



# A CLINICAL EVALUATION OF DIRECT VENEERS MADE WITH TWO TYPES OF COMPOSITES

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## ABSTRACT

**Objectives:** the aim of this study was to provide a retrospective clinical evaluation of direct composite veneers performed with microfilled or universal composites, through two evaluation criteria (FDI and USPHS).

**Materials and methods:** patients should be in compliance with the inclusion criteria: having a composite veneer in anterior teeth made either with microfilled or universal using composites (microhybrid/nanohybrid), conventional dentin-bonding agents and for a minimum of 6 months period in service. A calibrated blind examiner assessed the veneers using the FDI and USPHS criteria and the results were subjected to statistical analysis by the Mann-Whitney test ( $p < 0.05$ ).

**Results:** Twenty-eight patients (mean age 42.9 year-old) and seventy-four composite veneers were examined. The mean period of time in service was three years, with periods varying from six months up to ten years. Three cases of total failure (veneers lost, universal composites group) occurred in the surveyed patients, out of 17 failures in total. In general, the veneers showed a clinical satisfactory outcome (77% survival rate). Concerning the two composite types, better clinical performance was observed for microfilled in relation to surface luster, surface staining, colour match and marginal adaptation.

**Conclusion:** In this interim evaluation, direct composite veneers demonstrated an acceptable clinical behavior. Microfilled composite veneers showed a better performance compared to universal composites. The two criteria (USPHS and FDI) were similar in the clinical evaluation process.

**Clinical relevance:** direct composite veneers have a good clinical performance, microfilled composites are interesting options regarding esthetic properties.

**KEYWORDS:** Composite Resins. Esthetics Dental. Dental Veneers. Dental Restoration Permanent.

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## INTRODUCTION

Since their introduction in dentistry, composite resins have been increasingly used, for both anterior and

posterior teeth (Baldissera et al., 2013). The characteristics of adhesion, conservative approach and aesthetic are the main reasons for the success of composites (Malhotra et al, 2011; Frese et

al, 2013; Mante et al, 2013). Also, composite restorations present a good clinical performance even after long periods of time in both posterior (Vande

Sande et al., 2013) and in few studies in anterior teeth (Baldissera et al., 2013).

Currently there are a series of different types of composite available in the market, some of them designed to be more applied in regions where the esthetic requirement is more intense (anterior teeth) and others where the resistance to mastigatory forces are more needed (posterior teeth), while some composites claim to be universal materials, able to be used in different clinical situations (Baldissera et al, 2013). The amount of fillers and the size of these fillers have been reported to influence the surface roughness and resistance to staining, for example, with microfilled composites exhibiting a better superficial behavior than the microhybrid composites (Lu et al, 2005).

The perception of individual and consequently the quality of life can be affected by esthetic damage in smile appearance (Sadowski et al, 2006; Afroz et al, 2013). In such situations, direct composite veneers might be an excellent option to rehabilitate the impaired esthetic (Wolff et al., 2010). Indeed, in modern dentistry, the minimally invasive approach should be the choice in relation to indirect procedures (Nalbandian & Millar, 2009; Prieto et al, 2014). Few studies (Gresnigt et al, 2012; Frese et al, 2013) have evaluated the performance of direct composite veneers, especially in long periods of time (Alonso et al, 2012). While for problems leading to restoration failure, a long period of time might be required (Baldissera et al., 2013), minor surface alterations could be observed after months of restoration placement and this small alterations could be perceived by the patients, requiring intervention from the dentist.

To perform the clinical evaluation of restorations most of the

studies have used the United States Public Health Service (USPHS) criteria (Hickel et al., 2007; Hickel et al., 2010). This method is based on direct clinical evaluation by examiners trained and calibrated, of the different characteristics that involve the aesthetics and functionality aspects of the restorations, ranking them according to a standardized rating scale (categories). More recently, due to the better performace of materials, which required a more detailed and accurate method of evaluation, a new proposal for clinical evaluation of restorative procedures, called FDI criteria (Hickel et al., 2007; Hickel et al., 2010) was introduced. These criteria were based on the criteria imposed by Ryge (Ryge, 1980), but with some important changes in the evaluation method, election of criteria and distribution of scores, with an intention to make a more complete and standardized evaluation (Hickel et al., 2007; Hickel et al., 2010; Zander-Grande et al, 2014; Mena-serrano et al, 2014). Few studies have compared the screening capacity of the two methods when performing clinical evaluation of composites.

