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Flowable resin composite as a class II restorative in primary molars: A two-year clinical evaluation

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Abstract

Objective. To evaluate the clinical durability of flowable resin composite and resin-modified glass ionomer cement when used as class II restoratives in primary molars. ***Material and Methods***. A total of 190 restorations were placed in 61 children, age in the range of 5–11 years. The restoratives, Tetric Flow, in combination with the adhesives, Excite or Prompt-L-Pop and Vitremer, were used in class II cavities in primary molars. An intra-individual study design was used and the restorations were evaluated by modified USPHS criteria over a 2-year period. ***Results***. 146 of the restorations could be evaluated at 2 years. The cumulative failure rate was 10.6% for Vitremer and 13.6% for Tetric Flow. No statistically significant differences were found in failure rates between different materials or between bonding systems. The main cause of failure for Tetric Flow was secondary caries and for Vitremer wear and dissolution. ***Conclusions***. Vitremer and Tetric Flow showed no significant difference concerning clinical durability at 2 years when used as class II restoratives in primary molars. Both materials demonstrated acceptable clinical results.

Key Words: *Clinical trial, dental restoration, glass ionomer cement, primary teeth, resin composite*

Introduction

Commonly used dental restoratives in pediatric dentistry today are glass ionomer cements, compomers, and resin composites. These materials are suitable in the preparation of tooth-substance-saving cavities (the Swedish government recommended a discontinuation of amalgam in pediatric dentistry in 1995). Since child compliance is often a limiting factor, a desirable property of a dental restorative is good handling characteristics in the sense of a smooth application technique. This may not always be true for resin composite materials, but could be more valid for resin-modified glass ionomer cement which, together with compomer, is the most commonly used restorative material in primary teeth in Scandinavia today [1]. Other advantages of glass ionomer cement materials are adhesion to tooth substance and the possibility of fluoride release. However, resin composite materials have higher flexural strength than resin-modified glass ionomer cement, although these materials have higher strength than traditional glass ionomer cement [1,3]. Sufficient flexural strength is essential in restoratives exposed to high tensile forces, for example class II restorations. High annual failure rates of restorations in stress-bearing areas have been reported for materials with poor mechanical properties such as glass ionomer cement and glass cermet cement [4–6]. The development of modern adhesive systems towards a simplified clinical application mode in combination with the higher mechanical properties reported for resin composites makes those materials interesting for use in pediatric dentistry. However, studies concerning durability of restorations in the primary dentition are still lacking.

The aim of the present study was to evaluate a flowable resin composite used with two different simplified adhesive systems in comparison with a resin-modified glass ionomer cement for class II cavities in primary teeth. The null hypothesis to be tested was that there were no differences in durability between the tested materials after 2 years of clinical service.

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Material and methods

The study was approved by the ethics committee of the University and informed consent was received from all the participating patients. During a period of 22 months, patients regularly visiting three different public dental health clinics were invited to join the study. An inclusion criterion was that the child had at least 2 proximal carious lesions in primary molars with an expected exfoliation time exceeding 2 years. Exclusion criteria were if availability for recall was uncertain, if the child was very uncooperative or had serious health problems, or if consent to join the study was not obtained. The children were treated at their regular appointments and no extra time was reserved for participation in the study. All teeth were vital with no sign of pulpitis. Each patient received at random at least one of each restorative material to be tested in as similar sized cavities as possible. Five dentists familiar with the dental materials used treated all patients. Procedure time was measured from start of cavity preparation to finishing. The caries risk for each patient at baseline was estimated by the treating clinician by means of clinical and socio-demographic information routinely available at the annual clinical examinations, e.g. incipient caries lesions and former caries histories [7,8]. Postoperative sensitivity was noted at the next visit. At the annual visits, bitewing radiographs were taken of all restorations and, in addition, color slides were made of selected cases (Figures 1 and 2).

The restorative materials were placed, if possible, in the same type of tooth in order to make an intra-individual comparison possible. The cavities were allocated randomly to be filled with one of the two materials. Minimal cavities with rounded angles and without any bevelling of the margins were prepared. Occlusal extension was prepared only if needed for carious reasons. The operation field was isolated with cotton-rolls, dry-tips, and a saliva suction device. After placement of a thin matrix steel band and wooden wedges the cavities were cleaned with liberal water spray. In the case of blood contamination, 0.2% EDTA (ethylene diamine tetra-acetic acid; Tubulicid blue, Dental Therapeutics Ltd., Ektorp, Sweden) was used for cleansing, and a few deep cavities were locally isolated with small amounts of calcium hydroxide (Dycal, De Trey/Dentsply, Switzerland).

