

## A Retrospective Clinical Evaluation of Direct and Indirect Aesthetic Restorations with Cuspal Replacement

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### Abstract

**Introduction:** The increasing demand for aesthetic restorations had enabled new treatment choices to restore posterior teeth with extensive cavities. The treatments of these teeth involve direct composite restoration or indirect onlays, made with ceramic or composite. However, clinical data on the longevity of cuspal restorations comparing direct and indirect techniques and the restorative materials are rare.

**Purpose:** To perform a retrospective clinical evaluation of direct restorations (composite resin) and indirect restorations (composite resin and ceramics) with cuspal involvement, using the FDI criteria.

**Materials and Methods:** 229 restorations were evaluated in 121 patients (37 men and 84 women) who received at least one direct composite restoration with involvement of at least one cusp or ceramic/composite onlays among the years 2003 and 2016. The visual evaluation was done by an examiner previous calibrated by Cohen's Kappa coefficient, using the FDI criteria. Data were analyzed by Kaplan-Meier, multivariate Cox regression analysis and Kruskal-Wallis test ( $p < 0.05$ ).

**Results:** Among the evaluated restorations, 69 failures were detected. The average evaluation time was 4.3 years. Restorations achieved a survival rate of 69.9%, with annual failure rate (AFR) of 8.0%. Direct composite restorations presented 34.1% of failure, with AFR of 9.6%. Composite onlays presented 27.3% of failure, with AFR of 7.1%. Ceramic onlays showed a 28.8% failure rate with AFR of 7.6%. Restorations in men have failed more than in women. The most common reason for failure was fracture of the material and retention, occurring in 48 cases (69.56% of the failures).

**Conclusion:** Direct and indirect restorations showed similar longevity, regardless of the number of cusps involved. Indirect restorations had lower annual failure rate than direct restorations, presenting better performance in the qualitative analysis. Female patients presented lower risk of failure, and the most prevalent type of failure in restorations with cusp involvement was fracture and retention.

**Keywords:** Dental restoration; survival rate; longevity; composite resins; ceramics

### Introduction

The necessity of an alternative treatment to substitute amalgam restorations and the increasing demand for aesthetic restorations in the last decades has changed modern Dentistry. Esthetic and minimally invasive treatments, instead of

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traditional metallic materials, are the new trend to restore posterior teeth with extensive cavities [1]. The good performance of adhesive systems and the principles of conservative dentistry allow these teeth to be rehabilitated through the adhesive techniques, which present as advantages restorative material retention and bond strength without the need of tissue removal when preparing a tooth [2].

Posterior teeth that have lost a substantial amount of dental structure as a result of caries injuries, cavity preparation, fractures, detrition, endodontic treatments or any combination of these factors frequently represent a dilemma for dentists in relation to the best treatment strategy for these restorations. Fragile or structurally compromised cusps can be reduced and/or covered by restoration material in indirect restorations [1]. Restorations with cuspal coverage can increase fracture resistance of restored teeth that can be compared to the resistance of a sound tooth [2, 3].

The treatment of teeth with extensive cavities involve direct composite restoration [4, 5] or indirect onlays [1, 6], made with ceramic or composite resin [1, 3]. Direct composite resin restorations have been used on a large scale due to its low cost, small amount of sound dental tissue removal [7-10], positive physical, mechanical, adhesive, and aesthetical properties and the possibility of repair when necessary. Composite resins are currently the chosen material for posterior teeth conservative aesthetic restorations [11, 12], which present proven clinical longevity by several studies [9, 10, 13].

On the other hand, issues such as elevated C-Factor, polymerization shrinkage, the difficulties to reestablish proximal contacts and reproduce dental anatomy and the incomplete curing on the deepest parts of the cavity are some of the challenges regarding the extensive direct restorations built ups [5, 8].

Indirect restorations (onlays) aim to cover at least one dental cusps with a reduced cavity preparation [1, 5], when compared to a traditional crown. The use of the onlays has increased significantly due to the evolution of adhesive systems, luting cements and ceramics, that promotes efficient sealing, fracture strength and retention of the restorations [1, 2, 3].

To restore extensive cavities, the use of onlays presents some advantages when compares to the direct technique. Among these advantages, we can highlight its ease to achieve a satisfactory anatomic shape, better proximal contact getting, predictable occlusion parameters and polishing, with improved physical and mechanical properties of the material [3, 14]. Further, onlays keep the polymerization shrinkage restricted to the composite luting cement line [2, 14] and demonstrate a positive longterm clinical performance [14, 15], presenting a survival rate up to 92.4% in 12 years [6]. The development of etched ceramic systems, such as leucite and lithium disilicate, allow partial ceramic restorations adhesively cemented to recover tooth structure [1].