Thus, the aim of this study was to provide a retrospective clinical evaluation of direct composite veneers in anterior teeth performed with microfilled and universal composites. Also, two criteria (FDI and USPHS) were compared for the clinical evaluation of these direct veneers.

## **MATERIALS AND METHODS**

The research protocol (21736) of this study had the approval of the Ethics Committee, Federal University of Rio Grande do Sul (UFRGS, Porto Alegre, Brazil). Two types of composites with

different mechanical properties were evaluated for veneer restorations: microfilled (Durafil VS, Heraeus Kulzer, Hanau, Germany) and universal restoratives (Charisma, Heraeus Kulzer, Hanau, Germany; 4Seasons, Ivoclar-Vivadent, Elwangen, Germany; Filtek Z350XT, 3M ESPE, St. Paul, MN, USA).

## **PATIENTS' SELECTION**

Patients' records were assessed and the selection was carried out from those individuals attending to the Dental Clinic, Graduate and Post-Graduate Program in Dentistry of the Federal University of Rio Grande do Sul. The inclusion criteria to be fulfilled:

- Patients should have received a direct composite veneer in anterior teeth; which should be performed with microfilled or universal composites (microhybrids or nanohybrid) between January 2000 and January 2010;
- The restorations should be in clinical service for a minimum of 6 months;
- The veneers should be performed with a total etch dentin-bonding agent, with or without liner of calcium hydroxide or glass ionomer cements; and the teeth could be vital or non-vital, presenting or not intracanal posts.

Patients were not included in the study if they were smokers, had indirect ceramic or composite, occlusion problems or severe parafunctional habits, or if they had poor oral hygiene or with special needs.

A total of 28 patients were included in the study (09 men and 19 women), with the mean age of 42.9 year-old.

## RESTORATIVE PROCEDURES

Direct composite veneers were performed by undergraduate students (final year of faculty) and dentists in the operative dentistry post-graduate course (certificate program).

The dentin-bonding agent used in all composite veneers was the 3-step etch-and-rinse Scotchbond Multipurpose (3M ESPE). Composite resins were inserted through incremental/layer technique, light-cured by a light-emitting diode (LED) unit.

## EVALUATION PROCEDURES AND STATISTICAL ANALYSIS

Patients were contacted by phone to come in one of the clinics of the School of Dentistry at UFRGS on predetermined date for conducting the evaluations. After signed the informed consent, the patient was clinically evaluated by an examiner calibrated by the Cohen's Kappa coefficient and blind to the study aims.

The visual evaluation was assisted by explorer probe, dental mirror and light reflector, and performed after prophylaxis of teeth with a rubber cup and prophylaxis paste. Those patients who presented treatment needs found in clinical evaluation were referred to the clinics at school graduation. When restorations had failed before the examination, date and reason for failure were recorded from the patients' files.

The evaluation criteria used in the study were the modified USPHS and the FDI, including the aesthetic, functional and biological properties.

The data obtained in the clinical evaluation were tabulated and subjected to non-parametric statistical analysis by the Mann-Whitney test with a

significance level set at 5%, comparing microfills and the universal restoratives.

## RESULTS

Data of the independent variables of restorations are shown in Table 1. In total, 28 patients were evaluated during the study period, being 9 men and 19 women with ages between 18 and 77 years (mean 42.9 year-old). The final number of veneers evaluated was 74 (35 microfilled and 39 universal restoratives), and these varied according to time in service from 6 months to 10 years, as noted in Table 1, with mean service time of 3 years. From the 74 veneers evaluated, 3 received score 5/C (FDI/USPHS) for fractures and retention criterion because they had been missed (all performed with the universal composites). A total of 17 direct veneers

failed (23%) in the evaluated period (6 microfilled and 11 universal), being 3 missed, 9 fractured, 3 with recurrence of caries and 2 with intensive postoperative hypersensitivity. Some veneers had more than one reasons for failure.

The statistical analysis of the clinical performance between the two groups of composite veneers (microfilled and universal restoratives) was made by Mann-Whitney test ( $p < 0.05$ ) and it is arranged in tables 2 and 3.

There was no statistically significant difference between the two types of composite resins in relation to the failed restorations. The differences found in the criteria: surface luster, surface staining, marginal staining, colour match, marginal adaptation (FDI); and luster and roughness,

Table 1 – Distribution of composite veneer restorations.