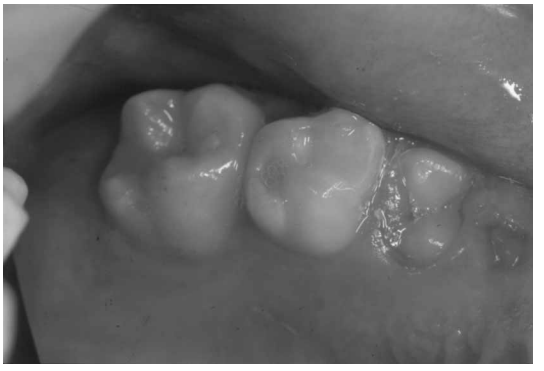

Figure 1. Maxillary 2nd primary molar (MD) restored with Tetric Flow/Excite restoration after 2 years; acceptable scores.

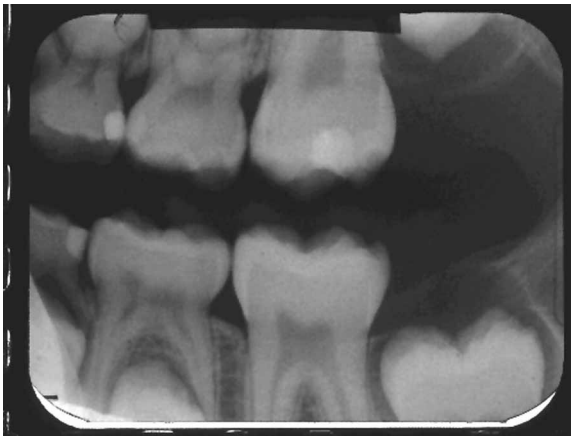

Figure 2. Radiograph of maxillary 1st primary molar (DO) restored with Tetric-Flow/Excite restoration after 2 years. Marginal adaptation score 3 not acceptable.

Owing to the difficulties in finding individuals with more than two proximal carious lesions, the study was further conducted in two parts. Part one investigating flowable resin composite restorations versus resin-modified glass ionomer cement restorations in class II cavities. Part two investigating flowable resin composite restorations placed in class II cavities in combination with two different adhesive systems; either a two-step adhesive system with combination primer and adhesive Excite (Ivoclar, Vivadent Ets., Schaan, Liechtenstein) or a self-etching, "all in one", adhesive Prompt-L-Pop (3M Svenska AB, Sollentuna, Sweden).

Part one

In 57 children (30 M and 27 F, with a mean age of 8 years, range 5–11 years), a total of 66 pairs of restorations were placed. Fifty-three pairs of teeth were anesthetized with 3% Citanest-Octapressin (Astra, Södertälje, Sweden). The restorative materials used were a resin composite, Tetric Flow (Vivadent Ets., Schaan, Liechtenstein), and as control the resin-modified glass ionomer cement Vitremer (3M ESPE Dental Products, St. Paul, Minn., USA). The Tetric Flow cavities were acid-etched with 35% phosphoric acid (Ultra etch; Ultradent Products Inc., South Jordan, Ut., USA). The gel was first placed on the enamel, while the dentin part of the cavity was conditioned during the last 5 s of the 20 s etching time. The cavity was then thoroughly rinsed with air-water spray for 15–20 s, allowing a wet bonding technique. The primer Excite was applied for 10 s and then carefully air-blown to

Table I. Criteria for direct clinical evaluation, modified USPHS criteria according to van Dijken 1986, and Pallesen and van Dijken 2000

Category	Score		Criteria
	Acceptable	Unacceptable	
Anatomical form	0		The restoration is contiguous with tooth anatomy.
	1		Slightly under- or over-contoured restoration; marginal ridges slightly undercontoured; contact slightly open (may be self-correcting); occlusal height reduced locally.
		2	Restoration is undercontoured, dentin or base exposed; contact is faulty, not self-correcting; occlusal height reduced; occlusion affected.
		3	Restoration is missing partially or totally; fracture of tooth structure; shows traumatic occlusion; restoration causes pain in tooth or adjacent tissue.
Marginal adaptation	0		Restoration is contiguous with existing anatomic form, explorer does not catch.
	1		Explorer catches, no crevice is visible into which explorer will penetrate.
	2		Crevice at margin, enamel exposed.
		3	Obvious crevice at margin, dentin or base exposed.
		4	Restoration mobile, fractured or missing.
Caries	0		No evidence of caries contiguous with the margin of the restoration.
	1		Evidence of superficial caries, no operative treatment necessary.
		2	Caries is evident contiguous with the margin of the restoration, operative treatment indicated.

