Restorative caries therapy in nursing home residents using composite resins and compomers without a rubber dam

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Objective: This study was designed to investigate the prognosis of restorative caries therapy applied in nursing home residents. **Method and materials:** In 25 consecutive patients a total of 42 restorations were placed, 23 of composite resin (APX/SE Bond) and 19 of compomer (Dyract). The working conditions, such as patient cooperation, quantity of saliva, location of cavity margins, cavity size, and gingival inflammation, were evaluated prior to treatment. The restorations were evaluated qualitatively at baseline, after 6 months, and after 12 months.[18] **Results:** At 12 months, all examined restorations were clinically acceptable (6 patients had died). There was no significant difference between the quality of the restorations in composite resin and compomer. The plaque scores increased significantly during the study period. **Conclusions:** The study showed that, within the limitation of a short-term follow-up, restorative caries therapy using composite resin or compomer was successful in nursing home residents although rubber dam was not used.
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Key words: caries, composite resin, geriatric dentistry, nursing home residents

Older adults are retaining more teeth than in past generations because of an increased awareness of oral hygiene, better knowledge of prevention and treatment of oral diseases, and greater use of dental services.

It is predicted that people 50 to 54 years old will have an average of 6.6 more teeth than the current population when they are 75 or more years old.[1] Furthermore, the percentage of edentulous patients 75 or more years old will decrease by about 50% from 1990 to 2025. According to a recent Swedish study, 95% of subjects 65 to 74 years old and 90% of subjects 75 to 84 years old will have remaining natural teeth in 2015.[2] Thus, geriatric dentistry will increasingly entail nonoperative and restorative caries therapies.

The prevalence of caries in older populations is available in many recent studies, indicating that untreated caries is an increasing problem.[3–5] Prevalence studies indicate that root caries is the major problem, particularly among elderly persons living in long-term

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institutional care compared to noninstitutional older adults.[6,7] The incidence of coronal and root caries per 100 susceptible root surfaces over 4 to 5 years was about 4% for coronal and 17% for root surfaces.[8,9] In nursing home residents the major associated predisposing conditions for caries development are impaired functional status, decreased salivary secretion rates, diabetes mellitus, number of exposed root surfaces, and poor oral hygiene.[5,10–12]

In a longitudinal study carried out in a nursing home, the effects of the introduction of an oral health program reduced caries incidence and *Mutans streptococci* colonization.[13] However, untreated caries remained a problem despite the oral hygiene program. Therefore, adequate restorative caries therapy remains a frequent treatment option to control caries progression that otherwise would result in pulp complications and tooth fractures. Today, composite resins and polyacid-modified composite resins are widely used to restore carious teeth, particularly in the anterior region.[14] Such restorative procedures require adequate technical skill and optimal conditions such as absence of saliva to secure retention and integrity of the margins of the restoration. These conditions are rarely present when restorative caries therapy is implemented on frail or physically or mentally handicapped residents of long-term care facilities. No studies seem to have investigated the prognosis of restorative caries therapy applied on residents of long-term care facilities compared to the remaining life span of the patients. In this study, operative caries treatment was applied when the lesions had reached a depth at which maintenance of a plaque-free cavity surface by proper oral hygiene was no longer possible.[15] In this situation the alternatives would have been no treatment with the risk of pulp complications, or tooth fracture or extraction and prosthetic therapy.

METHOD AND MATERIALS

This study was approved by the local Ethics Committee of the Dental School of Geneva. Twenty-five consecutive patients needing restorative caries therapy on the anterior teeth (Class III and/or Class V caries) were randomized for treatment with a fine-hybrid composite resin (APX/SE Bond, Clearfil) or a compomer, polyacid-modified composite resin (Dyract AP, Dentsply). In both groups, the adhesive systems were used without phosphoric acid conditioning, relying solely on the etching action of the self-etching primers. If the patients needed more than 1 restoration, both restorative materials were applied. Thus, approximately an equal number of teeth were restored with the 2 restorative materials.

