Universidade do Estado do Rio de Janeiro
Centro Biomédico
Faculdade de Odontologia

Roberta Costa Jorge

Hipomineralização Molar-Incisivo: avaliação da ocorrência de fratura pós-eruptiva e da retenção de selante de fóssulas e fissuras

Rio de Janeiro
2021

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Tese apresentada, como requisito parcial para obtenção do título de Doutor ao Programa de Pós-graduação em Odontologia, da Universidade do Estado do Rio de Janeiro.
Área de concentração: Odontopediatria

Orientadora: Prof.ª Dra. Vera Ligia Vieira Mendes Soviero

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Aprovada em 28 de julho de 2021.

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Rio de Janeiro

2021

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RESUMO

JORGE, Roberta Costa. *Hipomineralização Molar-Incisivo: avaliação da ocorrência de fratura pós-eruptiva e da retenção de selante de fóssulas e fissuras.* 2021. 100 f. Tese (Doutorado em Odontologia) - Faculdade de Odontologia, Universidade do Estado do Rio de Janeiro, Rio de Janeiro, 2021.

A presente tese é composta por dois estudos. O primeiro, uma revisão sistemática, objetivou responder a pergunta: “Em dentes hipomineralizados (P), opacidades amarelo-amarronzadas (E) são mais propensas a fratura pós-eruptiva do esmalte (PEB) (O) comparadas com opacidades branco-cremes(C)?”. As bases MedLine, LILACS, BBO, Cochrane Library, Web of Science, Scopus, Embase, Google Scholar e OpenGrey foram exploradas. Seleção dos estudos, extração dos dados, e avaliação do risco de viés usando a ferramenta Newcastle-Ottawa Scale (NOS) foram realizadas de forma independente e em duplicata. A certeza da evidência foi avaliada segundo o GRADE. De 814 registros recuperados, 8 foram incluídos. A prevalência de PEB foi mais frequente em opacidades amarelo-amarronzadas. Os resultados sugerem que a cor das opacidades em dentes hipomineralizados pode mudar o risco de ocorrência de PEB. Porém a evidência é heterogênea e a certeza de evidência muito baixa. O segundo, um ensaio clínico controlado randomizado objetivou avaliar a retenção do selante de fóssulas e fissuras em primeiros molares permanentes (FPM) com HMI. Os pacientes foram alocados randomicamente em dois grupos: selante ionomérico (Equia Forte® – GC, Europa) e selante resinoso (FluroShield® – Dentisply Sirona, Brasil). A amostra foi composta por 42 crianças, com média de idade de 8,48 anos (±0,55), 20 meninas e 22 meninos. A taxa de sobrevivência dos selantes foi de 0,81 e 0,89 após 6 meses e 0,72 e 0,83 após 12 meses para os grupos RES e GIC, respectivamente. Não foi observada influência do tipo de dente, cor da opacidade ou escore de cárie. Os selantes GIC e RES em molares HMI apresentaram uma taxa de retenção semelhante após 12 meses. (p valor >0,05, Teste Qui-quadrado de Pearson).

Palavras-chave: Odontologia Preventiva. Selante de Fóssulas e Fissuras. Cárie Dentária. Hipoplasia do Esmalte Dentário. Opacidades de Esmalte.

ABSTRACT

JORGE, Roberta Costa. 2021. *Molar-Incisor Hypomineralization: evaluation of the occurrence of post-eruptive breakdown and retention of pit and fissure sealant.* 2021. 100 f. Tese (Doutorado em Odontologia) - Faculdade de Odontologia, Universidade do Estado do Rio de Janeiro, Rio de Janeiro, 2021.

This thesis comprises two studies. The first, a systematic review, aimed to answer the question: “In hypomineralized teeth (P), yellow-brown (E) opacities are more prone to post-eruptive enamel breakdown (PEB) (O) compared to creamy-white opacities (Ç)?". MedLine, LILACS, BBO, Cochrane Library, Web of Science, Scopus, Embase, Google Scholar and OpenGrey databases were explored. Study selection, data extraction, and risk of bias assessment using the Newcastle-Ottawa Scale (NOS) tool were performed independently and in duplicate. The certainty of the evidence was evaluated according to GRADE. Of 814 retrieved records, 8 were included. The prevalence of PEB was more frequent in yellow-brown opacities. results suggest that the color of opacities in hypomineralized teeth can change the risk of occurrence of PEB. However the evidence is heterogeneous and the certainty of evidence very low. The second, a randomized controlled clinical trial, aimed to evaluate the retention of pit and fissure sealant in first permanents molars (FPM) with HMI. Patients were randomly allocated into two groups: glass-coated sealant (Equia Forte® – GC, Europe) and resin sealant (FluroShield® – Dentisply Sirona, Brazil). The sample consisted of 42 children with a mean age of 8.48 years (±0.55), 20 girls and 22 boys. The survival rate of sealants was 0.81 and 0.89 after 6 months and 0.72 and 0.83 after 12 months for the RES and GIC groups, respectively. In the bivariate analysis, there was no influence of tooth type, opacity color or caries score. GIC and RES sealants on HMI molars showed a similar retention rate after 12 months. (p value >0.05, Pearson's chi-square test).

Keywords: Preventive Dentistry. Pit and Fissure Sealants. Dental Caries. Dental Enamel Hypoplasia. Enamel Opacities.

LISTA DE ABREVIATURAS E SIGLAS

ACTA	Academisch Centrum Tandheelkunde Amsterdam
EAPD	European Association of Paediatric Dentistry
FPM	First Permanents Molars
HMI	Hipomineralização Molar-Incisivo
HSPM	Hypomineralized Second Primary Molars
IDHM	Índice de Desenvolvimento Humano Municipal
MIH	Molar Incisor Hypomineralization
NOS	Newcastle-Ottawa Scale
PEB	Post-eruptive Enamel Breakdown
TCLE	Termo de Consentimento Livre e Esclarecido
UERJ	Universidade do Estado do Rio de Janeiro
UFRJ	Universidade Federal do Rio de Janeiro
UNIFASE	Centro Universitário Arthur Sá Earp Neto

SUMÁRIO

INTRODUÇÃO

Hipomineralização Molar-Incisivo

Definição

Hipomineralização Molar-Incisivo (HMI) é um defeito de desenvolvimento do esmalte dentário de origem sistêmica que afeta de um a quatro primeiros molares permanentes, podendo ou não estar presente nos incisivos permanentes(1). A HMI é caracterizada por opacidades demarcadas assimétricas, com coloração variando do branco-creme ao amarelo-amarronzado, presença de fratura pós-eruptiva do esmalte (*post-eruptive enamel breakdown* – PEB), restaurações atípicas e/ou ausência de um primeiro molar permanente(2). Segundo Weerherijm et al., 2003 (3), oito anos de idade é considerado o melhor momento para o diagnóstico da HMI, pois nesta idade, a maioria das crianças possuem todos os quatro molares permanentes em erupção, assim como os oito incisivos permanentes. A gravidade da HMI considera a integridade estrutural, estética e hipersensibilidade dentária; quadros leves são representados apenas pelas opacidades demarcadas, ausência de queixa estética e hipersensibilidade quando provocada, enquanto a perda de estrutura dentária, queixa estética e a presença de hipersensibilidade persistente são características dos quadros severos(4). A presença de hipomineralização em dentes decíduos, acomete mais comumente os segundos molares e foi denominada de Hypomineralized Second Primary Molars (HSPM)(5).