remove the primer ethanol, and then light-cured for 10 s. Tetric flow was applied in 2-mm layers maximum, and each layer was light-cured for 40 s with a regularly controlled light-curing unit (Belas AB, Bredaryd, Sweden) with an output level at a minimum of 300 mW/cm^2. After removal of the matrix band and wooden wedges the occlusion was checked. Finishing of the restorations was done under liberal water spray with fine diamond burs followed by Shofu finishing points and strips.

The accompanying self-etching primer was used in the Vitremer cavities. It was applied for 30 s and then directly light-cured for 20 s. The restorative Vitremer was hand-mixed in accordance with the manufacturer's instructions and placed in a syringe tip (Centrix Inc., Shelton, Ct., USA). The restorative was placed in bulk in the cavity and a cotton pellet, moistened and then well compressed in a paper napkin, was used to condense the material; the restoration was thereafter immediately light-cured for 40 s. After removal of the matrix band the same treatment as described earlier followed.

Part two

In 24 children (15 M and 14 F, with a mean age of 8 years, range 5–10 years), a total of 29 pairs of restorations were placed. All teeth were anesthetized with 3% Citanest-Octapressin. The restorative material used was a resin composite, Tetric Flow, in combination with the two different adhesive systems, Excite and Prompt-L-Pop. The cavities were randomly allocated to be treated with one of the two adhesive systems (by the toss of a coin). The Tetric Flow/Excite cavities were etched and treated as described above. No separate etching was performed in the Tetric Flow/Prompt-L-Pop. The adhesive Prompt-L-Pop was applied on the cavity surface for 15 s and then carefully dried by gentle air-blowing and immediately light-cured for 10 s. Tetric Flow was then directly applied in the same manner as described for part one.

Evaluation

The quality of the restorations was evaluated in accordance with slightly modified USPHS criteria for Anatomic Form, Marginal Adaptation and Caries (Table I) at baseline and after 1 year and 2 years or until exfoliation or failure [9,10]. The five dentists were calibrated in the criteria before the start of the study. A calibration exercise was done before the 2-year evaluation. The majority of the restorations were assessed at 2 years by two dentists independently with no knowledge of earlier assessments. Disagreement was resolved by consensus. Because of logistical problems between the locations of the clinics, the two operators in part two made and evaluated their own restorations. Evaluations at recalls were done with no knowledge of earlier assessments.

Statistical analysis

The evaluated characteristics of the restorations, including the number of non-acceptable restorations (failures), are described by descriptive statistics using frequency distributions of the scores. The Statistical Package for Social Sciences, version 10.0 (SPSS, Chicago, Ill., USA) was used to process the data. Durability of the three restorative techniques was tested with the chi-squared test and analyzed using univariate and multivariate logistic regression. Survival of the restorations was tested using the

Table II. The total numbers of evaluated teeth, exfoliated teeth, drop-outs and failures in part one of the study

	Evaluated teeth		Exfoliated teeth		Drop-outs		Failure	
	V	T/E	V	T/E	V	T/E	V	T/E
Baseline	66	66	–	–	–	–	–	–
12 months	65	62	–	1	1	3*	3	2
24 months	50§	50§	9	6	3	5	4	7

*Two patients attending at 2 years failed to show up at 1 year.
§All acceptable restorations at 1 year minus drop-outs.
V = Vitremer, T/E = Tetric Flow/Excite.

Table III. The total numbers of evaluated teeth, exfoliated teeth, drop-outs and failures in part two of the study

	Evaluated teeth		Exfoliated teeth		Drop-outs		Failure	
	T/P	T/E	T/P	T/E	T/P	T/E	T/P	T/E
Baseline	29	29	–	–	–	–	–	–
12 months	28	25	–	2	1	2	–	1*
24 months	24	22	4	3	–	–	–	1

*Tooth extracted due to endodontic problems before 12 months, included in drop-outs.
T/E = Tetric Flow/Excite, T/P = Tetric Flow/Prompt-L-Pop.

Kaplan Meier test. A 95% confidence interval was used and the level of significance was set at $p < 0.05$.