Selection criteria and restorative treatment

The patients were selected among the residents of Trembley-Colladon, a long-term care facility with a mobile unit installed by our department for dental care, teaching, and research purposes. The following selection criteria were used:

- Under regular oral health care by a hygienist or clinical teacher of our department
- Having interproximal, buccal, or lingual caries lesions of the anterior teeth of the maxilla or mandible that needed restorative caries therapy
- Having a mental status that allowed acquisition of an informed consent
- Having a life expectancy of 2 or more years

In patients fulfilling the requirements and who agreed to be included in the study, the restorative therapy was carried out as follows:

- All soft tissue was removed mechanically from the carious lesions.
- Further tooth preparation was carried out according to current principles.[16]
- Restorations were placed according to the instructions and current prescriptions; however, in no instance was a rubber dam applied. An attempt was made to obtain field isolation by means of absorbent cotton rolls and hygoformic saliva ejector.
- To secure an acceptable result, 4-handed dentistry was applied in all cases.

Clinical parameters

The working conditions for restorative treatment were evaluated prior to treatment with a median score of 1 as described by the following criteria. The quality of the restorations was evaluated at baseline (1 week after placement of the restoration) and 6 and 12 months later using standardized criteria. The following parameters were evaluated:

Working conditions:

- Patient cooperation: good (0); medium (1); poor (2)
- Quantity of saliva: hyposalivation (0); normal salivation (1); hypersalivation (2)
- Cavity margins: supragingival (0); at gingival level (1); subgingival (2)
- Gingival inflammation of the tooth to be restored: healthy (0); bleeding on probing (1); spontaneous bleeding (2)
- Cavity size: <2 mm (0); 2 to 4 mm (1); >4 mm (2)
- General score: optimal (0 to 2); medium (3 to 7); poor (>7)

Plaque index[17] of the tooth to be restored
Qualitative evaluation of restorations[18] based on the criteria of Ryge and Cvar[19]

I. Anatomic form
   A. Perfect margins continuous with tooth surface
   B. Margin opening; the probe can enter superficially
   C. Marginal restoration fracture resulting in large border discrepancy
II. Cavosurface marginal discoloration
   A. No discoloration
   B. Surface discoloration that has not penetrated in pulpal direction
   C. Marked discoloration, penetrating in pulpal direction
III. Excess of material
   A. No overhang by inspection or by probing
   B. Slight excess by probing
   C. Excess clearly present by inspection or probing
IV. Surface texture
   A. Smooth and brilliant
   B. Small surface irregularities, white spots visible
   C. Important surface irregularities, large porosities
V. Loss of material
   A. Continuous with existing tooth form
   B. Discontinuous with existing tooth form but dentin not exposed
   C. Restoration loss or exposure of dentin
VI. Secondary caries
   A. No caries present
   B. Caries present along the margin of the restoration

Restorative therapy and evaluation of restorations

Two groups of 2 clinicians collected the baseline data and carried out the restorative therapy. Group 1 evaluated the restorations made by Group 2 and vice versa. Thus, the qualitative examination of the restorations was carried out blindly. Regarding the clinical examination, the clinicians were calibrated prior to the study by one of the authors (I.K.). The clinicians were clinical teachers with 4 to 5 years of experience as general practitioners.

Statistical analysis

Data were analyzed using the nonparametric Pearson chi-square and Mann-Witney statistical tests. Possible differences in average age between the 2 treatment groups were analyzed by the *t* test. *P* values ≤.05 were accepted as statistically significant.

