



Materials and techniques for restoration of primary molars by pediatric dentists in Florida

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Abstract

Purpose: The purpose of this study was to obtain an overview of materials and techniques used by pediatric dentistry clinicians for posterior restorations in primary molars and to compare the results to what is being taught in dental schools.

Methods: A form with questions in different formats was mailed to all 180 members of the American Academy of Pediatric Dentistry in Florida. The information requested included material selection for restorations in primary molars and the type of cavity preparation for amalgam and resin-based materials, and the bonding system in use. The response was anonymous, but information about gender and year of graduation for the clinicians was provided.

Results: Seventy percent of the clinicians responded to the survey. Resin-based materials were the most commonly selected for Class I and II restorations, while stainless steel crowns were the predominant material when 3 or more surfaces are involved. The slot-type of preparation was the most commonly used for tooth-colored restorations and the fifth generation ("one-bottle system") of bonding agents was the preferred adhesive system in use in primary molars.

Conclusions: Different opinions were found between clinicians and educators in respect to material selection and contraindication criteria for the use of tooth-colored restorations in primary molars. (*Pediatr Dent.* 2002;24:326-331)

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Restorative dentistry in general practice, and for pediatric patients in particular, has advanced markedly during the 20th century. The large variety of products available on the market and different materials indicated for the same restorative purpose make the selection decision difficult for the clinician. Christensen¹ enumerated concepts that can help the clinician in this selection, such as manufacturer's reputation, independent non-profit evaluating groups' reviews, professional peers' opinions, dental school recommendations and continuing education courses with distinguished researchers and clinicians.

Mjör et al.,² recognized that size and location of the prepared cavities and physical properties of the materials are important factors in the selection of materials. Other factors considered were esthetics, the dentition treated, the age and gender of the patient, the type of practice (private or public health), socioeconomic status and the experience and

gender of the clinician. Third-party payment system, including insurance coverage and political restrictions on the use of certain materials, may also have an effect on the availability and selection of dental materials. Berg,³ in a comprehensive review of pediatric restorative dental materials, advised that once the clinician understands the materials' properties, the material selection should be based on the individual needs.

A recent survey assessing the teaching of posterior restorations in primary molars in North American dental schools revealed that amalgam continued to be the material of choice for Class I and II restorations and resin-based materials were being considered alternative materials for amalgam. However, for Class II restorations, resin-based materials had some restrictions.⁴ On the other hand, recent assessments of pediatric practitioners in Scandinavia^{5,6} and Wales⁷ reported the use of glass ionomer as the preferred material for restorations

Questionnaire

- Is your practice limited to pediatric dentistry?
 Yes No
- For posterior restorations in primary molars, what is/are the material(s) in use in your practice?
 Amalgam Compomers
 Hybrid composites Macrofilled resin
 Microfilled composites Resin modified glass-ionomer
 Stainless steel crowns Other
- Based on the number of tooth surfaces affected, what is your preferred material for:
 1 surface (occlusal): _____(material);
 2 surfaces: _____(material);
 or more: _____(material).
- If you use amalgam, do you prepare classic GV Black Class I and II cavity preparations in primary teeth?
 Yes No
- When a base is deemed or considered necessary under an amalgam restoration for a primary molar, which of the following options is being performed in your clinic?
 Ca(OH)₂ based material
 Glass-ionomer based material
 Total etch technique, including bonding materials
 None
 Other _____.
- If you use composite resins, compomers and/or glass-ionomers as alternative materials for amalgam in Class II restorations in primary molars, what type of Class II cavity preparation do you perform in cases where only the proximal surface is involved?
 Conservative, rounded preparation with no occlusal extension (slot-type of preparation)
 Conservative preparation with retention grooves in the box
 Classic Class II preparation, similar to amalgam
 Other _____
- What is the preferred bonding system in use in your clinic?

