UNIVERSIDADE FEDERAL DE PELOTAS

Faculdade de Odontologia

Programa de Pós Graduação em Odontologia

Dissertação

Influência da resina flow como material intermediário na longevidade de restaurações em dentes posteriores

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Pelotas, 2019

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Dissertação apresentada ao Programa de Pós-Graduação em Odontologia, ênfase em Dentística e Cariologia da Universidade Federal de Pelotas, como requisito parcial à obtenção do título de Mestre em Clínica Odontológica.

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Pelotas, 2019

Universidade Federal de Pelotas / Sistema de Bibliotecas
Catalogação na Publicação

L864i Lopes, Karen Do Nascimento

Influência da resina flow como material intermediário na longevidade de restaurações em dentes posteriores / Karen Do Nascimento Lopes ; Maximiliano Sérgio Cenci, orientador ; Kaue Farias Collares, coorientador. — Pelotas, 2019.

27 f.

Dissertação (Mestrado) — Programa de Pós-Graduação em Clínica Odontológica - ênfase em Dentística e Cariologia, Odontologia, Universidade Federal de Pelotas, 2019.

1. Estudo clínico. 2. Resina composta. 3. Restauração dentária. 4. Longevidade. 5. Análise de sobrevida. I. Cenci, Maximiliano Sérgio, orient. II. Collares, Kaue Farias, coorient. III. Título.

Black : D2

Elaborada por Fabiano Domingues Malheiro CRB: 10/1955

Karen do Nascimento Lopes

INFLUÊNCIA DA RESINA FLOW COMO MATERIAL INTERMEDIÁRIO NA LONGEVIDADE DE RESTAURAÇÕES EM DENTES POSTERIORES

Dissertação apresentada para obtenção do grau de Mestre em Clínica Odontológica com ênfase em Dentística e Cariologia, Faculdade de Odontologia, Universidade Federal de Pelotas.

Data: 29/04/2019

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Agradecimentos

Aos meus pais, **Marcos Lopes** e **Deusiene Lopes**, por todo apoio e incentivo a seguir os meus sonhos. Tudo que conquistei até hoje é mérito exclusivo da dedicação e empenho que tiveram por mim, e nada seria possível sem a educação que recebi de vocês.

A minha irmã, **Mariana Lopes**, pelo apoio e preocupação. O teu incentivo me inspira a sempre seguir em frente.

As minhas amigas, **Mayara Moraes** e **Juliana Uehara**, pelo papel tão importante que tiveram ao longo desses anos de mestrado. Obrigada pela amizade, ajuda e apoio, ao lado de vocês esses dois anos se tornaram muito mais leves.

Aos meus colegas, **Bruna Rodolpho, Marina Christ, Romulo Patias e Thaís Mazzetti**, por toda disponibilidade e ajuda durante a coleta de dados da minha dissertação. Toda ajuda de vocês foi extremamente importante pra finalização desse trabalho.

Ao meu co-orientador, **Kauê Farias Collares**, pela disponibilidade em me ajudar em todos os momentos e por sempre sanar minhas dúvidas com muita paciência.

Ao meu orientador, **Prof. Dr. Maximiliano Sérgio Cenci**, por todos os ensinamentos desde os anos de iniciação científica até hoje. Por toda paciência e gentileza que somente um grande professor é capaz de ter com seus orientados.

Ao cirurgião-dentista, **Paulo Rodolpho**, por disponibilizar os prontuários do seu consultório e pela gentileza de responder todas as dúvidas que surgiram ao longo do estudo.

“Se você deseja vencer, aprenda a sorrir, além do cansaço.
Esperança vitoriosa é aquela que não deixa de trabalhar.”

Chico Xavier

Resumo

LOPES, Karen do Nascimento**. Influência da resina flow como material intermediário na longevidade de restaurações em dentes posteriores.** 2019. 30f. Dissertação (Mestrado em Clínica Odontológica com ênfase em Dentística e Cariologia) - Programa de Pós Graduação em Odontologia, Universidade Federal de Pelotas, 2019.