Prevalência e Etiologia

A prevalência da HMI no mundo tem variado de 2,8 a 40,2% (6–11), tendo como prevalência média global estimada de 13,1% e 14,2% (12,13). Zhao et al. (2018) analisaram 70 estudos de prevalência, de base populacional, e observaram que a America do Sul foi o Continente que apresentou a maior prevalência da HMI. Dos 70 estudos incluídos, sete estudos haviam sido realizados no Brasil, onde foi encontrada a segunda maior prevalência média a nível de país (19,9%) perdendo apenas para a Espanha (21,11%)(13). Fatores pré, peri e pós-natais como estresse e doenças na gravidez, prematuridade e baixo peso ao nascer, complicações ao

nascimento (ex. parto prolongado), episódios de febre alta, infecções e uso de antibióticos nos dois/três primeiros anos de vida, poluentes ambientais (dioxinas, policlorados, bisfenol A) e até predisposição genética são investigados como possíveis causas da hipomineralização do esmalte. Estes fatores provocariam um desequilíbrio na função dos ameloblastos durante a fase de mineralização e maturação do esmalte(14–20).

Aspectos estruturais e implicações clínicas

Autores de uma revisão sistemática publicada em 2017 com 15 estudos in vitro (total de 201 dentes) que avaliou dentes humanos extraídos diagnosticados com HMI, verificaram que o esmalte hipomineralizado apresenta menor densidade mineral (menor teor de Cálcio e Fósforo) e menor dureza e módulo de elasticidade, maior concontração de carbono, carbonato e conteúdo proteico; é mais poroso e menos mineralizado(21). Essas características estruturais justificam a tendência deste esmalte hipomineralizado fraturar-se logo após o estabelecimento do contato mastigatório(4,22–24).

A fratura pós-eruptiva do esmalte expõe a dentina subjacente e atua como um nicho para depósito de biofilme, favorecendo o desenvolvimento da lesão cariosa (1,2,4,25–27). As opacidades amarelo-amarronzadas são mais porosas e possuem menor densidade mineral(23,28). Estudos clínicos recentes mostraram que as opacidades amarelo-amarronzadas, costumam fraturar-se com maior frequência que as opacidades brancas, sugerindo que estas representam um quadro de maior gravidade(22,29–31). A evidência desta relação ainda não foi verificada em um estudo de revisão sistemática de estudos clínicos. A revisão sistemática realizada apenas com estudos in vitro aponta que os resultados ainda são ambíguos e limitados em relação à extensão da lesão da HMI no esmalte, e a associação entre o aspecto clínico e a gravidade do defeito(21).

Pacientes acometidos pela hipomineralização do esmalte, frequentemente, queixam-se de sensibilidade térmica e mecânica à escovação, dificultando a remoção de placa bacteriana no local, sendo um outro fator que contribui para o desenvolvimento da cárie dentária(22,32–34). Em crianças, tem sido observada uma associação significativa entre a ocorrência de cárie e defeitos de desenvolvimento do esmalte(22,26,35–37), acarretando num índice de cárie significativamente mais

alto e uma maior necessidade de tratamento restaurador (22,26,36–39). Por isso medidas preventivas que posterguem ou evitem a ocorrência de cárie e fraturas do esmalte, assim como reduzam a sensibilidade dentária fazem-se necessárias.

Selante de Fóssulas e Fissuras

Histórico e indicações

Sulcos e fissuras são áreas anatomicamente vulneráveis de acúmulo de biofilme e consequentemente para o desenvolvimento de lesões cariosas. No final do séxulo XIX e início do século XX surgiram propostas de erradicação das fissuras através da restauração dos sulcos e fissuras previamente ao estabelecimento de lesões de cárie(40). Esse uso “profilático” era altamente prejudicial, uma vez que promovia um grande desgaste da estrutura dentária sadia na busca da retentividade para restauração com amálgama; iniciando o processo restaurador e propagando o entendimento de que lesões de carie não são evitáveis(40).

Os selantes adesivos surgiram no final a década de 60(41), em substituição dos “selantes de amálgama” que exigiam a conformação da anatômica dos sulcos e fissuras para promover a retenção do material. Os primeiros materiais testados foram cimento de silicato, cimento de cobre, o cianoacrilato, e por fim as resinas Bis-GMA(42). Após o advento do selante de fóssulas e fissuras à base de resina, a utilização do ionômero de vidro isoladamente ou combinado com resina foi o principal destaque. (40).

A Odontologia contemporânea é adepta da filosofia de mínima intervenção, que visa garantir a preservação de estrutura dentária, evitando ao máximo a realização de intervenções restauradoras(43,44). Controlar o processo carioso através de medidas não-invasivas ou micro-invasivas, como o selamento de fóssulas e fissuras, permite o adiamento da realização de restaurações, que muitas vezes, representam o início de um ciclo restaurador repetitivo(45). Este cenário é ainda mais preocupante quando se trata de dentes com HMI. Lygidakis et al. (2010)(4) recomendam o uso de selante de fóssulas e fissuras em molares permanentes com HMI leve a fim de proteger a área do esmalte afetada pela hipomineralização.

Atualmente o selante de fóssulas e fissuras é indicado quando há presença de cárie não cavitada ou microcavitada em superfície oclusal(46,47) ou julgamento clínico de risco aumentado ao desenvolvimento de cárie a nível do dente ou paciente, como por exemplo morfologia dentária, experiência pregressa de cárie, acúmulo de biofilme atual e a exposição a fluoretos(48,49).

Taxa de Retenção

Em dentes sadios, a taxa de retenção do selante de fóssulas e fissuras resinoso sobre a superfície dentária interfere diretamente no seu o efeito preventivo para o desenvolvimento de lesões de cárie(50). Selantes à base de resina têm apresentado maior retenção quando comparados ao selante de ionômero de vidro de alta viscosidade(51). Entretanto, a última revisão sistemática Cochrane sobre o uso de selantes na prevenção de cárie em dentes permanentes não observou diferença estatisticamente significativa entre a efetividade destes dois materiais(52). O selante à base de ionômero de vidro de alta viscosidade é um material menos sensível à umidade, sendo recomendado, por exemplo, para dentes onde a colocação do grampo para isolamento absoluto não é possível, seja pela dificuldade de colaboração do paciente ou a não irrupção completa do dente (53). Por este motivo, é um material amplamente utilizado nos programas de assistência escolar (54).

