Restorative treatment pattern and longevity of resin restorations in Denmark

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A survey has been made of the reasons for placement and replacement of 883 resin restorations in Denmark. In patients more than 16 years of age 39% of all restorations were made because of primary caries, and 61% were replacements of failed restorations. In primary teeth 63% and in permanent teeth of children 65% of the restorations were made because of primary caries. The reasons for replacement of restorations were dependent on dentition, age of the patient, and type of restoration. Secondary caries, loss of fillings, and marginal discrepancies were the most frequently recorded reasons for replacement of failed resin restorations. The age of the restorations replaced ranged from 0 to 15 years, and half of the replaced resin restorations in adults were just over 6 years old. In permanent teeth in children half of the failed restorations were replaced within 2 years, whereas half of those in primary teeth were replaced within 1 year. Information on a selected material of old silicate cement restorations in adults showed that two-thirds of these were replaced owing to marginal discrepancies and lost fillings. □ *Composites; dental materials; health care delivery; operative dentistry; silicate cements*

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Tooth-colored resin materials are being used with increasing frequency in restorative dental treatment. This development is a result of the introduction of improved materials and application techniques (1–6). There are reasons to believe that the classical failures of resin restorations due to inadequate marginal adaptation and lack of color stability have been reduced, leading to more extended durability. This communication describes information on treatment patterns and longevity of resin restorations collected from Danish dentists.

Materials and methods

The material was collected during the period 1980–82. A questionnaire was sent to 338 dentists who were about to participate in postgraduate courses in cariology. For each of the first 30 fillings they placed in a given period of 2 weeks, the dentists were asked to record information on whether a filling was made because of primary caries or as a replacement of an old filling. In the latter case the dentists were asked to record information about the type of old and new filling, filling material used, and the approximate age of the old filling in years on the basis of information from records. Finally, the dentists were asked to record their major reason for the replacement; this might be primary caries or one of the nine different reasons indicated in Table 3. The terms used were briefly described in enclosed instructions (7). In addition, information on patient age was recorded. Of the participating dentists 261 (77%) responded with information about 18 to 30 restorations placed during the study period. Information was obtained on the placement of 6999 new fillings, of which 6052 were amalgam restorations, 883 resin restorations, 13 silicate restorations, and 51 cast restorations. This communication focuses on the resin restorations.

Table 1. Distribution of 883 resin restorations in primary and permanent teeth in accordance with the age of patients and the reason for treatment

Dentition	Age of patient, years	Reason for treatment with resin restoratives		Total
		Primary caries	Replacement of failed fillings	
Primary	≤16	36 (63%)	21 (37%)	57
Permanent	≤16	263 (65%)	139 (35%)	402
Permanent	>16	165 (39%)	259 (61%)	424
Total		464 (53%)	419 (47%)	883

Results

The distribution of the 883 resin restorations in relation to dentition, age of the patients, and reason for restorative treatment is given in Table 1. The resin restorations represent 3% of the new restorations in primary teeth, 11% of those in permanent teeth of children, and 28% of the total number of restorations in permanent teeth in adults (7). Two-thirds of the resin restorations in children and just over one-third of those in adults were made to arrest primary caries; the rest were replacements of failed restorations (Table 1).

Table 2 gives the percentage distribution of the types of restoration in relation to dentition and age of the patients. The commonest type of restoration was class III fillings. In addition, class V fillings accounted for every fourth resin restoration in primary teeth and in permanent teeth of adults. Analysis of the total material (6999 restorations) disclosed that three-fourths of the class III and all the class IV fillings were resin restorations. Only 1% of the class I and II restorations and one-fourth of the class V restorations were made with resin materials.

Almost half of the resin restorations represent replacement of failed restorations (Table 1), and 110 (99 in adults and 11 in children) of these had previously been made in silicate cement. Table 3 includes information about the recorded major reasons for the replacement of the remaining 309 failed resin restorations. The three commonest reasons were secondary caries, marginal discrepancies and loss of filling. Secondary caries and marginal discrepancies accounted for about half of the replacements in permanent teeth, whereas discoloration played a minor role (Table 3).