As resinas compostas são utilizadas em restaurações de dentes posteriores desde 1970, permitindo a realização de tratamentos mais estéticos e minimamente invasivos. Hoje as resinas compostas são consideradas o material direto de primeira escolha para restaurações em dentes posteriores. No entanto, esse material possui uma técnica sensível, apresentando contração de polimerização e características de difícil inserção do material. Essas características podem influenciar principalmente na inserção e adaptação do material na região proximal e cervical de restaurações em dentes posteriores. Dessa forma, como uma alternativa para minimizar tais limitações, pode-se utilizar um material restaurador mais fluído como uma camada intermediária, base ou *liner,* abaixo da resina composta, como uma resina composta do tipo *flow*. O objetivo do presente estudo foi, através de um estudo clínico longitudinal retrospectivo, avaliar o desempenho clínico de restaurações de resina composta em dentes posteriores com uma camada de resina *flow* como material intermediário, comparado a restaurações convencionais de resina composta em dentes posteriores. Para isso foram coletados dados referentes a restaurações de resina composta em dentes posteriores que utilizaram como material intermediário resina flow e também restaurações convencionais de resina composta como comparação. Os dados foram coletados de prontuários de um consultório odontológico particular localizado na cidade de Caxias do Sul/RS. A coleta de dados dos prontuários foi realizada por quatro digitadores independentes, previamente treinados. Os dados foram extraídos para uma base de dados no programa Excel. Os dados foram tabulados e submetidos à análise estatística, que foi realizada utilizando o software Stata 12.0 (StataCorp LP; College Station, TX, USA). A análise estatística foi realizada com teste de log rank, Kaplan Meier e Regressão de Cox ($p<0.05$). Foram incluídos no estudo 79 pacientes, totalizando 237 restaurações no estudo. A taxa anual de falha das restaurações com camada intermediária de resina *flow* ao longo de 5 anos foi 4.4%, enquanto a taxa anual de falha das restaurações convencionais foi 9.1%, apresentando diferença estatisticamente significativa ($p=0.06$). Entretanto, essa diferença não foi consistente após ajuste da análise para sexo do paciente, tipo de dente e sistema adesivo ($p=0.20$). O único fator que permaneceu afetando a longevidade das restaurações após ajuste de análise foi o tipo de sistema adesivo utilizado, favorecendo o uso do Clearfill SE Bond em comparação com outros sistemas adesivos ($p = 0.06$). O uso de resina flow como material intermediário apresenta efeito na longevidade das restaurações, porém parece ser influenciado por outros fatores, como o tipo de sistema adesivo ou o tipo de dente.

Palavras-chave: estudo clínico; resina composta; restauração dentária; longevidade; análise de sobrevida.

Abstract

LOPES, Karen do Nascimento. **Influence of flowable resin composite as intermediate layer on the longevity of restorations in posterior teeth.** 2019. 30f. Dissertation (Master Degree em Clínica Odontológica) - Programa de Pós-Graduação em Odontologia, Faculdade de Odontologia, Universidade Federal de Pelotas, Pelotas, 2019.

The composite resins have been used in restorations of posterior teeth since 1970, allowing more esthetic and minimally invasive treatments. Today, composite resins are considered the first-choice direct material for restorations on posterior teeth. However, this material has a sensitive technique, presenting polymerization contraction and difficult material insertion characteristics. These characteristics may influence mainly the insertion and adaptation of the material in the proximal and cervical region of restorations in posterior teeth. Thus, as an alternative to minimize such limitations, a more fluid restorative material such as an intermediate layer, base or liner, below the composite resin, may be used as a composite resin of the flow type. The objective of the present study was, through a longitudinal retrospective clinical study, to evaluate the clinical performance of composite resin restorations on posterior teeth with a flow resin layer as an intermediate material, compared to conventional composite resin restorations on posterior teeth. For this, data were collected regarding composite resin restorations in posterior teeth that used as flow resin intermediate material and also conventional composite resin restorations as a comparison. Data were collected from records of a private dental office located in the city of Caxias do Sul / RS. The data collection of the medical records was performed by four independent, previously trained typists. The data was extracted into a database in the Excel program. The data were tabulated and submitted to statistical analysis, which was performed using Stata 12.0 software (StataCorp LP, College Station, TX, USA). Statistical analysis was performed using log rank test, Kaplan Meier and Cox regression ($p < 0.05$). The study included 79 patients, totaling 237 restorations in the study. The annual rate of failure of restorations with intermediate layer of resin flow over 5 years was 4.4%, while the annual failure rate of conventional restorations was 9.1%, presenting a statistically significant difference ($p = 0.06$). However, this difference was not consistent after adjusting the analysis for patient's sex, tooth type and adhesive system ($p = 0.20$). The only factor that remained to affect the longevity of the restorations after adjustment of analysis was the type of adhesive system used, favoring the use of Clearfill SE Bond in comparison with other adhesive systems ($p = 0.06$). The use of flow resin as an intermediate material has an effect on the longevity of the restorations, but it seems to be influenced by other factors, such as the type of adhesive system or the type of tooth.

Keywords: clinical study; composite resin; dental restorations; longevity; survival analysis

Sumário

1 Introdução Geral

As resinas compostas foram introduzidas na odontologia há mais de quatro décadas (LEINFELDER et at., 1975) e são utilizadas em restaurações de dentes posteriores desde 1970 (DAVIDSON & FEILZER, 1997), permitindo a realização de tratamentos mais estéticos e minimamente invasivos. (DA ROSA RODOLPHO et at., 2006). Hoje as resinas compostas são consideradas o material direto de primeira escolha para restaurações de dentes posteriores (SUNNEGARDH-GRONBERG et al., 2009). O sucesso desse material restaurador pode ser atribuído à suas diversas vantagens, tais como suas propriedades adesivas, que permitem que sejam feitos preparos conservadores proporcionando reforço da estrutura dental remanescente (SOARES et al., 2008), propriedades estéticas, custo aceitável, podem ser reparadas, e, além disso, apresentam uma taxa anual de falha entre 1 e 3% (DEMARCO et al., 2012; HEINTZE et al., 2012).

Embora as resinas compostas apresentem uma boa adesão ao esmalte (VAN DIJKEN, 1999), a adesão à dentina ainda não apresenta a mesma qualidade em relação à durabilidade clínica (VAN DIJKEN et al., 2007; VAN DIJKEN & PALLESEN, 2008). A falha da adesão pode ocasionar a formação de espaços (“*gaps*”) na interface dente/material restaurador, podendo contribuir para a sensibilidade pós-operatória ou até mesmo a formação de lesões de cárie dependendo do tamanho do defeito marginal (KARAMAT et al., 2014; MONTAGNER et al., 2015; KUPER et al., 2015).