O esmalte hipomineralizado é constituído de menor teor de fósforo e cálcio; maior conteúdo orgânico, esmalte aprismático e porosidade em relação ao esmalte sadio, assim como menor dureza e módulo de elasticidade, o que provavelmente influencia na retenção do selante(27,55). As evidências da retenção do selante em molares HMI ainda são escassas e até pouco tempo limitadas ao selante resinoso(22,39,56). Os resultados foram publicados em três estudos. No primeiro estudo(39), um longitudinal retrospectivo, avaliou a necessidade de tratamento em FPM hipomineralizados. De 8 em 35 (22,9%) dos molares com HMI selados foram refeitos (em média após os 33 meses), enquanto nos dentes sem HMI, 16 em 90 (17,7%) foram refeitos (em média após os 55 meses). No segundo estudo(56), um ensaio clínico que comparou a taxa de retenção do selante resinoso aplicado de duas formas diferentes (uma convencional e outra com acréscimo de uma aplicação de adesivo), em 47 molares HMI selados de forma convencional 21% falharam em

12 meses, e 53% e 28% em 2 e 3 anos, respectivamente. E no terceiro estudo(57), 25 FPM com HMI foram selados e após 18 meses, 7 selantes falharam (taxa de retenção de 72%).

No início de 2021 foi publicado um primeiro ensaio clínico(58) sobre o selamento de fóssulas e fissuras utilizando o uso cimento ionômero de vidro em dentes com HMI. Neste estudo a taxa de retenção total ou particial do selante ionomérico foi de 83% após 12 meses de acompanhamento. Os autores sugerem que o selante de fóssulas e fissuras feito com ionômero de vidro pode prevenir cárie, mas não a ocorrência de PEB. Sendo então necessários mais estudos para avaliar a retenção do selante ionomérico e resinoso em molares com HMI e seus efeitos preventivos de cárie e PEB.

1 DESENVOLVIMENTO

1. 1 Proposição

1.1.1 Objetivo geral

Avaliar a evidência disponível em relação aos fatores relacionados à ocorrência de fratura pós-eruptiva do esmalte em dentes hipomineralizados e a retenção do selamento de fóssulas e fissuras nestes dentes.

1.1.2 Objetivos específicos

a) Avaliar a evidência científica disponível a respeito da influência da cor da opacidade demarcada característica de hipomineraização na ocorrência de fratura pós-eruptiva.
b) Avaliar a sobrevida de dois materiais seladores em primeiros molares permanentes hipomineralizados através da taxa de retenção.

1.2 Metodologia

A presente tese é composta por dois estudos: uma revisão sistemática da literatura (Estudo 1) e um ensaio clínico controlado randomizado (Estudo 2).

1.2.1 Estudo 1

1.2.1.1 Procedimentos éticos

O protocolo desta revisão sistemática está registrado na Plataforma PROSPERO (CRD 42020203778).

1.2.1.2 Elegibilidade

• A pergunta desta revisão sistemática foi estruturada segundo a estratégia PICO/PECO para responder ao primeiro objetivo específico da Tese.

Representando: P - População; E – Exposição; C – Comparação e O – Desfecho avaliado.

• Estudos observacionais (caso-controle, transversal e coorte) que avaliaram dentes hipomineralizados (P) com opacidade amarelo-amarronzadas (E) em comparação com as branca-creme (C) no que diz respeito a ocorrência de PEB (O) em foram considerados para inclusão.

• Estudos com participantes de todas as idades e ambos os sexos podem ser incluídos.

• Estudos que relataram a presença de outros defeitos de desenvolvimento do esmalte dentário (DDE) além da HMI / HSPM foram excluídos.

• Como objetivamos observar a associação entre a cor da opacidade e o PEB, foram excluídos os estudos que não descreviam a cor das opacidades.

• Foram excluídos os estudos de intervenção, relatos de casos e séries de casos, artigos de revisão, artigos de opinião e cartas.

1.2.1.3 Estratégia de busca

A estratégia de busca nas bases de dados MedLine (via Pubmed), LILACS e BBO (via VHL), Cochrane Library (via Wiley), Web of Science (via Clarivate) e Scopus e Embase (via Elsevier) foi feita em abril de 2020. Os alertas foram salvos e recebidos até março de 2021. Termos MeSH, sinônimos e termos livres, bem como operadores booleanos OR / AND foram usados para desenvolver estratégias de busca. Nenhuma restrição relativa a publicação como (data e/ou idioma) ou relativas aos estudos (idade e/ou sexo dos participantes) foram impostas às buscas.

1.2.1.4 Seleção dos estudos

A estratégia de busca nas bases de dados foi feita em abril de 2020. Os alertas foram salvos e recebidos até março de 2021. Termos MeSH, sinônimos e termos livres, bem como operadores booleanos OR / AND foram usados para desenvolver estratégias de busca. Nenhuma restrição relativa a publicação como (data e/ou idioma) ou relativas aos estudos (idade e/ou sexo dos participantes) foram impostas às buscas nas bases de dados eletrônicas MedLine (por Pubmed), LILACS e BBO (por VHL), Cochrane Library (Wiley) e Web of Science (por

Clarivate), Scopus e Embase (por Elsevier). Uma busca manual da lista de referências dos estudos selecionados também foi realizada para identificar publicações potencialmente relevantes. A literatura cinzenta também foi pesquisada por meio do Google Scholar e do OpenGrey para verificar se possíveis artigos elegíveis foram perdidos na pesquisa do banco de dados principal. Foi realizado contato por e-mail com especialistas da área para identificação de dados potencialmente relevantes e ainda não publicados. Todas as etapas desse processo foram orientadas e supervisionadas por bibliotecário especializado (D.M). A estratégia de pesquisa usada e as adaptações para cada banco de dados são fornecidas no Apêndice A.

1.2.1.5 Extração de dados

Os dois revisores independentes realizaram a extração de dados dos estudos selecionados, coletando as seguintes informações: autor, ano e país de publicação, desenho do estudo, tamanho da amostra, idade média dos participantes, critérios diagnósticos HMI/ HSPM, unidade de análise (sujeito, dente ou dente superfície), avaliação e classificação da cor das opacidades, frequência de PEB em cada grupo de acordo com a cor da opacidade e a principal conclusão do estudo. Qualquer discordância entre os dois revisores durante a extração dos dados foi resolvida por meio de discussão com um terceiro autor (L.C.M). Os autores originais correspondentes foram contatados quando os dados necessários para a análise estavam faltando. Lembretes foram enviados por e-mail duas vezes em intervalos de 1 semana quando uma resposta não foi obtida.

