

Clinical Analysis of Compomer Restorations in Primary Dentition: 2-Year Evaluation

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Summary

Various materials are available as alternatives to amalgam for restorations in primary teeth. The aim of the study was to evaluate the clinical performance of two compomers: Hytac and Compoglass in class II restorations in primary teeth, as an alternative to amalgam. Seventy-nine second class cavities (60 patients) in primary molars were restored with amalgam (Vivadent/Ivoclar, Schaan, Liechtenstein, LOT 819798) (24 restorations), Compoglass (Vivadent/Ivoclar, Schaan, Liechtenstein LOT 819798) (24 restorations) and Hytac (3M Espe, Seefeld, Germany LOT 012) (26 restorations). Each material was placed by using the respective adhesive system in accordance with the manufacturer's instructions. Restorations were evaluated immediately after placement and after 6 months, one year and two years by using modified USPHS (Ryge & Cvar) criteria. After two years colour evaluation rate A was recorded in 79% of cases with compomer restorations with Compoglass and 80% for compomer restorations with Hytac. Marginal adaptation for amalgam restorations was evaluated as rate A in 62.5%, rate B in 33.3% and rate D in 4.2%, while for compomer restorations with Compoglass rate A was recorded in 50%, rate B in 37.5% and rate D in 12.5%. Compomer restorations with Hytac were evaluated as rate A in 48%, rate B in 36% and rate D in 16%. Changes in marginal discoloration for amalgam restorations were evaluated as rate A in 79.2%, rate B in 16.7% and rate C in 4.2%. Compomer restorations with Compoglass were evaluated as rate A in 70.8%, rate B in 12.5% and rate C in 16.7%, while the results for compomer restorations with Hytac were rate A in 60%, rate B in 24% and rate C in 16% of cases. Statistical analysis was performed by means of nonparametric Kruskal-Wallis and Mann-Whitney tests, which did not show statistically significant difference for the materials, according to the criteria used. Both evaluated compomer materials can be used as alternatives to amalgam restorations in clinical work. However, longer clinical testing is needed in order to obtain relevant results.

Key words: amalgam restoration, compomer, Compoglass, Hytac, USPHS criteria.

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Introduction

The need for a material that contains the desired mechanical and chemical properties of glass ionomers and adequate hardness and aesthetic composite has led to the development of a new category of dental materials, so-called compomers. The important characteristics of compomer, its good mechanical properties and excretion of fluoride into the environment makes it the material of choice in clinical work with children. When working with children the greatest problem is patient cooperation and maintenance of a dry working area (2).

Compomers are materials which consist of polyacid modified composite resins, strengthened with strontium or barium aluminosilicate glass particles (2). Hardness is attained by polymerisation with a camforquinon-amin initiator system activated by illumination with a blue light of 400-490 nm (3). The polymerisation reaction comprises three phases: acid basic reaction, polymerisation of composite components and reaction of free radicals (2). These materials combine the good characteristics of glass ionomers (release of fluor, adhesion to dentin) with the desired features of composite materials (hardness, wear resistance, aesthetics) (3). The aim of this study was to evaluate the clinical performance of compomers with regard to their resistance to abrasion, improved mechanical properties, cariostatic effect, tolerance to dry working area, aesthetics and simplicity of use, compared with amalgam (3).

Materials and methods

Seventy-nine second class restorations were performed on vital primary molars in 60 patients of pre-school and school age (28 girls and 32 boys (25 patients aged 4-6 years and 35 patients aged 7-10 years). Prior to inclusion in the study all the patients were acquainted with the preventive procedure which consisted of instruction on nutrition and oral hygiene (method of brushing, frequency of brushing at least twice daily, use of fluoride toothpaste). Parents were asked to help the children to brush their teeth. Children in pre-school establishments (nurseries) were included in the system of prevention which consisted of tooth brushing and