A resina composta possui uma técnica sensível e apresenta características de difícil inserção do material devido a sua alta viscosidade e consistência pegajosa, que podem influenciar principalmente na inserção e adaptação de material na parede cervical de caixas proximais de restaurações em dentes posteriores, podendo resultar em má adaptação cervical e espaços vazios no interior da cavidade dessas restaurações (JAIN & BELCHER, 2000). Adicionalmente, as características supracitadas do material tornam difícil a sua adaptação a paredes irregulares, sobretudo a parede pulpar, dificultando o intrínseco contato de resinas de alta viscosidade com o sistema adesivo dentinário. Dessa forma, como uma alternativa para minimizar tais limitações, pode-se utilizar um material restaurador mais fluído como uma camada intermediária, base ou *liner,* abaixo da resina composta. Alguns materiais têm sido utilizados como material intermediário a

restaurações como os cimentos de ionômero de vidro (CIV), os cimentos de ionômero de vidro modificados por resina e as resina flúidas (resinas *flow)* (VAN DE SANDE et al., 2015; ANDERSSON-WENCKERT; VAN DIJKEN; KIERI, 2004; VAN DIJKEN & PALLESEN, 2011).

O uso de cimento de ionômero de vidro utilizado como material intermediário foi introduzido na Odontologia no início dos anos 90, conhecido como técnica de sanduíche era utilizada de duas formas distintas: sanduíche aberto e sanduíche fechado (ANDERSSON-WENCKERT; VAN DIJKEN; KIERI, 2004; VAN DE SANDE et al., 2015 . No sanduíche fechado, o cimento de ionômero de vidro era usado para substituir a dentina e a restauração era finalizada com resina composta, que substituía o esmalte, portanto o CIV era usado somente no interior da restauração sem ficar exposto ao meio bucal. No sanduíche aberto, o cimento de ionômero de vidro se estendia para a parte cervical da cavidade formando um selamento cervical, ficando exposto ao meio bucal nas proximais. Essa técnica foi desenvolvida com a proposta de obter a adesão da resina composta à dentina e atuar como barreira de *stress-breaking* (DAVIDSON, 1994). A partir desta técnica, acreditava-se que uma base com baixo módulo de elasticidade tinha a capacidade de diminuir o efeito da contração de polimerização da resina composta. Além disso, sugeria-se que o CIV como base atuaria na liberação contínua de flúor, diminuindo a desmineralização em torno da restauração e, consequentemente, reduzindo o desenvolvimento de cáries.

A resina flow foi introduzida no mercado odontológico no final dos anos 90 (CHUANG et al., 2001). Embora apresentem módulo de elasticidade reduzido e baixa viscosidade, esse material é de fácil manuseio e melhor fluidez, o que facilita sua inserção e, assim, diminui a possibilidade de formação de espaços vazios (bolhas) no interior da cavidade, formando também uma base capaz de absorver as tensões as quais o dente é submetido (KEMP-SCHOLTE & DAVIDSSON, 1990; UNTERBRINK & LIEBENBERG, 1999). Alguns estudos *in vitro* mostraram resultados positivos na diminuição de microinfiltrações em restaurações que utilizaram resina flow como material intermediário (ATTAR et al., 2004; ÖLMEZ et al., 2004), enquanto outros estudos *in vitro* não apresentaram melhora na adaptação marginal (ERNST et al., 2002; JAIN & BELCHER., 2000; MALMSTROM et al., 2002; NEME et al., 2002; ÖLMEZ et al., 2004). Além disso, Chuang e colaboradores (2004) observaram através de um estudo *in vitro* que restaurações realizadas com uma camada espessa de resina flow como material intermediário apresentaram uma porcentagem

diminuída do selamento marginal, além de aumentar o risco de degradação marginal. Esses dados contrariam os resultados de um estudo clínico onde foi observada uma baixa taxa de falha por cárie secundária apesar da alta frequência de pacientes com alto risco de cárie no estudo, o que sugere um bom selamento marginal cervical (VAN DIJKEN & PALLESEN, 2011). Entretanto, um estudo clínico com sete anos de acompanhamento utilizando resina flow como base não encontrou resultados que melhorassem a eficácia de restaurações quando comparadas a restaurações convencionais (VAN DIJKEN & PALLESEN, 2011).

Embora os ensaios clínicos prospectivos sejam o desenho metodológico mais apropriado para comparar diferentes procedimentos clínicos e materiais odontológicos, muitas vezes tornam-se inviáveis devido ao alto custo necessário para acompanhar as restaurações durante um longo período de tempo. Outra dificuldade encontrada nesse tipo de método é na adesão dos pacientes ao longo do período do estudo, sendo comuns as perdas de acompanhamento clínico dificultando a análise final dos dados. Além disso, um ensaio clínico randomizado prospectivo algumas vezes não representa toda a realidade clínica dos diferentes tipos de serviços odontólogicos, já que os operadores são previamente treinados e os pacientes são selecionados com base em critérios de inclusão do estudo (OPDAM et al., 2015). Portanto, pacientes colaboradores e com um perfil favorável podem ser selecionados alterando assim o resultado final do estudo. Nesse sentido, estudos tem demonstrado que fatores relacionados ao operador e ao paciente desempenham um papel importante na longevidade das restaurações, reforçando a necessidade de inclusão desses fatores no desenho do estudo (VAN DE SANDE et al., 2016; DEMARCO et al., 2012).

