as relative contraindications for use of composite in the posterior permanent dentition (Table 1): poor oral hygiene or high risk of caries, presence of a gingival margin on root structure, inability to place a rubber dam, parafunctional activity or heavy occlusion, and large cavity size (more than one-half to two-thirds of the intercuspal width). Three of the schools prefer not to use composite for vital core buildup before crown procedures, and 3 schools advocate against composite for proximo-occlusal restorations in a removable partial denture abutment. Relative contraindications for amalgam included patients' concerns about mercury and pregnancy. Three schools teach that amalgam should not be used if it will come in contact with dissimilar metals. Respondents cautioned that these contraindications were not always



**Figure 2:** Proportion of curriculum time for direct posterior restorations spent on silver amalgam and composite materials within pedodontic departments.

absolute and that case-specific factors are considered in each clinical situation.

The responses for the pedodontic program curricula were more diverse. All schools reported that they teach both materials didactically, but the time devoted to each varied widely. The proportions of curriculum time for direct restorations devoted to silver amalgam and posterior composite each varied from less than 25% to more than 75% (Fig. 2). In most schools, less than 25% of the curriculum time was devoted to direct posterior composite restorations. About equal numbers of programs devoted less than 25% or 25% to 50% of curriculum time to silver amalgam. Two schools reported that more than 75% of curriculum time was devoted to teaching and use of silver amalgam, and one school reported that more than 75% of curriculum time was devoted to teaching and use of posterior composite. There was a wide range of teaching practices among pedodontic programs, with some schools not using composite for proximal caries in primary teeth and others not using silver amalgam.

All of the program directors for pedodontic programs provided additional information about the use of stainless steel crowns, which clearly play an important role in direct restoration of heavily decayed primary teeth. The omission of the stainless steel option from the questionnaire influenced the actual percentages but not the relative emphasis between composite and silver amalgam in the pedodontic curricula. In terms of the emphasis on each material in the 10 pedodontic programs, 5 schools favoured silver amalgam, 3 schools gave equal emphasis and 2 schools favoured posterior composite. There were few differences within each school between preclinical emphasis and clinical use of materials in the pedodontic programs. Some program directors noted that for patients with a high risk of caries and those needing larger preparations in primary molars, the best treatment option would be silver amalgam or a stainless steel crown.

The reasons for the diversity of responses appeared to be related to biocompatibility and longevity. Material-specific issues documented by respondents included balancing esthetic considerations with durability for the primary dentition and the sensitivity to technique of composite placement in young children. Many respondents commented that composite restorations are performed on a case-by-case basis and that this option is reserved for conservative cavity preparations in both the primary and the young permanent dentition; however, one respondent mentioned the 1996 Health Canada recommendations<sup>8</sup> and noted that “non-mercury filling materials [are used] whenever possible to restore primary teeth.” Another respondent stated that “students and patients enthusiastically embrace posterior composite but are aware of [its] limitations.” One school reported that students are given a handout about use of restorative materials in its pedodontic clinic, but the handout mentions only composite and stainless steel crowns (composite for conservative preparations and stainless steel crowns for multisurface lesions or after pulp therapy). Respondents from Quebec noted that the provincial dental plan covers only the cost for silver amalgam restorations in children under 10 years of age and that many parents refuse composite because of the extra cost. At one school outside Quebec, composite is never used for proximal caries in primary teeth. Patient populations and payment schemes therefore influenced the diversity of practices in pedodontic programs, but teaching philosophies also covered a wide spectrum.

No clinical requirements were specified in any of the pedodontic programs. It appeared that all schools conduct a specific number of pedodontic sessions through the undergraduate clinic program, with the students providing the clinical care required by the children attending. Three of the 10 dental schools conduct tests of clinical competency in the pedodontic discipline. The relative contraindications for each material taught in the pedodontic programs were similar to those reported for the operative and restorative programs (Table 2).

