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As aplicações clínicas das resinas bulk fill: uma revisão sistemática

Jean-baptiste BERNARD

Dissertação conducente ao Grau de Mestre em Medicina Dentária (Ciclo Integrado)

Gandra, XX de XX de 2022

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Trabalho realizado sob a Orientação da Mestre Célia Marques

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Resumo

Introdução: As resinas compostas são o material de eleição para as restaurações diretas, usando a técnica de estratificação das camadas de resina por incrementos de 2 milímetros a fim de diminuir o *stress* na interface dente-restauração resultante da polimerização do material. Estas resinas sofreram um constante desenvolvimento até que surgiu um novo tipo de resinas compostas, chamado resinas "bulk fill", permitindo sua colocação por incrementos de 4 a 5 milímetros e facilitando assim a técnica de colocação para diminuir o tempo da consulta.

Objetivo: O objetivo desta revisão sistemática é definir quais são as possíveis aplicações clínicas das resinas bulk-fill tendo em conta suas características.

Metodologia: A pesquisa bibliográfica foi realizada na base de dados PubMed. Foram reunidos um total de 65 artigos, dos quais 25 foram considerados relevantes para a realização deste trabalho.

Discussão: As resinas bulk fill têm parâmetros estéticos e funcionais iguais ou superiores aos das resinas convencionais, exceto para a força de ligação ao esmalte e à dentina e para a formação de "*gaps*" após polimerização, mas ficam clinicamente aceitáveis. Elas podem ser usadas em vez das resinas convencionais nos dentes permanentes como na dentição de leite, para o preenchimento de cavidades após lesões cariosas, para o tratamento de lesões cervicais não cariosas (devido à atrição, abrasão, abfração ou erosão), para a restauração de dentes endodonciados e também para a elevação das paredes das caixas proximais. Para a elevação das margens cervicais, as resinas bulk fill têm resultados promissores.

Conclusão: As resinas bulk fill têm um bom desempenho clínico. Muito utilizadas para preencher as cavidades em dentes posteriores, suas aplicações clínicas podem ser alargadas. Sua facilidade de colocação faz delas o material de eleição para restaurar os dentes das crianças e dos pacientes debilitados.

Palavras-chave: Bulk fill*, tooth fracture, dental caries, cervical, esthetic, primary teeth.*

Abstract

Introduction : Composite resins are the material of choice for direct restorations, using the technique of layering the resin by 2 millimeters increments, in order to decrease the stress at the tooth-restoration interface resulting from the polymerization of the material. These resins underwent constant development until a new type of composite resin appeared, called "bulk fill" resins, allowing placement in increments of 4 to 5 millimeters, thus facilitating the placement technique to decrease the appointment time.

Objective : The aim of this systematic review is to define what are the possible clinical applications of bulk-fill resins taking into consideration their characteristics..

Methodology: The bibliographic search was carried out in the PubMed database. A total of 65 articles were collected, of which 25 were considered relevant for this work.

Development: Bulk fill resins have aesthetic and functional parameters equal or superior to conventional resins, except for bond strength to enamel and dentin and gap formation after polymerization but are clinically acceptable. They can be used instead of conventional resins on permanent teeth as well as on primary teeth, for the filling of cavities after carious lesions, for the treatment of non-carious cervical lesions (due to attrition, abrasion, abfraction or erosion), for the restoration of endodontically treated teeth, and for the elevation of proximal boxes walls. For the elevation of cervical margins, bulk fill resins have promising results.

Conclusion: Bulk fill resins have good clinical performances. Widely used to fill cavities in posterior teeth, their clinical applications can be extended. Their ease of placement makes them the material of choice for restoring the teeth of children and debilitated patients.

Keywords: Bulk fill, tooth fracture, dental caries, cervical, esthetic, primary teeth.

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ANEXOS

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1 Introdução

Outrora, o amálgama era o material mais usado nas restaurações diretas, especialmente em restaurações de dentes posteriores, devido aos seus bons resultados clínicos e baixo custo. No entanto, com a convenção de Minamata, a procura de novos materiais de restauração com uma elevada longevidade clínica, estética, um custo atrativo e uma técnica de fácil manuseamento, cresceu (1).

Atualmente, os compósitos à base de resina, ditos convencionais, são os materiais mais aplicados para as restaurações diretas devido às suas boas propriedades físico-químicas, estética e baixo custo (2). Desde a sua introdução na prática clínica, as mesmas têm vindo a sofrer constante desenvolvimento para provar a sua eficácia. São realizadas modificações na sua composição orgânica, e inorgânica, com o objetivo de produzir materiais restauradores com melhor resistência à degradação. Propriedades mecânicas, estéticas, de polimento e resistência à abrasão vão sendo otimizadas, no entanto, o médico dentista depara-se constantemente com desafios. A contração de polimerização continua a ser um dos maiores desafios no que concerne às restaurações de resina composta. A aplicação da resina composta requer uma técnica incremental, com incrementos até 2 milímetros de espessura, com o objetivo de diminuir o *stress* de contração resultante da fotopolimerização. Mas esta técnica torna-se demorada e de onde poderá resultar no aparecimento de *gaps* entre as camadas de resina composta. O *stress* de contração pode originar problemas pós-operatórios tais como desconforto, degradação marginal e cáries secundárias. De forma a minimizar igualmente o *stress* da fotopolimerização, as paredes preparadas têm de ser em menor número, reduzindo o fator C (2–10). Ao haver dano na ligação da resina composta às paredes cavitárias, por sua vez, originará microinfiltrações que poderão levar à transferência de fluídos e bactérias na interface (2).

Uma nova resina composta apareceu no mercado, denominada resina bulk fill, com o objetivo de simplificar a técnica de estratificação e diminuir o tempo de aplicação do material, sem a necessidade de prolongar o tempo de fotopolimerização. Aquando da sua introdução no mercado, foi afirmado que exibiriam baixo *stress* de polimerização e menor deflexão cuspídea, como principais avanços (3,11).

A resina bulk-fill permite restaurar os dentes colocando uma só camada de compósito de 4 a 5 milímetros de espessura, não necessitando da técnica incremental. Além disso, devido à baixa viscosidade e facilidade de manuseamento das resinas bulk-fill, elas são particularmente aplicadas em restaurações de cavidades de difícil acesso. Apresentam na sua composição, mediadores de polimerização que diminuem a contração sem que haja comprometimento do grau de conversão de monómeros a polímeros (10,12).

Este trabalho visa realizar uma revisão sistemática da literatura recente sobre as aplicações clínicas possíveis das resinas bulk fill.

2 Objetivo

O objetivo desta revisão sistemática é definir quais são as possíveis aplicações clínicas das resinas bulk fill tendo em conta suas características.

3 Metodologia

A pesquisa bibliográfica foi orientada pela metodologia PICO para responder à pergunta: "Em que tipos de tratamentos dentários as resinas bulk-fill podem ser aplicadas?"

Problema: reconstruções dentárias.
Intervenção: reconstrução com resina composta bulk-fill.
Comparação: reconstruções dentárias com outros materiais.
Resultado: diferenças encontradas ou não entre os materiais.

A pesquisa bibliográfica foi realizada na base de dados PubMed, com as seguintes palavras-chaves combinadas entre si: bulk fill *AND tooth fracture,* bulk fill *AND dental caries,* bulk fill *AND cervical,* bulk fill *AND esthetic,* bulk fill *AND primary teeth*.
Com os critérios de seleção e o filtro "2019-2022" foram encontrados no total 65 artigos que, após aplicação dos critérios de inclusão e exclusão, resultaram em 25 artigos.
Os critérios de inclusão foram: artigos disponíveis na integra, em inglês e cuja metodologia se enquadrava no objetivo do trabalho.
Os critérios de exclusão foram: não incluir dentes humanos *in vitro* ou *in vivo*, revisões de literatura, suporte digital não disponível.
O total de artigos foi compilado para cada combinação de palavras-chave e, portanto, os duplicados foram removidos usando o software Mendeley.
Uma avaliação preliminar dos resumos foi realizada para determinar se os artigos atendiam ao objetivo da dissertação.
Os artigos selecionados foram lidos e avaliados individualmente quanto ao objetivo desta dissertação.

4 Resultados

Da pesquisa bibliográfica, usando o filtro "2019-2022", resultou um total de 65 artigos dos quais foram removidos:

- 2 artigos duplicados.
- 18 artigos não revelantes para o tema estudado.
- 3 artigos não disponíveis na integra.
- 17 artigos após aplicação dos critérios de exclusão (12 artigos não utilizaram dentes humanos, 2 foram revisões de literatura e 3 não tiveram uma versão digital disponível).

No final, ficaram 25 artigos para a realização da revisão sistemática (1–3,10–31).
Todo o procedimento é explicado no fluxograma (figura 1) a seguir.