Devido à carência de estudos clínicos com longo período de acompanhamento avaliando clinicamente restaurações diretas de resina composta com resina *flow* como material intermediário, foi proposto um estudo longitudinal retrospectivo que permitiu avaliar um grande número de restaurações com um longo tempo de acompanhamento clínico. Este tipo de delineamento permite a análise da longevidade através de dados coletados sobre as restaurações avaliadas, sendo muito importantes para a análise as informações registradas ao longo do tempo, como datas de avaliações, além da data de realização das mesmas (Opdam et al., 2018).

2 Capítulo - Influence of flowable resin composite as intermediate layer on the longevity of restorations in posterior teeth

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Keywords: clinical study; composite resin; dental restorations; longevity; survival analysis.

LOPES, Karen do Nascimento. **Influence of flowable resin composite as intermediate layer on the longevity of restorations in posterior teeth.** 2019.

Composite resins have been used in posterior tooth restorations since 1970, allowing for more aesthetic and minimally invasive treatments and are currently considered the first choice material for direct restorations. However, composite resins have a sensitive technique, show polymerization contraction and are difficult to place due to its high viscosity and sticky consistency. These characteristics may influence the insertion and adaptation of the material into the tooth cavity and to overcome these limitations, the use of intermediate materials has been proposed. Thus, this study aims to evaluate the clinical performance of composite restorations in posterior teeth with or without the use of a flow resin layer as an intermediate material. For this, data on composite resin restorations placed from 2010 to 2018 were collected from records of a private dental office. Statistical analysis was performed with log rank test, Kaplan-Meier, and Cox regression ($p < .05$). Seventy nine patients' files were included, with 237 restorations. At 5 years (mean follow up time), restorations placed with a layer of flow composite presented an annual failure rate (AFR) of 4.4%, compared to an AFR of 9.1 of restorations without the liner, an estatistically significant difference ($p=0.06$), which was not consitent after adjustment of the analysis by patient gender, tooth type and type of adhesive system ($p=0.20$). The only factor that remained affecting the longevity of restorations after analysis adjustment was the type of adhesive system used, favoring the use of Clearfill SE Bond comapared to other adhsesive systems ($p=0.06$). In conclusion, the use of flowable resin composites as intermediate materials has some effect in the survival of restorations, but this effect seems to be overtaken by other factors, as the type of adhesive system or tooth type.

Keywords: clinical study; composite resin; dental restorations; longevity; survival analysis

Introduction

Composite resin has become very popular because of its aesthetic and conservative features of healthy dental tissues in anterior and posterior restorations[1]. Today, due to its advances, composite resin is considered the first choice material for posterior restorations[1]. In addition to these characteristics, the adhesion of the composite resin to the enamel presents a satisfactory clinical result, however to the dentin does not present the same quality, which can contribute to restoration failures[2].

Because of its sensitive technique, resin composites have some limitations that may influence the survival of restorations, such as stress generated during the polymerization contraction process[3] marginal defects and formation of secondary caries[3,4]. Some factors may influence the polymerization contraction of the resin, such as power density of the curing unit, the exposure time, the resin shade, the filler size, and the loading level[5].

To avoid the contraction of polymerization the indicated is to use the incremental technique, which establishes that the maximum incremental thickness is 2mm[6,7]. This technique, however, requires a longer clinical procedure time and may also incorporate bubbles within the restoration, increasing the risk of restoration failure[8]. In addition, the high viscosity of some composite resins hinders insertion into the cavity, which may promote inadequate adaptation of the restoration to the dental surface. As an alternative to try to improve interfacial adaptation, one can use the sandwich technique using different types of glass ionomer cement or low-modulus resin-based materials[9,10].

A new class of fluid resins was introduced at the end of 1990 with the aim of facilitating the insertion of resin into the cavities[11]. Flowable resin composite have a difference in viscosity because they present filler loading reduced to 37% -53% (volume) compared to 50% -70% (volume) for conventional minifilled hybrids[12]. It is suggested that the use of flowable resin composite as an intermediate material can reduce interfacial debonding and reduces voids at the cervical interface due to easy handling properties, enhanced flow, reduced elastic modulus and better wettability[13,14,15].

During the early 2000s, several so-called bulk-fill resin composites have been introduced in the market, bringing a new approach to composite resin application that allows the use of thicker increments. The first bulk-fill resin composite commercialized was SDR (DentsplySirona, Konstanz, Germany), which allows the introduction of 4mm increments because it is based on a stress-decreasing resin technology[16].

The aim of the present study was to investigate the influence of flowable resin composite as intermediate layer on the longevity of restorations in posterior teeth. The hypothesis tested was that the use of flowable resin composite as intermediate material would have no effect in restoration survival, when compared to restorations without a base material.

Metodology

4.1 Study design

The present study is characterized as a longitudinal retrospective study that was performed through the collection of data from the database of a private dental office located in the city of Caxias do Sul RS, Brazil.