1.2.1.6 Risco de viés

A qualidade dos estudos incluídos foi pontuada de acordo com a escala de Newcastle-Ottawa Scale (NOS)(59). O NOS é um sistema de classificação por estrelas para estudos de coorte e caso-controle que aloca no máximo nove estrelas em três categorias: seleção de participantes (quatro estrelas), comparabilidade (duas estrelas) e medição do resultado em estudos de coorte (três estrelas). Em relação aos estudos transversais, a NOS foi utilizada de acordo com uma versão adaptada que aloca no máximo dez estrelas em três categorias: seleção de

participantes (cinco estrelas), comparabilidade (duas estrelas) e resultado (três estrelas)(60). Discordâncias entre os revisores sobre o risco de viés foram resolvidas por um terceiro autor (V.M.S).

1.2.1.7 Síntese dos dados

As características dos estudos incluídos foram resumidas e tabuladas em planilhas Excel (Excel®, Microsoft, EUA). Os estudos foram agrupados para a síntese com base no desfecho relacionado ao PEB ao nível do tipo de dente: molar ou incisivo, e quanto ao tempo de acompanhamento (em meses). Os dados foram interpretados criticamente com o objetivo de combinar os resultados relatados e as conclusões.

1.2.1.8 Certeza da evidência

A certeza da evidência foi avaliada usando o software de Classificação de Recomendações, Avaliação, Desenvolvimento e Avaliação Pro (GRADEpro Guideline Development Tool)(61). Risco de viés, inconsistência, indireto, imprecisão, suspeita de viés de publicação, presença de grande efeito, gradiente dose-resposta e fatores de confusão plausíveis foram os itens considerados para classificar a certeza geral da evidência(62). Todos os julgamentos foram adaptados para qualificar as evidências sintetizadas de forma narrativa(63).

1.2.2 Estudo 2

1.2.2.1 Procedimentos éticos

Este projeto foi aprovado pelo Comitê de Ética em Pesquisa do Hospital Universitário Pedro Ernesto da Universidade do Estado do Rio de Janeiro (UERJ) (CAAE 18266919.6.0000.5259) (ANEXO A) e do Comitê de Ética em Pesquisa da Instituição Coparticipante Faculdade de Medicina de Petrópolis/Centro Universitário Arthur Sá Earp Neto (FMP/UNIFASE) (CAEE 18266919.6.3001.5245) (ANEXO B) e está registrado na Plataforma de Registro Brasileiro de Ensaios Clínicos (número:

RBR-3xwprn). Os responsáveis pelas crianças que participaram desta pesquisa foram previamente informados sobre os procedimentos a serem realizados, incluindo possíveis riscos e desconfortos e foram convidados a assinar o Termo de Consentimento Livre e Esclarecido – TCLE (APÊNDICE B). As crianças participantes deste estudo assinaram um Termo de Assentimento (APÊNDICE C), redigido em linguagem acessível a compreensão das mesmas, onde se encontravam todas as informações presentes no TCLE.

1.2.2.2 Local do Estudo

O presente estudo é um ensaio clínico randomizado controlado, com avaliações semestrais e duração de 36 meses, realizado no Ambulatório Escola do Centro Universitário Arthur Sá Earp Neto (UNIFASE), Petrópolis – RJ.

Petrópolis é um município localizado na Região Serrana do Estado do Rio de Janeiro, com população de 295.917 habitantes, segundo o último Censo de 2010, apresentando um IDHM (Índice de Desenvolvimento Humano Municipal) de 0,745. O acesso ao saneamento básico é de 82,1% e a taxa de mortalidade infantil média na cidade é de 19.39 para 1.000 nascidos vivos. A taxa de escolaridade das crianças de 6 a 14 anos de idade do município é de 97,4 % (64). A população é beneficiada pelo abastecimento de água tratada e fluoretada (65).

1.2.2.3 Amostra

Critérios de elegibilidade

Foram elegíveis todas as crianças, de 8 anos de idade, matriculados na rede municipal de ensino de Petrópolis, diagnosticadas com hipomineralização de molar e incisivo no Levantamento Epidemiológico de Cárie realizado na cidade no ano de 2018.

Critérios de inclusão

- Cada criança deveria possuir pelo menos um primeiro molar permanente com coroa completamente erupcionada com opacidade demarcada relacionada a

HMI (escore 1 ou 2), segundo critério *European Association of Paediatric Dentistry* (EAPD) (3), e esmalte hígido (escores 0, 1 ou 4), segundo critério de cárie Nyvad (66).

- Responsável e criança assinaram o Termo de Consentimento Livre Esclarecido e Termo de Assentimento, respectivamente.

Critérios de exclusão

Foram excluídas crianças que apresentem comprometimento sistêmico crônico que determine a necessidade de cuidados especiais, incapacidade de colaborar durante o atendimento odontológico ou outras alterações de desenvolvimento do esmalte além da HMI, assim como, uso aparelho ortodôntico fixo.

1.2.2.4 Randomização

Os pacientes foram aleatoriamente randomizados em um dos respectivos grupos: Teste GIC - selamento com cimento ionômero de vidro, Equia Forte® (GC Europe, Leuven, Bélgica) e Controle Res - selamento com resina, FluroShield® (Dentisply Sirona, São Paulo, Brasil). A randomização foi realizada pela auxiliar de pesquisa em blocos baseada na lista de pacientes agendados por dia, através de sorteio que garantia a igualdade da distribuição diária entre os procedimentos seladores.

1.2.2.5 Treinamento e Calibração

Previamente ao início do estudo, um examinador experiente conduziu um treinamento teórico sobre os critérios de avaliação para HMI, cárie e retenção do selamento ionomérico e resinoso. Inicialmente, foi realizado treinamento teórico de todos os critérios diagnósticos. Um treinamento prático foi realizado com 5 crianças diagnosticadas com HMI. Em seguida, para o teste de calibração, foram avaliadas e reavaliadas, no intervalo de 2 semanas, com 40 fotografias clínicas. Para cárie

dentária e retenção de selante, foram examinadas e re-examinadas, com intervalo de 3 semanas, 20 crianças apresentando lesões de cárie em diferentes estágios de progressão e molares que tenham recebido selante. O diagnóstico realizado por um examinador experiente foi utilizado como padrão-ouro para o cálculo do coeficiente kappa inter-examinadores. A repetição dos exames foi utilizada para cálculo de concordância intra-examinador. Os resultados obtidos de concordância inter e intra-examinador foram considerados satisfatórios, com coeficiente Kappa ≥ 0,86.

1.2.2.6 Coleta de Dados

Ficha de antecedentes de saúde e avaliação socioeconômica

Para avaliação dos antecedentes de saúde (APÊNDICE D) foi entregue aos responsáveis um questionário autoaplicado juntamente com o TCLE. Os dados da avaliação socioeconômica foram extraídos do Levantamento Epidemiológico de Cárie realizado nesta amostra em 2018.