Independent variables	N	%
<i>Sex</i>		
Male	09	32.1
Female	19	67.9
Total	28	100
<i>Tooth type</i>		
Lower incisor	6	8.1
Upper incisor	54	73
Upper canine	10	13.5
Lower canine	4	5.4
Total	74	100
<i>Follow-up time (years)</i>		
0.5 - 2	38	51.3
2 - 4	19	25.6
4 - 6	7	9.5
6 - 8	5	6.8
8 - 10	5	6.8
Total	74	100
<i>Composite type</i>		
Microfilled	35	47.3
Universal	39	52.7
Total	74	100

Table 2 - Clinical evaluation of composite veneers: comparison between the composites types (microfilled and universal restoratives), according to the FDI criteria:

		Microfill		Universal		Mann-Whitney
		Restorations scores* n (1/2/3/4/5)	Restorations clinically acceptable	Restorations scores n (1/2/3/4/5)	Restorations clinically acceptable	p
		<i>Aesthetics properties</i>	Surface luster	35 (33/2/0/0/0)	100%	36 (15/19/2/0/0)
	Surface staining	35 (31/3/1/0/0)	100%	36 (13/14/9/0/0)	100%	0.001
	Marginal staining	35 (27/7/1/0/0)	100%	36 (8/22/6/0/0)	100%	0.001
	Color match	35 (32/3/0/0/0)	100%	36 (22/12/2/0/0)	100%	0.026
	Anatomic form	35 (28/4/3/0/0)	100%	36 (24/8/4/0/0)	100%	0.359
<i>Functional properties</i>	Fracture and retention	35 (25/2/4/4/0)	88.6%	39 (29/1/1/5/3)	79.5%	0.961
	Marginal adaptation	35 (24/9/2/0/0)	100%	36 (4/25/6/1/0)	97.2%	0.001
	Patient's view	35 (31/1/3/0/0)	100%	39 (30/5/1/0/3)	92.3%	0.397
<i>Biological properties</i>	Recurrence of caries, erosion and abfraction	35 (31/0/2/2/0)	94.3%	36 (34/1/0/1/0)	97.2%	0.665
	Postoperative sensitivity	35 (33/2/0/0/0)	100%	36 (33/1/0/2/0)	94.4%	0.835

\*For each evaluation criterion a score from 1 to 5 is given: 1-3 when the restoration is clinically acceptable, while 4 and 5 designate failure. Kappa 0.87.

Table 3 - Clinical evaluation of composite veneers: comparison between the composites types (microfilled and universal restoratives), according to the USPHS criteria:

		Microfill		Universal		Mann-Whitney
		Restorations scores* n (A/B/C)	Restorations clinically acceptable	Restorations scores n (A/B/C)	Restorations clinically acceptable	p
		<i>Aesthetics properties</i>	Anatomic form	35 (30/5/0)	100%	36 (25/11/0)
	Luster and roughness	35 (32/3/0)	100%	36 (16/20/0)	100%	0.001
	Marginal staining	35 (27/8/0)	100%	36 (10/26/0)	100%	0.001
	Color match	35 (32/3/0)	100%	36 (26/10/0)	100%	0.164
<i>Functional properties</i>	Fracture and retention	35 (31/0/4)	88.6%	39 (31/0/8)	79.5%	0.504
	Marginal integrity	35 (28/7/0)	100%	36 (4/31/1)	97.2%	0.001
<i>Biological properties</i>	Secondary caries	35 (33/0/2)	94.3%	36 (35/0/1)	97.2%	0.835
	Postoperative sensitivity	35 (33/2/0)	100%	36 (33/1/2)	94.4%	0.835

\*For each evaluation criterion a score from A to C is given: A and B when the restoration is clinically acceptable, while C designate failure. Kappa 0.87.

marginal integrity (USPHS) were related to the scores 1, 2 and 3 (FDI) and A and B (USPHS), all clinically acceptable.

## DISCUSSION

Despite large clinical use of composites for anterior teeth, especially for direct composite veneers, there is a lack of scientific evidence in relation to

the restorations longevity (Lacy, 1998; Alonso et al, 2012; Frese et al, 2013).