Data were collected of posterior composite resin restorations with flowable resin composite as intermediate material and the data of conventional composite resin restorations. The survival of resin composite restorations in posterior teeth was determined retrospectively for up to 8 years, and the influence of several variables in the outcome was investigated. The absence or presence of a liner of flowable resin composite underneath composite restorations was the main factor under analysis, considering survival and annual failure rate. The other examinated factors were age and gender of participants, restored tooth, number of restored surfaces, type of material restorative and adhesive system.

All restorations were performed by an experienced professional and in patients with high socioeconomic status.

4.2 Sample selection and eligibility criteria

All records of patients who attended the practice between 2010 and 2018 were selected for this study. The following inclusion criteria were used:

- Posterior resin composite restorations with or without flowable resin as intermediate material (to make an intra-individual comparison possible, each patient received at least two restorations);
- Direct restorations in posterior permanent teeth, excluding deciduous teeth;
- Simple (involving one surface), composed (involving two surfaces) and complex restorations (involving three or more surfaces), excluding Class V restorations;
- Restorations with at least 5 years of clinical follow-up, except in cases with premature failure;
- Records with complete description of the procedures, including date the restoration was performed, date of last visit to the dentist, restorative material, adhesive system, tooth and surfaces involved.

4.3 Data collection and variables

The data collection of dental records was performed by three independent typists. All the typists were trained together prior to the beginning of the data collection in order to standardize the interpretation of the detailed procedures in the dental records. The data was extracted into a database in the Excel program. If in doubt, the dentist who performed the restorations was contacted.

For each restoration, variables related to the patients (sex, age and number of visits during the period) and restoration (tooth type, restoration surfaces, type of adhesive system and restorative material) were collected. In addition to this information, three dates were collected: restoration placement, restoration interventions (if present), and the date of the last visit to the dentist (censoring date).

The interventions were all treatments performed after the placement of the restoration during the observation period: a new restoration in the same tooth including at least one surface of the first restoration, endodontic treatment and extraction of the tooth. All interventions were considered as failures. It was not

possible to evaluate the causes of failure of all restorations, but the main causes of failure were fracture (tooth and restoration) and secondary caries.

4.4 Clinical Procedures

A single experienced operator performed all restorations. Patients received one surface, two surfaces or three or more surfaces restorations, performed with both techniques, convencional and with flowable resin as intermediate material. All restorations were placed under rubber dam isolation. Cavities were prepared using diamond burs, and low-speed steel burs were used to remove carious tissue, and the preparations were restricted to the removal of carious tissue and/or failed restorations.

In deep cavities an intermediate layer of flowable resin was used to cover the dentin, and the restoration was finished with composite resin. Restorations were performed using universal microhybrid composites (Z100, 3M ESPE; Z250, 3M ESPE; Z350, 3M ESPE; Tetric Ceram, IvoclarVivadent, Amherst, NY, USA; 4 Seasons Direct, IvoclarVivadent, Amherst, NY, USA; Charisma, Heraeus Kulzer South America Ltda., São Paulo, SP, BR; Empress Direct, IvoclarVivadent, Amherst, NY, USA;) and flowable resin composite (Natural Flow, Nova DFL, Taquara, RJ, BR; Tetric Ceram N-Flow, IvoclarVivadent, Amherst, NY, USA) Bonding systems used were Single Bond 2 (3M ESPE), Clearfill SE Bond, or other adhesives systems.

4.5 Statistical analysis

Statistical analysis was carried out using the Stata 14.0 software package. Descriptive analysis was independently performed for each independent variable Survival analysis was performed using the Kaplan–Meier method to obtain the survival curves for the variables of interest. Annual failure rates (AFRs) were calculated from life tables according to the formula: $(1 - y)z = (1 - x)$, in which “y” expresses the mean AFR and “x” the total failure rate at “z” years. The proportional-hazards test was assessed for each variable. The evaluation of associated factors to failure during the study period was performed by multivariate analysis of Cox’s

regression with shared frailty, which considers that observations within the same patient are correlated. Hazard Ratios (HRs) with respective 95% confidence intervals (CIs) were determined. Only variables presenting p≤0.2 were selected for multivariate analysis.

4.6 Ethical aspects

This project was submitted to the Research Ethics Committee of the Faculty of Medicine of the Federal University of Pelotas and approved (No. 139,840).

Results

In total 237 posterior composite restorations placed in 79 patients were investigated. Regarding gender, 44 (55.7%) of the patients were female and 35 (44.3%) male. Concerning the use of an intermediate layer underneath composite restorations, in 72.5% (172) of the flowable resin composite liner was placed and in 27.5% (80) no liner material was placed.

Distribution according to individual and tooth related variables are shown in Table 1. The majority of the patients were women (55.7%), the most common restorations were composite resin restorations with an intermediate layer of flowable resin composite (72.5%), with two surfaces (62.62%), in molars (66.46%).

Table 1. Distribution of Restorations According to Individual and Restoration Variables.

