

UNIVERSIDADE FEDERAL DO RIO GRANDE DO SUL  
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ÁREA DE CONCENTRAÇÃO CLÍNICA ODONTOLÓGICA - ODONTOPEDIATRIA

DJESSICA PEDROTTI

**O USO DE RESINA COMPOSTA FLUIDA INFLUENCIA A RESISTÊNCIA DE  
UNIÃO EM LONGO PRAZO DE REPARO DE RESINA COMPOSTA  
CONVENCIONAL ENVELHECIDA?**

Porto Alegre, RS

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Tese apresentada ao Programa de Pós-Graduação em Odontologia da Universidade Federal do Rio Grande do Sul (UFRGS) como requisito parcial para a obtenção do título de Doutora em Odontologia, área de concentração em Clínica Odontológica/Odontopediatria.

Linha de Pesquisa: Biomateriais e Técnicas Terapêuticas em Odontologia

Orientadora: Prof<sup>ª</sup>. Dr<sup>ª</sup>. Tathiane Larissa Lenzi

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*“Se vi mais longe, foi por estar sobre ombros de gigantes” (Isaac Newton)*

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*“Sua visão ficará clara apenas quando  
puder olhar para seu próprio coração.*

*Quem olha para fora, sonha;  
Quem olha para dentro, desperta!”*

*(Carl Jung)*

## RESUMO

### O USO DE RESINA COMPOSTA FLUIDA INFLUENCIA A RESISTÊNCIA DE UNIÃO EM LONGO PRAZO DE REPARO DE RESINA COMPOSTA CONVENCIONAL ENVELHECIDA?

AUTORA: Djessica Pedrotti

ORIENTADORA: Tathiane Larissa Lenzi

O presente estudo laboratorial objetivou avaliar a influência do uso de resina composta fluida na resistência de união imediata e após 6 meses de reparo de resina composta convencional. Dezesesseis blocos de resina composta nanohíbrida convencional (8x8x4mm) (Filtek Z350 XT, cor WE, 3M Oral Care) foram armazenados em água destilada a 37°C por seis meses. Após envelhecimento, os blocos foram asperizados manualmente com lixa d'água de granulação #320 para simular a rugosidade obtida com o uso de uma broca diamantada de granulação média. Em seguida, os blocos foram divididos aleatoriamente em dois grupos experimentais (n=8) de acordo com a resina composta utilizada para o reparo: convencional (Filtek Z350 XT, cor A2B, 3M Oral Care) ou fluida (Filtek Z350 Flow, cor A2, 3M Oral Care). O sistema adesivo universal (Scotchbond Universal, 3M Oral Care) foi utilizado no modo autocondicionante. Após 24 horas de armazenamento em água destilada a 37°C, os blocos reparados (8x8x8mm) foram seccionados em palitos com área de secção transversal de aproximadamente 0,8mm<sup>2</sup>. Metade dos palitos foi submetida imediatamente ao teste de microtração e a outra metade após 6 meses de armazenamento em água destilada. O padrão de fratura foi avaliado em estereomicroscópio por um examinador cego e treinado. Os dados obtidos foram submetidos à Análise de Variância de dois fatores (tipo de resina composta e tempo de armazenamento) e teste de Tukey considerando um nível de significância de 5%. O padrão de fratura foi analisado descritivamente. O uso de resina composta fluida resultou em maiores valores de resistência de união de reparo em comparação à resina composta convencional (p<0,01). Seis meses de armazenamento em água destilada não reduziu a resistência de união de reparo, independente do tipo de resina utilizada (p=0,27). Uma maior frequência de falhas adesivas/mistas foi observada em todos os grupos. Em conclusão, o uso de resina composta fluida resultou em maiores valores de resistência de união de reparo de resina composta convencional envelhecida em comparação ao uso de resina composta convencional.

**Palavras-chave:** Resistência à Tração; Reparação de Restauração Dentária; Resinas Compostas.



## ABSTRACT

### DOES THE USE OF FLOWABLE RESIN COMPOSITE INFLUENCE THE LONG-TERM REPAIR BOND STRENGTH OF AGED CONVENTIONAL RESIN COMPOSITE?