For both pedodontic and operative and restorative programs, almost all of the schools indicated some stability of curricula and did not anticipate major curriculum changes in this area over the next year or 2. One school suggested the possibility of fine-tuning the didactic information, and 2 schools indicated that they might increase the number of preclinical exercises for posterior composite restorations. Within some of the faculties, there were differences between the operative and restorative program and the pedodontic program with respect to emphasis on different materials. Four schools reported the same relative curriculum time for both materials, 3 indicated greater emphasis on composite restorations in the pedodontic

**Table 2 Agreement with suggested contraindications for Class II restorations with either composite or amalgam (pedodontic departments)<sup>a</sup>**

Contraindication	Composite	Amalgam <sup>b</sup>
Poor oral hygiene or high risk of caries	9	1 (SS crown)
Gingival margin on root structure	8	2 (SS crown)
Inability to place rubber dam	9	1 (SS crown)
Parafunctional activity or heavy occlusion	3	1 (SS crown)
Cavity size > half to two-thirds of intercuspal width	5	6 (SS crown)
Large pulps	2	2 (SS crown)
Direct or indirect pulp cap	4	2
Patient's health problems	1	2
Patient's concerns about mercury	0	8
Contact with dissimilar metal	0	3

<sup>a</sup>Data are presented as number of programs indicating that the specified problem or condition is taught as a relative contraindication for restoration.

<sup>b</sup>Some respondents indicated that a stainless steel (SS) crown is used when there is a contraindication to use of a composite material.

curriculum, and 1 indicated greater emphasis on silver amalgam restorations in the pedodontic curriculum.

## Discussion

The most recent surveys of educational curricula for dentistry, published in 1998 and 2000, showed that teaching and clinical use of posterior composites in permanent teeth were increasing.<sup>3-6</sup> At that time, most North American schools devoted less than 20% of operative teaching time to Class I and II composites, and graduates received minimal clinical experience.<sup>3</sup> The percentage was higher for Europe, and the authors commented that teaching in Europe was moving more toward an emphasis on clinical practice than was the case in North American schools.<sup>4</sup> The previous survey of the North American academic community<sup>3</sup> indicated greater confidence in the clinical longevity of silver amalgam restorations and the list of contraindications for posterior composites taught in the various programs revealed academic awareness of potential limitations of composite material. The most common contraindications for posterior composite reported in both the earlier North American<sup>3</sup> and European<sup>4</sup> surveys included routine replacement of silver amalgam restorations with composite, inadequate gingival enamel and patient susceptibility to caries. Many factors other than the material itself influence restoration longevity, including the skills of the operator and the patient's risk of caries. The authors of the European survey report commented that “care should be taken to avoid the pitfall of continuing to view restorations as we know them today as ‘permanent’ rather than as a stage in the lifelong management of diseased and otherwise damaged teeth.” A popular modern textbook emphasizes the limitations of and preferences for

placement of posterior composites, with emphasis on appropriate case selection, conservative cavity preparation and technical excellence.<sup>1</sup> This approach is reflected in current teaching practices across Canada with respect to use of composites in adult patients.

The results of the current survey indicate that the teaching of posterior composites for restorations in adults has increased since 1997 and that the proportion of curriculum time in most schools has stabilized between 25% and 50% of the teaching time devoted to direct posterior restorations. The majority of schools indicated that they anticipate little or no curriculum change to this aspect of their curricula in the next year or 2. The comments provided by course directors indicate that universities are facing the same pressures as private practitioners and that choice of material may reflect patients' desires rather than scientific considerations. Many respondents indicated that even though silver amalgam is still the major posterior direct material, the preference among patients is tending toward composite restorations. Educators indicated that because today's patients request tooth-coloured restorations, graduates must be competent to meet the demand.

The diversity in the controversy between silver amalgam and posterior composite was most evident in curricula pertaining to pedodontic care, and the results among schools were somewhat polarized. A diversity of responses was also reported in a larger survey of North American pediatric dentistry departments published in 2001.<sup>7</sup> The authors of that survey concluded that this diversity might reflect uncertainty related to the requirements for optimal restoration of primary teeth. However, for the majority of schools, silver amalgam continued to be the material of choice for Class I and II restorations in primary molars. When tooth-coloured materials were indicated, the slot type of cavity preparation was preferred. A weakness of the current questionnaire was the omission of the option of stainless steel crowns as direct restorations for the primary dentition. The use of stainless steel crowns in more heavily decayed, multisurface lesions and after pulp therapy reduces dependence on silver amalgam. It is clear that educators in many schools are aware of the limitations on placement and longevity of posterior composites in such situations, particularly for children with high risk of caries.