- What *contraindications* do you consider (x) for the use of tooth-colored filling materials in posterior restorations in primary molars?
 None Behavior management problem
 Poor oral hygiene Parafunctional activity (bruxism)
 Patient's age After pulpotomy/pulpectomy
 Inability to place rubber dam More than 2 surfaces involved
 Proximal gingival margin On large restorations (more than 1/3
 Allergy intercusp distance)
- Regarding the use of cement bases/liners for primary molars, indicate (x) your preference:

	None	Ca(OH) ₂ type	Glass ionomer type	Total etch and bonding
Shallow (- outer 1/3 of dentin)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Moderate (- middle 1/3 of dentin)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Deep (- inner 1/3 of dentin)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
- Year of graduation from dental school: _____.
- Gender: Male Female

Fig 1. Survey form

in primary molars, regardless of the type of cavity preparation.

The purpose of this study was to obtain an overview of materials and techniques used by pediatric dentistry clinicians for posterior restorations in primary molars and to compare the results to what is being taught in dental schools.

Methods

In December 2001, a questionnaire (Fig 1), with a cover letter explaining the study, was mailed to all 180 members of the American Academy of Pediatric Dentistry in Florida. A pre-stamped envelope was included for the reply. In January 2002, a reminder was sent to all those who received the initial letter.

The survey form consisted of 10 questions: a few open-ended questions for comments to be made, some in a yes/no format and others in a multiple-choice format. They were based on a previous study by Guelmann et al,⁴ addressed to

pediatric undergraduate dental programs in North America. The questions assessed the type of practice (limited or not to children), the material selection for restorations in primary molars and its specific indication for the different types of cavity preparation. Furthermore, detailed information about the type of cavity preparation for amalgam and resin-based materials, the preferred bonding system in use, contraindications for the use of tooth-colored materials, and the type of bases and liners indicated for different depths of preparations were requested. The participants responded anonymously to the survey, but identified their gender and year of graduation from dental school.

Results

A 70% response rate was obtained (126/180), but one did not disclose his/her gender or year of graduation. Most clinicians answered the majority of questions related to the different issues and the

response rate for each category was calculated based on the number of respondents. For some questions, more than one alternative was selected. Table 1 illustrates the study group distribution. It consisted of 72% male and 28% female practitioners. Seventy-four percent (25/34) of the female dentists graduated during the last decade. Ninety-seven percent of

Table 1. Study Group Distribution

Year of graduation	Male (n)	Female (n)	Total (n)
Group 1: 1959-1970	18	1	19
Group 2: 1971-1980	23	3	26
Group 3: 1981-1990	23	5	28
Group 4: 1991-2000	27	25	52
Unknown	-	-	1
Total	91	34	126

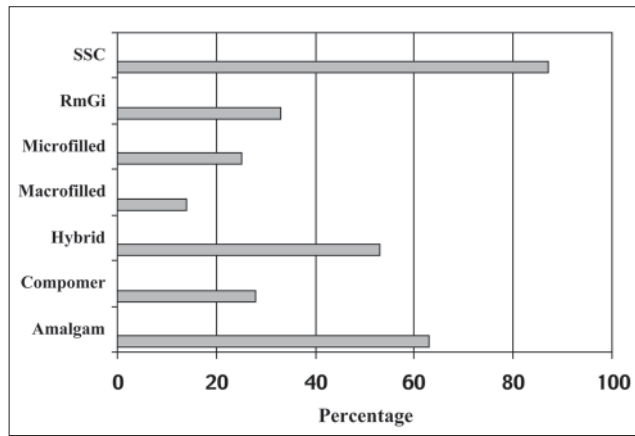


Fig 2. Material selection for posterior restorations in primary molars. RmGi: resin-modified glass ionomer; SSC: stainless steel crown.

the respondents' practices (122/126) were restricted to pediatric patients.

Material selection

Figure 2 shows the materials selected for general use in primary molars. Multiple alternatives were selected by most clinicians. Forty-seven clinicians (37%) reported their clinics to be amalgam free. Among these, 53% (25/47) belonged to the group of practitioners that graduated during the last decade. For resin-based materials (hybrid, macrofilled, microfilled and compomer), the hybrid type was the most popular (53%). Stainless steel crown (SSC) was selected by 110 (87%) clinicians as one of several restorative materials for posterior restorations.