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ADVISOR: Tathiane Larissa Lenzi

This in vitro study aimed to evaluate the effect of flowable resin composite on the immediate and six-month repair bond strength of old conventional resin composite. Sixteen blocks of nanohybrid conventional resin composite (8x8x4mm) (Filtek Z350 XT shade WE, 3M Oral Care) were stored in distilled water at 37°C for six months. After aging, the blocks were manually roughened with #320 sandpaper to simulate the roughness obtained with a medium diamond bur. Then, the blocks were randomly assigned into two experimental groups (n=8) according to the composite resin used for the repair: conventional (Filtek Z350 XT shade A2B, 3M Oral Care) or flowable (Filtek Z350 Flow shade A2, 3M Oral Care). The universal adhesive system (Scotchbond Universal, 3M Oral Care) was used in self-etching mode. After 24 hours of storage in distilled water at 37°C, the repaired blocks (8x8x8mm) were sectioned into sticks with approximately 0.8mm<sup>2</sup> of cross-sectional area. Half of the sticks were submitted immediately to the microtensile test, and the other half were tested after six-month of storage in distilled water. The failure mode was evaluated under a stereomicroscope by a blinded and trained examiner. Data were analyzed using two-way repeated measures ANOVA (type of composite resin and storage period) and Tukey's test considering a significance level of 5%. The failure mode was analyzed descriptively. The use of flowable resin composite resulted in higher values of repair bond strength compared to conventional resin composite (p<0.01). Six months of storage in distilled water did not decrease the repair bond strength values, irrespective of the resin composite used for repair (p=0.27). A higher frequency of adhesive/mixed failures was observed in all groups. In conclusion, the use of flowable composite resin results in higher repair bond strength of old conventional resin composite in comparison with use of conventional resin composite.

**Keywords:** Tensile Strength; Dental Restoration Repair; Composite Resins

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## 1 INTRODUÇÃO E JUSTIFICATIVA

Restaurações de resina composta são amplamente utilizadas na prática clínica e a taxa de falha anual dessas restaurações em dentes permanentes varia de 0,08 a 6,3% (DEMARCO et al., 2023), enquanto que em dentes decíduos varia entre 1,7 e 12,9% (CHISINI et al., 2018). Fratura do dente e/ou da restauração e presença de lesão de cárie ao redor da restauração são os principais motivos de falhas em dentes posteriores (DEMARCO et al., 2023), enquanto motivos estéticos, como alteração de cor, forma anatômica e pigmentação, levam à reintervenção de restaurações em dentes anteriores (DEMARCO et al., 2015).

No entanto, os parâmetros utilizados para avaliação da qualidade das restaurações são muitas vezes subjetivos e pequenas alterações podem levar a intervenções desnecessárias ou mais invasivas. As reintervenções se tornam necessárias diante da presença de falhas que comprometam o controle do biofilme cariogênico e/ou função do dente, ou ainda, suscitem alguma queixa do paciente, como dor ou insatisfação estética. Em odontopediatria, fatores como idade do paciente e padrão de higiene bucal podem influenciar a decisão de tratamento frente à uma restauração defeituosa. Crianças mais velhas apresentam melhor controle de biofilme e o dente decíduo apresenta um período curto até sua esfoliação fisiológica. Nessas situações, nem sempre a reintervenção em uma restauração com defeitos se faz necessária. Tem sido reportado que restaurações com falhas decorrentes de fratura do material restaurador em molares decíduos de crianças com adequado controle do biofilme que não foram substituídas apresentaram uma taxa de sobrevida de 75,9% após 3 anos de acompanhamento enquanto restaurações clinicamente satisfatórias que foram acompanhadas pelo mesmo período apresentaram uma taxa de sobrevida de 96,3% (HILGERT et al., 2016).

Na presença de falhas importantes na restauração, especialmente relacionadas à fratura da restauração e/ou do dente e presença de lesão de cárie ativa em dentina ao redor da restauração, o clínico pode optar por realizar o reparo ou a substituição. A substituição da restauração envolve a remoção total da restauração e por isso é tecnicamente mais complexa e pode resultar em desgaste de estrutura dentária sadia (HICKEL et al., 2013). O reparo é uma abordagem minimamente invasiva que envolve a remoção da parte defeituosa da restauração e do tecido cariado, quando presente, seguida da restauração do defeito preparado (HICKEL et al., 2013). Sendo assim, o reparo possibilita a preservação de estrutura dentária e minimiza o risco de complicações pulpares (HICKEL et al., 2013). Tem sido demonstrado que o reparo pode aumentar a sobrevida de restaurações com falhas em dentes permanentes (CASAGRANDE et al., 2017) e decíduos (RUIZ et al., 2019), evitando intervenções mais

invasivas. Além disso, o risco de falha de restaurações reparadas tem se mostrado similar ao das restaurações substituídas em dentes permanentes (MENDES et al., 2022).

Entretanto, os profissionais tendem a realizar a substituição quando a restauração está associada com fratura (GORDAN et al., 2014). Ademais, os clínicos são mais propensos a reparar restaurações que foram realizadas por eles e substituir restaurações realizadas por outros profissionais (GORDAN et al., 2014). Embora o ensino do reparo de restaurações de resina composta esteja bem estabelecido nos currículos da maioria dos cursos de graduação em Odontologia no Brasil (GIROTTTO et al., 2023; MENDES et al., 2020), a falta de treinamento adequado, de experiência clínica e de um protocolo clínico bem estabelecido para realização do reparo de restaurações são barreiras que dificultam sua implementação na prática clínica (KANZOW et al., 2018).