Cárie Dentária

A presença de cárie dentária foi avaliada em ambiente clínico, com a criança deitada na cadeira odontológica. O exame foi realizado por método visual-tátil, sob luz artificial (proveniente da torre acoplada ao equipamento da cadeira odontológica), utilizando espelho bucal e sonda exploradora esterilizados. Para controlar a umidade, foram utilizados roletes de algodão descartáveis e ar comprimido. Os examinadores foram calibrados previamente e auxiliados por anotadores treinados. O exame foi realizado após escovação dentária profissional. O diagnóstico de cárie foi feito através do critério Nyvad (66) e anotado na ficha do paciente (APÊNDICE D).

Hipomineralização Molar-Incisivo

Os primeiros molares e os incisivos permanentes foram examinados visualmente, classificados de acordo com o critério da EAPD (3) e classificados em:

0- normal; 1- opacidade branco-creme; 2- opacidade amarelo-marrom; 3- fratura pós-eruptiva em esmalte; 4- fratura pós-eruptiva expondo dentina; 5- restauração atípica satisfatória. 6 – restauração atípica insatisfatória; 7- extraído devido a HMI. Esta avaliação também foi realizada em ambiente clínico, com a criança deitada na cadeira odontológica. O exame foi realizado por método visual-tátil, sob luz artificial (proveniente da torre acoplada ao equipamento da cadeira odontológica), utilizando espelho bucal e sonda exploradora esterilizados. Os dados foram anotados na ficha clínica do paciente (APÊNDICE D).

1.2.2.7 Intervenção

Grupo TESTE GIC: selamento com cimento de ionômero de vidro

Procedimento foi realizado em ambiente clínico odontológico com a criança deitada na cadeira odontológica e utilização de procedimentos operacionais de biossegurança. O selamento foi feito com cimento ionômero de vidro de alta viscosidade, Equia Forte® (GC Europe), de acordo com as recomendações do fabricante.

Passo a passo da técnica de selamento com Equia Forte® (GC Europe):

a) Limpeza da superfície oclusal utilizando taça de borracha e pedra pomes, lavar e secar.
b) Condicionamento do complexo de fóssulas e fissuras utilizando o Cavity Conditioner® (GC Europe) durante 10 segundos.
c) Lavagem com água e secagem com ar comprimido evitando ressecamento excessivo.
d) Inserção do ionômero Equia Forte® (GC Europe) encapsulado sobre a superfície limpa e seca.
e) Após inserção do material, o operador deve executar a pressão digital com o dedo enluvado e vaselinado no dente por 40 segundos.
f) Em seguida, faz-se a remoção dos excessos e checagem da oclusão com o uso do papel carbono fino.

g) Limpa-se com bolinhas de algodão seca e, e finaliza-se o procedimento com a aplicação de um selante de superfície resinoso e fotoativado (Equia Coat ®, GC Europe) por 20 segundos em toda a superfície selada.

Grupo CONTROLE Res: selamento com selante resinoso

Procedimento foi realizado em ambiente clínico odontológico com a criança deitada na cadeira odontológica e utilização de procedimentos operacionais de biossegurança. O selamento foi feito com selante resinoso, FluroShield® (Dentsply Sirona), de acordo com as recomendações do fabricante.

Passo a passo da técnica de selamento com FluroShield® (Dentsply Sirona):

a) Limpar a superfície oclusal utilizando taça de borracha e pedra pomes, lavar e secar.
b) Anestesia papilar com anestésico tópico (Benzocaína) seguida de anestesia local (Lidocaína 2% 1:100.000) e colocação do isolamento absoluto com dique de borracha apenas no dente que será selado.
c) Aplicar o Condicionador Dental Gel (ácido fosfórico 37%) sobre todo o complexo de fóssulas e fissuras por 30 segundos.
d) Remover o Condicionador Dental Gel com o auxílio de um sugador de saliva de alta potência e um vigoroso spray de água / ar por no mínimo 15 segundos e secar com ar.
e) Fixar a ponta aplicadora cuidadosamente ao corpo da seringa, testar o fluxo do material longe do campo operatório.
f) Dispensar o selante diretamente sobre a superfície oclusal a ser selada e com o auxílio de um aplicador de hidróxido de cálcio, estender o selante até o meio dos planos inclinados das cúspides, evitando-se áreas de interferência oclusal.
g) Fotopolimerizar por 20 segundos
h) Checagem dos pontos de contato oclusais com o uso do papel carbono fino.
i) Quando necessário, remoção dos excessos com broca de acabamento.

1.2.2.8 Desfechos

Desfecho Primário

O desfecho primário foi cárie em dentina. Avaliado através da comparação da proporção de dentes que evoluírem para o escore 3 ou 6 do Critério Nyvad, nos grupos Teste GIC e Controle Res, durante o período de 36 meses de acompanhamento. A avaliação de presença de cárie em dentina foi realizada por método visual-tátil, sob luz artificial, em consultório odontológico, sob isolamento relativo, após secagem com ar comprimido, utilizando espelho bucal e sonda exploradora. A efetividade do selante em prevenir lesão de cárie em dentina foi avaliada através do teste de McNemar.

Desfecho Secundário

São dois os desfechos secundários. O primeiro foi a taxa de retenção de selante de fóssulas e fissuras, ao nível do dente, avaliado a cada 6 meses, durante o período total de 36 meses, através de análise de sobrevida (curva de Kaplan-Meier e Teste Log-Rank). Para avaliação deste desfecho foi utilizado a classificação de Oulis and Berdouses(67) que julga, ao nível do dente, a presença do selante sobre a superfície dentária: 1- totalmente retido; 2-parcialmente retido e 3 -totalmente perdido. O exame foi realizado por método visual-tátil, sob luz artificial, em consultório odontológico, sob isolamento relativo, após secagem com ar comprimido, utilizando espelho bucal e sonda exploradora. A taxa de sucesso será avaliada comparando a proporção de dentes com selante totalmente retido entre o grupo TESTE e CONTROLE usando a análise de sobrevivência de Kaplan-Meier.

O segundo desfecho secundário foi a ocorrência de fratura pós-eruptiva. Foi avaliado através da comparação da proporção de dentes que evoluírem para o escore 3 ou mais do critério EAPD, nos grupos Teste GIC e Controle Res, durante o período de 36 meses de acompanhamento. A avaliação de presença de fratura pós-eruptiva foi realizada por método visual-tátil, sob luz artificial, em consultório odontológico, sob isolamento relativo, após secagem com ar comprimido, utilizando espelho bucal e sonda exploradora, de acordo com os critérios propostos pela Academia Europeia de Odontopediatria, seguindo as pontuações descritas: 1:

opacidade branca-creme = ausência de perda de estrutura pós-eruptiva; 2: opacidade amarelo-acastanhada = ausência de perda de estrutura pós-eruptiva; 3: perda da integridade do esmalte restrita ao esmalte = presença perda de estrutura pós-eruptiva; 4: perda da integridade do esmalte expondo a dentina = presença de perda de estrutura pós-eruptiva; 5: presença de restauração atípica = presença de perda de estrutura pós-eruptiva. 6: presença de restauração atípica insatisfatória = presença de perda de estrutura pós-eruptiva. 7: extraído devido a HMI = presença de perda de estrutura pós-eruptiva. A efetividade do selante em prevenir fratura pós-eruptiva foi avaliada através do teste de McNemar.