Variable/Category	**Total of restorations**		**Total of individuals**
	N=237 (%)		N=79 (%)
Individual variable	**No liner**	**Liner**	
Gender	80	157	79
Male	37 (36.27)	65 (63.73)	35 (44.3)
Female	43 (31.85)	92 (68.15)	44 (55.7)
Restoration variable			
Number of restored surfaces	80	157	
1	12 (26.09)	34 (73.91)	
2	40 (37.38)	67 (62.62)	
3 a 5	28 (33.33)	56 (66.67)	

Tooth type	80	157
Molar	53 (33.54)	105 (66.46)
Premolar	27 (34.18)	52 (65.82)
Adhesive system	80	157
SB2	41 (57.75)	30 (42.25)
Clearfill	19 (14.18)	115 (85.82)
Others	20 (64.52)	11 (35.48)

The average follow-up time for the included restorations was 5.0 years. Annual failure rate percentages (AFR) at 5 years were 2.2% for restorations with an intermediate layer of flowable resin composite and 6.7% restorations without intermediate layer. The overall success rate was 83.6%. Concerning the type of adhesive system used, the calculated 5-year AFR were 5.9 and 1.4 for restorations placed with Single Bond 2 or Clearfill SE Bond, respectively.

Table 2 shows the results of crude and adjusted multivariate Cox-regression models analysis for the success of restorations in posterior teeth. The investigated variables gender (p=0.029), tooth type (p=0.038), and type of restoration (p=0.006) and adhesive system (p=0.001) influence the survival of restorations, while age (p=0.393) did not affect the survival of restorations. However, after adjustment, only the factor adhesive system affected the survival of restorations (p=0.006 – Table 2). The Hazard Ratio (HR) of resin composite restoration without liner was 1.54 (CI 0.79-2.99) compared with resin composite restoration with liner.

Table 2. Results of Cox-regression analyses for independent variables and failure of posterior restorations (79 patients; n=237). (Multivariate adjusted analysis includes a shared frailty [a])

Independent Variables	Crude		Adjusted	
	HR (95%CI)	p-Value	HR (95%CI)	p-Value
Age (Continuous variable)	1.01 (0.98-1.04)	0.393		
Gender (ref=Female)		0.029		0.084
Male	2.31 (1.08-4.90)		1.90 (0.91-3.96)	
Tooth type [b] (ref=Premolar)		0.038		
Molar	2.35 (1.04-5.28)			
Number of surfaces (ref= 1)		0.958		
2	1.02 (0.46-0.23			
3 to 5	1.30 (0.80-2.12)			
Adhesive system (ref=Clearfill)		0.001		0.006

SB2	3.67 (1.67-8.05)		3.05 (1.37-6.78)	
Others	5.49 (2.26-13.33)		3.64 (1.44-9.17)	
Type of restoration [b] (ref=liner)		0.006		0.200
No liner	2.42 (1.29-4.55)		1.54 (0.79-2.99)	

[a] theta value = 0.43 and likelihood-ratio test ≤ 0.141.
[b] Not included in the final model. Test of proportional-hazards (p≤0.05).

Fig. 1 shows the Kaplan–Meier survival curves according to the technique used. In this graph it is possible to observe that restorations with flowable resin composite as liner present a greater survival for 8 years than conventional restorations.

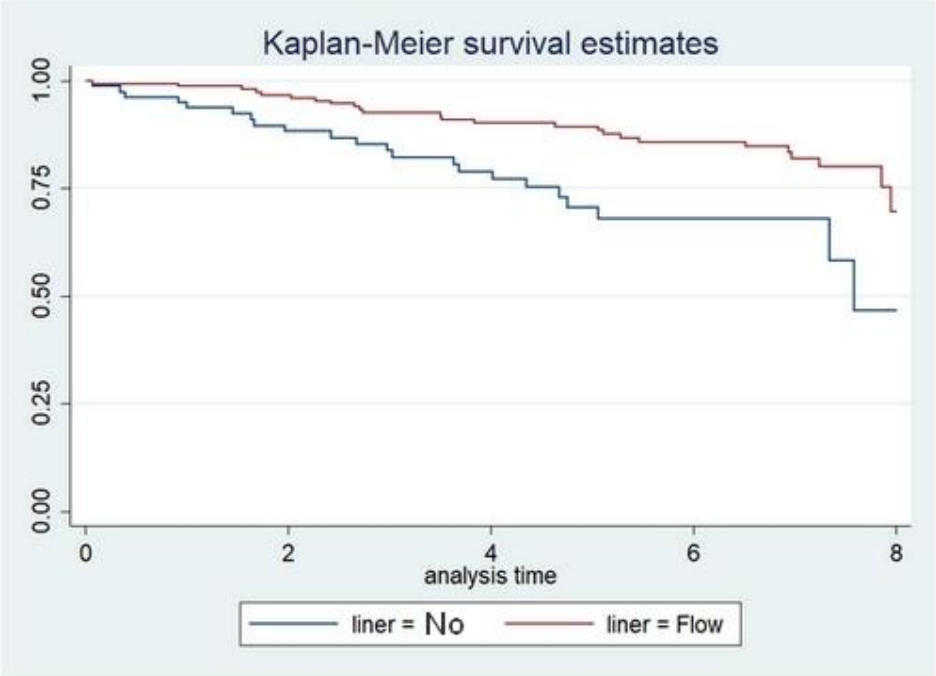

Fig 1. Kaplan-Meier graph showing survival of restorations with and without flowable resin composite as intermediate layer.

Kaplan–Meier survival curves according to gender and adhesive system are shown in Figs. 2 and 3.