Nonetheless, onlay restorations also present a few disadvantages when compares to direct restorations, like a more invasive tooth removal and the complexity of luting process [16], as well as the greater cost to the patient due to laboratorial phase and number of dental appointments.

The importance of the knowledge about direct and indirect restorations with cuspal involvement is undeniable. The constant need for more clinical data regarding the performance and longevity of restorations with cuspal involvement is clear. Longitudinal clinical studies comparing direct and indirect restorations are rare. Also, composites and ceramic onlays comparison is still unclear [1, 16]. Ultimately, retrospective studies could evaluate the quality and longevity of the restorations with cuspal involvement, reflecting the clinical reality [11].

Thus, the purpose of the present study was to perform a retrospective clinical evaluation of direct restorations (composite resin) and indirect restorations (composite resin and ceramics) with cuspal involvement, using the FDI criteria.

### Materials and Methods

#### Study Type and Ethical Considerations

The present research consists in a blind clinical retrospective study of direct composite resin restorations with cuspal involvement and indirect restorations (onlays) made of composite resin and ceramic. The study was performed in the school of Dentistry of the Federal

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University of Rio Grande do Sul (UFRGS) and was evaluated and approved by the Ethics Committee (protocol number 24358/1.202.537). All patients have signed a consent term before participating in the study.

### Sample Calculation

The sample size needed for the study was calculated based on a 90% confidence interval, presumed error of 10% and an outcome of secondary caries of 22.4% [9]. The minimum value found for n was 47 patients.

### Patient Selection

Patients were selected according to pre-determined inclusion criteria:

- Patients who were treated with composite resin or ceramic onlays
- Patients who received posterior direct composite restorations with total cuspal involvement
- Adult patients of both genders
- Restorations with or without a liner of calcium hydroxide cement or glass ionomer cement
- Restorations on vital or non-vital teeth.

A research was conducted among the patients' records of the school of Dentistry of UFRGS. Patients who received at least one direct composite restoration with cuspal involvement or one composite or ceramic onlay between 2003 and 2016 were included in this study. Restorations should be at least for 06 months in service before evaluation.

Among 1500 patients' records analysed, 135 patients were selected and invited to participate in the study by phone calls. 121 patients were included (37 men and 84 women), and 229 restorations were evaluated. Patients who agreed with the study terms signed written informed consent and were evaluated in the clinics of the school of Dentistry, by an examiner blind for the study objectives, calibrated by Cohen's Kappa coefficient. All restorations were placed by a final year under graduation dental students of UFRGS.

### Restorative Procedures

Patients selected had direct composite restorations built of ten different brands of composite resin. Indirect restorations were made of either composite Sinfony (Ceromer - 3M) or ceramic IPS Empress II/ e.max Press (Ivoclar Vivadent). Direct restorations were built by incremental technique and received finishing and polishing immediately. All restorations were placed using a total etch 3-step adhesive system Scotchbond Multipurpose (3M), and all indirect restorations were cemented with dual composite luting cement RelyXTM ARC (3M). Information about restorative materials can be checked on table 1.

Resin	Manufacturer	Inorganic Particles Classification	E-module (GPa)	Percentage of Inorganic Particles	Average size of Particles	N Restorations
Charisma	Heraeus Kulzer	Micro hybrid	14,06	59.4vl	0.7µL	17
Z350 XT	3m/ESPE	Nanoparticulate	13.3	63.3vl	20-75nm	23
Opallis	FGM	Nano hybrid	9.1	58vl	0.5 µm	20
Amelogen Plus	Ultradent	Micro hybrid	7.6	76wt	0.7 µm	9
Esthet -X HD	Dentsply	Nano hybrid	12.3	77wt	0.6-0.8 µm	5
Solitaire	Heraeus Kulzer	Highly Filled	6.0	66wt	2-20 µm	3
4Seasons	Ivoclar Vivadent	Nano hybrid	9.05	76wt	0.6 µm	2
Amaris	VOCO	Fine Hybrid	-	80wt	0.6-1 µm	1
IPS Empress	Ivoclar Vivadent	Nano hybrid	10.4	75-79wt	0.6-1 µm	1
TPH3	Dentsply	Hybrid	9.6	74wt	0.6-1 µm	1
Sinfony	3M/ESPE	Micro hybrid	12.3	45wt	0.6-1 µm	88
Empress II/ e.max Press	Ivoclar Vivadent	Vitreous ceramic with lithium disilicate	96	70vl	3-6 µm	59