topical fluoridation under the control of a member of staff. Patients and parents were informed of the purpose of the study and their agreement was obtained. Compomer materials Hytac and Compoglass (Vivadent/Ivoclar, Schaan, Liechtenstein, LOT 819798) were used in the clinical study and compared with amalgam (Vivadent/Ivoclar, Schaan, Liechtenstein, LOT E 29926). Twenty-nine amalgam restorations were performed, 24 compomer restorations with Compoglass and 26 with Hytac. The composition of the material is presented in Table 1. The materials were used with their relevant adhesive system, in accordance with the instructions of the manufacturer. Clinical evaluation of the restorations was carried out by using modified USPHS criteria (Ryge, 1980) (4), which includes evaluation of colour change, marginal adaptation, marginal discoloration, secondary caries and postoperative oversensitivity after 6 months, one year and after two years (Table 2). A sharp probe was used for evaluation of marginal adaptation and discoloration and a colour key for evaluation of colour. Evaluation of restoration quality was performed by two independent examiners for all subjects, according to the given criteria. In cases of different interpretation consensus was achieved between the examiners. The results obtained were statistically analysed by Kruskal-Wallis and Mann Whitney nonparametric tests.

Results

Apart from laboratory tests the properties of the material to be used for restorations should also be tested in clinical conditions, during work with the patient in the dental surgery. This study has demonstrated the good clinical properties of the examined compomer materials compared with amalgam restorations. After two years no change in colour was determined (criteria A) for 79% of the compomer restorations with Compoglass and 80% of the compomer restorations with Hytac. Marginal adaptation for amalgam restorations was evaluated as A in 62.5%, B in 33.3% and D in 4.2% of cases, while for compomer restorations with Compoglass it was evaluated as A in 50%, B in 37% and D in 12% of the restorations. Compomer restoration with Hytac showed value of marginal adaptation (A) for 48% of restorations, somewhat poorer (B) for 36%, and

unacceptable (D) for 16% of restorations (Table 3). No change in marginal discoloration was determined for amalgam restorations in 79.2% of restorations (criteria A), while in 16.7% change was determined of less than one shade (B), and in 4.2% change of more than one shade (C). In the case of compomer restorations with Compoglass lack of marginal discoloration was determined in 70.8% of restorations (criteria A), while in 12.5% the colour had changed by less than one shade (B). Change of more than one shade was determined in 16.7% of restorations (C). The results for Hytac were: criteria A for 60% of restorations, B for 24% and C for 16% (Table 4). After two years no secondary caries was determined on the edges (criteria A) in 75% of the compomer restorations with Compoglass, while for compomer restorations with Hytac this value amounted to 80% after two years. Amalgam restorations had the best result in this group, according to the criteria of secondary caries, as only 4.17% of the restorations had caries on the edges after two years (Table 5). After two years the presence of postoperative oversensitivity in amalgam restorations was registered in 4.17% of the restorations. The same value (4.17%) was also registered for compomer restorations with Compoglass, while for compomer restorations with Hytac no cases of postoperative oversensitivity were registered after two years (Table 6).

Discussion

The most important characteristic of material for restorations, both on permanent and primary teeth is good edge closure and lack of edge leakage. The primary problems of preparing restorations in pedodontics are connected with attainment of satisfactory patient cooperation, attainment of a dry working area, simple handling of materials for preparation of the restoration, good mechanical properties of the material, preventive effect (excretion of fluoride ions) and aesthetics (5). Adhesive preparation with removal of only the carious dentine and preservation of healthy tissue is preferred (6). Edge leakage occurs because of polymerisational stress, contraction of the material, poor adaptation of the material to the cavity wall. Edge leakage by capillary effect causes the occurrence of secondary caries and changes/lesions on the tooth pulp (7).

In 1999 Marks et al (8) carried out an investigation on 30 amalgam restorations and 30 compomer restorations (Dyract) evaluated by Rygeov's criteria after 24 and 36 months. After 36 months the results showed statistically significant difference in the marginal adaptation of the compomer restorations with Dyract ($p=0.028$) compared with amalgam restorations. After three years secondary caries was recorded in one compomer restoration (Dyract) and two amalgam restorations. On the basis of these results the authors concluded that Dyract is a good alternative to amalgam restoration in primary dentition. In the present study marginal adaptation of amalgam restorations after two years, according to category A of USPHS criteria, amounted to 62.5% for amalgam restorations and 50% for compomer restorations with Compoglass and 48% Hytac. The incidence of secondary caries after two years was 4.17% for amalgam restorations and 25% and 20% respectively for compomer restorations with Compoglass and Hytac. The results obtained depended on the type of preparation, which in this case for amalgam restorations involved classical class II preparation according to Black and for compomer restorations adhesive class II preparation.