Ainda não existe um protocolo padrão indicado para reparo de restaurações (KANZOW et al., 2019). Tratamentos de superfície físicos tem o objetivo de melhorar a união mecânica entre o material restaurador antigo e o novo, enquanto que os agentes químicos são usados visando melhorar a união entre os materiais na interface adesiva. Tem sido demonstrado que a associação de tratamentos de superfície físicos, como asperização com pontas diamantadas, e químicos, como uso de agentes de união, parece ser benéfica no aumento da adesão entre a restauração antiga e a nova porção do material restaurador (VALENTE et al., 2016). Ainda, tem sido evidenciado que o uso de um adesivo universal contendo silano aumenta a resistência de união de reparo de resina composta em comparação ao uso de um sistema adesivo convencional de dois passos (DA SILVA et al., 2020).

No entanto, a maioria dos estudos laboratoriais avalia a resistência de união de reparo de resinas compostas convencionais (DA SILVA et al., 2020; ELSACA et al., 2023) ou bulk-fill (BENZI et al., 2021; UGURLU et al., 2022). Resinas compostas fluidas tendem a se adaptar melhor nos preparos cavitários em função da menor viscosidade (BAROUDI E RODRIGUES, 2015). Nesse sentido, o uso de resina composta fluida para reparar restaurações com defeitos pode facilitar a adaptação do material à porção da restauração a ser reparada e à estrutura dentária envolvida (CANEPPELE, 2013). Entretanto, a maior fluidez está associada à uma redução da quantidade de carga na matriz resinosa, o que pode impactar diretamente nas propriedades físicas da resina composta e ser um problema quando o reparo é realizado em áreas de maior estresse oclusal. Todavia, a composição das resinas compostas fluidas é variável e resinas com alto teor de carga podem apresentar resistência mecânica semelhante às resinas compostas convencionais.

A simplificação da técnica do reparo através da utilização de um adesivo universal e de uma resina composta fluida pode otimizar tempo clínico e diminuir a chance de falhas operatórias. A realização de uma abordagem menos invasiva e que aumente a sobrevida de restaurações é desejável em Odontopediatria, não somente pelo ponto de vista biológico (preservação de estrutura dentária), mas também pelo ponto de vista comportamental (abordagem *patient-friendly*).

Somente um ensaio laboratorial (CANEPPELE et al., 2013) avaliou a resistência de união imediata de reparo de resina composta convencional com o mesmo material ou com resina composta fluida ou ainda com a associação de ambas. Os valores de resistência de união de reparo não foram influenciados pelo tipo de resina (convencional ou fluida). Por outro lado, a associação de uma fina camada de resina fluida sob a resina composta convencional, utilizada como agente intermediário, resultou em menores valores de resistência de união de reparo.

Na realização do reparo, a adesão não deve ser considerada apenas entre o material e os tecidos dentários, mas também entre a antiga e a nova resina composta. A possibilidade de obter uma ligação química à resina composta diminui lentamente ao longo do tempo devido à pós-cura e absorção de água, levando à hidrólise das ligações duplas disponíveis, deixando poucos carbonos para ligação química à nova resina composta (LAGOUVARDOS et al., 2003).

Sendo assim, é essencial a realização de um estudo que avalie a influência do uso de resina composta fluida na resistência de união imediata e em longo prazo de reparo de resina composta convencional envelhecida.

## 2 ARTIGO

### 3 CONCLUSÃO

Com base nos resultados do presente estudo laboratorial pode-se concluir que o uso de uma resina composta fluida aumenta a resistência de união de reparo de resina composta convencional. É importante ressaltar que esses achados são limitados aos materiais utilizados neste estudo. A resina composta fluida utilizada possui alto teor de carga (65% em peso e 55% em volume), o que pode ter influenciado positivamente os resultados.

Procedimentos clínicos que possibilitem maior preservação de estrutura dentária em menor tempo clínico são desejáveis em Odontopediatria. Nesse sentido, o uso de uma resina composta fluida é uma abordagem relevante para reparar restaurações com falhas em dentes decíduos. A utilização de uma resina composta fluida com menor conteúdo de carga ainda é questionável, mas pode ser uma alternativa, especialmente considerando o menor estresse oclusal dos dentes decíduos. Todavia, são necessários mais estudos que avaliem o efeito de resinas compostas fluidas com diferentes quantidades de partículas de carga na resistência de união de reparo de resinas compostas convencionais. Da mesma forma, ensaios clínicos que avaliem a sobrevida de restaurações de resina composta reparadas com resina fluida em dentes decíduos são imprescindíveis para o estabelecimento de um protocolo clínico para reparo de restaurações.