Dentro destes 25 artigos retidos, 13 (52%) estudaram o preenchimento de cavidades (1–3,10–12,14–18,20,21), 2 (8%) o preenchimento de cavidades e a influência dos sistemas adesivos associados às resinas bulk fill (13,19), 2 outros (8%) a restauração de lesões cervicais não cariosas (22,23), 3 (12%) a restauração de dentes endodonciados (24–26), 1 (4%) examinou a elevação da margem cervical (27), 1 (4%) outro a elevação das paredes das caixas proximais (28) e 3 (12%) analisaram a influência dos sistemas adesivos associados às resinas bulk fill (29–31).
Dos artigos selecionados, em 7 foram utilizados para o estudo, dentição de leite (10,11,14,20,21,26,31), bem como com dentes permanentes (1,15,17–19,22,23), 1 estudo utilizou dentição de leite e dentes permanentes (29), e nos restantes estudos não foi especificado qual o tipo de dente utilizado na amostra (2,3,12,13,16,24,25,27,28,30).

Os artigos selecionados são relatados na tabela 1 nos anexos.

Os maiores resultados tirados são os seguintes:

- No preenchimento de cavidades, as resinas bulk fill exibem um bom desempenho clínico com parâmetros estéticos e mecânicos iguais ou superiores às resinas convencionais. A

única exceção é o maior volume dos *gaps* formados nas margens cervicais dentinárias das cavidades profundas em comparação com um compósito convencional fluido, mas fica igual a um compósito convencional compactável (1–3,10–20).

- Nos dentes primários tratados por pulpotomia é aconselhado restaurar os dentes com as resinas bulk fill porque permite melhorar a resistência à fratura em relação ao uso de uma resina convencional (21).
- Comparado às resinas bulk fill de alta viscosidade, as de baixa viscosidade são responsáveis por uma maior contração de polimerização e um maior stress interface, uma menor força de ligação ao dente, uma maior formação de "*gaps*" na interface, o que resulta numa pior integridade marginal (3,11,19).
- Na restauração de lesões cervicais não cariosas (causadas por abrasão, abfração, erosão ou atrição), as resinas bulk fill exibem resultados estéticos e mecânicos iguais às resinas convencionais, com uma menor rugosidade de superfície após 1 ano. A distância oclusogengival da restauração não afeta o desempenho clínico das resinas bulk fill ao contrário das resinas convencionais (22,23).
- Na restauração de dentes endodonciados, as resinas bulk fill têm uma resistência à fratura igual à das resinas convencionais e dos *inlays* em cerâmica, com um risco inferior de desenvolver fraturas irreparáveis do que estes 2 outros materiais (24–26).
- Na elevação das margens cervicais, as resinas bulk fill têm resultados promissores (27).
- Na elevação das paredes da caixa proximal de subgengival para supragengival, as resinas bulk fill proporcionam resultados iguais às resinas convencionais, aos cimentos de ionómero de vidro e aos cimentos de ionómero de vidro modificados por resina (28).
- Utilizar um adesivo, associado a uma resina bulk fill, permite diminuir a contração do material que resulta da sua polimerização (19).
- Os sistemas adesivos *self-etch* e *etch-and-rinse* permitem melhorar o selamento marginal e diminuir assim as microinfiltrações, e os sistemas *total-etch* resultam numa maior força de ligação da restauração ao dente o que melhora a capacidade de retenção da restauração (13,29,30).
- As resinas bulk fill podem ser utilizadas na dentição de leite como em dentes permanentes, tendo em conta que a sua força de ligação ao dente é melhor em dentes permanentes (29).

- Uma restauração feita num dente de leite com uma resina bulk fill parece ter melhor desempenho clínico e taxa de sobrevivência quando o ácido fosfórico 37% é aplicado na dentina durante somente 7 segundos (31).

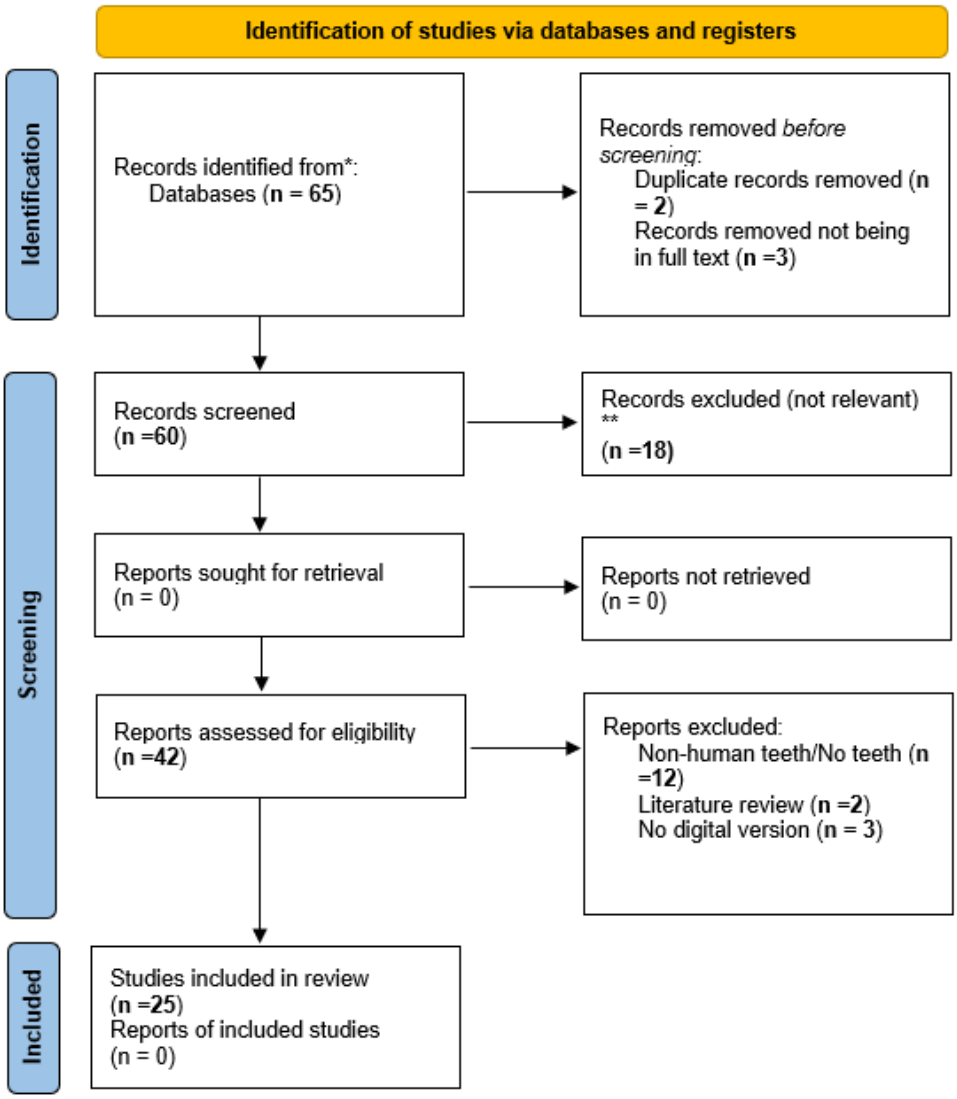

Figura 1 - Fluxograma da pesquisa bibliográfica

5 DISCUSSÃO

As resinas bulk fill são um tipo de resinas compostas desenvolvidas com o objetivo de facilitar a técnica de colocação e de diminuir o tempo de aplicação do material, sem comprometer o desempenho clínico das restaurações: podem ser aplicadas num só incremento de 4 a 5 milímetros sem aumentar o tempo de fotopolimerização. São resinas compostas de baixa viscosidade e fácil manuseamento em comparação com as convencionais, muito utilizadas nas restaurações dos dentes posteriores de difícil acesso hoje em dia, entretanto, as suas aplicações clínicas poderiam ser alargadas.

5.1 Propriedades das Resinas bulk fill

5.1.1 Parâmetros funcionais

Selamento marginal: comparativamente às restaurações com cimento de ionómero de vidro, as resinas bulk-fill demonstraram melhor selamento na interface material restaurador-dente. Quando se compara as resinas bulk-fill condensáveis com as bulk-fill fluídas, as primeiras obtiveram um melhor selamento marginal. Foi verificado que a utilização de um adesivo *self-etch* associado a uma resina bulk fill permite melhorar o selamento marginal, em comparação à utilização da resina bulk fill sem auxílio do sistema adesivo ou à associação adesivo *total-etch* (11,13–15).

Força de ligação ao esmalte e à dentina: as resinas bulk fill têm uma força de ligação inferior às resinas convencionais. As resinas bulk fill têm uma boa força de ligação, mas torna-se melhor quando associados a uma resina convencional fluída (3,16,17).