An important factor is the clinical experience of the dentist preparing the restoration, in view of the fact that the patients are children and that there is the problem of cooperation during work. In this study the tooth was isolated with cotton-wool rolls and not a cofferdam as in the previous study, which may have lead to the poorer results of compomer restorations compared to amalgam, because adhesive techniques are used and are more sensitive to the conditions of work. Also it can be assumed that the whole of the caries is removed. A two-year evaluation carried out by Duggal et al in 2002, in which they investigated the clinical characteristics of compomer and amalgam restorations in class II cavities in primary dentition also corroborates our study. Of the 60 restorations only 4 amalgam and 2 compomer restorations (Dyract) were inadequate after two years and needed to be changed. Statistically significant difference in marginal adaptation was observed after two years between the two materials, where the results for Dyract were significantly better ($p<0.05$). The survival rate after two years was 66.6% for amalgam restorations and 71.6% for compomer resto-

rations with Dyract. The above difference was not statistically significant which is consistent with the results obtained in this study. The better results for compomer restorations can be explained by the good adhesive properties of Dyract compared with amalgam restorations, which rely exclusively on mechanical retention and classical preparation of the cavity. Local anaesthesia was used for all patients, which alleviated the work technique (9). Attin et al carried out a three-year clinical analysis of class II restorations in primary dentition, prepared with acid modified composite resins and hybrid composites. According to Kaplan-Meierov's analysis the results of survival after three years were 79.5% for Compoglass and 85.8% for TPH-Spectrum restorations. No significant difference was observed with regard to colour, discoloration of the cavity surface, anatomic shape, marginal adaptation and the occurrence of caries (10). In this study the results agree with the above investigation, for all the evaluated criteria the materials showed a high degree of success after two years, with no statistically significant differences between the tested materials (e.g. 79.2% for amalgam restorations and 70.8% for compomer restorations with Compoglass, with no marginal discoloration after two years). Also, the obtained results of the study corroborate the results of Hicks et al in 2000, in which the caries protective characteristic of composite materials and compomers were analysed. The results show that compomer materials significantly reduce the process of demineralisation in contrast to composite materials which do not contain fluor (11). The results of this study show that after two years the incidence of secondary caries was 20% for compomer restorations with Hytac. Cortes et al recommends the use of compomer, particularly for class III and V. Compomer materials are easy to manipulate, have cariostatic properties and a minimal irritating effect on the pulp of primary teeth (12).

Fukushima et al carried out a comparison of fractures in restorations on the cavity walls of lateral teeth of amalgam preparations with composite preparations. Their investigation showed difference in poorer marginal adaptation and poorer edge closure of amalgam compared with composite restorations (13). The present study showed good mar-

ginal adaptation in all three tested materials, with no statistically significant difference between them ($p>0.05$). The effect of polymerisational stress was analysed in an investigation by van Dijken, and class I restorations were evaluated by application of polyacid modified composite resin and composite restorations. Polymerisation was performed by the technique of two-phase polymerisation. After six years the results showed high resistance of both types of materials with no significant differences (14). In this study slight differences were determined in marginal adaptation of the materials. Such a result can be explained by the relatively short period of examination. Analysis of marginal discoloration after the first year showed statistically significant difference between the compomer restorations with Compoglass and the other two materials ($p>0.001$). After the second year this difference was lost. For compomer restorations with Compoglass edge fracture was determined after the first year which did not penetrate towards the pulp in 20.8% of restorations, and for compomer restorations with Hytac in 7.7% of restorations. After the second year statistically significant difference between the materials was lost ($p<0.361$). After one year the percentage of the incidence of new carious lesions in compomer restorations with Compoglass amounted to 20.8% and for compomer restorations with Hytac 7.7%, while for amalgam restorations it was 3.4%. In this case amalgam gave the best result, probably because of the technique of classical cavity preparation. After the second year there were no statistically significant differences. Analysis of postoperative oversensitivity showed that no statistically significant differences existed between the materials.

Conclusion

After a clinical study of the quality of restorations performed with compomer materials in primary dentition it can be concluded that both the tested compomer materials, with regard to colour change, marginal adaptation, marginal discoloration, secondary caries and postoperative oversensitivity, can be used as an alternative to amalgam.