**Table 1:** Characteristics and properties of restorative materials evaluated

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### Evaluation Procedures

Clinical evaluation was conducted with exploratory probe, mirror and odontologic light reflector, using the FDI criteria, including aesthetic, functional and biological properties. When the restoration failed before clinical evaluation, date and reasons for failure were registered according to patient's records or reports. Patients were asked about bruxism, if there was a habit of clenching or grinding their teeth, pain or muscular fatigue, teeth wearing or if they had a bruxism diagnosis before. All patients were subjected to an interproximal radiographic examination.

### Data Evaluation

Data obtained from clinical evaluation of restorations were subjected to statistical analysis. Kaplan-Meier and Log-Rank tests were used to make a comparison among different restorations. Cox Regression was used to check independent variables and the risk of restorations' failures and Kruskal-Wallis was used to compare the FDI criteria of the qualitative analysis. For all tests, the significance level was set at 5% (0.05). Annual failure rates were calculated for the three types of restorations.

### Results

Distribution of restorations according to the independent variables is presented in table 2. Overall, 229 restorations were evaluated in 121 adult patients (mean age 50.7 years), with a survival rate of 69.9% (69 failures, annual failure rate (AFR) of 8.0%). The follow-up time ranged from 6 months to 13 years, with an average observation time of 4.3 years.

Table 3 shows the qualitative evaluation of the restorations using the FDI criteria. In the Figures 1, 2, 3, 4 and 5 Kaplan-Meier survival curves demonstrate the clinical behavior of different material restorations, techniques, dental vitality, and number of substituted cusps.

Independent Variables		n	%
Gender	Male	37	16.1
	Female	84	36.6
	Total	221	100
Tooth	Premolar	67	29.2
	Molar	162	70.7
	Total	229	100
Material	Direct Composite	82	35.8
	Indirect Composite	88	39.4
	Ceramic	59	25.7
	Total	229	100
Tooth Vitality	Vital	161	70.3
	Non-Vital	68	29.6
	Total	229	100
Bruxism	Yes	94	41.0
	No	135	58.9
	Total	229	100
Technique	Direct	82	35.8
	Indirect	147	64.1
	Total	229	100
Number of Cusps	One	87	44.6
	Two	67	34.3
	Three	8	4.10

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	Four	14	7.17
	Five	19	9.74
	Total	195	100
Time in mouth (years)	05-1.9	84	36.7
	2-3.9	57	4.9
	4-5.9	23	10.1
	6-7.9	29	12.6
	More than 8	36	15.7
	Total	229	100

**Table 2:** Distribution of restorations according to independent variables

In the Table 4, Cox regression analysis showed that restorations made in women had a 58% of protection against failure when compared to men (HR = 0.416; p = 0.001). In addition, there was no association among material, technique, tooth type, number of cusps, dental vitality and bruxism with risk of failure of the restorations.