Results

In part one of the study, 100 restorations of 132 restorations placed could be evaluated at 2 years (recall rate 76%) and in part two, 46 of the 58 restorations at 2 years (recall rate 79%). The main reason for non-evaluation was exfoliation of teeth between 12 and 24 months recall. The numbers of exfoliated teeth, drop-outs, and failures for both parts of the study are given in Tables II and III. The scores for anatomical form, marginal adaptation and caries at different recalls (12 and 24 months) are given in Tables IV and V. The cumulative failure frequency in part one of the study at 2 years was 10.6% for the Vitremer restorations and 13.6% for the Tetric Flow restorations. A main failure cause of the Tetric Flow restorations was secondary caries and for the Vitremer restorations material wear and excessive dissolution (Table VI). In part two of the study the cumulative failure frequency was 6.9% for the Tetric Flow/Excite restorations and none of the Tetric Flow/Prompt-L-Pop had failed after 2 years. The reasons for failure of both parts of the study are given in Tables VI and VII. No statistically significant differences were found in failure rates between different materials or between bonding systems, nor for survival of restorations in different age groups of patients, cooperation at treatment, caries risk, or size of restorations.

Discussion

The hypothesis stated in the introduction, i.e. that there was no difference between the tested materials, cannot be rejected. A drawback of the present study design is the difficulty, partly due to exfoliation, of following the restorations long enough to find true differences between materials and bonding systems, especially when failure incidence is low. To be able to draw conclusions that are as robust as possible, not only is time needed but also an appropriate study design. Randomization of dental materials and cavities is not always easy in a clinical trial. It is extremely demanding to conduct a randomized clinical trial since the large patient support needed is time consuming and contributes to the expense of such a study. The intra-individual way of comparing the restorations within the patients in this study, a kind of split mouth design, was done to restrict the influence of patient variability. If it had been clinically possible to evaluate a triad of restorations rather than pairs, patient influence would have been suppressed and a study design with only one part

Table IV. The scores of the evaluated criteria for the class II restorations at baseline, 12, and 24 months (%) in part one of the study

	Score 0			Score 1			Score 2			Score 3			Score 4		
	B	12	24	B	12	24	B	12	24	B	12	24	B	12	24
Anatomincal form															
V	87.9	61.5	36.7	12.1	36.9	55.1			8.2		1.5				
T/E	92.3	85.5	79.6	7.7	12.9	16.3					1.6	4.1			
Marginal adaptation															
V	97.0	83.1	48.0	3.0	10.8	34.0		1.5	14.0		3.1	4.0		1.5	
T/E	95.4	80.6	65.3	4.6	14.5	26.5			2.0		1.6	2.0		3.2	4.1
Caries															
V	100.0	96.9	100					3.1							
T/E	100.0	95.2	92.0					4.8	8.0						

V = Vitremer and T/E = Tetric Flow/Excite.

Table V. The scores for the evaluated criteria for the class II restorations at baseline, 12, and 24 months (%) in part two of the study

	Score 0			Score 1			Score 2			Score 3			Score 4		
	B	12	24	B	12	24	B	12	24	B	12	24	B	12	24
Anatomical form															
T/E	83.3	84.6	100.0	16.7	15.4										
T/P	82.8	96.4	87.5	17.2	3.6	12.5									
Marginal adaptation															
T/E	80.0	73.1	73.9	20.0	26.9	17.4			4.3			4.3			
T/P	86.2	75.0	66.7	13.8	21.4	29.2		3.6	4.2						
Caries															
T/E	100.0	100.0	100.0												
T/P	100.0	100.0													

T/E = Tetric Flow/Excite and T/P = Tetric Flow/Prompt-L-Pop.

Table VI. Failure reasons at time in months after placement for part one of the study

	<12 months		12–24 months		Total	
Failure reasons	V ($n=65$)	T/E ($n=62$)	V ($n=50$)	T/E ($n=50$)	V	T/E
Fracture	–	–	1	–	1	–
Lost	1	–	–	2	1	2
Secondary caries	2	2	–	5	2	7
Other	–	–	3*	–	3	–
Total	3	2	4	7	7	9

*1 = excessive material wear, 2 = material dissolution.
V = Vitremer, T/E = Tetric Flow/Excite.