As resinas convencionais fluídas mostram um volume inferior de *gaps* na interface imediatamente após a restauração, comparativamente com as resinas bulk fill e resinas convencionais compactáveis. Entretanto, as resinas bulk fill e as resinas convencionais compactáveis são mais

estáveis ao longo do tempo, após a mastigação, do que as resinas convencionais fluídas que sofrem um aumento do volume de *gaps* com o tempo (18).

Contração de polimerização: as resinas bulk fill e as resinas convencionais obtiveram resultados semelhantes. As cavidades de maior profundidade são responsáveis por uma maior contração de polimerização, que pode ser diminuída pelo uso de um adesivo. As resinas bulk fill fluídas são responsáveis por uma maior contração de polimerização comparativamente às resinas bulk fill compactáveis (3,19).

Quando se trata da sensibilidade pós-operatória e do desenvolvimento de cáries secundárias, os cimentos de ionómero de vidro, as resinas bulk fill e as resinas convencionais têm desempenhos clínicos parecidos (14,15). Restaurações com cimento de ionómero de vidro, restaurações com resina bulk fill e restaurações com resina composta convencional não demonstraram diferenças significativas entre si, quando comparada sensibilidade dentária e desenvolvimento de cáries secundárias (15,16).

As resinas bulk fill condensáveis têm uma menor deflexão cuspídea do que as resinas convencionais compactáveis, o que resulta numa maior resistência à fratura e menos riscos de desenvolver *microcracks* e fissuras (12).

5.1.2 Parâmetros estéticos

Forma anatómica: as resinas bulk fill e as resinas convencionais obtiveram bons resultados. Entretanto, os cimentos de ionómero de vidro exibem falha na forma anatómica e descontinuidade da restauração com o dente ao longo do tempo (14,15).

Ao nível da cor e a descoloração marginal, as resinas bulk fill e as resinas convencionais tiveram desempenhos clínicos semelhantes após 1 ano. No entanto, mais estudos se tornam necessários, analisando estes parâmetros após um maior período para ter uma ideia mais fiável da evolução da cor das resinas bulk fill ao longo do tempo (10,14,15).

Em 2021, Fabian Cieplik *et al.* publicaram um estudo avaliando a estética e o desempenho clínico de duas resinas bulk fill : uma "clássica" que precisa do condicionamento do dente com um adesivo antes da sua aplicação, e uma "nova da mesma cor que o dente" com adesão tipo *self-etch,* desenvolvida com o objetivo de eliminar a etapa do condicionamento dos tecidos duros antes da aplicação da resina, de forma a ganhar ainda mais tempo. A nova resina bulk fill mostrou resultados funcionais semelhantes aos da resina bulk fill clássica, mas essa nova resina obteve resultados piores em todos os pontos do tempo relativamente ao brilho da superfície, à cor e à translucidez, e também com uma maior descoloração marginal aos 12 meses (1).

Os estudos feitos durante os 3 últimos anos mostraram que as resinas bulk fill têm parâmetros estéticos e funcionais iguais ou superiores aos das resinas convencionais, exceto na força de ligação ao esmalte e à dentina (que pode ser melhorada associando uma resina bulk fill com uma resina convencional fluída) e na formação de "*gaps*" logo após a polimerização (1–3,10–20).

5.2 Aplicações clínicas das resinas bulk fill

1/Preenchimento de cavidades

Devido às suas propriedades mecânicas iguais ou superiores às das resinas convencionais, ao baixo *stress* de polimerização que exibem e à sua técnica de colocação mais rápida, elas apresentam-se como um dos materiais mais indicados para o preenchimento de cavidades, especialmente nos dentes posteriores com fator C elevado (1–3,11–19).

Olhando especialmente este tipo de restauração na dentição de leite, vê-se que as resinas bulk fill exibem um bom desempenho clínico após 1 ano, tanto como as resinas convencionais (10,14). As resinas bulk fill esculpíveis mostram uma integridade marginal semelhante, ou melhor, do que as resinas convencionais colocadas em incrementos de 2 milímetros, em molares de leite (11).
Vicky Ehlers *et al.* compararam o desempenho clínico de um compómero com o de uma resina bulk fill fluída em cavidades classe II em dentes de leite. Relativamente aos parâmetros estéticos, o compómero mostrou resultados ligeiramente mais satisfatórios do que a resina bulk fill fluída.

Ambos os materiais mostraram resultados semelhantes para os parâmetros funcionais e biológicos (20).

Quando se trata de dentes de leite tratados com pulpotomia, as resinas bulk fill são recomendadas para reforçar o dente, e diminuir assim o risco de fratura do dente (21).

2/Tratamento de lesões cervicais não cariosas

Na restauração dos terços cervicais dos dentes degradados por abrasão, abfração, erosão ou atrição, quando se compara uma resina bulk fill com uma resina convencional, verificou-se que os dois tipos de resina têm resultados semelhantes e aceitáveis aos 12 meses, tanto em termos de adaptação e descoloração marginal como em termos de retenção da restauração, sensibilidade pós-operatória e ocorrência de fraturas e caries secundárias. A única diferença que pode ser notada é a menor rugosidade de superfície da resina bulk fill que tornará a restauração menos suscetível à acumulação de placa, e diminui assim o risco de inflamação gengival e de cáries secundárias. Anota-se que a distância ocluso-gengival da restauração não afeta a sua qualidade aos 12 meses (22,23).

3/Restauração de dentes endodonciados

Os dentes permanentes endodonciados, restaurados por restauração direta com resina composta convencional (com ou sem espigão de fibra) ou resina bulk fill, ou indireta com restaurações de dentes endodonciados com cerâmicas *emax,* mostraram resistência à fratura semelhante. Contudo, as restaurações de dentes endodonciados indiretas com cerâmicas *emax* exibiram falhas mais agressivas (da raiz) e uma consequente taxa de fraturas irreparáveis mais alta, tal como as resinas convencionais (24,25).

Resultados semelhantes foram encontrados após restauração de dentes anteriores de leite endodonciados com uma resina bulk fill e com uma resina convencional. Foi num estudo *in vitro*

realizado em dentes de leite destruídos devido a severas cáries, com um mínimo de 2/3 da raiz formada, os canais foram preenchidos com uma pasta de hidróxido de cálcio deixando 1mm em apical e o terço coronal vazios. O terço coronal foi posteriormente preenchido pelas resinas e a coroa foi reconstruída usando coroas de acetato preenchidas com as diferentes resinas (coroas transparentes preenchidas por uma resina composta e eliminadas apos polimerização do material, muito usadas nas restaurações provisórias de dentes anteriores em odontopediatria). Após análise da resistência à fratura, não houve diferenças entre as restaurações (26).

4/ Elevação da margem cervical

Jelena Juloski *et al.* fizeram elevação da margem cervical, de subgengival para supragengival, com uma resina bulk fill e com uma resina convencional fluída, e posterior colocação de um *overlay*. A elevação da margem cervical parece fornecer uma selagem menos adequada da margem do que a obtida através da cimentação da restauração diretamente, sem elevação dessa margem. A capacidade de selagem da interface marginal depende dos materiais utilizados para realizar essa elevação: a utilização de uma resina bulk fill associada a um adesivo universal em "*selective enamel etch mode*" permite obter menos infiltrações em comparação a uma resina convencional fluida associada a um adesivo *total-etch* de 3 passos, sem que haja diferenças estatisticamente significativas na observação das margens da restauração ao microscópio eletrónico. Esse resultado permite pensar que a resina bulk fill poderia ser um melhor material para esse tratamento, mas o uso de sistemas adesivos diferentes obriga-nos a duvidar disso (27).

5/Elevação das paredes da caixa proximal

Thomas D Grubbs *et al.* elevaram as paredes das caixas proximais de subgengival para supragengival com quatro matériais diferentes (ionómero de vidro, ionómero de vidro modificado por resina, resina bulk fill e resina convencional) e foi posteriormente colocado um *onlay*. Não houve diferenças estatisticamente significativas entre os materiais, nem entre os materiais e o controle sem elevação das paredes da caixa proximal, tanto na qualidade das margens das interfaces dente/material e material/*onlay*, como na resistência à fratura (28).

6/A influência dos sistemas adesivos associados às resinas bulk fill, e dos seus métodos de aplicação

Utilizar um adesivo, associado a uma resina bulk fill, permite diminuir a contração do material que resulta da sua polimerização (19).