A comparison between the reasons for replacements of resin and silicate cement

Table 2. Distribution (%) of the 883 resin restorations in primary and permanent teeth in accordance with the age of patients and the type of restorations

Type of restoration	Distribution of restorations (%)		
	Primary dentition, ≤16 years	Permanent dentition, ≤16 years	Permanent dentition, >16 years
Class I and II	9	10	9
Class III	56	69	55
Class IV	11	10	11
Class V	25	12	25
No. of restorations	57	402	424

Table 3. Distribution (%) of replaced failed resin restorations in primary and permanent teeth in accordance with the age of patients and the major reason for replacement

Reason for replacement	Distribution (%)		
	Primary detention, ≤16 years	Permanent dentition, ≤16 years	Permanent dentition, >16 years
Secondary caries	24	22	38
Discoloration	—	12	10
Marginal discoloration	—	9	4
Marginal discrepancies	5	21	17
Anatomic form	—	2	3
Fracture of filling	—	6	3
Fracture of tooth	—	1	4
Lost filling	71	27	17
Other reasons	—	2	6
No. of restorations	21	128	160

Table 4. Distribution (%) of replaced failed resin and silicate cement restorations in permanent teeth in adults in accordance with the major reason for replacement

Reason for replacement	Resin	Silicate
Secondary caries	38	10
Discoloration	10	5
Marginal discoloration	4	4
Marginal discrepancies	17	46
Anatomic form	3	6
Fracture of filling	3	3
Fracture of tooth	4	2
Lost filling	17	21
Other reasons	6	2
No. of restorations	160	99

fillings in adults is presented in Table 4. These silicate cement restorations represent a highly selected sample, because silicate cements have not been used routinely in Denmark for the last 10 years (Fig. 1). The most striking differences were observed with regard to secondary caries and marginal discrepancies.

Table 5 illustrates the relationship between the type of filling and the major reasons for replacement of resin fillings. Secondary caries was the most frequently recorded reason for the replacement of class III and V restorations. Lost and fractured fillings were frequent reasons for failed class

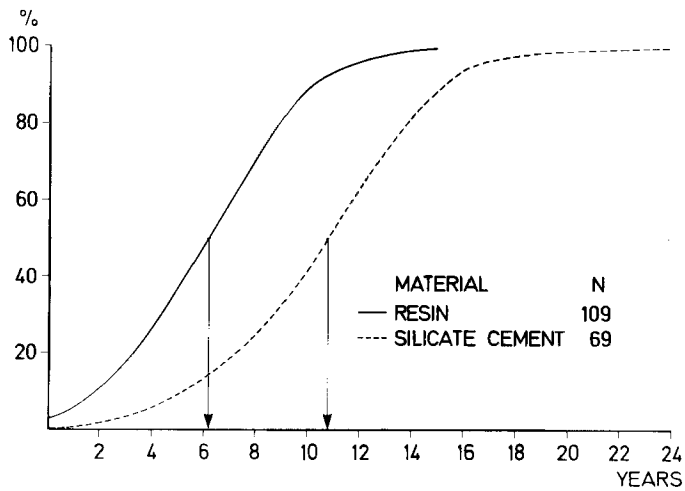

Fig. 1. Accumulated percentage distribution of the age of replaced, failed resin restorations and a selected sample of replaced, failed silicate cement restorations in adults.

Table 5. Distribution (%) of replaced failed resin restorations in primary and permanent teeth in accordance with the type of restorations and the major reason for replacement

Reason for replacement	Distribution (%)			
	Class I, II restoration	Class III restoration	Class IV restoration	Class V restoration
Secondary caries	23	32	7	47
Discoloration	9	11	10	9
Marginal discoloration	5	7	—	4
Marginal discrepancies	27	20	12	11
Anatomic form	9	2	—	2
Fracture of filling	9	1	21	—
Fracture of tooth	—	3	5	—
Lost filling	9	24	40	20
Other reasons	9	2	5	7
No. of restorations	22	200	42	45

IV restorations, and even for class III and V restorations, 'lost filling' was often noted as the reason for replacement.

Information on the age of the replaced fillings was given for 248 (80%) of the 309 resin restorations with failures. The accumulated percentage distributions of the point of time of resin restoration replacement in primary and permanent teeth in children and in permanent teeth in adults are shown in Fig. 2. The distribution curve illustrating replacement time of resin restorations in adults shows that maximum survival time was 15 years and that 90% of the restorations were replaced within 10 years. Of the fillings in adults 50% survived for more than 6 years, whereas the median longevity in children's teeth was low—that is, less than 2 years in permanent teeth and less than 1 year in primary teeth. Detailed analysis further showed that the durability of class III and V restorations in adults exceeded that of class IV restorations and that lost fillings were replaced earlier after treatment than fillings with secondary caries and esthetic shortcomings.