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## ANEXO A – Normas do periódico *International Journal of Adhesion and Adhesives*



# INTERNATIONAL JOURNAL OF ADHESION AND ADHESIVES

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### DESCRIPTION

The *International Journal of Adhesion and Adhesives* draws together the many aspects of the science and technology of **adhesive materials**, from fundamental research and development work to industrial applications. Subject areas covered include: **interfacial interactions**, **surface chemistry**, methods of **testing**, accumulation of test data on **physical** and **mechanical properties**, **environmental effects**, **new adhesive materials**, **sealants**, design of **bonded joints**, and manufacturing **technology**. The IJAA also welcomes scientifically robust research and reviews on the developments of technologies related to hard and soft tissue adhesion of dental and biomedical materials.

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*List:* Number the references (numbers in square brackets) in the list in the order in which they appear in the text.

#### *Examples:*

Reference to a journal publication:

[1] Van der Geer J, Hanraads JAJ, Lupton RA. The art of writing a scientific article. *J Sci Commun* 2010;163:51–9. <https://doi.org/10.1016/j.Sc.2010.00372>.

Reference to a journal publication with an article number:

[2] Van der Geer J, Hanraads JAJ, Lupton RA. The art of writing a scientific article. *Heliyon*. 2018;19:e00205. <https://doi.org/10.1016/j.heliyon.2018.e00205>

Reference to a book:

[3] Strunk Jr W, White EB. *The elements of style*. 4th ed. New York: Longman; 2000.

Reference to a chapter in an edited book:

[4] Mettam GR, Adams LB. How to prepare an electronic version of your article. In: Jones BS, Smith RZ, editors. *Introduction to the electronic age*, New York: E-Publishing Inc; 2009, p. 281–304.

Reference to a website:

[5] Cancer Research UK. Cancer statistics reports for the UK, <http://www.cancerresearchuk.org/aboutcancer/statistics/cancerstatsreport/>; 2003 [accessed 13 March 2003].

Reference to a dataset:

[dataset] [6] Oguro M, Imahiro S, Saito S, Nakashizuka T. Mortality data for Japanese oak wilt disease and surrounding forest compositions, *Mendeley Data*, v1; 2015. <https://doi.org/10.17632/xwj98nb39r.1>.

Note shortened form for last page number. e.g., 51–9, and that for more than 6 authors the first 6 should be listed followed by 'et al.' For further details you are referred to 'Uniform Requirements for Manuscripts submitted to Biomedical Journals' (*J Am Med Assoc* 1997;277:927–34) (see also [Samples of Formatted References](#)).

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## ANEXO B – Aprovação da Comissão de Pesquisa em Odontologia

Sistema Pesquisa - Pesquisador: Tathiane Larissa Lenzi

Dados Gerais:		<a href="#">Retornar</a>
<b>Projeto N°:</b>	39582	<b>Título:</b> EFEITO DE UM SILANO NAO HIDROLISADO PREVIAMENTE A APLICACAO DE SISTEMAS ADESIVOS UNIVERSAIS CONTENDO SILANO NA RESISTENCIA DE UNIAO DE REPARO DE RESINA COMPOSTA ENVELHECIDA
<b>Área de conhecimento:</b>	Odontologia	<b>Início:</b> 01/09/2020 <b>Previsão de conclusão:</b> 01/07/2022
<b>Situação:</b>	Projeto em Andamento	
<b>Origem:</b>	Faculdade de Odontologia Programa de Pós-Graduação em Odontologia	<b>Projeto da linha de pesquisa:</b> BIOMATERIAIS E TÉCNICAS TERAPÊUTICAS EM ODONTOLOGIA
<b>Local de Realização:</b>	não informado	
<b>Não apresenta relação com Patrimônio Genético ou Conhecimento Tradicional Associado.</b>		
<b>Objetivo:</b>		
<p>O objetivo do estudo é avaliar a influência do uso de silanos previamente à aplicação de sistemas adesivos universais contendo silano na resistência de união de reparo de resina composta envelhecida. Para isso, 90 corpos de prova (4 mm x 4 mm x 4 mm) de resina composta (Z350 XT, 3M ESPE) serão divididos aleatoriamente em 9 grupos experimentais: silano hidrolisado (RelyX Ceramic Primer, 3M ESPE) + adesivo</p>		
<b>Palavras Chave:</b>		
REPARO RESINA COMPOSTA RESISTÊNCIA DE UNIÃO SILANO		
<b>Equipe UFRGS:</b>		
<b>Nome:</b> Tathiane Larissa Lenzi Coordenador - Início: 01/09/2020 Previsão de término: 01/07/2022 <b>Nome:</b> Djessica Pedrotti Ensino: doutorado - Início: 01/09/2020 Previsão de término: 01/07/2022 <b>Nome:</b> Laura Teixeira Mendes Ensino: doutorado - Início: 01/09/2020 Previsão de término: 01/07/2022		