Para restaurações com uma resina bulk fill, quando se compara um sistema adesivo universal *self-etch* com um universal *total-etch*, vê-se que o uso do sistema *self-etch* permite melhorar o selamento marginal e diminuir assim as microinfiltrações, mas o uso do sistema adesivo universal *total-etch* resulta numa maior força de ligação da restauração ao dente. Então, usar um adesivo *self-etch* permitiria diminuir o risco de desenvolver cáries secundárias ou coloração marginal da restauração, mas o uso de um adesivo *total-etch* poderia aumentar a longevidade das restaurações melhorando sua probabilidade de sobrevivência. Nota-se que essas resinas têm uma força de ligação maior em dentes permanentes do que em dentes de leite (13,29).

Entretanto, quando se compara um sistema adesivo universal *etch-and-rinse* com um adesivo universal *self-etch*, o adesivo *etch-and-rinse* resulta num selamento marginal ainda melhor (30).

Cleber Paradzinski Cavalheiro *et al.* tentaram determinar se o tempo de aplicação do ácido fosfórico a 37% na dentina de dentes de leite influencia a taxa de sobrevivência das restaurações feitas com resina bulk fill. Concluíram que o tempo de aplicação do ácido na dentina, a partir do momento que não ultrapassa 15 segundos, não afeta de maneira significativa a taxa de sobrevivência das restaurações, com uma tendência a obter um melhor desempenho clínico quando o ácido está aplicado somente durante 7 segundos em vez de 15 segundos (31).

6 CONCLUSÃO

As resinas bulk fill têm parâmetros estéticos e funcionais iguais ou superiores aos das resinas convencionais, exceto para a força de ligação ao esmalte e à dentina e para a formação de "*gaps*" logo após a polimerização, mas ficam clinicamente aceitáveis.

Elas podem ser usadas em vez das resinas convencionais, para o preenchimento de cavidades após lesões cariosas, para o tratamento de lesões cervicais não cariosas (devido à atrição, abrasão, abfração ou erosão), para a restauração de dentes endodonciados e também para a elevação das paredes das caixas proximais. Para a elevação das margens cervicais, as resinas bulk fill têm resultados promissores. Para os dentes de leite tratados por pulpotomia, parece aconselhado utilizar as resinas bulk fill em vez das resinas convencionais para restaurar o dente porque permite diminuir o risco de fratura do dente.

As resinas bulk fill podem ser utilizadas na dentição de leite como em dentes permanentes, tendo em conta que a sua força de ligação ao dente é melhor em dentes permanentes.

Um adesivo deve ser associado às resinas bulk fill para diminuir a contração que resulta da polimerização do material: os *total-etch* permitem aumentar a força de ligação da restauração ao dente, os *self-etch* e *etch-and-rinse* permitem melhorar o selamento marginal. O condicionamento ácido durante 7 segundos em vez de 15 segundos na dentina de dentes de leite parece melhorar o desempenho clínico das resinas bulk fill.

A maior vantagem deste tipo de resina é a sua facilidade de colocação que permite diminuir o tempo na cadeira dos pacientes, sendo o tipo de resina ótimo para a restauração dos dentes das crianças ou dos pacientes debilitados, mas os preços elevados destas resinas tornam difícil a sua utilização na rotina.

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ANEXOS

Tabela 1 - Características, resultados e conclusões dos estudos analisados a partir da pesquisa bibliográfica.

TITLE/(N°NA BIBLIOGRAFIA)/AUTOR/(YEAR)/TYPE OF STUDY/	OBJECTIVES	METODOLOGY	RESULTS	CONCLUSION
1/ One-year results of a novel self-adhesive bulk-fll restorative and a conventional bulk-fll composite in class II cavities—a randomized clinical split-mouth study (1) Fabian Cieplik1 · Konstantin J. Scholz1 · Julian C. Anthony1 · Isabelle Tabenski1 Sarah Ettenberger1 · Karl-Anton Hiller1 · Wolfgang Buchalla1 · Marianne Federlin1	Evaluate the clinical performance of a novel, tooth-colored, self-adhesive bulk-fill restorative (SABF, 3M Oral Care) and a conventional bulk-fill composite (Filtek One, 3M Oral Care; FOBF) for restoring class II cavities.	In this randomized split-mouth study, 30 patients received one SABF and one FOBF restoration each. Scotchbond Universal (3M Oral Care) was used as adhesive for FOBF (self-etch mode), while SABF was applied directly without adhesive. Restorations were evaluated by two blinded examiners at baseline, 6 months and 12 months employing FDI criteria. Non-parametric statistical analyses and χ2-tests (α = 0.05) were applied.	Thirty patients (60 restorations) were available for the 6- and 12-month recalls exhibiting 100% restoration survival. All restorations revealed clinically acceptable FDI scores at all time points and for all criteria. Only regarding esthetic properties, FOBF performed significantly better than SABF regarding surface lustre (A1) and color match and translucency (A3) at all time points and marginal staining (A2b) at 12 months.	Both materials performed similarly regarding clinical performance within the first year of clinical service. SABF exhibited slightly inferior, but clinically fully acceptable esthetic properties as compared to FOBF. Clinical relevance: Within the limitations of this study, the self-adhesive bulk-fill restorative showed promising results and may be recommended for clinical use.

(2022) randomized split-mouth study				
2/ Microleakage in class II restorations of two bulk fll resin composites and a conventional nanohybrid resin composite: an in vitro study at 10,000 thermocycles (2) César F. Cayo-Rojas1,2* , Karen K. Hernández-Caba2 , Ana S. Aliaga-Mariñas2 , Marysela I. Ladera-Castañeda1,2 and Luis A. Cervantes-Ganoza3 (2021)	Evaluate the degree of in vitro marginal microleakage in class II restorations with two bulk fill resin composites compared to a conventional nanohybrid resin composite.	The present study was an in vitro experimental design. A total of 30 standardized class II cavities were prepared in 15 human molars (mesially and distally). These cavities were later distributed in 3 groups according to the type of resin. Groups A and B were restored with bulk fill resin composites (Filtek—3 M/ESPE and Tetric N-Ceram—Ivoclar/Vivadent respectively) in a single increment of 4 mm. Group C was restored with the Filtek Z350 XT – 3 M/ESPE resin composite and two increments of 2 mm. The crowns were then sectioned mesiodistally and observed under the stereomicroscope to determine the degree of marginal microleakage at the occlusal and cervical areas..	There were no statistically significant differences regarding the degree of microleakage between the three types of resin composites in the occlusal and cervical areas ($p > 0.05$). Similarly, there were no significant differences after comparing each resin type in its occlusal and cervical area ($p > 0.05$).	Filtek Bulk Fill and Tetric N-Ceram Bulk Fill resin composites showed no statistically significant differences with the conventional nanohybrid resin composite Filtek Z350XT at both occlusal and cervical areas.

In vitro study				
3/ Bonding States of In Vitro Class 2 Direct Resin Composite Restoration Applied by Various Incremental Techniques (16) Misato Okada, Masahiko Maeno and Yoichiro Nara (2021) In vitro study	Examine the bonding states of class 2 direct resin composite restoration applied by various incremental techniques.	Three types of resin composites, namely, bulk-fill (B), flowable (F), and conventional resin composite (C), were applied to standardized class 2 cavities by incremental techniques with single- or bi-resin restoratives. After cyclic loading, the micro-tensile bond strength (μ-TBS) of the dentin cavity floor was measured. The Weibull modulus and Weibull stress values at 10%/90% probability of failure were analyzed.	Single-resin incremental restorations with B or F and bi-resin incremental restorations with F + B and F + C demonstrated superior μ-TBS (quantitative ability), bonding reliability, and durability (qualitative ability) compared with the single-resin restoration with C (as control). Furthermore, F + B and F + C restoration yielded an excellent performance compared with the single-resin restorations with B, F, and C.	In particular, the F + C restoration, which indicates not only the maximum mean μ-TBS, but also the highest values of the Weibull parameters, may be the optimal restoration method, including the esthetic benefits.
4/ Comparing the Ability of Various Resin-Based Composites and Techniques to Seal Margins in Class-II Cavities (13) Abdullah Saleh Aljamhan, Sultan Ali Alhazzaa,	Assess the ability of various dental RBCs (Resin-based composites)) and techniques utilized for sealing deep dentin margin in class-II cavities	Box-cavities (class-II) on extracted (premolar) teeth were prepared with a gingival margin placed 1mm apical to the cemento-enamel junction. Four study groups according to the type of restorative materials (conventional RBC; bulk-fill RBC; conventional RBC lined with flowable RBC and conventional RBC lined with resin-modified glass-ionomer-cement (GIC) as open sandwich-technique). Each group was further subdivided into a total-etch subgroup in which a	The least dye penetration values were reported for group 4 (GIC) followed by the group Bulk-fill using the self-etch adhesive system (group 2b). The highest dye penetration was reported for the group Bulk-fill using the total-etch adhesive system (2a), followed by the group	The self-etch adhesive system significantly reduced the micro-leakage compared to the total-etch system. Bulk-fill RBC when bonded with the self-etch adhesive provided good marginal sealing ability comparable to open sandwich-technique using GIC.

