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Evaluation of the marginal adaptation of class II restorations carried out in a Faculty in the State of Espírito Santo

Avaliação da adaptação marginal das restaurações classe II realizadas em uma Faculdade no Estado do Espírito Santo

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Resumo

Introdução: as resinas compostas são materiais muito utilizados para restaurações Classe II, com função de restabelecer a anatomização do elemento dental. No entanto, diversos são os fatores que podem interferir na qualidade de uma boa restauração. **Objetivo:** o objetivo do presente estudo é realizar uma avaliação retrospectiva do desempenho clínico de restaurações Classe II executadas por alunos da graduação de Odontologia da Escola São Francisco de Assis (ESFA) e identificar as principais falhas cometidas. **Material e método:** foram selecionados os prontuários dos pacientes atendidos nas disciplinas de Dentística II, Integrada I e II na clínica de Odontologia da ESFA, que apresentaram as informações detalhadas do procedimento de Classe II, bem como exames radiográficos iniciais, usando o método FDI. A amostra foi composta por 33 prontuários que incluíam 72 dentes. **Resultado:** observou-se que mais de 80% das restaurações foram classificadas como aceitáveis. Visto que, apenas 19,44% das restaurações estiveram inaceitáveis, pecando para as propriedades funcionais e biológicas. **Conclusão:** constatou-se que os alunos da graduação em Odontologia da ESFA, os quais são orientados por professores a realizar tratamentos seguindo protocolos clínicos pré-estabelecidos, são capazes de confeccionar procedimentos restauradores de qualidade.

Descritores: Adaptação marginal; restauração dentária; resina composta.

Abstract

Introduction: composite resins are materials widely used for Class II restorations, to restore the anatomization of the dental element. However, there are several factors that can interfere with the quality of a good restoration. **Objective:** the objective of the present study is to carry out a retrospective evaluation of the clinical performance of Class II restorations performed by undergraduate students of Dentistry at the Escola São Francisco de Assis (ESFA), and to identify the main errors. **Material and method:** we selected the medical records of patients treated in the disciplines of Dentistry II, Integrated I and II in the Dentistry clinic at ESFA, which presented detailed information on the Class II procedure, as well as initial radiographic examinations, using the FDI method. The sample consisted of 33 medical records that included 72 teeth. **Result:** it was observed that more than 80% of the restorations were classified as acceptable. And, only 19.44% of the restorations were unacceptable, failing due to functional and biological properties. **Conclusion:** it was found that undergraduate students in Dentistry at ESFA, who are guided by professors to perform treatments following pre-established clinical protocols, are capable of carrying out quality restorative procedures.

Descriptors: Marginal adaptation; dental restoration; composite resin.

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INTRODUCTION

Composite resins were introduced in schools of Dentistry in the late 1990s. The universal composites currently available show good clinical performance, such as volumetric shrinkage less than 4%, mechanical strength, good "polishability", retention of polish and resistance to wear[1].

However, clinical variables such as type, size and location of the restoration, quality and technique of the operator, socioeconomic and demographic factors, and behavioral aspects can influence the quality and durability of restorations made with composite resins. Differences in oral hygiene, availability of fluoride and dietary habits may also be associated[2].

The purpose of proximal restorations is to reestablish the proximal contacts and to seal the cervical margins appropriately since the limitations of marginal sealing, coming from polymerization contraction and long-term degradation of the adhesive system, among other factors, have been identified as possible causes for replacement of the restoration[1].

In Class II, the success of the restoration results from the correct use of the matrix, matrix holder and wedge for making satisfactory contact points between the dental elements. When the operator neglects this step, problems such as excess or lack of material arise, promoting damage to the periodontium[3].

Faced with the high prevalance of failures of Class II restorations, the technique used by the operator should be analyzed and studied. Thus, the purpose of the present study is to carry out a retrospective evaluation of the clinical performance of Class II restorations performed by undergraduate dental students at ESFA, and to identify the main errors.