		Direct Composite Resin		Indirect Composite Resin		Indirect Ceramic		Kruskal-Wallis p
		Scores N(1/2/3/4/5)	Clinically Acceptable Restorations	Scores n(1/2/3/4/5)	Clinically Acceptable Restorations	Scores n(1/2/3/4/5)	Clinically Acceptable Restorations	
Esthetic Properties	Surface Luster	76(20/50/6/0/0) <sup>A</sup>	100%	72(50/21/1/0/0) <sup>B</sup>	100%	44(42/1/1/0/0) <sup>B</sup>	100%	0.001
	Manchamento Superficial	76(27/40/9/0/0) <sup>A</sup>	100%	72(47/20/5/0/0) <sup>B</sup>	100%	44(42/1/1/0/0) <sup>C</sup>	100%	0.001
	Marginal Staining	76(5/41/29/1/0) <sup>A</sup>	98.6%	72(10/53/9/0/0) <sup>B</sup>	100%	44(24/17/3/0/0) <sup>C</sup>	100%	0.001
	Color Match/ Transfucency	76(53/21/2/0/0) <sup>A</sup>	100%	72(68/2/2/0/0) <sup>B</sup>	100%	44(43/1/0/0/0) <sup>B</sup>	100%	0.001
	Esthetic Anatomic Form	76(13/34/29/0/0) <sup>A</sup>	100%	72(43/24/5/0/0) <sup>B</sup>	100%	44(40/2/2/0/0) <sup>C</sup>	100%	0.001
	Fracture and Retention	82(63/0/5/10/4) <sup>A</sup>	82.9%	88(68/0/1/3/16)	78.4%	59(43/1/0/0/15)	74.5%	0.551
	Marginal Adaptation	76(8/55/11/2/0) <sup>AB</sup>	97.3%	72(15/49/8/0/0) <sup>B</sup>	100%	44(10/32/2/0/0) <sup>A</sup>	100%	0.048
Functional Properties	Occlusal Wear	76(17/43/16/0/0) <sup>A</sup>	100%	72(35/34/3/0/0) <sup>B</sup>	100%	44(39/3/2/0/0) <sup>C</sup>	100%	0.001
	Contact Point	57(19/14/7/17/0) <sup>A</sup>	70.1%	62(30/19/9/4/0) <sup>AB</sup>	93.5%	43(26/5/10/2/0) <sup>B</sup>	95.3%	0.008
	Radiographic Examination	76(62/6/2/0/6) <sup>A</sup>	92.6%	88(60/10/1/0/17) <sup>B</sup>	80.6%	59(38/4/1/0/16) <sup>AB</sup>	74.5%	0.015
	Patient's View	76(76/0/0/0/0)	100%	72(67/2/3/0/0)	100%	44(44/0/0/0/0)	100%	0.080
Biological Properties	Postoperative Sensitivity	76(74/2/0/0/0)	100%	72(71/1/0/0/0) <sup>A</sup>	100%	44(42/2/0/0/0)	100%	0.586
	Recurrence of Caries, Erosion, Abfraction	76(71/0/3/2/0)	97.3%	72(68/0/1/3/0)	95.8%	44(43/0/0/1/0)	97.7%	0.600
	Tooth Integrity	76(73/0/2/1/0)	98.6%	72(71/0/1/0/0)	100%	44(44/0/0/0/0)	100%	0.301
	Peridontal Response	68(60/0/5/3/0) <sup>AB</sup>	95.5%	72(70/0/1/1/0) <sup>B</sup>	98.6%	44(44/0/0/0/0) <sup>A</sup>	100%	0.013

Each criteria was evaluated in scores of 1-5: 1-3 when the restoration is clinically acceptable, while 4 e 5 designate failure (Kappa=0.87).

Dunn's Test- Equal letters in the same line do not differ

**Table 3:** Clinical evaluation of restorations according to FDI criteria

Direct composite restorations presented a 34.1% of failure, with AFR of 9.6%. Composite onlays (ceromer) presented 27.3% of failure, with AFR of 7.1%. Ceramic onlays showed 28.8% of failure rate with AFR of 7.6%. Restorations performed in men presented a 45% failure, with AFR of 13%, whereas for women there were 24.9% of failure, with AFR of 6.4%, in an average of 4.3 years of follow-up. The most common reason for failure was fracture and retention, occurring in 48 cases (69.56% of the failures).

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Independent Variables	HR	Confidence Interval 95%	p-value
Gender	0.416	0.245-0.706	0.001
Tooth	0.843	0.468-1.521	0.572
Material	1.229	0.633-2.385	0.542
Tooth Vitality	0.981	0.587-1.639	0.943
Bruxism	1.430	0.840-2.435	0.187
Technique	0.441	0.147-1.323	0.144
N cusps	1.152	0.933-1.423	0.188

Table 4: Cox regression analysis with Hazard Ratio (HR) adjusted for independent variables and restoration failures

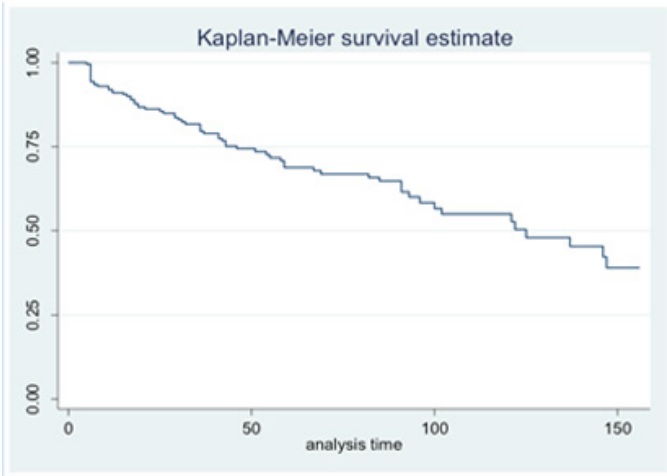


Figure 1: Kaplan-Meier survival curve for restorations on posterior teeth (time in months)