Figure 3 displays clinicians' material preference for Class I, Class II and when three or more surfaces are involved. Table 2 summarizes the results based on gender and year of graduation. Resin-based materials were commonly selected for Class I (59%) and Class II (46%) restorations. Amalgam only, was chosen by 20% (Class I) and 28% (Class II) of the respondents (Figs 4 and 5). In general, female dentists use more resin-based materials and less amalgam for posterior restorations than male practitioners. When three or more surfaces are involved, stainless steel crowns were the preferred material for 60% of the clinicians.

Type of cavity preparation

When amalgam was selected as the preferred material, the classic G.V. Black type of cavity preparation was used in 85% of the cases. For resin-based materials, the slot-type of preparation was the most frequently used (80/123) when only the proximal surface was carious. Among those clinicians using this conservative type of preparation, 33 reported adding retention grooves (Fig 6).

Bonding system

The respondents named the brand of adhesive system used in their clinics. Due to the great variety of products listed, the materials were classified by their generation to facilitate

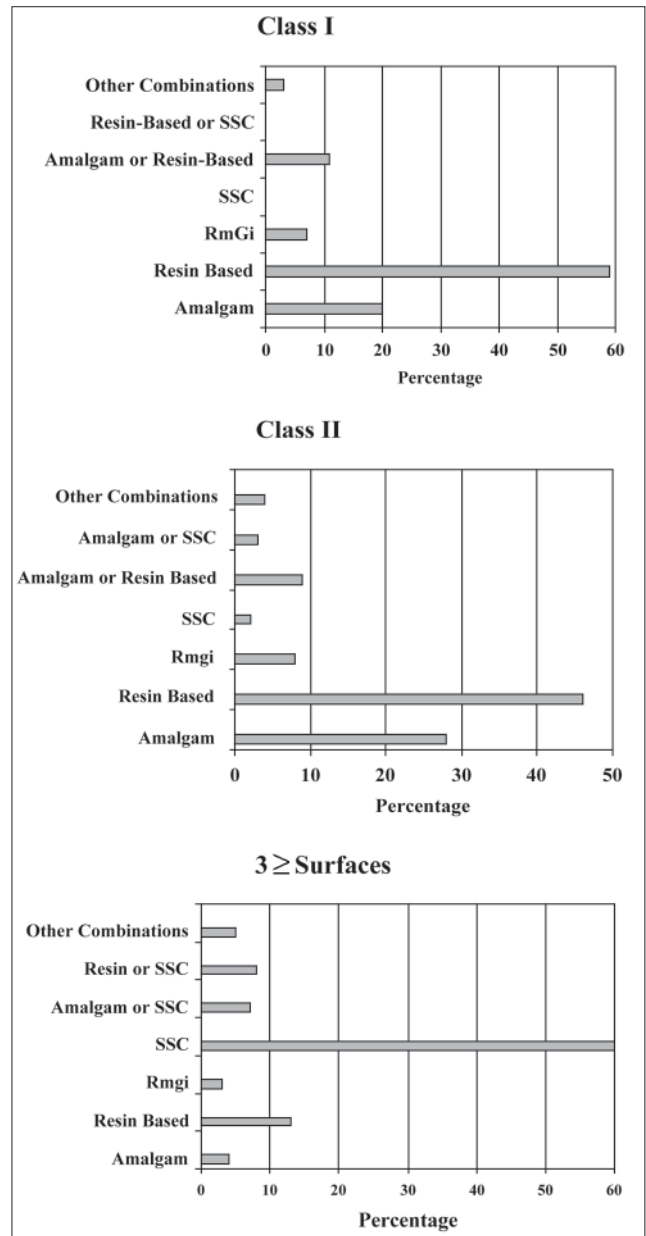


Fig 3. Material selection according to type of cavity preparation. RmGi: resin-modified glass ionomer; SSC: stainless steel crown.

the data analysis. The fifth generation of bonding agents ("one-bottle" system) was the preferred type for posterior restorations in primary molars (68%): Prime & Bond, Single Bond and Optibond, in this order, were the most popular materials. Scotchbond Multipurpose Plus for the fourth generation ("multiple bottle" system) and Prompt-L-Pop followed by Clearfill SE was the most frequently selected brand for the self-etching type of materials (sixth generation).