Table VII. Failure reasons at time in months after placement for part two of the study

	<12 months		12–24 months		Total	
Failure reasons	T/P ($n=28$)	T/E ($n=25$)	T/P ($n=24$)	T/E ($n=22$)	T/P	T/E
Fracture	–	–	–	1	–	1
Lost	–	–	–	–	–	–
Secondary caries	–	–	–	–	–	
Other	–	1*	–	–	–	1
Total	–	1	–	1	–	2

*1 = extraction due to endodontic problems.
T/P = Tetric Flow/Prompt-L-Pop, T/E = Tetric Flow/Excite.

would have been possible. The different failure rates for the flowable resin composite in parts one and two, 13.6% and 0–6.9%, respectively, may be an expression of patient and operator influence over the results. The results of part two are compromised by the fact that only one operator evaluated the restorations and did so at baseline. Another weakness of the study design was the unequal number of pairs in the two patient groups studied. This was because of problems associated with finding operators willing to participate in clinical trials. A well-conducted collaboration between the universities and the general practitioners is of great importance for the success of future clinical trials.

After two years, survival of the restorations in the actual study was still relatively high and no statistically significant differences were seen between the study groups. The longevity of the restorations is in line with findings reported by others [11–13]. Today, resin-modified glass ionomer cements (RMGIC), together with compomers, are replacing amalgam as standard materials in pediatric dentistry [14]. Great effort has been put into the evaluation of "new" dental materials and a number of studies have been carried through [4–6,11–20]. In an 8-year study, Qvist et al. compared conventional glass ionomer cement and amalgam in primary teeth and found a significantly longer survival time in favor of the amalgam restorations, but a reduced survival time for surfaces adjacent to the restorations compared with those adjacent to conventional glass ionomer cement [15]. In comparisons between conventional glass ionomer cement and RMGIC, a significantly better success rate with RMGIC than with conventional glass ionomer cement has been found [12,20]. Three RMGIC materials and one compomer have been investigated and it has been shown that material and cavity conditioning influenced the survival of the restorations but not the caries progression on adjacent surfaces [13]. If used with cavity conditioner, the RMGIC (Vitremer) and compomer (Dyract) were at the same survival level as amalgam and both RMGIC and compomers were considered as appropriate materials in class II cavities in primary teeth. Compomers are closely related to resin composites, but their handling characteristics are simple compared to those of resin composites, and this has probably led to their more widespread use in pediatric dentistry. Compomers have shown survival rates in parity with or even better than RMGIC in class II restorations in primary molars [13]. Fuks et al. [19] compared Dispersalloy, Vitremer, and Z100/ScotchBond Multipurpose and found satisfactory durability for all three materials in restorations that could be followed over 2 years. However, the resin composite restorations showed a large proportion (47%) of

radioluscent defects at the cervical margins, the authors deducing that later replacement might be necessary. Attin et al. [11] reported 79–86% success after 3 years for Compoglass and TPH Spectrum/total-etch. Thus, satisfactory durability for resin composite in pediatric clientele is seen despite the more demanding handling characteristics of materials and bonding systems. However, large variability in results concerning durability may indicate a technique sensitivity of compomer and RMGIC materials [13,17]. Variability in results is also seen in older studies using resin composite and early bonding systems requiring optimal cooperation from the patient [18].

Simplified bonding systems used in permanent teeth have been evaluated in laboratory and clinical studies. Generally, a gradual degradation of the bond to enamel and dentin has been seen to lead to increasing clinical failure, and is especially pronounced for the so-called "all-in-one" systems [21,22]. Among reasons proposed for this degradation are the high hydrophilic content of the adhesive allowing moisture to leak through the thin adhesive layer formed, where residual solvent may still be present, and a high acidity which may interfere with polymerization of the resin.

However, demands are different in the primary dentition. Primary teeth have a limited functional time, and the varying cooperation of the child patient increases the value of simplified bonding systems. In the restricted time-span of 2 years, the adhesive systems showed only a minimal influence on the failure rate in our study. Resin composites are in general technique-sensitive materials to use. The flowable resin composite used in the study cannot be condensed and requires no modulating of the material into the cavity; this is time-saving and therefore an advantage in pediatric dentistry. On the other hand, the material can easily "flow" in the wrong direction, requiring a special light-curing technique. None of the participating operators in the study are using flowable resin composite as a routine material in class II cavities in primary teeth today, preferring the ease of use and acceptable longevity of the RMGIC. A cotton pellet, moistened and well compressed in a paper napkin, was used in the study to "condense" the RMGIC into the cavity. This is a clinical praxis, since the RMGIC readily sticks to ordinary metallic instruments. The degree of moisture can of course contribute to alteration of mechanical properties and thereby the longevity of the material. All operators were aware of this and the procedure was carefully calibrated among the participating operators.