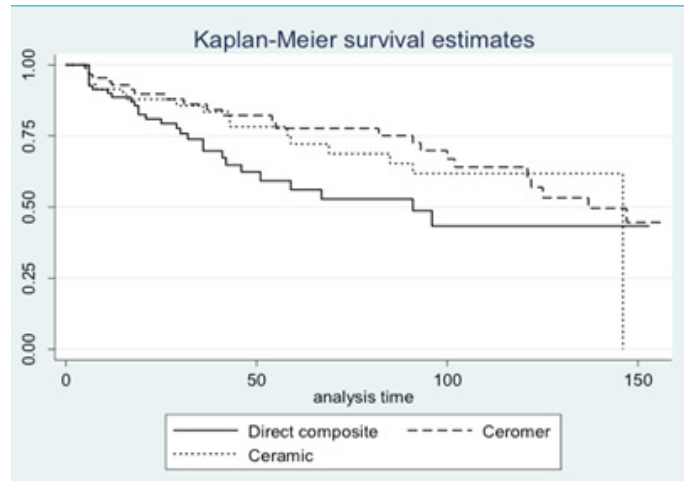


Figure 2: Kaplan-Meier survival curves for restorations with different materials (log-rank:  $p = 0.110$ ) (time in months)

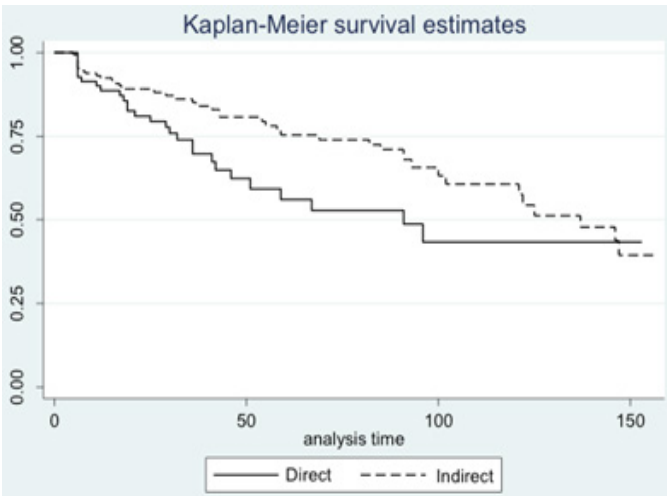


Figure 3: Kaplan-Meier survival curves for restorations with different techniques (log-rank:  $p = 0.045$ ) (time in months)

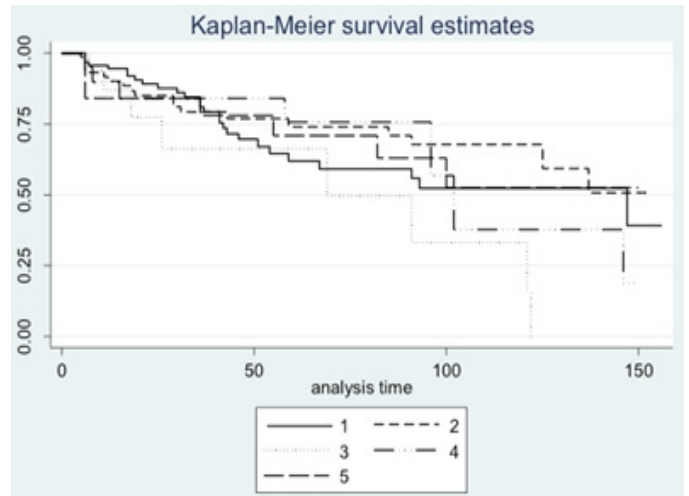
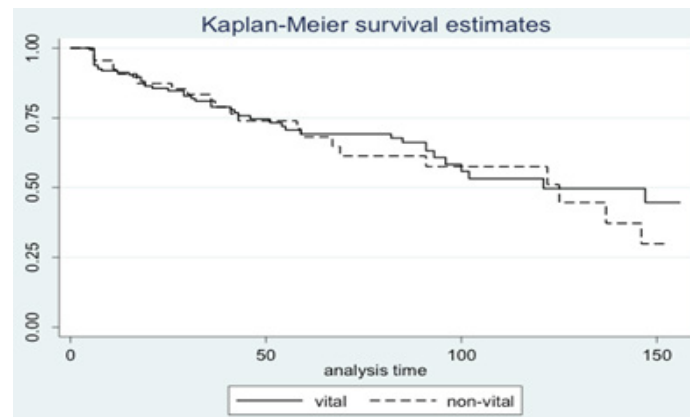