1.2.2.9 Acompanhamento

A ficha de acompanhamento (APÊNDICE D) foi utilizada para registrar os dados relativos aos desfechos primário e secundário semestralmente por período máximo de 36 meses.

1.3 **Resultados**

Artigo 1: Are yellow-brownish opacities in hypomineralized teeth more prone to breakdown compared to white-creamy ones? A systematic review.

Artigo 2: Retention rate of fissures sealants in MIH molars: randomized clinical trial.

1.3.1 Are yellow-brownish opacities in hypomineralized teeth more prone to breakdown compared to white-creamy ones? A systematic review (manuscrito)

Are yellow-brownish opacities in hypomineralized teeth more prone to breakdown compared to white-creamy ones? A systematic review

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Abstract

Objetive: The aim of this systematic review was to evaluate all the available evidence assessing if in hypomineralized teeth, yellow-brownish opacities are more prone to post-eruptive breakdown compared to white-creamy opacities.

Data: The protocol was registered (PROSPERO CRD42020203778). Observational studies that evaluated the occurrence of post-eruptive breakdown (PEB) in hypomineralized teeth were considered for inclusion.

Sources: Electronic searches were performed up to March 2021 in MedLine, LILACS, BBO, Cochrane Library, Web of Science, Scopus and EMBASE. The grey literature was also searched through Google Scholar and OpenGrey. Neither publication date nor language restrictions were imposed to the searches. Two researchers independently performed the study selection, data extraction and quality assessment of the included studies according to the Newcastle-Ottawa Scale (NOS). Datasets from studies were grouped for narrative synthesis based on the dental tissue affected (enamel and/or dentin), tooth type (molar or incisor), unit of analysis (subject or tooth or tooth surface), and follow-up period (in months). The certainty of evidence was evaluated using the GRADE approach.

Study Selection: Eight studies were included, five cohort and three cross-sectional, published in English between 2011 and 2020 and conducted in four different countries. Permanent teeth was the object of observation in 7 out of 8 studies. All studies, both cohort and cross sectional, assessed the opacities and PEB by visual examination and diagnosed MIH according to EAPD criteria. According to NOS, issues in comparability were the main methodological limitations in the studies. In the cohort studies, considering all follow-up periods, dark opacities fractured more than light opacities, at both enamel and enamel/dentin levels, and molars fractured more than incisors. In two out of three cross sectional studies, dark opacities also fractured more than light opacities, but the deph of the PEB (enamel breakdown or dentin breakdown) or the type of tooth (molar or incisor) was not considered in the analysis.

The certainty of evidence of an association between opacity color and the occurrence of PEB was very low.

Conclusion: Although it seems plausible to state that darker demarcated opacities in MIH patients broke more often than light ones, based on this systematic review of the literature, the certainty of the available evidence about this association is still very low. More reliable and valid research is still necessary to support the recommendation that MIH children who present dark opacities (yellow, yellow-brownish and/or brown) should be monitored at shorter intervals compared to those who present only light opacities (white and/or white-creamy).

Key-words: Dental Enamel Hypoplasia; Molar Incisor Hypomineralization; Demarcated Opacity; Tooth Fractures; Post-eruptive breakdown; Structural Integrity

Introduction

Hypomineralization is a qualitative developmental defect of dental enamel that can affect both primary and permanent teeth[1,2]. When it is present in primary teeth, it usually affects the second molars and is called hypomineralized second primary molars (HSPM)[3]. When it occurs in the permanent dentition, it is called Molar Incisor Hypomineralization (MIH) and it is characterized by the presence of at least one permanent first molar affected[2]. The global prevalence of MIH is estimated at 13,1%[4]. The etiology of MIH has not been completely established, but it is recognized to have a systemic origin combining genetic predisposition and environmental factors related to injuries between birth and the first years of life, thus being a multifactorial condition[5–8]. MIH has been extensively studied in the last 20 years and has been considered a challenge for the Pediatric Dentistry.

Clinically, the hypomineralized enamel is characterized by an abnormal enamel translucency (opacity). The demarcated opacities have distinct edges with the adjacent enamel and vary in color between white, yellow or brown[2,9]. MIH is classified into two stages of severity: mild (demarcated opacity without post-eruptive enamel breakdown (PEB) and/or sensitivity to cold air or water) and severe (demarcated opacity associated with PEB and/or sensitivity to cold air or water), which may cause persistent dental hypersensitivity, presence of atypical restoration or even extraction of a permanent first molar[9,10].

The hypomineralized enamel is more porous and less mineralized compared to normal enamel[11], tending to fracture soon after the establishment of masticatory contact, increasing MIH severity with age[12–15]. The PEB exposes the underlying dentin creating a niche for biofilm deposition and favoring the development of caries[16–19]. In vitro studies have shown that hypomineralized enamel has higher organic content and amount of aprismatic enamel than normal enamel and that yellow-brownish opacities are more porous than white-creamy ones[20,21].

Recent clinical studies have shown that yellow-brown opacities tend to fracture more frequently than white opacities, suggesting that they represent a more severe condition [13–15,22]. Evidence of this relationship has not yet been verified in a systematic review study of clinical observational studies. There is only one systematic review in the literature carried out with in vitro studies indicating that the evidence presents still limited results regarding the association between the clinical aspect (color) and the severity of the defect (structural aspects)[11].

Thus, the aim of this study was to assess, through the available scientific evidence, if yellow-brownish opacities have a greater occurrence of post-eruptive breakdown compared to white-creamy ones.

Materials and Methods

This systematic review followed the PRISMA 2020 checklist (http://prisma-statement.org/) to guide it reporting items for systemic reviews and meta-analysis statement. The protocol was registered in PROSPERO (CRD42020203778).

Eligibility Criteria

The search strategy was defined based on the elements of the PECOS question:

Population (P) - hypomineralized teeth of participants of all ages and of both genders.

Exposure (E) – yellow-brownish opacities;

Comparison (C) – white-creamy opacities;

Outcome (O) - occurrence of post-eruptive breakdown;

Study desing (S) - Observational studies (cohort, case-control, and cross-sectional).

Studies that reported the presence of other developmental defects of enamel (DDE) than MIH/HSPM and interventional studyies, case reports or case series, review articles, opinion articles and letters were excluded.