MATERIAL AND METHOD

The present clinical study was approved by the Committee for Ethics in Research (Brazilian Platform) under number 5084622. It was carried out by evaluating the marginal adaptation of Class II restorations performed in the dental clinic at ESFA.

Medical records of patients between 18 and 60 years of age, treated from 2015 to 2021 in the disciplines of Dentistry II, Integrated I and II, in the Dental clinic at ESFA, were selected. Also, those that presented detailed information of the Class II procedure, as well as the presence of initial interproximal radiography of the dental element to be analyzed, using the FDI method, and having the Terms of Free Informed Consent signed. The study was carried out on the premises of the ESFA dental clinic, located in the municipality of Santa Teresa, state of Espírito Santo.

Patients younger than 18 and older than 60 years of age, those with incomplete medical records, pregnant and lactating women and those with special needs were excluded from the present study.

The universe was composed of 191 medical records that included 422 teeth. The sample was composed of 33 medical records that included 72 teeth. Patients who responded to the contact, and agreed to participate, took part in the study. Patients who were absent twice in a row without justifiable cause, and had dental elements that were no longer in the oral cavity or did not have an adjacent element, were dismissed.

The present study was conducted by an examiner and an undergraduate student in Dentistry at ESFA, during November, 2021. For each restoration, the examiner filled out a previously prepared evaluation form.

The restorations were evaluated by visual and tactile inspection, after prophylaxis and surface drying, illuminated by reflector light, using a flat dental mirror, exploratory probe, dental floss and radiographic examination to qualify the restorations according to FDI Method Evaluation Criteria for analyzing the esthetic, functional and biological properties of the restorations evaluated.

The dental element was classified as clinically excellent, clinically good (after polishing), clinically sufficient or satisfactory, clinically unsatisfactory and clinically deficient (requiring replacement). The information was collected, recorded and analyzed for display in tables correctly.

The IBM SPSS *Statistics version 24* and the BioEstat version 5.0 programs were used for statistical treatment of the data. The characterization of the criteria for clinical evaluation using the FDI method was presented by observed frequency and percentage. The binomial test for two proportions compared

each FDI clinical evaluation category across properties. Fisher's Exact test associated the FDI clinical evaluation with the properties. Simple logistic regression associated the properties with restoration time, tooth surface, face and discipline. The alpha level of significance used was 5%.

RESULTS

The restoration time, position of the teeth in the arch, evaluated surface and discipline in which the students performed the restoration were analyzed. The most prevalent restoration time was from 12 to 24 months, with 47.2% (34) of the total. The most evaluated tooth position was on the upper right side, with 38.9% (28). The highest recurrence of restoration was on the mesial surface, with 41.7% (30). The discipline from which there was a greater number of dental elements evaluated was Integrated Clinic I, with 38.9% (28).

The esthetic, functional and biological properties were also analyzed according to the criteria of the modified FDI method.

The resorations evaluated with scores of excellent (1), good (2) and sufficient/satisfactory (3) were considered clinically acceptable, whereas scores of unsatisfactory (4) and poor (5) were considered clincially unacceptable. Thus, regarding the evaluated criteria, the following results were observed.

Regarding the surface shine, surface staining and anatomical shape, all the restorations were clinically acceptable. The following percentages were classified as excellent, respectively, 86.1%, 75% and 87.5% (Table 1).

Table 1. Description of the clinical evaluation criteria for esthetic properties

Properties		FDI Clinical Evalution										p-Value*
		Clinically Excellent		Clinically Good (after polishing, Excellent)		Clinically Sufficient or Satisfactory		Clinically Unsatisfactory		Clinically Deficient (requiring replacement)		
		n	%	n	%	N	%	n	%	n	%	
Esthetics	Surface Shine	62	86.1	9	12.5	1	1.4	-	-	-	-	0.201
	Surface Staining	54	75.0	13	18.1	5	6.9	-	-	-	-	
	Anatomic Shape	63	87.5	8	11.1	1	1.4	-	-	-	-	

*Fisher's Exact Test. (-) Categories not included due to lack of observations; significant if p ≤ 0.050. Source: Authors (2022).

