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Clinical Research

12 Years of Repair of Amalgam and Composite Resins: A Clinical Study

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Clinical Relevance

Repairing defective composite resin and amalgam restorations is a safe and effective treatment that might increase restoration longevity.

SUMMARY

Objective: The objective of this study was to clinically evaluate repaired posterior amalgam and composite restorations over a 12 year period, investigate the influence of repair in the survival of restorations, and compare their behavior with respect to controls.

Methods: Thirty-four patients, 18 to 80 years of age with 167 restorations, 67 composite resin (RC), and 100 amalgam (AM) restorations, participated. Restorations with localized, marginal, anatomical deficiencies and/or secondary caries, and "clinically judged" suitable for repair or replacement according to US Public Health Service (USPHS) criteria, were randomly assigned to four groups: repair (n=35, 20 AM, 15 RC), replacement (n=43, 21 AM, 22 RC), positive control (n=71, 49 AM, 22 RC), or negative control (n=18, 10 AM, 8 RC). The quality of the restorations was blind scored according to the modified USPHS criteria. Two examiners scored them at initial status (κ=0.74) and after one to five, 10, and 12 years (κ=0.88). Wilcoxon and Mann-Whitney tests provided for comparisons within the same group and between years, respectively.

Results: After 12 years, all groups behaved similarly in marginal adaptation, marginal stain, teeth sensitivity, anatomic form, and

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luster ($p \geq 0.05$). Better behavior in roughness was observed in replaced RC ($p = 0.049$).

Conclusions: Given that most clinical parameters investigated were similar between all groups during the follow-up, the repair of RC and AM restorations is a good clinical option because it is minimally invasive and can consistently increase the longevity of restorations.

INTRODUCTION

When a partial restoration of amalgam or composite resin fails, by secondary caries, fracture, or other causes, the simplest treatment, when possible, would be to repair the localized defect instead of full restoration replacement. However, clinicians commonly prefer to replace the restoration[1] despite the fact that current evidence suggests that secondary caries corresponds to a primary lesion with identical biofilm composition that does not compromise further the locally affected area.[2]

Studies indicate that there is no relationship between marginal staining[3] or marginal gap size and the appearance of new caries lesions adjacent to restorations.[4] Radiolucent halos beneath composite restorations may also not justify restoration replacement.[5] Previous studies[6-9] indicated that repaired and replaced restorations showed similar survival outcomes regarding marginal defects and secondary caries in patients with low and medium caries risk, and most of the restorations were considered clinically acceptable after five, seven, and 10 years of clinical service.[7,10,11] This could be a reliable alternative to increase the longevity of restorations, thereby avoiding an increase in cavity size and postponing the indication of more invasive treatments, such as crown restorations and root canal treatments.

The objective of this study was to clinically evaluate repaired posterior amalgam and composite restorations over a period of 12 years. The principal goals were 1) to investigate the failures of restorations that were repaired and replaced and 2) to compare their clinical condition to control groups. The hypothesis was that repair of amalgam and composite restorations with occlusal marginal defects would improve their clinical conditions, with performance similar to replacement after 12 years of clinical service.

METHODS AND MATERIALS

Study Design

A total of 34 patients from 18 to 80 years of age (mean 26.4 years), comprising both females (58%) and males (42%) who had a total of 67 posterior composite resin and 100 posterior amalgam restorations, were recruited at the Operative Dentistry Clinic at the Dental School of the University of Chile. The restorations presented localized, marginal, anatomical deficiencies and/or secondary caries adjacent to restorations that deviated from the ideal and thus were rated Bravo or Charlie according to the modified US Public Health Service (USPHS) criteria. The restorations were assigned to experimental groups (repair and replacement) and a control group, where the restoration was controlled without treatment. The study protocol was approved by the Institutional Research Ethics Committee of the Dental School at the University of Chile (Project PRI-ODO-0207/NCT02043873). All patients signed informed consent forms, completed registration forms, and agreed to participate in the study independent of the treatment received. Patients whose restorations failed were removed from the study and retreated but were still included in the final analytical statistics according to the intention to treat "CONSORT" protocol[12] (Figure 1).