Information Sources and Search Strategy

Search strategy was done on April 2020 and followed the syntax rules of each database. Alerts were saved and received from databases up to March 2021. MeSH/Emtree terms, synonyms and free terms, as well as Boolean operators OR/AND were used to develop search strategies. No publication date, neither language restrictions were imposed to the searches through the electronic databases MedLine (by Pubmed), LILACS and BBO (by VHL), Cochrane Library (Wiley), Web of Science (by Clarivate), Scopus and Embase (by Elsevier). In addition, a manual search was performed on the reference list of the selected studies to identify potentially relevant publications. The grey literature was also searched through

Google Scholar and OpenGrey. In the Google Scholar, the first 100 matches were manually processed to check if possible eligible papers were missed from the main database search. Contact by e-mail was made with experts in the area to identify potentially relevant data that had not been published yet. All stages of this process were guided and supervised by a specialized librarian (D.M). The search strategy used and adaptations for each database are provided in Appendix 1.

Study Selection

All electronically records identified in the search were imported to the software EndNote Web (Thomson Reuters, New York, NY, US) and duplicates were removed. Study selection was carried out by two independent reviewers (R.C.J and P.P.G.R) in the following stages:

- initial screening of potentially suitable titles and abstracts against the inclusion criteria, resulting in a selection list of potentially relevant papers included by at least one reviewer;
- full-text reading of the papers identified as potentially relevant in the initial screening.

Any disagreement between the reviewers on the eligibility of the studies was solved through discussion with a third reviewer (V.M.S).

Data Extraction

The two independent reviewers performed the data extraction from the selected studies, collecting the following information: author, year and country of publication, study design, sample size, mean age of the participants, MIH/HSPM diagnostic criteria, unit of analysis (subject, tooth or tooth surface), assessment and classification of the color of the opacities, frequency of PEB in each group according to the color of the opacity, and the main conclusion of the study. Any disagreement between the two reviewers during the extraction of data was solved through discussion with a third author (L.C.M). The original corresponding authors were contacted by e-mail when the data required for analysis were missing. Two reminders were sent with 1-wk intervals if no response was obtained. Articles published in languages other than English and Portuguese were translated using the Google® Translate tool (https://translate.google.com).

Quality Assessment (Risk of Bias)

The quality of the included studies was scored according to the Newcastle-Ottawa Scale (NOS)[23]. The NOS is a star rating system for cohort and case-control studies that allocates from zero to nine stars across three categories: participant selection (four stars), comparability (two stars) and measurement of outcome in cohort studies (three stars). For cross-sectional studies, it was used an adapted version of the NOS that allocates from zero to ten stars across three categories: participant selection (five stars), comparability (two stars) and outcome (three stars)[24].

Ascertainment of exposure was considered adequate when the EAPD[9] criteria was used to assess MIH/HSPM in the participants by trained and qualified examiners. In the comparability section, age and location of the demarcated opacity, i.e. if the area with PEB was exposed to masticatory forces or not, were considered as major confounding factors. Independent evaluation of color of the opacity and PEB done by two different examiners was required to consider the assessment of the outcome as independent and blind. A follow-up time of 12 months was considered sufficient for the detection of the outcome, i.e. PEB, with a dropout rate of 20% or less. Disagreements between the reviewers about the quality assessment were solved by a third author (V.M.S).

Synthesis methods

Initially, the characteristics of the included studies were summarized and tabulated using Excel spreadsheets (Excel®, Microsoft, USA). Studies were grouped for synthesis based on PEB-related outcome at the enamel and/or dentin level, tooth type (molar or incisor), unit of analysis (subject or tooth or tooth surface) and follow-up time (in months).

Certainty of evidence assessment

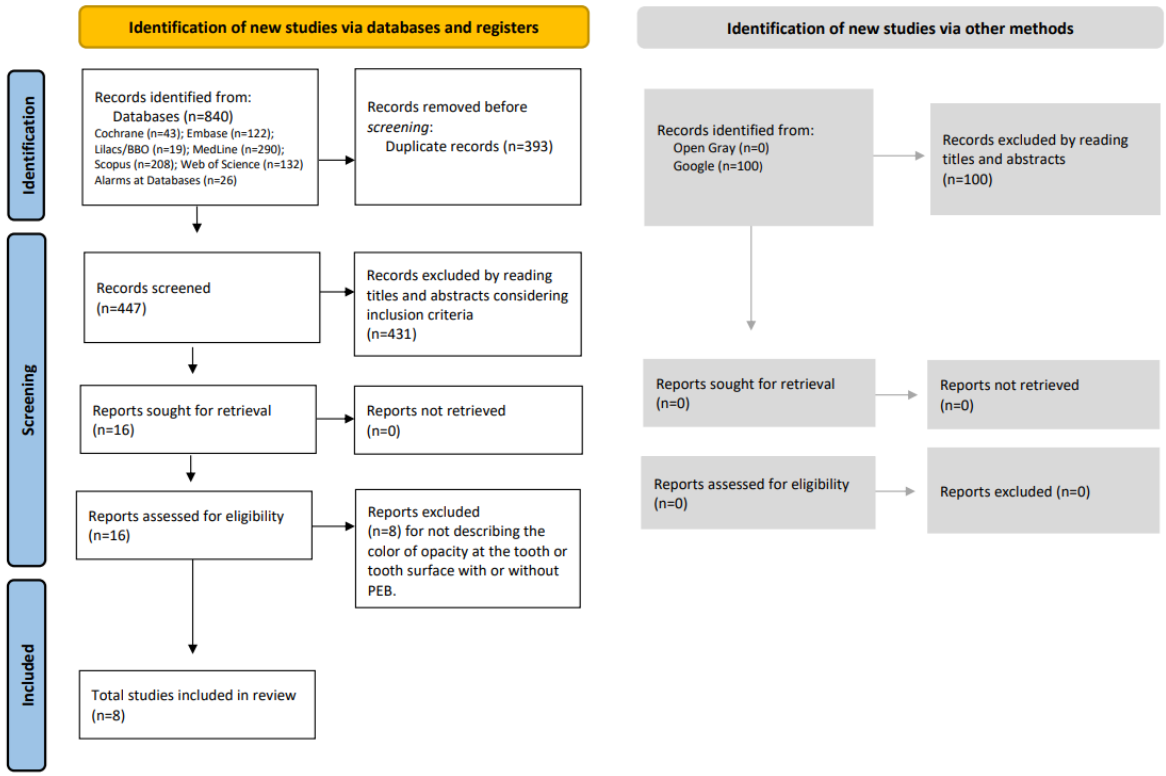
The certainty of evidence was evaluated using the GRADEpro tool[25]. Risk of bias, inconsistency, indirectness, imprecision, suspicion of publication bias, presence of large effect, and plausible confounders were the items considered to rate the overall certainty of evidence[26,27]. All the judgments were adapted to qualify the evidence synthesized in a narrative way[28].