According to fractures and retention, marginal adaptation, point of contact and radiographic exam, 19.4% of the restorations were clinically unacceptable. The following percentages were classified as excellent, respectively: 93.1%, 62.5%, 76.4% and 90.3% (Table 2).

Table 2. Description of the clinical evaluation criteria for functional properties

Properties		FDI Clinical Evaluation										p-Value*
				Clinically Good (after polishing, Excellent)		Clinically Sufficient or Satisfactory		Clinically Unsatisfactory		Clinically Deficient (requiring replacement)		
		N	%	n	%	N	%	n	%	N	%	
Functional	Fractures and Retention	67	93.1	4	5.6	1	1.4	-	-	-	-	< 0.001
	Marginal Adaptation	45	62.5	26	36.1	1	1.4	-	-	-	-	
	Point of Contact	55	76.4	6	8.3	4	5.6	5	6.9	2	2.8	
	Radiographic Exam	65	90.3	-	-	-	-	-	-	7	9.7	

*Fisher's Exact Test. (-) Categories not included due to lack of observations; significant if p ≤ 0.050. Source: Authors (2022).

As for the recurrence of caries, erosion or fracturing, dental integrity and adjacent mucosa, 11.1% of the restorations were clinically unacceptable. The following percentages were classified as excellent, respectively: 90.3%, 97.2%, and 97.2% (Table 3).

Table 3. Description of the clinical evaluation criteria for biological properties

Properties		FDI Clinical Evaluation										p-Value*
		Clinically Excellent		Clinically Good (after polishing, excellent)		Clinically Sufficient or Satisfactory		Clinically Unsatisfactory		Clinically Deficient (requiring replacement)		
		N	%	N	%	n	%	n	%	N	%	
Biological	Recurrence of caries, erosion or fracturing	65	90.3	-	-	-	-	-	-	7	9.7	**0.006**
	Dental Integrity	70	97.2	1	1.4	-	-	-	-	1	1.4	
	Adjacent Mucose	70	97.2	2	2.8	-	-	-	-	-	-	

*Fisher's Exact Test. (-) Categories not included due to lack of observations; significant if p ≤ 0.050. Source: Authors (2022).

DISCUSSION

In the present retrospective clinical study, the esthetic, functional and biological properties of composite resin restorations in posterior teeth were evaluated using modified FDI method criteria. It was observed that more than 80% of the restorations were classified as acceptable. Therefore, only 19.44% of the restorations were unacceptable, failing due to functional and biological properties.

Regarding surface shine, Demarco et al.[4] stated that it is unlikely that the color and anatomy of the restoration influence the durability of posterior restorations in general. According to Gerhardt-Szep et al.[5], the failures can be related to an inappropriate restorative technique, insufficient polymerization, or failure in the procedures for finishing and polishing the restorations.

Demarco et al.[4] stated that studies point to surface staining as one of the causes of restoration failure. Hickel et al.[6] reinforce this idea, in which marginal discoloration is considered an early sign of the presence of secondary caries. However, it should be considered that surface staining alone does not indicate the need for replacement of the restoration, but emphasizes the need for periodic clinical and radiographic monitoring.

For Gerhardt-Szep et al.[5], constructing the ideal anatomic shape is one of the problems in direct restoration of composite resins, and requires precise knowledge of the occlusal anatomic structures. Wang et al.[7] explain that the anatomic shape is maintained by the capacity of composite resins to resist wear caused by foods and liquids.