Clinicians were also asked to report their contraindications for the use of tooth-colored filling materials in primary molars. Those results are summarized in Table 3.

Table 2. Material Selection Based on Year of Graduation and Gender

Year of graduation	1959-1970		1971-1980		1981-1990		1991-2000		Total		
	M	F	M	F	M	F	M	F	(n)	M	F
Class I											
Amalgam	4	0	7	0	4	0	4	6	25	19	6
Resin-based	8	0	12	5	12	2	18	15	72	50	22
RmGi*	0	0	3	0	1	0	2	2	8	6	2
Amalgam or resin-based	3	0	2	0	3	0	3	1	12	11	1
Other combinations‡	0	1	0	0	2	0	0	0	3	3	0
Total	15	1	24	5	22	2	27	24	120	89	31
Class II											
Amalgam	4	0	7	0	9	0	5	9	34	25	9
Resin-based	7	1	6	3	8	2	16	12	55	37	18
RmGi	0	0	3	0	1	0	4	2	10	8	2
Amalgam or resin-based	3	0	2	0	1	2	1	1	10	7	3
Other combinations‡	2	0	4	0	4	1	1	0	12	11	1
Total	16	1	22	3	23	5	27	24	121	88	33
3 or more surfaces											
Amalgam	1	0	2	0	2	0	0	0	5	5	0
Resin-based	2	0	3	1	1	0	6	3	16	12	4
SSC†	8	1	13	1	12	3	17	18	73	50	23
Amalgam or SSC	2	0	1	0	3	1	0	1	8	6	2
Resin-based or SSC	1	0	1	1	2	1	1	2	9	5	4
Other combinations‡	1	0	2	0	3	0	3	1	10	9	1
Total	15	1	22	3	23	5	27	25	121	87	34

*RmGi: Resin-modified glass ionomer

†SSC: Stainless steel crown

‡Other combinations: included amalgam and Rmgi or resin-based and Rmgi

The use of cement bases/liners for primary molars

When a base was deemed necessary under an amalgam restoration, glass ionomer was selected by 41% (34/83) of the clinicians, while calcium hydroxide was selected by 29% (24/83). The combination of both materials was indicated by 12% (10/83) of the respondents.

Regardless of the type of filling material, in shallow cavities no base was used by most clinicians. For moderately deep cavities, no base or the use of a glass ionomer type of material were the preferred options. In deep cavities, glass ionomer alone or calcium hydroxide alone were the most selected materials (Fig 7).

Discussion

The response rate of 70% was considered to be good compared to other studies^{5,6} based on an open invitation to participate and without incentives provided. It is difficult to determine if the study group from Florida is representative of the pediatric clinicians in the United States, but there are no indications that they should not be. The male-female

distribution was uneven as far as years since graduation was concerned and females were heavily concentrated in the “recently graduated” group (1990-2000).