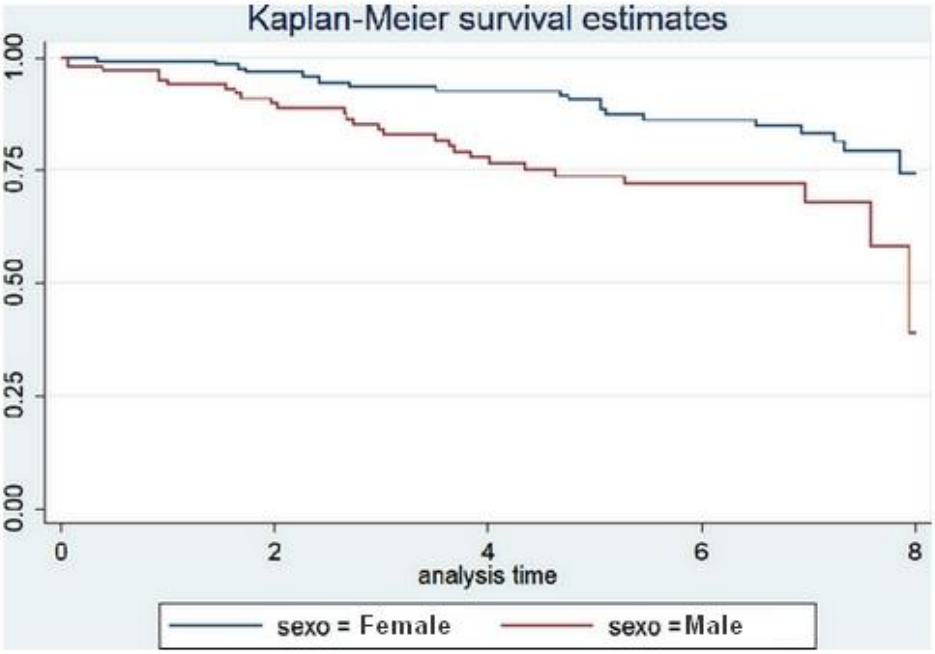

Fig 2. Kaplan-Meier graph showing survival of restoration according to gender.

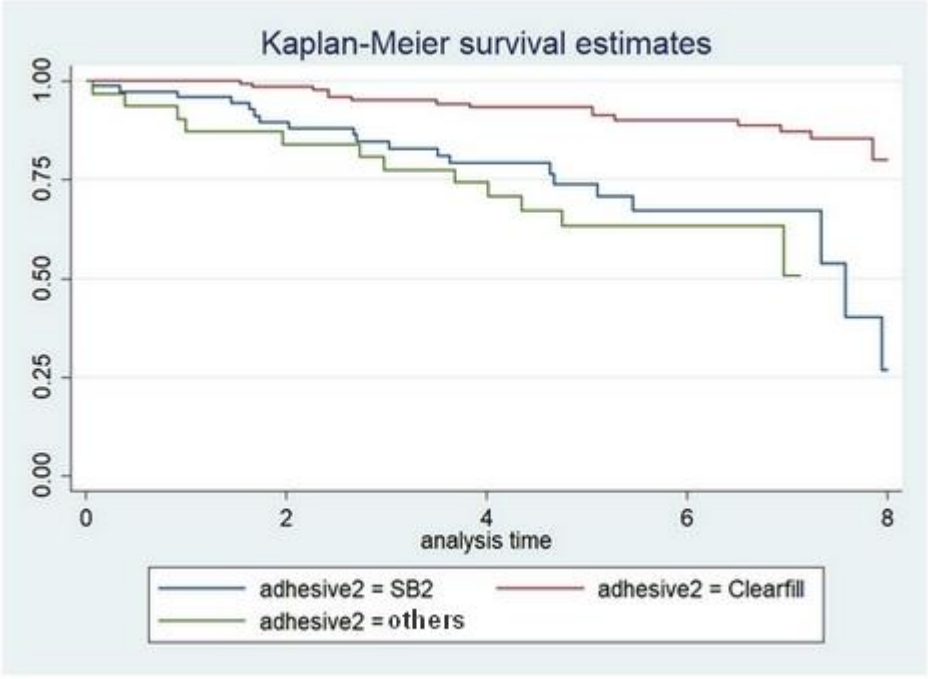

Fig 3. Kaplan-Meier graph showing survival of restoration according to adhesive system.

Discussion

This retrospective study evaluated the influence of different restorative techniques on longevity of posterior composite restorations. The main factor under evaluation concerned the presence of flowable resin composite as liner, which is seldom reported in other longitudinal studies. Other factors such adhesive system used, number of restored surfaces and gender of the pacient were also explored. This is one of the first studies reporting on the clinical effectiveness of using flow composite liner in posterior restorations, associated with different types of adhesive systems. Our results showed that the use of liner may be postivelly associated with an improvement of the lonvevity of the restorations, but this association was not consistent after the adjustement of the Cox Regression. Therefore, the study hypothesis was partially accepted.

Due to the low moduli of elasticity and increased flow capacity of flowable resin composites, it has been suggested by in vitro studies that these characteristics could provide contraction stress relaxation and improve the sealing property, and thereby reduce debonding of resin composite materials in proximal posterior boxes[17]. There are limited studies evaluating the clinical performance of flowable resin composites, most studies had a short time of clinical follow-up, which makes it difficult to evaluate the actual clinical performance of this type of restorations, especially in relation to long-term failures. Despite the limitations of a retrospective longitudinal clinical study, it was possible to follow the clinical performance of composite resin restorations with flowable resin composite as an intermediate material comparing with conventional restorations in posterior teeth through the collected data of restorations performed in the period between 2010 to 2018, taking thus a considerable time of clinical follow-up.