It can be concluded that RMGIC and flowable resin composite in combination with simplified bonding systems, used in class II cavities in primary molars, showed acceptable results.

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References

[1] Buerkle V, Kuehnisch J, Guelmann M, Hickel R. Restoration materials for primary molars – results from a European survey. J Dent 2005;33:275–81.
[2] Peutzfeldt A. Compomers and glass ionomers: bond strength to dentin and mechanical properties. Am J Dent 1996;9: 259–63.
[3] Attin T. Properties of resin-modified glass-ionomer restorative materials and two polyacid-modified resin composite materials. Quint Int 1996;27:203–9.
[4] Welbury RR, Shaw AJ, Murray JJ, Gordon PH, McCabe JF. Clinical evaluation of paired compomer and glass ionomer restorations in primary molars: final results after 42 months. Br Dent J 2000;189:93–7.
[5] Andersson-Wenckert IE, van Dijken JWV, Stenberg R. Effect of cavity form on the durability of glass ionomer cement restorations in primary teeth: a three-year clinical evaluation. J Dent Child 1995;3:197–200.
[6] Kilpatrick NM, Murray JJ, McCabe JF. The use of a reinforced glass-ionomer cermet for the restoration of primary molars: a clinical trial. Br Dent J 1995;179:175–9.
[7] Seppä L, Hausen H, Pollanen L, Helasharju K, Karkkainen S. Past caries recording made in Public Cental Clinicas as predictors of caries prevalence in early adolescence. Community Dent Oral Epidemiol 1989;17:277–81.
[8] Alanen P, Hurskainen K, Isokangas P, Pietila I, Levanen J, Saarni UM, et al. Clinicians' ability to identify caries risk subjects. Community Dent Oral Epidemiol 1994;22:86–9.
[9] Dijken van JWV. A clinical evaluation of anterior conventional microfiller and hybrid composite resin fillings. A six-year follow up. Acta Odontol Scand 1986;44:357–67.
[10] Pallesen U, van Dijken JWV. An 8-year evaluation of sintered ceramic and glass ceramic inlays processed by the Cerec CAD/CAM system. Eur J Oral Sci 2000;108:239–46.
[11] Attin T, Opatowski A, Meyer C, Zingg-Meyer B, Buchalla W, Monting JS. Three-year follow up assessment of Class II restorations in primary molars with a polyacid-modified composite resin and a hybrid composite. Am J Dent 2001; 14:148–52.
[12] Hübel S, Mejare I. Conventional versus resin-modified glass-ionomer cement for Class II restorations in primary molars. A 3-year clinical study. Int J Paediatr Dent 2003;13:2–8.
[13] Qvist V, Laurberg L, Poulsen A, Teglers PT. Class II restorations in primary teeth: 7-year study on three resin-modified glass ionomer cements and a compomer. Eur J Oral Sci 2004;112:188–96.
[14] Mjör IA, Dahl JE, Moorhead JE. Placement and replacement of restorations in primary teeth. Acta Odontol Scand 2002;60:25–8.
[15] Qvist V, Laurberg L, Poulsen A, Teglers PT. Eight-year study on conventional glass ionomer and amalgam restorations in primary teeth. Acta Odontol Scand 2004;62:37–45.
[16] Marks LAM, Weerheijm KL, van Amerongen WE, Groen HJ, Martens LC. Dyract versus Tytin Class II restorations in

primary molars: 36 months evaluation. Caries Res 1999;33: 387–92.

[17] Andersson-Wenckert IE, Folkesson UH, van Dijken JW. Durability of a polyacid-modified composite resin (compomer) in primary molars. A multicenter study. Acta Odontol Scand 1997;55:255–60.

[18] Kilpatrick NM. Durability of restorations in primary molars. J Dent 1993;21:67–73.

[19] Fuks AB, Araujo FB, Osorio LB, Hadani PE, Pinto AS. Clinical and radiographic assessment of Class II esthetic restorations in primary molars. Pediatr Dent 2000;22:479–85.

[20] Qvist V, Manscher E, Teglers PT. Resin-modified and conventional glass ionomer restorations in primary teeth: 8-year results. J Dent 2004;32:285–94.

[21] de Munck J, Van Landuyt K, Peumans M, Poitevin A, Lambrechts P, Braem M, et al. A critical review of the durability of adhesion. J Dent Res 2005;84:118–32.

[22] Dijken van JWV. Durability of three simplified adhesive systems in Class V non-carious cervical dentin lesions. Am J Dent 2004;17:27–32.