When one compares the results of this study to a previous one assessing what is being taught in dental schools for posterior restorations in primary molars,⁴ a distinct difference was obtained regarding material selection. Dental schools teach amalgam as the predominant material for Class I and II restorations in primary molars, whereas clinicians preferred resin-based materials. Among the resin-based materials, hybrid composites and compomers were the most chosen, confirming the increased popularity of these materials in pediatric dentistry,⁸ despite the short longevity reported for composite fillings.^{5,9}

Low popularity for selection of resin-modified glass ionomers materials was found among the clinicians in this study, although good clinical success has been reported.¹⁰⁻¹² Improved esthetics and better handling properties of other tooth-colored materials, like compomers and composite resins,^{3,13} may also have contributed to this selection. In

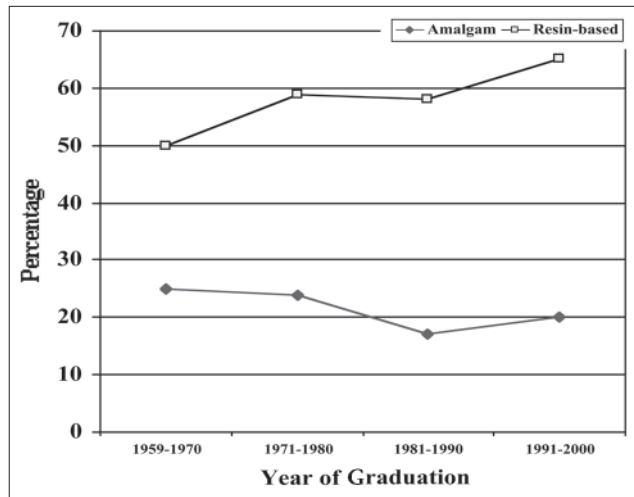


Fig 4. Material selection for Class I restorations based on year of graduation

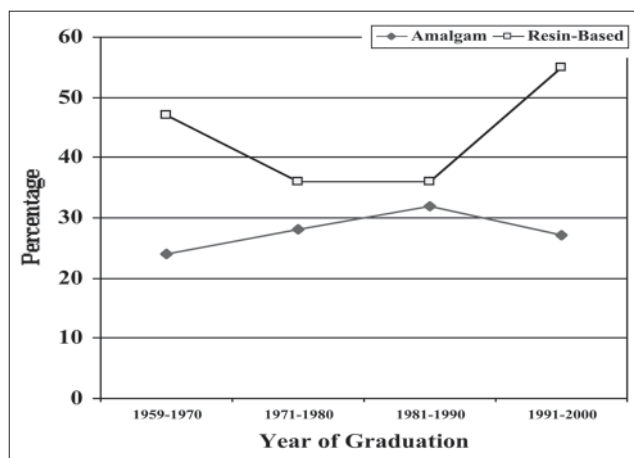


Fig 5. Material selection for Class II restorations based on year of graduation

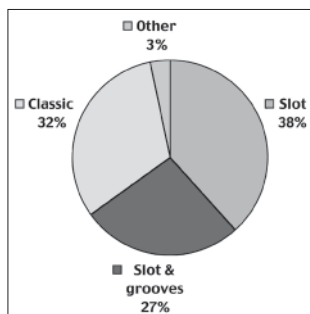


Fig 6. Type of proximal preparation for resin restorations

pediatric practices were similar to those taught in dental schools. However, when comparing contraindications for the use of tooth-colored materials, dental schools were more restrictive than practitioners. They differed from the present study group's opinion in that, poor oral hygiene, inability to place rubber dam and gingival margin subgingivally located were considered contraindications for the placement of resin-based types of restorations. Lack of attention to all or some of these technique details and conditions might have had a negative influence on the success rate of technically

Table 3. Contraindications for Using Tooth-Colored Materials

Chosen by >50% of respondents	Chosen by <25% of respondents
Behavior management	Patients' age
Bruxism	Inability to use rubber dam
After pulpotomy and pulpectomy	Gingival margin subgingival
Large restorations	Allergy

sensitive materials, like compomer restorations, in primary molars.¹⁴ Clinicians and dental schools are in agreement about the use of stainless steel crowns for large restorations and after pulpotomy and pulpectomies. The use of stainless steel crowns over time proved to be better than multisurface intracoronal restorations.¹⁵ The use of base materials by the clinicians was similar to that taught in dental schools in cavities of different depths.