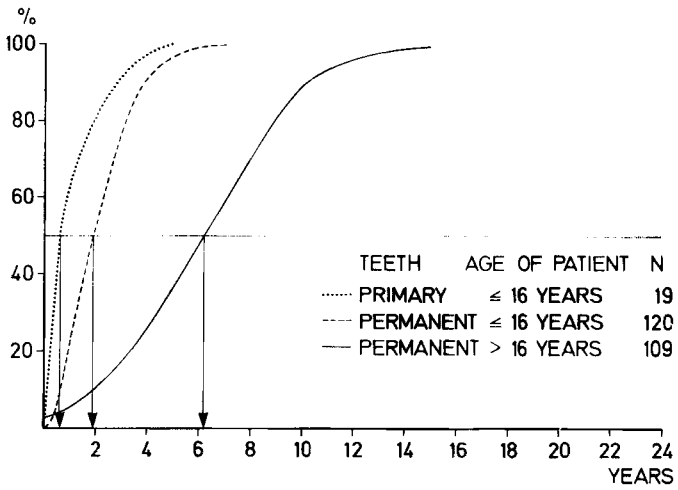

Fig. 2. Accumulated percentage distribution of the age of replaced, failed resin restorations in relation to the dentition and the age of the patient. The points at which the horizontal 50% line crosses the curves represent the time on the abscissa when 50% of the failed fillings had been replaced.

Discussion

Although secondary caries was recorded as the commonest reason for the replacement of both amalgam (7) and resin restorations in adults, the occurrence of the other failures differed considerably. These observations are in agreement with other reports (8–12). However, distinct differences from those in previous studies were also noted in that discolorations were not a major problem, whereas loss of fillings was relatively frequently recorded as reason for replacement of resin restorations (8, 9, 11, 13). Body discoloration of resin restorations is primarily a material defect, and improvements in this property have occurred over the past few years (1–3, 14, 15)—that is, during the period in which many of the failed restorations in our study had been performed.

Marginal discoloration also ties up with the use of still more efficient acid-etch restorative procedures (6, 16–19), which have been in common use in Denmark during the past decade. It is therefore reasonable to assume that the major part of the replaced resin restorations in the present study was performed with acid etching. However, the relatively high frequency of lost fillings may indicate lack of preparation for retention because of an unrealistically great faith of the profession in the retentive possibilities of acid-etching techniques. This may explain why the median longevity of resin restorations in adults in our study, in keeping with previous reports (9, 11, 13, 20–22), was several years less than in a longitudinal study of class III and V resin restorations performed in conventional cavities without acid etching (16, 17, 23). Loss of fillings was even more frequent for restorations performed in children, resulting in a low durability of such restorations. These results probably reflect the difficulties in meeting the requirements of successful use of acid-etch restorative techniques in children and justify the limited use of resin materials in caries treatment of children in Denmark.

The criterion 'marginal discrepancies', which comprised excess and deficiency of filling material together with marginal fractures and gaps between tooth and restoration, was relatively often cited as the major reason for replacement of resin and silicate cement restorations. That this criterion was especially frequent for silicate cement fillings indicates that the clinicians referred to the characteristic loss of material as a marginal problem rather than as a defective anatomic form. Although the present data on silicate cement restorations represent a highly selected sample of 'survivors', they confirm that such restorations have strong anticariogenic properties irrespective of marginal degradation and loss of material (24, 25).

In accordance with the data on replacement of failed amalgam restorations (7) detailed analysis showed that both the type of restoration and the reason for replacement influenced the median longevity of resin restorations, but the differences were relatively limited. Furthermore, the longevity of resin restorations in adults, comprising mainly class III and V fillings, was only slightly less than that of amalgam restorations, representing mainly class I and II restorations. However, the median longevity of class III and V amalgam restorations exceeded that of similar resin restorations by several years. In addition, it has been shown that the rate of functional wear of stress-bearing resin restorations is considerably higher than that for amalgam restorations (26) and that plaque forms more readily on resin materials than on amalgams (27), which is of particular importance for restorations in close proximity to gingival tissues. It is still important, therefore, not to expand the use of resin materials beyond very restricted esthetic indications or allergy to amalgam, even though recent significant advances in material properties and adhesive restorative procedures make it tempting to see tooth-colored resin restorations as an esthetic alternative to amalgam restorations.

The present data emphasize that neither resin nor amalgam restorations can be regarded as permanent types of treatment. Once inserted, the need for replacement is almost inevitable. Prevention of caries progression by non-operative treatment techniques is therefore considered the most important goal of contemporary dentistry.

When inevitable, restorations must be placed, and it must then be realized that the longevity of restorations is determined by several factors, including the properties of the restorative material, the dentist's proficiency, and the oral hygiene of the patient.

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