Inclusion and Exclusion Criteria

Inclusion

- Amalgam and composite restorations placed in posterior teeth with localized, marginal, anatomical deficiencies and/or secondary caries that were clinically judged to be suitable for repair or replacement according to the modified USPHS/Ryge criteria (Table 1)
- Patients with more than 20 teeth
- Posterior restorations in functional occlusion with an opposing natural tooth
- Asymptomatic restored tooth
- At least one proximal contact area with an adjacent tooth
- Patients older than 18 years
- Patients who agreed to and signed the consent form for participating in the study
- Remaining tooth structures in good condition

Exclusion

- Patients with contraindications for regular dental treatment based on their medical history
- Patients with special esthetic requirements that could not be solved by repair treatments
- Patients with xerostomia or taking medication that significantly decreased salivary flow
- Patients with high caries risk
- Patients with psychiatric or physical diseases that interfered with oral hygiene
- Composite and amalgam restorations with localized defects by secondary caries or marginal

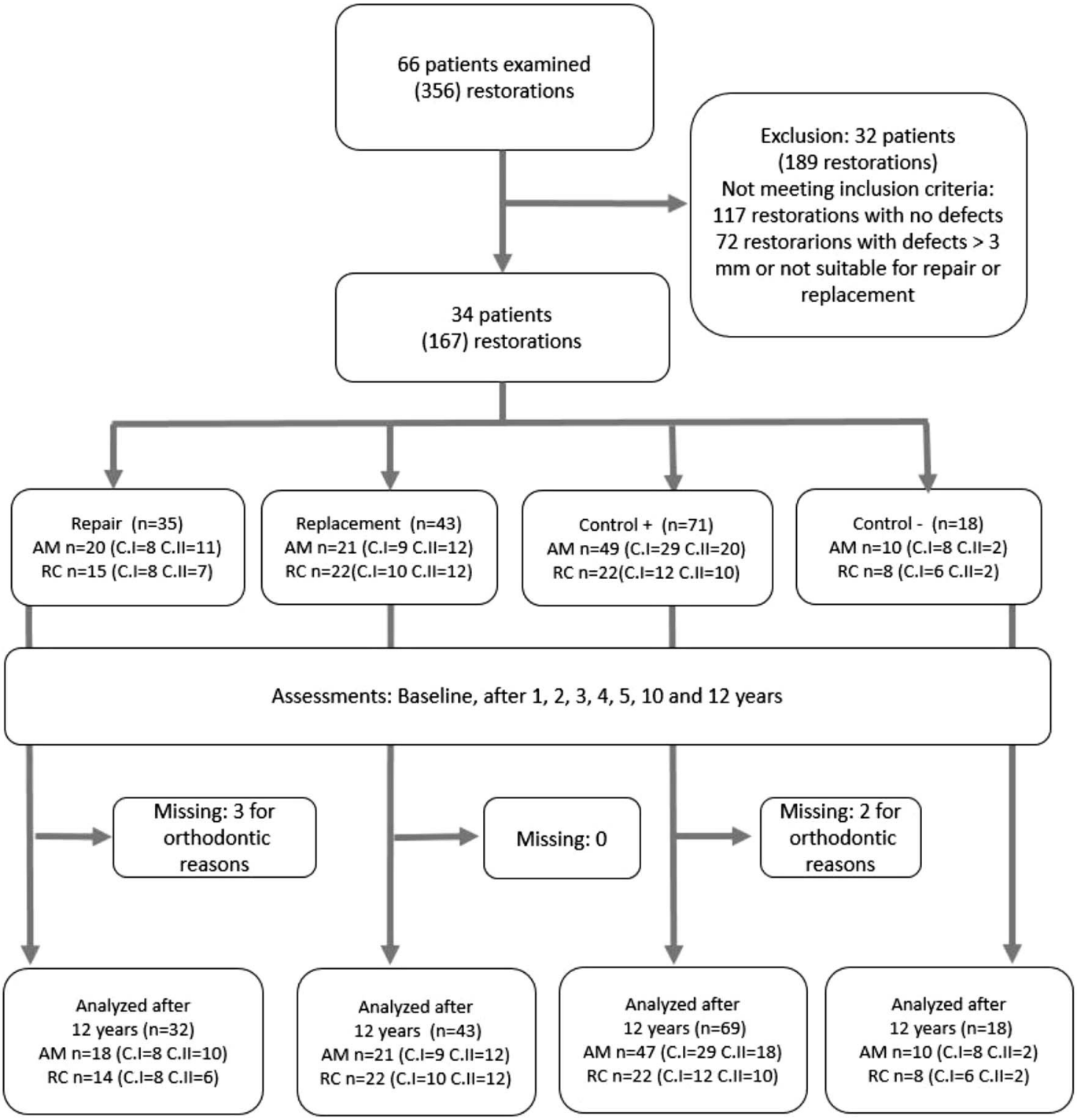

Figure 1. *Flow chart of clinical trial.*

defects greater than 3 mm and located and/or in the proximal surfaces

- Clinical judgment that repair was not indicated in resin or amalgam restorations, for example, when defective area covered most of the restoration.