It is usually accepted that an increase in the teaching and use of posterior composites reflects decreased emphasis and dependence on silver amalgam for load-bearing clinical situations. Because there has been a gradual improvement in composite bonding and restorative materials, as well as increasing documentation of adequate longevity in clinical studies and improvements in insertion techniques, the teaching of posterior composites has increased in recent years. The results of the survey reported here indicate that both silver amalgam and posterior composite are included

in the current educational curricula of all Canadian dental schools and that these curricula are not expected to change significantly in the near future. Teaching practices are relatively consistent across Canadian adult operative and restorative programs, and there is more diversity in teaching among the pedodontic programs. Dental school clinics face the same patient pressures and treatment dilemmas with respect to choice of direct restorative materials as do dentists in private practice. ♦

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## **Appendix 1: The Teaching of Silver Amalgam and Posterior Composite Restorations in Canadian Faculties of Dentistry**

This questionnaire is intended for separate responses from both Operative/Restorative and Pedodontic Undergraduate Programmes (i.e. one questionnaire each).

1) Please indicate your University:

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2) Please indicate [✓] which Undergraduate Programme:

Undergraduate Operative/Restorative Programme [ ]

Undergraduate Pedodontic Programme [ ]

3) What approximate proportion (✓) of the discipline undergraduate curriculum time, related to direct posterior restorations, is devoted to teaching:

a) silver amalgam restorations (circle)

Not taught [ ]      <25% [ ]      25-50% [ ]      50-75% [ ]      >75% [ ]

b) posterior composite restorations (circle)

Not taught [ ]      <25% [ ]      25-50% [ ]      50-75% [ ]      >75% [ ]

4) What are the pre-clinical requirements [number of laboratory exercises] for:

a) silver amalgam restorations:

Class I molars [ ]      Class II molars [ ]      Class V molars [ ]

Class I primary molars [ ]      Class II primary molars [ ]

Complex cusp replacements (molars) [ ]

Class I bicuspid [ ]      Class II bicuspid [ ]      Class V bicuspid [ ]

Core build-up restorations for crowns:

“vital” teeth [ ] with pins [ ]      “non-vital” teeth [ ] with pins [ ]

b) Posterior composite restorations:

Class I molars [ ]      Class II molars [ ]      Class V molars [ ]

Class I primary molars [ ]      Class II primary molars [ ]

Complex cusp replacements (molars) [ ]

Class I bicuspid [ ]      Class II bicuspid [ ]      Class V bicuspid [ ]

Core build-up restorations for crowns:

“vital” teeth [ ] with pins [ ]      “non-vital” teeth [ ] with pins [ ]

5) What are the clinical requirements at your faculty with respect to:

a) silver amalgam restorations:

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Please indicate [✓] whether the numbers provided above refer to surfaces [ ] or restorations [ ].

b) posterior composite restorations:

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Please indicate [✓] whether the numbers provided above refer to surfaces [ ] or restorations [ ].

6) What contra-indications, if any, do you teach (✓) with respect to use of each material in Class II situations:

	Silver amalgam	Composite
Poor oral hygiene/high caries risk	[ ]	[ ]
Gingival margin on root structure	[ ]	[ ]
Inability to place rubber dam	[ ]	[ ]
Parafunctional activity/heavy occlusion	[ ]	[ ]
Cavity size > 1/2-2/3 inter-cuspal width	[ ]	[ ]
Large pulps	[ ]	[ ]
Direct/indirect pulp cap	[ ]	[ ]
Endodontically treated teeth	[ ]	[ ]
Core build up (vital teeth)	[ ]	[ ]
Removeable partial denture abutment	[ ]	[ ]
Patient health problems	[ ]	[ ]
Patient mercury concerns	[ ]	[ ]
Contact with dissimilar metal	[ ]	[ ]
Pregnant patient	[ ]	[ ]

Other: \_\_\_\_\_

7) Please provide a brief statement, or statements, concerning your school's educational philosophy with regard to the teaching of silver amalgam and resin composite restorations:

8) Do you have a clinical competency test:

- a) Class II amalgam                      Yes [ ]                      No [ ]  
b) Class II composite                      Yes [ ]                      No [ ]

9) Provide any additional useful information (criteria/recommendations/adverse effects/external pressures/patient pressures, etc) concerning the current teaching of silver amalgam and/or posterior composite restorations at your faculty.

10) Do you anticipate any changes to this aspect of your curriculum in the next year or two?

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Contact Name: \_\_\_\_\_

Tel. No: \_\_\_\_\_

I would like a copy of the survey results [ ]

*Thank you most sincerely for completing this questionnaire, which will provide useful information for the Dental Materials and Devices Committee of the Canadian Dental Association.*

*Dr. Dorothy McComb, Chair*