Abdulrahman Hamoud Albakr, Syed Rashid Habib and Muhammad Sohail Zafar (2021) In vitro study		separate etching step was performed before applying the bonding agent and a self-etch subgroup in which a self-etch adhesive system was used (n = 10. The specimen teeth were sectioned for further microscopic examination for micro-leakage.	conventional RBC using the total-etch adhesive system). The total-etch adhesive system had significantly greater micro-leakage compared to the self-etch adhesive system (1a) (p = 0.026	
5/ Interfacial Stress and Bond Strength of Bulk-Fill or Conventional Composite Resins to Dentin in Class II Restorations (3) Júlio César Lemos Duarte , Ana Rosa Costa , Crisnicaw Veríssimo , Renata Webster Duarte4 , Saturnino Calabrez Filho , Ana Maria Spohr , Gilberto Antonio Borges , Lourenço Correr-Sobrinho (2020)	Evaluate the microtensile bond strength (μTBS) to dentin and interfacial stress in a class II cavity restored with bulk-fill or conventional composite resins and the margin interfaces.	Vertical slot class II cavities in the mesial face, with the gingival end in dentin, were prepared in 72 third molars, being divided into groups (n=24): G1-Tetric N-Ceram; G2-Tetric N-Ceram Bulk-Fill; G3-SonicFill. Clearfil SE Bond adhesive system was used in all groups. Half of the teeth in each group (n=12) were submitted to thermo-mechanical cycling (TMC). Restored teeth (n=9) were cut perpendicular to obtain beams, which were submitted to a μTBS test in an EMIC machine. The cervical margins in dentin of the restored teeth (n=3) were assessed using SEM through epoxy resin replicas as well as the section of the restoration. Interfacial stresses after load application were calculated by 2D finite element analysis.	Interfacial stress (MPa) was 4.4 for SonicFill, 3.9 for Tetric N-Ceram, and 3.5 for Tetric N-Ceram Bulk-Fill. SEM images showed continuous margins for all composite resin restorations.	SonicFill obtained a slightly higher interfacial stress and lower bond strength to dentin in comparison with Tetric N-Ceram and Tetric N-Ceram Bulk-Fill. Continuous margin interfaces were obtained for Tetric N-Ceram, Tetric N-Ceram Bulk-Fill, and SonicFill. However, voids were observed in the SonicFill restorations.

In vitro study				
6/Tridimensional Evaluation of the Interfacial Gap in Deep Cervical Margin Restorations: A Micro-CT Study (18) Nicolas Scotti, Mario Alovisi, Riccardo Michelotto Tempesta, Damiano Pasqualini (2020) In vitro study	Perform a tridimensional interfacial gap evaluation of class II cavities with enamel and dentin cervical margins, before and after cyclic fatigue, restored with different nanohybrid resin composites.	Standardized class II cavities were performed on 48 intact maxillary premolars, placing the mesial cervical margin 1 mm above the cement-enamel junction (CEJ) and the distal cervical margin 1 mm below the CEJ. Specimens were treated with two-step self-etch adhesive (Clearfil SE Bond2) and divided into six groups according to the restoration technique. Microcomputed Tomography imaging was executed before and after 1,000,000 cycles of chewing simulation at 50 N. Tridimensional interfacial gaps, expressed as cubic millimeters, were analyzed through a standardized software flowchart (Mimics). Data were analyzed with a two-way analysis of variance and Tukey post hoc tests (a=0.05).	Restoration technique (p=0.001) and chewing simulation (p=0.00001) significantly influenced interfacial gap on dentin but not on enamel. The post hoc test showed that, on dentin margins, flowable resins had a lower gap at baseline but a higher gap after chewing simulation, especially when a 2-mm-thick layer was applied, compared with nanohybrid and bulk-fill composites.	Based on the obtained results, no differences in interfacial gap volume were found on enamel margins. On dentin margins, flowable resins showed better marginal seal at baseline, but they seem to be more prone to interfacial degradation during chewing simulation than traditional composites.
7/ Clinical Evaluation of Noncarious Cervical Lesions of Different Extensions Restored With Bulk-fill or Conventional Resin Composite:	Influence of the occlusogingival distance (OGD) of noncarious cervical lesions (NCCLs) on the clinical performance of a regular bulk-fill resin	A total of 140 restorations were randomly placed in 77 participants by one operator. NCCLs were divided into four groups (n=35) according to OGD (1.5 mm610% or 3 mm610%) and resin composites (Filtek Bulk Fill Posterior [B] or Filtek Z350 XT [C]) used: 1.5 mm-B, 1.5 mm-C, 3 mm-B, and 3 mm-C. A two-step self-etch adhesive (Clearfil SE Bond) was applied. Clinical	Two restorations were lost at 12 months (1 for 1.5 mm-B and 1 for 3 mm-B). The retention rates at 12 months were 100% for 1.5 mm-C, 97% for 1.5 mm-B, 100% for 3 mm-C; and 97% for 3 mm-B, with no statistical difference	Both resin composites showed acceptable clinical performance, and the OGD of NCCLs did not influence the clinical performance of resin composite restorations after 12 months.

Preliminary Results of a Randomized Clinical Trial (22) AMO Correia ALB Jurema MR Andrade ALS Borges E Bresciani TMF Caneppele24 (2020) Randomized Clinical Trial	composite and a regular nanofilled resin composite.	evaluation was performed at baseline (7 days), 6 months, and 1 year by two calibrated examiners. Fractures/retention, marginal staining, marginal adaptation, recurrence of caries, anatomic form, postoperative sensitivity, and surface texture.	among the groups (p=0.570). At 12 months, a statistically significant difference was found among the follow-up times for the same group (1.5 mm-B, 1.5 mm-C, and 3 mm-B) regarding the marginal staining (worse after 12 mon ths)criterion; moreover, the 3 mm-C group showed a significant difference from 6 months. No significant difference was found for the other parameters.	
8/ Efficacy of Direct Restorative Materials in Proximal Box Elevation on the Margin Quality and Fracture Resistance of Molars Restored With CAD/CAM Onlays (28) TD Grubbs M Vargas J Kolker EC Teixeira24	Investigate the effect of four direct restorative materials that can be used in the proximal box elevation (PBE) technique.	Seventy-five molar teeth were randomly assigned to one of five groups (n=15): *type II glass ionomer (GI), type II resin-modified glass ionomer (RMGI), resinbased composite (RBC)*, bulk-fill (BF) resinbased composite, and a control with no box elevation procedure. Specimens were prepared for a standard mesio-occlusal-distal, computer-aided design/computer-aided manufactured (CAD-CAM) resin, nanoceramic onlay with mesial cervical margins located 1 mm above the cementoenamel junction (CEJ) and distal cervical margins located 2 mm below	For dentin margins, a statistically significant difference was detected between the RMGI and control groups at baseline (p=0.0442). All other groups—GI, RBC, and BF—showed no difference from the control at baseline (p.0.05). No statistical significance was observed among groups for post-cyclic fatigue (p=0.8735). For onlay margins, no	Within the parameters of this study, after mechanical fatigue, the materials used for PBE: RMGI, RBC, and BF, did not influence results in terms of margin quality and fracture resistance. Therefore, collective findings suggest that these materials might be suitable for PBE procedures. Nevertheless, clinical caution is recommended

(2020) In vitro study		the CEJ. PBE was used to elevate the distal margins to 1 mm above the CEJ in all groups except the control group. For the control group the onlay margin was placed directly on the prepared distal tooth structure without PBE. A Lava Ultimate CAD/CAM resin, nanoceramic onlay restorative was manufactured and bonded on all specimens with RelyX Ultimate adhesive resin cement. The quality of the tooth-PBE material and PBE material-onlay interface was evaluated.. In addition to margin quality, the fracture resistance of each group was measured using a universal testing machine. Fracture pattern was recorded by visual examination.	statistical significance was observed among groups for pre-cyclic fatigue, post-cyclic fatigue, or change (p=0.9713, p=0.528, p=0.4385, respectively). No significant difference was observed for the fracture resistance among groups or for the type of break by material used (p=0.1593, p=0.77, respectively).	with any PBE procedure and further testing of GI materials is needed.
9/ No correlation between two methodological approaches applied to evaluate cervical margin relocation (27) Jelena JULOSKI, Serhat KÖKEN1 and Marco FERRARI	The study evaluated the quality of gingival margins created by cervical margin relocation (CMR) technique using different materials.	Mesio-occlusal-distal cavities with subgingival proximal margins were prepared. Mesial margins were elevated supragingivally with total-etch adhesive and flowable composite (Group 1) or with universal adhesive and bulk-fill flowable composite (Group 2). Distal margins were not elevated. Teeth were restored with CAD/CAM overlays. Marginal quality was evaluated by microleakage test and SEM observation of epoxy resin replicas.	Statistical analyses showed no significant correlations between microleakage scores and percentage of marginal integrity observed under SEM at CMR margins, lower microleakage scores at margins without CMR compared to CMR margins, lower microleakage scores in Group 2 than in Group 1 and no difference	1. CMR seems to provide less adequate seal of the margin than the one achieved by cementing the restoration directly to dentin without CMR. 2. The sealing ability of the marginal interface depends on the adhesive materials used for performing CMR. 3. Differences in the quality of the marginal adaptation between two