The present study demonstrated a satisfactory clinical performance of the direct composite veneers, with a mean survival time of 3 years. Similar results had been reported by some studies (Alonso et al, 2012; Gresnigt et al, 2012; Frese et al, 2013). Even though both kind of composites presented good performance, veneers

performed with microfilled composites demonstrated statistically better surface luster, lower marginal and surface staining, better color match and better marginal adaptation. Turssi et al (2001) showed that microfilled composites have better luster and smooth surface than microhybrid composites, after brushing procedures. Rather, the lack of statistically significant differences in anatomic form, fractures and retention, patient's view, postoperative hypersensitivity and recurrence of caries, reveals the similarity of microfilled and universal composite groups in these specific conditions. In relation to the patient's view about the restoration observed in this study through the group of functional properties according to the FDI, the majority of the veneers evaluated received score 1 or "completely satisfied". Other studies show that patients' satisfaction can be explained not only by the improvement in the color and shape of their teeth, but also by other factors such as a more conservative approach of tooth structure and low cost of the restorations (Goldstein, 1984; Meijering, 1997.)

The pioneering work of Ryge and collaborators from the evaluation of amalgam restorations resulted in the elaboration of a series of simple application criteria for clinical evaluation of direct restorations, known as USPHS criteria. This evaluation method reflects the aesthetic quality and functional performance of the restorations and provides information about the relative loss of anatomical form or failures after a long period of time (Ryge, 1980; Leinfelder et al, 1986). The FDI method, created by Hickel et al (2007) proposed a more detailed and careful analysis of the evaluation factors

since the system USPHS is a method with limited sensitivity, compared to the constant development of composite resins (Hickel et al, 2007; Zander-grande et al, 2014; Mena-serrano et al, 2014). Also within the criteria FDI in relation to failure of the restorations, the possibility of decision between need or not to repair becomes clear in the evaluation of the scores 4 and 5, where, generally, score 5 denotes clinical results worse than 4. Therefore, the distinction between acceptable and unacceptable result is facilitated. According to Hickel et al (2007), the result becomes unacceptable when retreatment is required.

The present study showed that both criteria of evaluation, USPHS and FDI, complied with the purpose of retrospective clinical evaluation and provided similar results. Although there are limitations in a retrospective clinical study, there are also some advantages such as the possibility of evaluation in a relative short period of time, of a large number of veneers with different clinical services times, compared to prospective clinical studies. Even though the best form to evaluate different treatments is using randomized clinical trials, this kind of research requires long period of time to be performed, a large dental team involved, high costs, and sometimes they do not reflect the real clinical practice (Demarco et al., 2012).

Our findings are reinforced by previous studies in relation to anterior composite restorations. A clinical study showed after five years a survival rate of 89% of the restorations evaluated, with restorations replaced due to loss of anatomic form and color changes (Peumans et al, 1997). A randomized clinical trial of composite restoration applied to close diastemas, found after five years an overall 80% survival rate

(Wolff et al, 2010), which compares favorable with the overall survival rate observed in our study (77%). In the present study, in general, the percentage of failures considering the scores 4 and 5 (FDI) and score C (USPHS) was 23%. Still, the fact of the restorations were performed in an academic environment, including undergraduate students, also reinforces the idea of the influence of the clinician on the restoration performance, as well as demonstrated by Kubo et al (2011) for class III and IV.

The large majority of studies found in the literature refers to porcelain veneers, which have a survival rate of around 90% in 10 years, with good color stability, marginal adaptation and satisfaction by patients (Peumans, 2004, Chen, 2005; Aykor, 2009; Kreulen, 1998). The scarcity of studies assessing the long-term direct composite resin veneers highlights the clinical relevance of our study, which compared two groups of composites widely used, microfilled and universal restorative. Gresnigt et al (2012) evaluated 96 microhybrid composite veneers (Enamel Plus and Miris), after 41 months, in a split-mouth clinical trial, and showed a survival rate of 87.5%, with no statistically differences between them.

Some limitations could be pointed out for our study, including the relatively small sample size evaluated (interim evaluation), the time in service assessed, and the specific kind of patients included in the research, with good oral health, no smoking habits and with a stable occlusion. On the other hand, this retrospective clinical study brought some important contribution about the behavior of direct composite veneers.

## CONCLUSION

From the results of this interim evaluation, we can conclude that:

- Direct composite veneers demonstrated an acceptable performance, and the survival rate was 77%.
- Microfilled composite veneers demonstrated a better behavior compared to universal composites on esthetic properties.
- The two criteria (USPHS and FDI) were similar in the clinical evaluation of direct composite veneers.

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