Regarding fracture and retention, for Takahashi et al.[8], the fracture in Class II restorations can be explained by the low resistance of the remaining teeth related to occlusal stress, and the teeth with better conservative cavities being more resistant. This is in disagreement with Barbosa, Piazza[9], who support the idea that the relationship of fracture and retention is linked to the adhesive system used, with the two-step self-etching adhesive showing significantly lower resistance to fracture compared to the conventional single-vial system.

Regarding the property of marginal adaptation, according to Berwanger et al.[2], the marginal adaptation of composite resin restorations, along with their durability, can be influenced by numerous factors such as the type, size and location of the restoration, quality and technique of the operator, socioeconomic and demographic factors, behavioral aspects, differences in the quality of oral hygiene, availability of fluoride and dietary habits. However, for Catelan et al.[10], marginal misadaptation is linked mainly to polymerization shrinkage, arguing that if the forces

related to shrinkage stress are greater than the adhesive strength, a rupture of the bond may occur, generating stress at the tooth-restoration interface, inducing marginal misadaptation, cusp deflection and cracks.

Regarding the point of contact, Costa et al.[11] states that for proximal restorations with a satisfactory point of contact, it is necessary to use some indispensable materials such as a wedge and a matrix, which provide dental spacing and excellent adaptation to the dental anatomy. This facilitates a restoration without either excess or lack of proximal contact. Torres et al.[12] adds that the point of contact is the biggest challenge of restorations involving proximal surfaces, since it depends on two fundamental factors: the contour of the proximal surface and the interproximal physiological space.

Regarding the radiographic exam, Moreira et al.[13] assures that the interproximal radiographic technique is intended for detecting the presence of carious processes, marginal adaptations of restorations (excesses or lacks), and the presence of periodontal lesions that show the involvement of bone structures with destruction of the alveolar crest. Besides, Araújo et al.[14], quote that it is not uncommon to find faults in elements even if they are seemingly intended as satisfactory.

Regarding secondary caries, Moura et al.[1] state that the probable causes for their reappearance would be the junction of the limitations of marginal sealing with the degradation of the adhesive system. In addition, Trowbridge[15] points out that restorations are subject to mechanical stresses from mastication, as well as thermal stresses arising from food. It is believed that these stresses are capable of interfering with the tooth/restoration interface, causing unwanted effects.

For the recurrence of erosion or fracturing, it was possible to see a gap in the literature. This made it difficult to discuss these effects in relation to the Class II restorations. On the other hand, there is a great discussion among authors about the marginal integrity of the Class II restorations.

For Carrilho et al.[16], the success of the restorationss and clinical longevity depend on the formation of a stable union between the dental substrate and the restorative material. Therefore, both the mechanical and chemical properties of the materials, as well as the restorative technique chosen, can affect the stability of the dental interfaces. Furthermore, Da Silva et al.[17] state that the greater or lesser amount of stress generated during the polymerization of the restorative resin determines, in a direct ratio, the emergence of consequences, such as marginal cracks, to damage the dental integrity with consequent microleakage. These can lead to a succession of deleterious effects, from the recurrence of caries and pulp irritations to the total failure of the restoration.

The relationship with the adjacent mucosa is addressed by some researchers who stated the following ideas. An important factor that should be observed regarding periodontal health is the lack of proximal contact. According to El-Badrawy et al.[18], this lack can lead to food impaction which, in turn, facilitates the accumulation of bacteria over time thus causing halitosis, gingival bleeding, tooth mobility and pain. Also, that periodontal health is directly related to a well-executed restoration. The precise execution of Class II restorations depends on the correct use of a matrix, a matrix holder and a wooden wedge, in order to obtain more appropriate proximal shapes and contacts. This step of the restorative procedure, when neglected, can have damaging consequences for the periodontium[3].

CONCLUSION

The satisfactory results of this study show that undergraduate Dentistry students at ESFA, who are guided by professors to carry out treatments following pre-established clinical protocols, are capable of performing quality restorative procedures, since the restorations were clinically acceptable.

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CONFLICTS OF INTERESTS

The authors declare no conflicts of interest.

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