(2020) In vitro study			in SEM integrity between groups at CMR margins.	different materials used for CMR could not be detected by SEM observations. 4. SEM examination of the marginal adaptation does not allow for the predictions of the functional sealing of the margins.
10/ Volumetric Cuspal Deflection of Premolars Restored With Different Paste-like Bulk-fill Resin Composites Evaluated by Microcomputed Tomography (12) G Demirel IH Baltacioglu ME Kolsuz M Ocak B Bilecenoglu K Orhan26 (2020) In vitro study	Measure the volumetric cuspal deflection of premolars restored with different paste-like bulk-fill resin composites using microcomputed tomography (micro-CT).	A total of 35 freshly extracted human maxillary second premolars were selected for this study. Standardized large MOD cavities were prepared in each premolar with a bucco-lingual width of 4 mm and a cavity depth of 4 mm measured from the palatal cusp tip. Four groups received different paste-like bulk-fill composites-Beautifil-Bulk Restorative *(BBR)*, Admira Fusion x-tra *(AFX)*, *x-tra fill*, and *Sonic Fill*-and the control group received a conventional universal composite and Clearfil Majesty Esthetic (CME The buccal and palatal regions of each restoration were evaluated separately in terms of cuspal deflection.	Multiple comparisons showed that teeth restored with the conventional paste-like composite and CME (control) had significantly different cuspal deflection from those filled with paste-like bulk-fill composites (p,0.05). Among the bulk-fill composites, a significant difference was observed between BBR and AFX (p,0.05).	Paste-like bulk-fill resin composites had significantly lower cuspal deflection than the conventional paste-like resin composite tested.

11/ Comparison of marginal adaptation of Class II cavities restored with bulk-fill and conventional composite resins using different universal bonding agent application strategies (30) Soodabeh Kimyai, Mahdi Rahbar, Atefeh Ebrahimi, Saeedeh Asdagh (2020) In vitro study	compare the effect of universal bonding application strategy (i.e., self-etch and etch-and-rinse) on marginal adaptation of bulk-fill and conventional composite resins in Class II restorations.	In this in vitro study sixty sound premolars extracted for orthodontic reasons were selected. The samples were allocated to four groups based on the universal bonding application strategy (self-etch and etch and rinse) and type of composite (bulk-fill and conventional). Finally, the marginal adaptation of the samples was evaluated under a stereomicroscope.	Considering the type of universal bonding application strategy, there was a statistically significant difference in marginal adaptation. Etch-and-rinse strategy showed better marginal adaptation compared to self-etch strategy ($P < 0.001$). However, there was no statistically significant difference in marginal adaptation between the two composite resins ($P = 0.829$). Furthermore, the interaction between the two factors (type of universal bonding application strategy and type of composite resin) was not statistically significant ($P = 0.629$).	Etch-and-rinse bonding application strategy in both the bulk-fill and conventional composite resins exhibited better marginal adaptation compared to self-etch bonding application strategy. However, the difference of marginal adaptation between the two types of composite resins (bulk and conventional) was not significant.
12/ Clinical Evaluation of Bulk-Fill Resins and Glass Ionomer Restorative Materials: A 1-Year Follow-Up Randomized Clinical Trial in Children	Evaluate the clinical performance of different restorative materials in primary molars with class II carious lesions.	A total of 160 class II carious lesions (with radiographic involvement of the outer half of dentin) in 30 patients were randomly divided into four groups and restored with a glass ionomer restorative system (Equia™), two different bulk-fill composites (Sonicfill™ and X-tra fil™), and a nanohybrid	After 1 year, 134 restorations were evaluated in 26 patients. Equia was statistically less successful than the other restorative materials in marginal adaptation and retention criteria ($P < 0.05$).	The bulk-fill and conventional composites exhibited good clinical performance, and Equia exhibited minor changes over the 1-year trial period.

(14) H Akman, G Tosun (2020) Randomized Clinical Trial		composite (Filtek Z550™). The restorations were clinically and radiographically evaluated at the baseline, and 3, 6, and 12 months according to the modified United States Public Health Service criteria. Statistical analyses were performed using Pearson's Chi-square and McNemar tests.	However, no material was found to be superior to the others over the study period in marginal discoloration, color matching, secondary caries, anatomical form, and postoperative sensitivity ($P > 0.05$).	
13/ Fracture resistance of pulpotomized and composite-restored primary molars: Incremental versus bulk-fill techniques (21) Masoud Fallahinejad Ghajari, Amir Ghasemi, Arash Yousefi Moradi, Khashayar Sanjari (2020) In vitro study	Assess the fracture resistance of pulpotomized primary molars restored with incremental and bulk-fill composite application techniques.	36 extracted primary molars were nonrandomly (selectively) divided into three groups of 12 each. All teeth underwent conventional pulpotomy treatment,. The teeth were then restored as follows: Group 1 (control) was restored with amalgam, Group 2 was restored with Tetric N-Ceram composite using the incremental technique, and Group 3 was restored with Tetric N-Ceram composite using the bulk-fill technique.	The mean fracture resistance was 1291.47 ± 603.88 N in the amalgam, 1283.08 ± 594.57 N in the Tetric N-Ceram incremental, and 1939.06 ± 134.47 N in the Tetric N-Ceram bulk-fill group. The difference in this regard between Group 3 and Groups 1 and 2 was statistically significant ($P = 0.019$ and $P= 0.035$, respectively).	Bulk-fill composite is recommended for reinforcing the remaining tooth structure after the primary molar pulpotomy procedure. Time-saving characteristics of this material are clinically important for reducing appointment time for children.

14/ Effect of Different Application Techniques of Universal Bonding System on Microtensile Bond Strength of Bulk-Fill Composites to Primary and Permanent Dentin (29) Fallahinejad Ghajari, Masoud, Sheikholeslamian, Mahsa, Ghasemi, Amir, Simaei, Leila (2020) In vitro study	Determine the microtensile bond strength (μTBS) of a bulk-fill composite to permanent and primary coronal dentin using a universal adhesive in self-etch and total-etch modes.	52 occlusal dentinal surfaces of human primary and permanent teeth. The crowns were cut to the gingival level. The 48 prepared dentin sections were randomly assigned to the following groups (n=13): A: Primary/Total-etch, B: Primary/Self-etch, C: Permanent/Total-etch, and D: Permanent/Self-etch. In groups A and C, after etching for 15 seconds, two layers of a universal bonding (Futurabond U) were applied and cured for 10 seconds. All samples were filled with a bulk-fill composite (x-trafil; VOCO) and cured for 40 seconds.	The mean μTBS was as follows: A: 15.03±2.0279, B: 11.11±2.4423, C: 23.50±4.8165, and D: 16.26±6.3200 MPa. Futurabond U showed a higher μTBS in the total-etch mode (P<0.001). The permanent teeth had greater μTBS than the primary teeth (P<0.001). Similar percentages of failure modes were observed in the total-etch groups but in the self-etch groups, most failures were in the form of adhesive and mixed.	Greater μTBS was observed in the permanent teeth with the total-etch technique.
15/ Shortening of etching time of the dentin in primary teeth restorations: a randomized clinical trial (31)	Investigate the influence of shortening of etching time for dentin on the restoration survival after selective carious tissue removal in primary molars.	Sixty-two subjects (5-8 year-old) and 100 primary molars presenting moderate dentin carious lesions on occlusal surface. The sample was randomly assigned into groups previously to adhesive application (Adper Single Bond 2; 3M ESPE): etching time recommended by manufacturer (15 s) or reduced (7 s). Resin composite (Filtek Bulk Fill Posterior Restorative; 3M	The etching time did not influence the restorations' survival (HR 0.35 95%CI 0.11-1.12; p = 0.06). Mean estimated time of survival was 17.6 months (95%CI, 17.2-17.9). The survival rates at the 18-month follow-up were	The etching time for dentin did not influence the clinical behavior of adhesives restorations. However, there was a tendency for better clinical outcome when using etching time of 7 s.