Due to local ethics committee requirements at the time the trial was formulated, it was not recommended to include high-caries-risk patients and defects greater than 3 mm because repair was classified as an experimental treatment 12 years ago.

Table 1: *USPHS/Ryge Modified Clinical Criteria*

Clinical Characteristics	Alpha	Bravo	Charlie
Marginal adaptation	Explorer does not catch when drawn across the restoration–tooth interface	Explorer falls into crevice or has one-way catch when drawn across the restoration–tooth interface	Dentin or base is exposed
Surface roughness	Surface of restoration has no defects	The surface of restoration has minimal surface defects	Surface of restoration has severe surface defects
Secondary caries	No clinical diagnosis of caries	Not applicable	Clinical diagnosis of caries
Marginal stain	No discoloration between the restorations and tooth	Discoloration on less than half of the circumferential margin	Discoloration on more than half of the circumferential margin
Teeth sensitivity	No sensitivity when an air syringe is activated for two seconds at a distance of half an inch from the restoration with the facial surface of the proximal tooth covered with gauze	Sensitivity is present when an air syringe is activated for two seconds at a distance of half an inch from the restoration with the facial surface of the proximal tooth covered with gauze	Sensitivity is present when an air syringe is activated for two seconds at a distance of half an inch from the restoration with the facial surface of the proximal tooth covered with gauze, and sensitivity does not cease when the stimulus is removed
Anatomic form	General contour of the restorations follows the contour of the tooth	General contour of the restoration does not follow the contour of the tooth	The restoration has an overhang
Luster	The restoration surface is shiny and has an enamel-like, translucent surface	Restoration surface is dull and somewhat opaque	The restoration surface is distinctly dull and opaque and is esthetically displeasing

Sample Size Determination and Randomization

Sample size was determined *a priori* using G*Power 2.22[13] with an error probability of $\alpha = 0.05$, effect size of 0.3, and power ($\beta - 1$ error probability) of 0.80. The restorations with marginal defects (Bravo) were randomly assigned (performed with PASS 2004 software, NCSS, Kaysville, UT, USA) to one of two groups of treatment: repair (n=35) and replacement (n=43). Two control groups were constituted: a positive control without marginal defects (Alpha) (n=71) and a negative control with clinically acceptable marginal defects (Bravo) (n=18). Only faculty members were allowed to provide the restorative treatment.

Caries Risk Assessment

Computer software (Cariogram) was used to assess individual patients' caries risk; the software weighted the interaction between the following 10 caries-related factors: caries experience, related general disease, diet contents, diet frequency, plaque amount by the Silness Loe Index, semiquantitative detection of mutans streptococci and lactobacilli in saliva by caries risk test (CRT) bacteria (Ivoclar Vivadent AG, Schaan, Liechtenstein), fluoride program, amount of saliva stimulated secretion by CRT buffer (Ivoclar), saliva buffer capacity, and clinical judgment. Patients were classified in the following three Cariogram caries risk categories: high = 0% to 40% chance to avoid caries, intermediate = 41% to 60% chance to avoid caries, and low = 61% to 100% chance to avoid caries. In addition, the results indicated where targeted actions to improve the situation would have the best effect.

Restoration Assessment

Two examiners underwent calibration exercises each year (J.M. and E.F.). The Cohen kappa interexaminer coefficient was 0.74 at the initial status and 0.88 at 12 years. The quality of the restorations was evaluated using the modified USPHS/Ryge criteria (Table 1). The two examiners assessed the restorations independently by visual (mouth mirror #5, Hu Friedy Manufacturing Co Inc, Chicago, IL, USA) and tactile examination using an explorer (N8 23, Hu Friedy) and indirectly by radiographic (Sirona Heliodent Vario, Charlotte, NC, USA) examination (Bite Wing, DF57, Kodak Dental System Healthcare, Rochester, NY, USA). The assessment of this initial status was considered as data immediately prior to the intervention for further statistical analysis.