Figure 4: Kaplan-Meier survival curves for restorations with different numbers of involved cusps (log-rank:  $p = 0.257$ ) (time in months)



**Figure 5:** Kaplan-Meier survival curves for restorations on vital and non-vital teeth (log-rank:  $p = 0.678$ ) (time in months)

## Discussion

The present retrospective study evaluated the performance of indirect onlay restorations made of composite resin and ceramic and direct composite restorations with cuspal involvement, using the FDI evaluation criteria.

According to some authors [7, 14], the longevity of direct restorations can be influenced by factors such as: operator, material, location and size of the restoration, caries risk and bruxism. In the present study, according to the Cox Regression, the independent variables that included material, tooth type, dental vitality, bruxism, technique and number of restored cusps had no association with the failures observed in the restorations. Other authors also found no correlation between location, size and class type in the longevity of the restorations [17, 18]. Other studies [9, 12, 13, 14, 19] concluded that restorations with a greater number of faces involved and in molar teeth tend to fail more.

According to Demarco et al. (2012) [7], bruxism influences the development of fatigue in tooth-restoration interface, resulting in long-term fracture. In the present study, the fact of bruxism has not demonstrated an association with failure and the high incidence of fractures can be related to the occurrence of this parafunction that was self-reported by the patient and not diagnosed by the dentist at the time of the clinical evaluation. 31.4% of the patients reported suffering with the bruxism symptoms. Manfredini et al. (2013) [20] showed similar results in a systematic review that evaluated the prevalence of bruxism in adults.

Among the independent variables, only gender presented significant statistical differences, revealing that in female patients there was a lower prevalence and a lower risk of failure of restorations. In a clinical evaluation [21] with 3 years of follow-up of extensive composite resin restorations involving cusps in molars, it was observed that restoration failures were approximately 5 times more prevalent in men than in women, relating this outcome with differences in masticatory forces between gender.

There was no statistically significant difference between direct and indirect restorations in dental integrity, postoperative sensitivity, patient opinion, caries recurrence, erosion or abfraction, and fracture and retention criteria. The low incidence of caries found in this analysis corroborates with other evidence [18, 20, 22], although restorative material fracture and/or caries have been reported as the main reasons for failure of restorations in several other studies [4, 7, 9, 12, 14, 17, 19, 21, 22].

In the present research, fracture and retention criterion has been shown to be one of the main reasons of failure for both direct and indirect restorations. However, the failures found in direct restorations were mostly classified as repairable (Score 4), as opposed to the failures found in indirect restorations, which had mostly catastrophic fractures, demanding the replacement of it (Score 5). Cubas et al. (2011) [2] observed a higher prevalence of material-restricted fractures in groups with ceramic restorations with cusps (onlays). Alshiddi and Aljinbaz (2016) [23] concluded that most of the fractures detected in composite onlays also occurred in the material, which

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has the characteristic of absorbing impacts and protecting the dental structure. Kujis., *et al.* (2006) [24] concluded that restorations containing cusps (indirect composite, ceramics and direct composite restorations) have comparable resistance to fatigue and fracture. However, indirect restorations tend to suffer more cohesive fractures than direct restorations, pointing out that indirect materials do not necessarily perform better than direct in posterior restorations.

In the present study, direct restorations performed worse than indirect restorations in the qualitative analysis. Composite onlays seem to have better mechanical properties than direct composite restorations [22, 24, 25], having their increased hardness and wear resistance due to the additional polymerization and greater conversion of monomers to polymers. Besides, the technique allows the control of polymerization contraction, proximal contour and the contact point obtainment [15, 26]. Indirect restorations also show superior color stability, resulting in better characteristics when compared to direct composite restorations [22, 26]. In this research, indirect restorations presented better characteristics when compared to direct restorations in the following criteria: color match and translucency, surface luster, marginal staining, occlusal wear and esthetic anatomic form.