Cleber Paradzinski CAVALHEIRO(a) Pablo Soares de SOUZA(b) Djessica PEDROTTI(a) Luciano CASAGRANDE(c) Thiago Machado ARDENGHI(d) Rachel de Oliveira ROCHA(d) Daniela Prócida RAGGIO(d) Tathiane Larissa LENZI(c) (2020) Randomized clinical trial		ESPE) was inserted in a single increment for all restorations. Restorations were evaluated at 1, 6, 12, and 18 months using FDI criteria. Survival estimates for restorations' longevity were evaluated with Kaplan-Meier method.	75.7% and 91.4% (AFR: 16.9% and 5.7%) when primary dentin was acid etched for 15 and 7 s, respectively (log-rank p = 0.06).	
16/ Margin Integrity of Bulk-Fill Composite Restorations in Primary Teeth (11) Alina Paganini, Thomas Attin and Tobias T. Tauböck (2020)	This in vitro study examined the margin integrity of sculptable and flowable bulk-fill resin composites in Class II cavities of primary molars.	Standardized Class II cavities were prepared in human primary molars and restored with the following resin composite materials after application of a universal adhesive: a sculptable bulk-fill composite (Tetric EvoCeram Bulk Fill (TEC) or Admira Fusion x-tra (AFX)), a flowable bulk-fill composite (Venus Bulk Fill (VBF) or SDR), or a conventional composite (Filtek Supreme XTE (FS)). The bulk-fill materials were applied in 4 mm layers, while the conventional composite was applied in either 2 mm (FS2, positive control) or 4 mm layers (FS4, negative control). The	All composites showed a significant decline in margin integrity after TML. AFX exhibited the significantly highest margin integrity of all materials after TML (97.5 ± 2.3%), followed by FS2 (79.2 ± 10.8%), TEC (73.0 ± 9.1%), and FS4 (71.3 ± 14.6%). SDR (43.6 ± 22.3%) and VBF (25.0 ± 8.5%)	The tested sculptable bulk-fill materials show similar or better margin integrity in primary molars than the conventional resin composite placed in 2 mm increments.

In vitro study		percentage of continuous margins (margin integrity) was statistically analyzed ($\alpha = 0.05$).	revealed the lowest margin integrity.	
17/ Evaluation of polymerization shrinkage of bulk-fill resin composites using microcomputed tomography (19) Kadriye Aybüke Ersen & Özge Gürbüz & Mutlu Özcan (2020) In vitro study	This study evaluated the influence of cavity depth on polymerization shrinkage of bulk-fill resin composites with and without adhesive resin.	Standardized box-shaped cavities (width, 4 mm; length, 5 mm, depth, 2 mm or 4 mm) were made on occlusal surfaces of extracted human third molars (N = 60). The teeth were assigned to 3 groups to receive bulk-fill resin composites (low-viscosity bulk-fill, SDR; high-viscosity bulk-fill; Filtek Bulk-Fill—FB; and TetricEvo Ceram Bulk-Fill—TB) in the prepared cavities with and without adhesive resin (Clearfil S3 Bond). Each specimen (n = 5 per group) was scanned twice using microcomputed tomography (micro-CT): once after application of the resin composite to the cavity prior to polymerisation and once after polymerisation.	The material type ($p < 0.05$), application of adhesive resin ($p < 0.05$) and cavity depth ($p < 0.05$) significantly affected the shrinkage values. The interaction terms were also significant ($p < 0.05$). All the bulk-fill resin composites tested showed significantly less shrinkage when applied in cavities with adhesive resin (0.94–2.55) compared with those without (2.01–3.45) ($p < 0.05$) and presented significantly more shrinkage after polymerisation ($p < 0.05$). At a 2-mm cavity depth without (2 mm, 2.28; 4 mm, 2.41) and with adhesive (2 mm, 0.94; 4 mm, 1.67), significantly less shrinkage was observed with FB compared with SDR and TB ($p < 0.05$). At a 4-mm cavity depth without (3.14)	The bulk-fill composites tested presented less shrinkage when used in conjunction with adhesive resin application on dentin. Overall, the low-viscosity bulk-fill resin SDR showed more shrinkage compared with high-viscosity resins tested. Clinical relevance: Low- or high-viscosity bulk-fill resin composites should be applied on dentin after application of adhesive resin to decrease shrinkage.

			and with adhesive (2.55), SDR showed significantly higher shrinkage compared with FB and TB ($p < 0.05$).	
18/ One-year clinical evaluation of bulk-fill flowable vs. regular nanofilled composite in non-carious cervical lesions (23) Gabriela D. Canali1 & Sergio A. Ignácio & Rodrigo N. Rached1 & Evelise M. Souza (2019) Double-blind randomized clinical trial	Evaluate the 1-year clinical performance of a bulk-fill flowable and a regular nanofilled composite in non-carious cervical lesions (NCCLs).	Twenty-two subjects with at least two NCCLs were enrolled in the study. A total of 89 restorations were performed by a single operator using Filtek Supreme (FS) Ultra Universal or Filtek Bulk (FB) Fill Flowable. A universal adhesive (Scotchbond™ Universal Adhesive) was used with a self-etching approach in dentin. The restorations were evaluated by two independent and previously calibrated examiners at baseline (7 days), 6 months and 1 year, according to the USPHS modified criteria.	One restoration was considered clinically unacceptable due to loss of retention after 6 months in the FS group. FS presented statistically high scores for surface roughness when compared to FB after 1 year ($p < 0.05$), but both were considered clinically acceptable. After 1 year, the frequency of clinically unacceptable rates was 3.3% for anatomical form in the FB group, 1.1% for retention in the FS group, and 2.2% for marginal adaptation in both groups. All restorations, in both groups, presented score 0 over the 1-year period for marginal staining, postoperative sensitivity, and secondary caries.	Both composite resins showed acceptable clinical performances for the restoration of NCCLs after 1 year. Clinical relevance: Both bulk-fill flowable and regular nanofilled composites showed good clinical performances for the restoration of NCCLs.

19/ Fracture Resistance of a Bulk-Fill and a Conventional Composite and the Combination of Both for Coronal Restoration of Severely Damaged Primary Anterior Teeth (26) Shahram Mosharrafian, Maryam Shafizadeh, Zeinab Sharifi (2019) In vitro study	Compare the fracture resistance of a bulk-fill and a conventional composite and a combination of both for coronal restoration of severely damaged primary anterior teeth.	45 primary anterior teeth were randomly divided into three groups. After root canal preparation, the canals were filled with Metapex paste such that after the application of 1 mm of light-cure liner, 3 mm of the coronal third of the canal remained empty for composite post fabrication. Filtek Z250 conventional composite was used in group 1, Sonic-Fill bulk-fill composite was used in group 2 and Sonic-Fill with one layer of Filtek Z250 as the veneering were used in group 3. Adper Single Bond 2 was used in all groups. Fracture resistance was measured by a universal testing machine. The mode of fracture was categorized as repairable or irreparable.	The mean fracture resistance was 307.00±74.72, 323.31±84.28 and 333.30±63.96 N in groups 1 to 3, respectively (P=0.55). The mean fracture strength was 14.53±2.98, 15.08±2.82 and 15.26±3.02 MPa in groups 1 to 3, respectively (P=0.77). The frequency of repairable mode of failure was 80% for the conventional, 73.6% for the bulk-fill and 80% for the bulk-fill plus conventional group, with no significant difference (P>0.05).	Bulk-fill composites can be used for coronal reconstruction of severely damaged primary anterior teeth similar to conventional composites to decrease the treatment time in pediatric patients.
20/ Flowable Bulk-Fill Materials Compared to Nano Ceramic Composites for Class I Cavities Restorations in Primary Molars: A Two-Year Prospective Case-Control Study	The aim of this split-mouth study is to compare the results of 24 months' clinical performance of primary molar Class I restorations with a nano-ceramic composite, Ceram•X mono (Dentsply)	Following the ethical approval, 27 patients with at least two class I cavities in primary molars were included in the study. A total number of 54 restorations were conducted (n = 27 for Ceram X and n = 27 for SDR). Restorations were evaluated at baseline, 6, 18, and 24 months, according to the modified Ryge criteria. The cavosurface marginal discoloration and color match were evaluated visually	At 24 months' follow-up, 54 restorations showed similar clinical performance. The statistical analysis did not reveal any statistical significance in the values between the groups in 7 out of 7 modified Ryge criteria. However, two restorations in both	Restorations with both materials (Ceram•X mono and SDR) have provided almost identical results.