If any difference was recorded between the two examiners and agreement could not be reached, a third clinician (G.M.) was called to assist with the

decision process. If the three clinicians did not reach an agreement, the lowest score was recorded.

Treatment Groups

Repair—The clinicians (P.V. and G.M.) used carbide burs (330-010 Komet, Brasseler GmbH Co, Lemgo, Germany) to explore the defective margins of the restorations, beginning with the removal of part of the restorative material adjacent to the defect to act as an exploratory cavity. This allowed a proper diagnosis and evaluation of the extent of the defect. Provided that the defect was limited and localized, the clinician then removed any defective, demineralized, and soft tooth tissue. For composite restorations, a one-step, self-etch adhesive was used (Adper Prompt L-Pop, 3M ESPE, St Paul, MN, USA) according to the manufacturer's instructions, followed by a restoration with nanofill composite resin restorative material (Filtek Supreme, 3M ESPE). For amalgam restorations, mechanical retention was used inside the existing amalgam restoration followed by use of a dispersed-phase amalgam alloy (Original D, Wyckle Research Inc, Carson City, NV, USA) following the manufacturer's intructions. Rubber dam isolation was used during the entire procedure.

Replacement—The clinicians totally removed and replaced the defective restorations. After completing the cavity preparations, restoration was carried out with new composite resin or amalgam, according to the material of the previous restoration. Elimination of the soft, infected carious dental tissue was made using carbide burs at high speed under full water irrigation. During cavity preparation, no preventive extension or undercut area was created, and all cavity angles were rounded. In deep dentin, a glass-ionomer liner (Vitrebond, 3M ESPE) was applied. Adper Prompt L-Pop (3M ESPE) was applied and the composite (Filtek Supreme, 3M ESPE) inserted using an incremental technique. For new amalgam restorations (Tytin, Kerr Corp, Orange, CA, USA), bonding agent and/or liner were not used. Rubber dam isolation was used during the entire procedure.

All treatments were performed by the same clinicians (P.V. and G.M), who did not serve as examiners. The occlusion was checked, and the restorations were finished and polished following the restorative material manufacturer's instructions.

Positive Control—The restorations were made at the start of the study and did not receive any treatment.

Negative Control—The defective restorations did not receive any treatment.

Restoration Assessment and Follow-Up

Patients were recalled each year in the first five years of clinical service, then after 10 and 12 years for clinical evaluation by the same examiners using the USPHS/Ryge modified clinical criteria as used at initial assessment (baseline). Failed restorations were removed from the study and treated according to their diagnosed needs. Digital photographs and bitewing radiographs were taken for all the restorations before and after treatment and every year prior to the examination.

Statistical Analysis

The Mann-Whitney test was performed for comparisons between groups at 12-year recall. The Wilcoxon test was performed for comparisons between the initial state and after one-year and 12-year recall in the same group with a significance level of 0.05. The statistical analysis was performed using SPSS 21.0 (IBM, New York, NY, USA) The "intention to treat" CONSORT protocol was used to analyze data on restorations that were evaluated in year 12 and lacked data from a previous evaluation. Restorations that could not be assessed in year 12 were considered absent and were not entered into the analysis.

RESULTS

The recall of this cohort of patients at 12 years was 100%. The distribution according to caries-risk patients was 80% medium risk (n=133) and 20% low risk (n=34); five missing restorations (2.99%) were lost by orthodontic treatment. The clinical condition of restorations evaluated at the initial state, after one year, and after 12 years is shown in Table 2.

Between-Group Comparisons: Mann-Whitney Test

Amalgam Restorations—When comparing values of the 12th year in all Ryge parameters of repair vs the positive control group, statistically significant differences were observed for marginal adaptation (p=0.021), roughness (p=0.041), and secondary caries (p=0.026), with better performance in the positive control group.

When comparing values of the 12th year in all Ryge parameters of repair vs the negative control group, no statistically significant differences were observed.