According to literature, indirect restorations have presented good survival rates and low annual failure rates [15, 27]. Although direct composite restorations presented inferior characteristics in some of the evaluated criteria, they have the advantages of not requiring an invasive tissue removal, being able to be built in only one session and demanding a lower cost [27, 28], revealing good clinical performance [7, 9, 10, 28, 29], with an annual failure rate of 1.5% in 22 years of follow-up [10] and a survival rate of 63% with annual failure rate of 1.1% with up to 30 years of follow-up [18] for restorations placed in dental schools. In the present study, the survival rate of restorations placed by students in a dental school was 69.9%.

In the marginal adaptation criterion, significant statistical differences were found between the direct and indirect techniques. However, when comparing composite onlays with ceramic onlays, the latter has better scores. The study by Fasbinder *et al.* (2005) [30], compared indirect ceramics and composite restorations with respect to marginal adaptation and found no statistical differences between them after three years of follow-up, classifying both materials as clinically excellent. The study by Van Dijken (2000) [4] also demonstrated that the marginal adaptation of the restorations remained clinically good after 11 years of evaluation.

No restoration was classified as clinically deficient (Score 5) in contact point criterion. However, many failures in score 4 were found for direct restorations in this criterion, which demands the need for intervention and repair in these restorations. Ceramic onlays presented better performance than direct composite restorations, but did not present statistical differences when compared to composite onlays. The latter group also had similar behavior when compared to the direct restorations, with no statistically significant differences between them. Lack of proximal contact was one of the main reasons for failure found in the clinical evaluation of 10-year composite restorations by Raskin., *et al.* (1999) [28] and also in the study by Opdam., *et al.* (2004) [29].

One limitation found in the present study was the incorrect filling of patients' records, where the students often did not detail the restoration that was performed, making it difficult to collect data and excluding the patient from the study. These disadvantages have also been reported by Opdam., *et al.* (2004) [29], who considered the retrospective design and lack of information in the medical records encountered for the development of their study.

The three evaluated type of restorations (direct, ceromer and ceramic) demonstrated a good long-term clinical performance in the rehabilitation of posterior teeth with cusp recovers. Although direct restorations demonstrated the worst behavior in the qualitative analysis, they still remained in function, presenting clinical satisfactory properties during the evaluation period, emphasizing the importance of this material that also has its use consecrated in modern Dentistry and that did not present statistical differences in the longevity of the restorations when compared with indirect restorations.

Finally, when understood that both techniques present their advantages and disadvantages, the selection of the best treatment protocol for posterior teeth with cusp involvement becomes a subjective option by the dentist, who must consider the amount of tooth structure, clinical cost and time, as it is possible to reach a good clinical longevity of the restorations using both direct and

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indirect techniques. Further, long-term studies should be performed with the purpose of making comparisons, recommendations and confirming the findings of the present study on the direct and indirect techniques and their respective restorative materials.

### Conclusion

Within the limitations of the present study, it is possible to conclude that:

1. Restorations with cuspal involvement have a survival rate of 69.9% in 4.3 years, with direct composite resin, indirect composite or ceramics showing similar longevity, regardless of the number of cusps involved.
2. Indirect restorations had lower annual failure rate than direct restorations and presented better performance in the criteria of surface luster, marginal staining, surface staining, color match and translucency, esthetic anatomic form, occlusal wear, marginal adaptation, periodontal response and contact point.
3. Female patients presented lower prevalence and lower risk of failure of restorations than male patients.
4. The most prevalent type of failure in restorations with cuspal involvement was fracture and retention.