(10) Sarapultseva, Maria Sarapultseva, Alexey (2019) split-mouth study	with a flowable bulk-fill material regular viscosity, SDR (Dentsply).	after air-drying the tooth and after removing the plaque (if necessary).	groups received Bravo ratings in the cavosurface marginal discoloration scoring. No side effects were reported by the participants of the study.	
21/ One-year Clinical Performance of Flowable Bulk-fill Composite vs Conventional Compomer Restorations in Primary Molars. (20) Ehlers, Vicky Callaway, Angelika Azrak, Birgül Ernst, Claus-Peter (2019) Randomized clinical trial	Evaluate the clinical performance of a flowable bulk-fill composite vs a compomer in Class II cavities of primary molars.	In a clinical study, 100 restorations were placed in two randomly assigned comparable Class II cavities in 32 children (aged 6.7 ± 1.2 years) with at least one bulk-fill composite (Venus Bulk Fill, Heraeus Kulzer) and one compomer (Dyract eXtra, Dentsply). After caries excavation, the adhesive Scotchbond Universal (3M Oral Care) was applied in self-etching mode. According to the manufacturer's instructions, Venus Bulk Fill was used for the entire Class II cavity of primary molars without a cover layer. Both restorative materials were evaluated at baseline and after one year, including esthetic, functional, and biological parameters, using the FDI criteria.	After one year, 99 restorations were reevaluated; one tooth had exfoliated physiologically. Concerning the esthetic parameters, Dyract eXtra showed slightly higher scores than Venus Bulk Fill. Both materials showed similar scores regarding functional and biological parameters. No severe postoperative sensitivities or side-effects were reported. There was no statistically significant difference between the performance of Venus Bulk Fill and Dyract eXtra for primary molars.	The flowable bulk-fill composite Venus Bulk Fill can be considered as an alternative material for clinical use in primary teeth, but longer-term studies might still be needed.

22/ A randomized, prospective clinical study evaluating effectiveness of a bulk-fill composite resin, a conventional composite resin and a reinforced glass ionomer in Class II cavities: one-year results (15) Hacer BALKAYA1 Soley ARSLAN Kanşad PALA (2019) Randomized clinical trial	Evaluate the clinical performance of a highly viscous reinforced glass ionomer material, a bulk-fill composite resin and a micro hybrid composite resin in Class II restorations.	In total, 109 Class II restorations were performed in 54 patients using three different restorative materials: Charisma Smart Composite (CSC); Filtek Bulk Fill Posterior Restorative (FBF); Equia Forte Fil (EF). Single Bond Universal adhesive (3M ESPE, Germany) was used with composite resin restorations. The restorations were evaluated using modified USPHS criteria in terms of retention, color match, marginal discoloration, anatomic form, contact point, marginal adaptation, secondary caries, postoperative sensitivity and surface texture.	At the end of one year, 103 restorations were followed up. No changes were observed during the first 6 months. At the end of one year, there were small changes in composite restorations (FBF and CSC) but no statistically significant difference was observed between the clinical performances of these materials for all criteria ($p>0.05$). However, there was a statistically significant difference between EF, FBF and CSC groups in all parameters except marginal discoloration, secondary caries and postoperative sensitivity in one-year evaluation ($p<0.05$).	Bulk-fill composite resins and conventional composite resins showed more successful clinical performance than highly viscous reinforced glass ionomers in Class II cavities.
23/ Adhesiveness of bulk-fill composite resin in permanent molars submitted to Streptococcus mutans biofilm	Evaluate the microtensile bond strength and the microleakage of a bulk-fill composite resin compared with a conventional incremental composite	Permanent human third molars (n = 60) with an occlusal cavity of 5x3x2 mm were randomly allocated into four subgroups of restorative treatments: conventional composite resin with (n = 15) and without (n = 15) cariogenic challenge (Z350-E and Z350-C experimental and control groups,	Filtek Z350 XT resin presented higher microtensile bond strength than Bulk Fill resin without (19.02 ± 4.90 and 8.76 ± 3.94MPa, respectively; $p < 0.001$) and with cariogenic challenge	The conventional composite resin had higher microtensile bond strength than the bulk-fill resin, but both resin types had similar adhesion quality and microfiltration scores.

(17) Tatiana Kelly da Silva FIDALGO(a) Gabriela AMERICANO(a) Debora MEDINA(a) Glaucia ATHAYDE(a) Aline dos Santos LETIERI(b) Lucianne Cople MAIA (2019) In vitro study	resin, in permanent molars and under cariogenic challenge using a Streptococcus mutans model.	respectively), and bulk-fill composite resin with (n = 15) and without (n = 15) cariogenic challenge (Bulk Fill-E and Bulk Fill-C, respectively). Ten specimens from each subgroup were submitted to microtensile strength, and 5, to microleakage. The cariogenic challenge was conducted using the Streptococcus mutans strain (ATCC) for 7 days. The stickers obtained (1 x 1 x 2 mm) were submitted to a microtensile strength test, followed by classification of the fracture mode. Microleakage was performed using a scoring system.	(22.69 ± 7.86 and 13.31 ± 3.38MPa, respectively; $p < 0.02$). Z350-C and Bulk Fill-C resins presented a higher prevalence of mixed fractures (23 and 14%, respectively) in the specimens submitted to cariogenic challenge than those of the control groups, whereas microleakage was similar ($p = 0.85$).	
24/ New material perspective for endocrown restorations: effects on mechanical performance and fracture behavior (25) José Augusto SEDREZ-PORTO(a) Eliseu Aldrighi MÜNCHOW(b) Lisia Lorea VALENTE(a) Maximiliano	Investigate the mechanical performance and the fracture behavior of endocrown restorations prepared using distinct restorative materials.	A total of 42 sound molars with similar crown size and shape were cut at 2 mm above the cementoenamel junction and endodontically treated. They were categorized according to the restorative material used to fabricate endocrown restorations (n=7), namely, conventional composite (Filtek™ Z350 XT), bulk fill composite (Filtek™ Bulk Fill), conventional composite modeled using resin adhesives (SBMP: Scotchbond™ Multipurpose Adhesive; or SBU: Scotchbond™ Universal Adhesive), and IPS e.max lithium disilicate (Ivoclar Vivadent; positive control). Unprepared sound teeth were used as negative control. All endocrowns	The endocrowns did not fracture or de-bond upon fatigue, showing similar load-to-fracture and work-of-fracture values, regardless of the restorative material ($p > 0.05$). The endocrowns fabricated by combining Z350 and SBMP had the least harsh fractures, in contrast to endocrowns prepared using Z350 only, which exhibited an equilibrium between	Dental practitioners may satisfactorily restore severely damaged nonvital teeth using the endocrown technique. Composite endocrowns prepared using resin adhesive as modeler liquid or using bulk fill material may result in less aggressive failures, thus providing a new material perspective for endocrown restorations.

Sergio CENCI(a) Tatiana PEREIRA-CENCI(a) (2019) In vitro study		were bonded using a self-adhesive cement (Rely-X™ U200	repairable and irrepairable fractures. The e.max endocrowns exhibited more aggressive failures (root fracture) than other groups, resulting in higher rates of irrepairable fractures.	
25/ Fracture Resistance of Endodontically Treated Maxillary Premolars Restored With Different Methods (24) VA Mergulha˜o LS de Mendonc¸a MS de Albuquerque R Braz37 (2019) In vitro study	Evaluate the resistance and patterns of fracture of endodontically treated maxillary premolars (ETPs) restored with different methods.	Mesio-occluso-distal cavities were prepared in 50 extracted caries-free human maxillary premolars after endodontic treatment. The teeth were divided into five groups (n=10), according to the restorative method. G1: intact teeth (control group); G2: conventional composite resin; G3: conventional composite resin with a horizontal glass fiber post inserted between buccal and palatal walls; G4: bulk-fill flowable and bulk-fill restorative composites; and G5: ceramic inlay. For direct restorations, Filtek Z350 XT, Filtek Bulk Fill Flowable Restorative, and Filtek Bulk Fill Posterior Restorative were used. Indirect restorations were fabricated from a pressable lithium disilicate glass-ceramic (IPS e-max Press) and adhesively cemented (RelyX Ultimate).	All specimens survived fatigue. Mean (standard deviation) failure loads (N) for groups were as follows: G1: 949.6 (331.5); G2: 999.6 (352.5); G3: 934.5 (233.6); G4: 771.0 (147.4); and G5: 856.7 (237.5). The lowest fracture resistance was recorded for G4, and the highest ones were recorded for G2, followed by that of G1 and G3. One-way ANOVA did not reveal significant differences between groups (p.0.05). The highest repairable fracture rates were observed in G1 (100%) and G3 (80%).	ETPs restored with conventional composite resin with or without horizontal fiber post, bulk-fill composite, and ceramic inlay showed fracture resistance similar to that of sound teeth. Conventional composite resin restorations exhibited the highest prevalence of unrepairable fractures, and the insertion of a horizontal fiber post decreased this prevalence. Intact teeth showed 100% of repairable fractures. It is difficult to extrapolate the results directly to a clinical situation due to the limitations of this study.