Table 2: *Frequency of Alpha Scores for Amalgam Restorations and Resin Composite Over Time Expressed as Percentage*

		Repair			Replacement			Positive Control			Negative Control		
		IA	1	12	IA	1	12	IA	1	12	IA	1	12
Amalgam	MA	20%	60%	0%	10%	91%	5%	100%	82%	16%	0%	0%	0%
	A	20%	60%	10%	19%	76%	10%	82%	80%	18%	60%	50%	10%
	R	50%	60%	10%	29%	67%	5%	92%	82%	31%	90%	80%	0%
	MS	80%	95%	50%	52%	95%	24%	100%	94%	41%	70%	60%	20%
	S	100%	100%	95%	91%	100%	91%	100%	100%	100%	100%	100%	100%
	SC	80%	100%	90%	62%	100%	100%	100%	100%	100%	100%	100%	100%
	L	35%	80%	5%	43%	91%	0%	76%	61%	14%	40%	40%	0%
Resin composite	MA	20%	60%	0%	27%	91%	23%	100%	96%	23%	0%	0%	0%
	A	27%	93%	27%	18%	91%	41%	86%	73%	23%	50%	50%	13%
	R	53%	93%	7%	59%	82%	46%	96%	96%	55%	75%	75%	38%
	MS	40%	87%	13%	64%	100%	55%	91%	91%	55%	88%	63%	38%
	S	100%	100%	100%	91%	100%	100%	100%	100%	100%	100%	100%	100%
	SC	100%	100%	80%	46%	100%	96%	100%	100%	100%	100%	100%	100%
	L	60%	87%	13%	36%	96%	41%	96%	73%	23%	88%	63%	13%

Abbreviations: MA, marginal adaptation; IA, initial assessment (baseline); A, anatomy; R, roughness; MS, marginal staining; S, sensitivity; SC, secondary caries; L, luster.

When comparing values of the 12th year in all Ryge parameters of replacement vs the positive control group, statistically significant differences were observed for roughness (p=0.043), with better performance in the positive control group.

When comparing values of the 12th year in all Ryge parameters of replacement vs the negative control group, no statistically significant differences were observed.

When comparing values of the 12th year in all Ryge parameters of replacement vs the repair group, no statistically significant differences were observed.

Composite Resin Restorations—When comparing values of the 12th year in all Ryge parameters of repair vs the positive control group, statistically significant differences were observed for roughness (p=0.014), with better performance in the positive control group.

When comparing values of the 12th year in all Ryge parameters of repair vs the negative control group, no statistically significant differences were observed.

When comparing values of the 12th year in all Ryge parameters of replacement vs the positive control group, no statistically significant differences were observed.

When comparing values of the 12th year in all Ryge parameters of replacement vs the negative control group, no statistically significant differences were observed.

When comparing values of the 12th year in all Ryge parameters of replacement vs the repair group, statistically significant differences were observed for roughness (p=0.049), with better performance in the replacement group.

Within-Group Comparisons: Wilcoxon Test

Amalgam Restorations—In the repair group, roughness (p=0.013), marginal staining (p=0.007), and luster (p=0.007) presented statistically significant differences between baseline and 12-year follow-up, whereas the remaining clinical parameters had similar outcomes ($p \geq 0.05$). When comparing first-year follow-up with 12-year follow-up, significant differences were observed for marginal adaptation, anatomy, roughness, marginal staining, and luster ($p < 0.007$).

When comparing the inital assessment and 12-year exam for the replacement group, marginal adaptation (p=0.021), marginal staining (p=0.014), secondary caries (p=0.005), and luster (p=0.011) showed statistically significant differences, and the remaining clinical parameters showed similar outcomes ($p > 0.05$). When comparing first-year follow-up with 12-year follow-up, significant differences were observed for marginal adaptation, anatomy, roughness, marginal staining, and luster ($p < 0.00$).

In the positive control group, all parameters showed statistically significant differences ($p \leq 0.001$) except in sensitivity and secondary caries.

Table 3: *Characteristics of Failed Restorations*

Group	Material	Class	Reason for Failure	Year of Recall at Time of Failure
Repair	Amalgam	I	Secondary caries	10
	Amalgam	II	Marginal adaptation	10
	Amalgam	I	Secondary caries	4
	Composite	I	Marginal adaptation	3
	Composite	I	Secondary caries	10
	Composite	I	Secondary caries	3
	Composite	I	Secondary caries	10
Replacement	Composite	I	Secondary caries	4
Positive control	Amalgam	II	Marginal adaptation	1
Negative control	Amalgam	II	Secondary caries	1
	Amalgam	II	Secondary caries	5
	Amalgam	II	Secondary caries	5

In the negative control group, all parameters showed statistically significant differences ($p \leq 0.046$) except in marginal adaptation, sensitivity, and secondary caries.