RESULTS

In the patients, 42 restorations were placed, 23 in composite resin and 19 in compomer. The average age of the patients in both groups was 88 years. Similar working conditions were observed for the 2 groups of patients (Table 1). Optimal working conditions for carrying out the restorative therapy were observed only in a minority of the cases, whereas in most of the cases the working conditions were scored as medium (1). The average plaque index of the teeth to be restored was 1.8 for both the composite resin group and the compomer group. A

Table 1 Working conditions

	Composite			Compomer		
Score	(0)	(1)	(2)	(0)	(1)	(2)
Patient cooperation	19	2	2	15	2	2
Quantity of saliva	2	19	2	2	16	1
Cavity margins	7	10	6	6	7	6
Gingival inflammation	6	15	2	4	14	4
Cavity size	1	13	9	5	9	5
General score	2	19	2	3	13	3

Table 2 Evaluation of the restorations immediately after placement

	Composite			Compomer		
Score	(0)	(1)	(2)	(0)	(1)	(2)
Anatomic form	23	0	0	19	0	0
Cavosurface margin discoloration	21	2	0	19	0	0
Excess of material	23	0	0	18	1	0
Loss of material	23	0	0	19	0	0
Surface texture	22	1	0	18	1	0
Secondary caries	23	0	0	19	0	0

Table 3 Evaluation of the restorations 12 months after placement

	Composite			Compomer		
Score	(0)	(1)	(2)	(0)	(1)	(2)
Anatomic form	18	1	0	10	0	0
Coloration of margins	19	0	0	9	1	0
Excess of material	18	1	0	9	1	0
Loss of material	19	0	0	9	1	0
Surface of restoration	19	0	0	10	0	0
Secondary caries	19	0	0	10	0	0

majority of the teeth to be restored showed gingival inflammation and cavity margins at the gingival or subgingival level (Table 1).

A qualitative evaluation of the restorations immediately after their placement is recorded in Table 2. Of the composite resin restorations, 2 showed slight discoloration and 1 showed a small surface irregularity. Of the compomer restorations, 1 showed slight overhang and 1 showed a small surface irregularity. The other restorations were perfect in all clinical aspects.

After 6 months, only 35 restorations could be reevaluated because of the death of 3 patients. None of the restorations showed any loss of material, surface coloration, or secondary caries. Of the 20 restorations in composite resin that could be reevaluated, 1 showed superficial opening of the margins and 2 showed slight excess by probing. Of the 15 restorations in compomer that could be reevaluated, there were 1 superficial opening of the margins, 1 slight surface discoloration, 1 small surface irregularity, and 1 surface fracture without exposure of dentin.

After 12 months, only 29 of the original 42 restorations (19 in composite resin and 10 in compomer) could be reevaluated because of the death of another 3 patients. The results at the final examination are reported in Table 3. Slight modifications of the quality of the restorations were observed for 2 restorations in composite resin and 3 restorations in compomer; however, all restorations were clinically acceptable, and no secondary caries was observed. During the 12-month period,

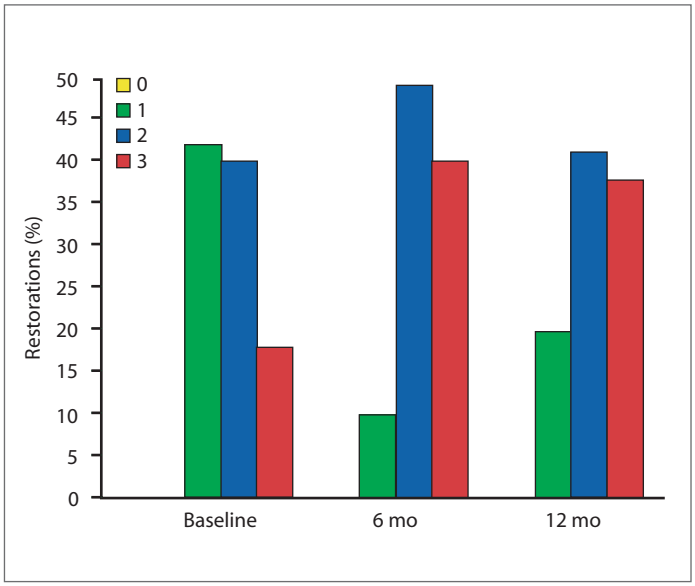

Fig 1 Distribution of plaque scores according to Silness and Löe[17] adjacent to restored tooth surfaces (composite or compomer).

no significant difference between composite resin and compomer was found. No difference between the distribution of the plaque scores to the restored tooth surfaces was found when comparing the 2 restorative materials (Fig 1). However, the plaque scores increased significantly when comparing the baseline data with those seen after 6 and 12 months ($P < .001$).