### References

1. Lempel E., et al. "Clinical evaluation of lithium disilicate versus indirect resin composite partial posterior restorations - A 7.8-year retrospective study". *Dental Materials* 39.12 (2023): 1095-1104.
2. Gloria Beatriz de Azevedo Cubas., et al. "Fracture resistance of premolars restored with inlay and onlay ceramic restorations and luted with two different agents". *Journal of Prosthodontic Research* 55.1 (2011): 53-59.
3. PA Brunton., et al. "Fracture resistance of teeth restored with onlays of three contemporary tooth-colored resin-bonded restorative materials". *Journal of Prosthetic Dentistry* 82.2 (1999): 167-171.
4. Van Dijken JW. "Direct resin composite inlays/onlays: an 11 year follow-up". *Journal of Dentistry* 28.5 (2000): 299-306.
5. Camillo D'Arcangelo., et al. "Five-year retrospective clinical study of indirect composite restorations luted with a light-cured composite in posterior teeth". *Clinical Oral Investigations* 18.2 (2014): 615-624.
6. Ulrike Stephanie Beier., et al. "Clinical performance of all-ceramic inlay and onlay restorations in posterior teeth". *The International Journal of Prosthodontics* 25.4 (2012): 395-402.
7. Flávio F Demarco., et al. "Longevity of posterior composite restorations: not only a matter of materials". *Dental Materials* 28.1 (2012): 87-101.
8. Brunthaler A., et al. "Longevity of direct resin composite restorations in posterior teeth". *Clinical Oral Investigations* 7.2 (2003): 63-70.
9. Da Rosa Rodolpho PA., et al. "A clinical evaluation of posterior composite restorations: 17-year findings". *Journal of Dentistry* 34.7 (2006): 427-435.
10. Da Rosa Rodolpho PA., et al. "22-Year clinical evaluation of the performance of two posterior composites with different filler characteristics". *Dental Materials* 27.10 (2011): 955-963.
11. Opdam NJ., et al. "A retrospective clinical study on longevity of posterior composite and amalgam restorations". *Dental Materials* 23.1 (2007): 2-8.
12. Opdam NJ., et al. "Longevity of posterior composite restorations: a systematic review and meta-analysis". *Journal of Dental Research* 93.10 (2014): 943-949.
13. Manhart J., et al. "Three-year clinical evaluation of direct and indirect composite restorations in posterior teeth". *Journal of Prosthetic Dentistry* 84.3 (2000): 289-296.
14. Marcondes M., et al. "Clinical Evaluation of Indirect Composite Resin Restorations Cemented with Different Resin Cements". *The Journal of Adhesive Dentistry* 18.1 (2016): 59-67.
15. Hickel R and Manhart J. "Longevity of restorations in posterior teeth and reasons for failure". *The Journal of Adhesive Dentistry* 3.1 (2001): 45-64.
16. Scheibenbogen-Fuchsbrunner A., et al. "Two-year clinical evaluation of direct and indirect composite restorations in posterior teeth". *Journal of Prosthetic Dentistry* 82.4 (1999): 391-397.

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17. Barkmeier WW, *et al.* "Localized and generalized simulated wear of resin composites". *Operative Dentistry* 40.3 (2015): 322-335.
18. Pallesen U and van Dijken JW. "A randomized controlled 30 years follow up of three conventional resin composites in Class II restorations". *Dental Materials* 31.10 (2015): 1232-1244.
19. Van de Sande FH, Opdam NJ, Rodolpho PA, Correa MB, Demarco FF, Cenci MS. "Patient risk factors' influence on survival of posterior composites". *Journal of Dental Research* 92.7 (2013): 78S-83S.
20. Manfredini D, *et al.* "Epidemiology of bruxism in adults: a systematic review of the literature". *Journal of Orofacial Pain* 27.2 (2013): 99-110.
21. Van Nieuwenhuysen JP, *et al.* "Long-term evaluation of extensive restorations in permanent teeth". *Journal of Dentistry* 31.6 (2003): 395-405.
22. Pallesen U and Qvist V. "Composite resin fillings and inlays. An 11-year evaluation". *Clinical Oral Investigations* 7.2 (2003): 71-79.
23. Alshiddi IF and Aljinbaz A. "Fracture resistance of endodontically treated teeth restored with indirect composite inlay and onlay restorations - An in vitro study". *Saudi Dental Journal* 28.1 (2016): 49-55.
24. Kujis RH, *et al.* "A comparison of fatigue resistance of three materials for cusp-replacing adhesive restorations". *Journal of Dentistry* 34.1 (2006): 19-25.
25. Cetin AR, *et al.* "A five-year clinical evaluation of direct nanofilled and indirect composite resin restorations in posterior teeth". *Operative Dentistry* 38.2 (2013): E1-11.
26. Monaco C, *et al.* "Short-term clinical evaluation of inlay and onlay restorations made with a ceromer". *The International Journal of Prosthodontics* 14.1 (2001): 81-86.
27. Angeletaki F, *et al.* "Direct versus indirect inlay/onlay composite restorations in posterior teeth. A systematic review and meta-analysis". *Journal of Dentistry* 53: 12-21.
28. Raskin A, *et al.* "Clinical evaluation of a posterior composite 10-year report". *Journal of Dentistry* 27.1 (1999): 13-19.
29. Opdam NJ, *et al.* "Five-year clinical performance of posterior resin composite restorations placed by dental students". *Journal of Dentistry* 32.5 (2004): 379-383.
30. Fasbinder DJ, *et al.* "The clinical performance of CAD/CAM-generated composite inlays". *Journal of the American Dental Association* 136.12 (2005): 1714-1723.



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