Composite Resin Restorations—When comparing the assessments at baseline and 12-year exams for the repair group, roughness ($p=0.008$) and luster ($p=0.020$) showed statistically significant differences; the other clinical caracteristics had similar results ($p>0.05$). When comparing first-year follow-up with 12-year follow-up, significant differences were observed for marginal adaptation, anatomy, roughness, marginal staining, and luster ($p<0.004$).

In the replacement group, anatomy ($p=0.029$) and secondary caries ($p=0.001$) presented statistically significant differences; the remaining clinical parameters showed similar outcomes ($p>0.05$). When comparing first-year follow-up with 12-year follow-up, significant differences were observed for marginal adaptation, anatomy, roughness, marginal staining, and luster ($p<0.002$).

In the positive control group, all parameters showed statistically significant differences ($p \leq 0.003$) except in sensitivity and secondary caries.

In the negative control group, luster presented significant differences when comparing 12-year vs initial assessment ($p=0.014$) and vs one-year ($p=0.046$); the remaining clinical parameters showed similar outcomes ($p>0.05$).

The observed failures in the study groups are shown in Table 3.

DISCUSSION

This clinical, prospective study assessed patients who received repair in localized defects of amalgam and composite restorations for a 12-year observation period compared to full restoration replacement. In order to evaluate the influence of repair on the longevity of restorations, a comparison year after year with the initial state of the restorations at the beginning of this study was necessary. Following this logic, it was assumed that a restoration recently replaced (replacement group as a positive control) was an Alpha score restoration because it was performed by an experienced clinician and under all the ideal conditions, unlike other designs where the effectiveness of a treatment is itself compared from its initial state (baseline).

Over time, continuing deterioration in all parameters was observed for all groups. This finding is related to the deterioration of the restorative material properties with time, particularly the surface properties in this study. Tooth sensitivity, interestingly, remained at levels close to zero, which means that the so-called bonding degradation ascribed to dentin adhesives over time[14,15] was not able to clinically influence the restorations, at least in terms of sensitivity. Secondary caries was also a low-occurrence event that was observed in a few cases since the third year of follow-up, showing that both treatments are equally well tolerated. A similar observation has been shown in reports with five- and 10-year follow-up.[6,8,16] However, in the current study, surface roughness had significantly greater deterioration in repaired composite resin restorations than repaired amalgam restorations at the 12-year observation period. This finding is explained by the different ways that the surface qualities of composites and amalgams might react to oral conditions with time. Whereas biofilm, dietary media, and toothbrushing, for example, are virtually unable to affect the roughness of metal alloys,

composite resins may present surface alteration because of those effects. *In situ* studies[17-20] have shown that composite resin experience structural alteration caused by oral biofilms, with decreased surface hardness and higher roughness when compared with amalgam in particular, mainly due to amalgam's antibacterial effect over dental biofilms.

Interestingly, when comparing the performance of amalgam repair vs positive control, that is, restorations without marginal defects (alpha), the latter group had better behavior in marginal adaptation, secondary caries, and roughness. It is important to note that it is not possible to determine if the failures of the restorations were in the repaired area or the old portion of restoration or even if a restoration that has defects has a tendency to deteriorate again.

As stated in the inclusion criteria, restorations had some marginal/anatomic defects or secondary caries in order to be included in the study. For composite resin restorations, the main cause of inclusion was wide marginal defects, which might be considered material- and technique-dependent clinical issues. In contrast, the main reason for repair in amalgams was secondary caries, which is explained by the fact that the antibacterial potential of corrosion products from amalgam is not fully in place in old restorations. The same initial failure conditions were not observed in the subsequent follow-ups since no differences in the reasons for failure were observed between materials. In contrast, Opdam and others,[21] in a retrospective study using a multivariant Cox regression, found that composite resin restorations showed better performance and better prognosis if caries was the repair indication compared to fracture as the reason for failure.