In a prospective clinical study with 7 years of follow-up, the success rate of 85.3% was obtained, similar to the success rate 83.6% of the present study[20]. After 7 years of follow-up, van Dijken et al. presented an annual failure rate (AFR) 2.2-2.3%, while in the present study, AFR 3.52% over 5 years of follow- up. The van Dijken study found no significant difference between the two techniques, contrary to the present study, which showed a significant difference, pointing to a lower AFR for restorations that used flowable resin composite as intermediate material, suggesting

that restorations performed with this technique show improvement in clinical performance and longevity.

In addition to the significant difference presented in liner restorations, a significant difference was observed for the factor type of adhesive system. In fact, the influence of the type of adhesive seems to be more important than the presence of flow lining for the survival of the restorations, since this was the unique factor affecting the longevity of restorations after the adjustment of the analysis in the Cox Regression. The restorations that were performed with the Clearfill adhesive system presented higher longevity than the restorations performed with the other adhesive systems. The reasons why the use of Clearfill could prolong the longevity of posterior restorations, preventing replacements and repairs is not completely clear. No cases of post-opereratory sensitivity were reported for the restorations evaluated or in the practice, and most failures were related to tooth or restoration fractures. Several patients have clinical history of tooth clenching or bruxism, and these conditions are well known as predisponent of restoration failure (van de Sande et al 2013).

The main limitation of this study is its non-randomized characteristic, which can not preclude some bias selection for the indication of materials and techniques. Especially in this report, deeper lesions where more probably restored with the use of flow composite as a liner, which could have affected the results. However, the selection of adhesive system was not affected by the type the cavity to be restored, and the choice was explained by the disponibility of the material in the market. Another important limitation is that all restorations in the present study were placed by a single high experienced operator in low caries risk patients, which may overestimate the success rates for these restorations when compared to general practice. Moreover, the limitations of the restrospective studies made it difficult to evaluate with precision some important data that could have played a role, such as the profile of patients regarding the risk of caries and occlusal stress, as well as the type and cause of failure of the restorations[18,19].

5 Conclusion

Under the limits of this retrospective evaluation, Acceptable annual failure rates of about 3.52% after 5 years can be achieved with both techniques. The use of flowable resin composites as intermediate materials has some effect in the survival of restorations, but this effect seems to be overtaken by other factors, as the type of adhesive system or tooth type.

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3. Considerações finais

Apesar das limitações de um estudo longitudinal retrospectivo, o presente estudo encontrou uma taxa anual de falha geral das restaurações de 3.52% após 5 anos (tempo médio de acompanhamento), considerada aceitável. A resina flow utilizada como material intermediário em restaurações de dentes posteriores tem algum efeito na sobrevivência das restaurações, mas este efeito parece ser influenciado por outros fatores, como o tipo de sistema adesivo ou tipo de dente.

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Anexos

Anexo A – Carta de aprovação do Comitê de Ética em Pesquisa

FACULDADE DE MEDICINA DA UNIVERSIDADE FEDERAL DE PELOTAS

Plataforma Brasil

PARECER CONSUBSTANCIADO DO CEP

DADOS DO PROJETO DE PESQUISA

Título da Pesquisa: RESTAURAÇÕES DIRETAS EM DENTES PERMANENTES POSTERIORES: LONGEVIDADE, CAUSAS DE FALHAS E FATORES RELACIONADOS

Pesquisador: Maximiliano Sérgio Cenci

Área Temática:

Versão: 2

CAAE: 09418712.5.0000.5317

Instituição Proponente: Faculdade de Medicina da Universidade Federal de Pelotas

DADOS DO PARECER

Número do Parecer: 139.840

Data da Relatoria: 06/11/2012

Apresentação do Projeto:

Estudo clínico longitudinal retrospectivo, onde pacientes que procuraram atendimento em clínica odontológica privada receberam restaurações em dentes posteriores, as quais foram realizadas com resinas compostas com técnica totalmente adesiva ou técnica de

sanduíche com material restaurador intermediário. Os pacientes deverão ter recebido ao menos uma restauração em dentes posteriores. Os grupos experimentais serão independentes, representados pelas referidas técnicas. Para avaliação das restaurações, serão aplicados os critérios de avaliação clínica preconizados por Hickel et al., 2010 (HICKEL et al., 2010). Os pacientes serão selecionados a partir de um arquivo de prontuários de uma clínica privada de acordo com critérios pré-determinados de inclusão, e convidados a participar do estudo, através de contato por telefone ou carta.

Objetivo da Pesquisa:

O objetivo geral é avaliar a longevidade clínica de restaurações diretas em dentes permanentes posteriores, as principais causas de falha atribuídas,e determinar alguns fatores potencialmente relacionados às falhas. No estudo clínico, os objetivos específicos serão avaliar comparativamente as taxas de sobrevivência e causas de falha com o uso de técnica totalmente adesiva ou utilização de material restaurador intermediário.

Avaliação dos Riscos e Benefícios:

Riscos:

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