The use of "one-bottle" (fifth generation) adhesives has gained popularity among pediatric dentistry clinicians, as reported in this study. However, there is no support in the literature that fifth generation of bonding agents performs better than the traditional and successful "multiple-bottle" technique (fourth generation).¹⁶ Perhaps the simplicity of the "one-bottle" technique, with fewer steps involved, could be one of the reasons for this popularity. The fact that 18% of the respondents selected the "all-in-one" type of bonding agents as their main use substantiates the importance of using a simple technique. Although poor laboratory results were reported,^{17,18} a survival rate of 88% after 2 years was recently reported for Class II restorations in primary molars.¹⁹ According to Christensen,¹ clinicians should not rely on in vitro data to make clinical decisions, because in vivo reports are necessary before conclusions on a material's or technique's performance can be made.

A conflict of concepts was found between the opinion of academicians and clinicians. Private practice dentistry for children, at least in the state of Florida, showed to be more esthetically inclined than what pediatric programs teach dental students and residents. Educators should critically analyze the results of this study and review materials used in their teaching programs in pediatric dentistry. The practitioners' reason for selecting tooth-colored materials may be based on esthetic demands rather than longevity data. This discrepancy between dental schools and clinicians in the selection of restorative materials can only be settled after longevity data on the various options become available.

Conclusions

1. Clinicians selected resin-based materials as the preferred restorative material for Class I and II cavities in primary molars. When 3 or more surfaces are involved, stainless steel crowns were the predominant material.

2. Marked diversity in the criteria for contraindications for the use of tooth-colored materials was noted by comparing the clinicians' use and that taught by dental schools.
3. Fifth generation ("one-bottle") bonding agents were most commonly selected for use in primary molars.
4. Cavity preparation and the use of bases and liners, regardless of the material used by practitioners, were similar to that taught in dental schools.

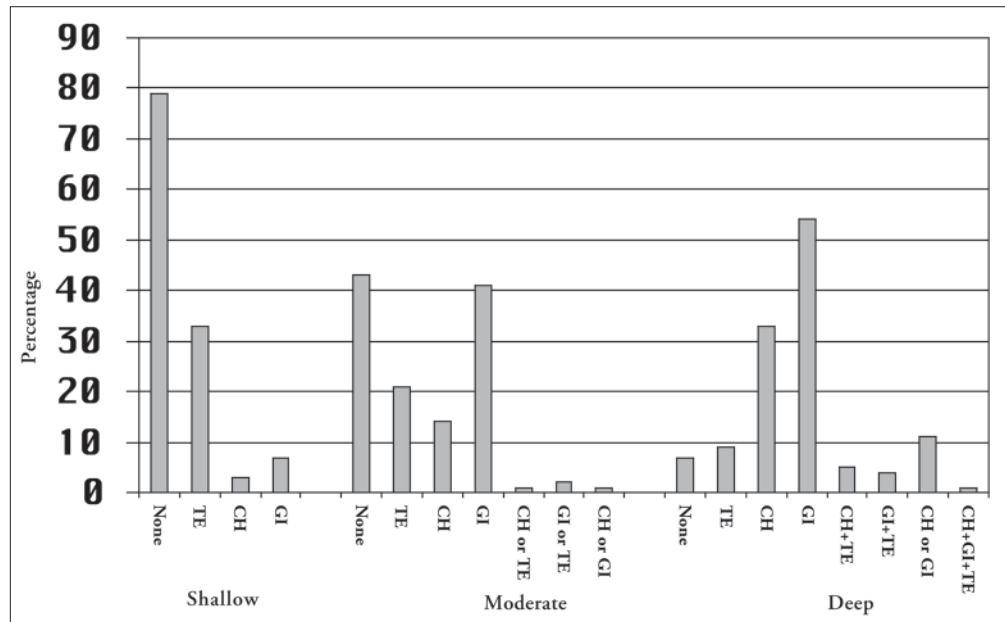


Fig 7. Indications for the use of bases and liners in different depth cavity preparations. GI: glass ionomer; CH: calcium hydroxide; TE: total etch.

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