DISCUSSION

Within the limitation of a short follow-up time, this study on a limited number of patients showed that restorative caries therapy using composite resin or compomer was successful in nursing home residents although rubber dam was not used. Patients refused the use of the dam mostly based on their compromised health situations. At the final examination after 12 months, only 29 of 42 restorations could be re-evaluated as 6 patients had died. However, all re-evaluated restorations were clinically satisfactory according to accepted criteria for evaluation of tooth restorations.[18,19] The plaque scores of the restored tooth surfaces were elevated and even increased during the study period; this corresponds to the results obtained in other longitudinal studies of residents in geriatric institutions and probably reflects a deterioration of the residents' general health.[20–23]

The placement of adhesive restorations seems to be a realistic treatment to restore esthetics and function and prolong the longevity of the teeth in the anterior part of the maxilla and the mandible. When carrying out such restorative treatment, it is important to preserve a maximum of the natural tooth structure.[25] Other possible ways of treating dental caries in the elderly are instoration of oral hygiene including treatment with fluoride and chlorhexidine, placement of atraumatic restorative treatment (ART), or tooth extraction.

Clinical observations suggest that caries lesion progression can be arrested at any stage of lesion development provided that clinically plaque-free conditions are obtained.[15] Treatment with fluoride can prevent and arrest caries by inhibiting bacterial metabolism, by inhibiting demineralization of the tooth, and by enhancing remineralization of initial carious lesions.[25] For patients predisposed to caries and with high levels of cariogenic bacteria in the oral cavity, treatment with chlorhexidine gluconate rinse or gel at 3-month intervals is indicated to control bacterial levels.[25,26] However, in elderly patients with distinct carious lesions it may be impossible to maintain a low bacterial level, even by

regular application of fluoride or chlorhexidine. Therefore, restorative caries therapy may be indicated to prevent caries progression and restore esthetics and function.

Treatment with amalgam restorations, which are less sensitive to moisture control, may be less appropriate for esthetic reasons and since it is necessary to remove more tooth structure to obtain a retentive preparation.

The ART technique has been developed particularly for the treatment of people in rural or suburban areas in less industrialized countries.[27] The concept is a minimal intervention based on removing infected tooth material using hand instruments only, and filling the subsequently cleaned cavity with glass-ionomer cement. The success rate of ART fillings in the permanent dentition for single surface fillings was 93% after 1 year.[28] This technique has also been applied with success in deciduous teeth where composite resin was applied in minimally prepared cavities.[29] Such procedures might also be applied in restorative caries therapy of elderly patients, but to obtain the most reliable results it seems appropriate to use a conventional operative treatment. The extraction of carious teeth should not take place if other treatment options are possible. Particularly in a population of dependent elderly, it is important to avoid the psychologic trauma of tooth extractions. In addition, mastication, swallowing, and speech disorders may be the consequence of tooth extractions and subsequent replacement with partial or complete dentures.[30,31]

Controlling caries is a major issue for successful aging of residents in long-term care.[32] To achieve this, carious teeth should be restored, and appropriate hygiene measures including regular mouth wash with chlorhexidine with or without fluoride supplement should be introduced.[33] However, educational strategies to reduce the threat of caries in this population are focused mainly on oral hygiene, with almost no attention paid to the control of sugar abuse.[32] In the future, much more effort should be used to reduce the ingestion of refined carbohydrates, which is a little-recognized risk factor of caries in long-term care facilities.

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