Despite the low number of Alpha score restorations for marginal adaptation and marginal staining, these parameters apparently have no direct relationship with the incidence of caries, confirming the review of Demarco and others[22] indicating that other factors, such as patient cariogenic risk, operator characteristics, and socioeconomic conditions, are key factors for the longevity of posterior composite restorations. Amalgam restorations presented an increased number of Bravo scores for marginal staining at 12 years, although this clinical feature seems to have no relationship with the development of secondary caries, nor is it a risk factor by itself. This finding has been documented previously in an *in vitro* study.[23]

When observing the behavior of the replacement group, amalgam showed a decrease of several clinical parameters over time, related mainly to marginal stability, unlike the group of composites. Composite restorations have the advantage of being bonded to the tooth by an adhesive interface; on the other hand, anatomy was the parameter that deteriorated statistically over time. This finding could be explained mainly by the mechanical behavior of the restorative material placed in a previously defective zone that probably had mechanical failures by overextension, excessive masticatory forces, or habits that could accelerate the deterioration of the restoration surface; this original situation was not modified.

When the presence of secondary caries, tooth sensitivity, or wide marginal gaps is detected, it makes sense to carry out an intervention urgently; in fact, the criteria used in the current study state that these situations constitute the failure of the restoration. However, not all Charlie scores observed here indicate failures. Some restorations with parameters such as marginal staining, luster, or superficial roughness were detected from the first year of evaluation, and these restorations remained in a functional state without being associated with secondary caries, restoration fracture, or marginal gaps for more than 12 years. Therefore, it seems that these clinical conditions have questionable predictive value in the longevity of the restoration, and are mainly related to the demand for esthetics by patients and dentists.

The sample was made up of restorations of different ages that were equally assigned to study groups, showing similar outcomes and failure rates after 12 years, so this factor apparently does not have a relationship in the decision-making process for treatment of either repair or replacement. One study[24] suggested that patient caries risk, the clinical setting of the study, and the socioeconomic characteristics of patients would be determinants of the reasons for failure when compared to the clinical age of the evaluated restorations.

In the present study, after 12 years for both repaired and replaced restorations, composite resin restorations showed an incidence rate of secondary caries of 5% to 10%, and no new caries lesions were observed on restorations. These results were obtained from a sample of patients of medium and low cariogenic risk determined using Cariogram. Our findings are consistent with the results of the group of low cariogenic risk following 12 years by Opdam and others,[24] where the cariogenic risk was assigned retrospectively using clinical records data on the incidence of new caries in the observation period,

indirectly confirming the congruence between the two estimates of risk. Also, the study of Opdam and others noted that there were differences in results between amalgam and composite resin restorations in patients with a high cariogenic risk.

A limitation of this study could be the current number of restorations in the observation; this situation can overstate findings such as the failure rate of the repair group, where each failed restoration (three failures in amalgam restorations and four failures in composite resin restoration over time) represents a high percentage of failures. However, the replaced restorations have values similar to the 12-year follow-up of restorations by Opdam and others.[24]

Another limitation of this study was the fact that the blinding of the evaluators made it difficult to ensure that the failures or Charlie values corresponded in 100% of the cases to the repaired area or areas belonging to old restorations. Adding to the difficulty was that all restorations show a degree of deterioration over time, that intervening restorations have considerable clinical service, and that, despite this, the replaced restorations were in a similar state as the repaired. Hickel[25] recommended overcoming this problem by using the SQUACE (semiquantitative clinical evaluation) method, which consists of a diagram of the restoration, for taking into consideration the extent of a clinical defect or observation in relation to the entire restoration or to record the exact location of the defect using the FDI World Dental Federation clinical criteria. However, the Ryge/USPHS and FDI World Dental Federation criteria do not consider the evaluation of the restoration–repair interface; this could be an interesting point to analyze because this could be the cause of the Charlie values in parameters such as surface roughness and luster.

Our findings are consistent with previous reports of five-, seven-, and 10-year observation periods,[6-9] showing the same trend that the repair of restorations is as effective as the total restoration replacement, with the advantages of preserving healthy tooth structure, consuming less clinical time, being more tolerated by patients, presenting lower economic costs, and increasing the longevity of existing restorations.

CONCLUSIONS

Repairing amalgam and composite resin restorations is a treatment as effective as replacing restorations. Considering the many benefits of the repair treatment, this treatment modality should be indicated more often in patients with low to medium cariogenic risk and failures due to secondary caries or marginal defects.

Regulatory Statement

This study was conducted in accordance with all the provisions of the local human subjects oversight committee guidelines and policies of the Institutional Research Ethics Committee of the Dental School at the University of Chile. The approval code for this study is Project PRI-ODO-0207/ NCT02043873.

Conflict of Interest

The authors of this article certify that they have no proprietary, financial, or other personal interest of any nature or kind in any product, service, and/or company presented in this article.

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