Results

Study Selection

The selection of the studies is described in the Flowchart according to Prisma 2020 Statement (Figure 1). The search strategy, done on April 2020, retrieved 814 articles from the databases. After eliminating the duplicates, 421 articles remained and 26 records were identified from alarms at Databases (April 2020 – March 2021). Sixteen articles out of 447 were considered eligible, but eight [29–36] were excluded for not reporting the assosication between the color of the opacities and PEB. Hence, eight studies[12–15,37–40] were finally included in the review.

Figure 1 - Flowchart of study selection



Characteristics of the Studies

The eight studies were published in English between 2011 and 2020 and conducted in four different countries: Brazil[12–15]; Iraq[38]; India[39,40] and Bosnia and Herzegovina[37]. The longitudinal studies[12–15] were five and cross-sectional studies[38–40], three. The number of participants included in the eight studies ranged from 25 to 210 and age between 6 and 12 year-old. Permanent dentition was the object of observation in 7 out of 8 studies[12–15,39,40]. Only one study

presented data on primary teeth[38]. All studies assessed the opacities and PEB by visual examination and diagnosed MIH according to EAPD criteria[9]. Two studies[14,37] used, in addition to the visual examination, photographic monitoring of teeth with demarcated opacity to assess the outcome.The selection of participants resulted from representative epidemiological surveys in 7[12–14,37–40] out of 8 studies. Only one study[15] was based on a convenience sample. The follow-up period ranged from 6 to 36 months in the longitudinal studies.

PEB was evaluated as present / absent regardless of the level of depth (enamel or enamel + dentin) in five studies[14,37–40], while three studies[12,13,15] distinguished PEB at the level of enamel and at the level of enamel + dentin. The association or the influence of the color of the opacity and the occurrence of PEB was analysed through odds ratio (OR)[12,15], relative risk (RR)[13], Pearson r correlation [37], or simple percentage[12–15,37–40]. The characteristics and results of the studies are shown in Table 1.

The classification of the color of the opacity varied between studies: ligth or dark opacities[37], white/creamy or yellow/brown opacities[12,15,38–40], white or yellow or brown opacities[13,14]. Another criterion that diverged between the studies was the unit of analysis: patient[39,40], tooth[12–14,37,38] or tooth surface[15]. In two studies, statistical analyses were adjusted for potencial confounders[13,15].Due to the high methodological heterogeneity between the studies, the quantitative synthesis through a meta-analysis was not possible.

Quality Assessment (Risk of Bias)

Quality assessment using NOS is presented in table 2. Comparability was a relevant bias in both cohort and cross-sectional studies and outcome was a critical issue in the cross-sectional studies.

All studies[12–15,38–40] used controls recruited from the same population from the exposed children. The sample of one study[15] were not representative of the population studied because it was a convenience sample of patients seen at an University Clinic. In two studies[14,37] although the sample was considered somewhat representantive, there was a loss of about 50% of the target patients during recruitment.

One study[37] did not receive the star for “ascertainment of exposure” because it didn’t inform the diagnostic criteria used, as well as the training and

calibration of the examiners. Two studies[15,37] controlled the area of the PEB in the statistical analysis. Two out of 8 studies [13,15] controlled the age by stratification in the statistical analysis. In the outcome criterion, none of the studies received a star in the question related to the “assessment of outcome” because it was not possible to guarantee blinding assessment. Additionally, sectional studies did not received a star for the question relating to the “statistical test” because they did not performed any test.

Results of the Studies

A narrative synthesis of the included studies was performed and the results of the individual studies are shown in table 1. Overall, longitudinal and cross-sectional studies observed a higher rate of PEB associated to dark / yellow / yellow-brownish / brown demarcated opacities compared to light / white / white-creamy opacities[12–15,37–40]. The occurrence of PEB in molars was more frequent than in incisors [12–14]. Longitudinal studies evaluated the occurrence of PEB at different times, ranging from 6 months[14], 12 months[12,14,15,37], 18 months[12,13], 24 months[12] and 36 months[12].

Certainty of Evidence

The certainty of evidence was very low (table 3). All syntheses were seriously affected by the risk of bias and the insufficient amount of data evaluated. The imprecision item was additionally affected for one of the syntheses, because the confidence interval estimate, based on data from a single study, included no effect and meaningful effect in one direction. Furthermore, the synthesis including cross-sectional studies showed inconsistent results. Since the evidence presented major threats to validity, the possibility of upgrading the certainty of evidence was not considered.

Discusssion

MIH/HSPM is a multifactorial condition. Its clinical presentation and distribution in the dentition may vary in extent, location and severity. Particularly the more severe cases represent a great challenge in the daily clinical practice [7,41].

Systematic reviews regarding its etiology[5,8,42–44], prevalence[4,45,46], association with other dental conditions[19,47], treatment alternatives[41,48–50], and ultrastructural features of the hypomineralized enamel are already known [11]. The focused question of this systematic review was whether the color of the demarcated opacity in hypomineralized teeth increases the risk of post-eruptive breakdown (PEB). The studies suggest that demarcated yellow-brownish opacities fracture after tooth eruption more frequently than white-creamy opacities[12–15,37–39]. In line with this finding are several in vitro studies showing through microstructural analyses that yellowish and brownish opacities are less mineralized, more porous, and consequently more fragile than whitish and creamy ones[11,20,21].

The eight studies[12–15,37–40] included in this systematic review were heterogeneous in several aspects, such as the unit of analysis (subject/ tooth/ tooth surface) and the evaluation period (ranging from 6 to 36 months). Thus, it was not possible to perform a quantitative synthesis through meta-analysis. Regarding the color of the opacities, although not always using the same word to identify the color, in all studies it was possible to differentiate the light opacities (called as white or white-creamy) from the dark opacities (called as yellow, yellow-brownish and/or brown). Despite the heterogeneity of the studies, which may be considered a limitation of the present review, the finding that darker opacities are at higher risk of PEB was somehow consistent[12–15,37–39]. Only one out of the eight studies did not report a higher proportion of PEB among the darker opacities in comparison with the lighter ones[40].

Only studies that assessed the occurrence of PEB in MIH/HSPM teeth were included[12–15,37–40]. This decision aimed to exclude studies that reported the presence of other developmental defects of enamel (DDE) than MIH/HSPM. Considering the wide difference between patterns of alteration of the DDE, such data would not contribute to answer the critical question of this review. Studies that evaluated enamel hypomineralization in primary and permanent teeth were accepted since primary (HSPM) and permanent (MIH) hypomineralized teeth are similar in clinical and microstructural patterns[3,51], as well as probably having the same multifactorial systemic etiology with environmental influence[3,8,47,52]. However, only one study that evaluated HSPM was included in this review[38].

The studies had methodological flaws either in the selection of participants, in the comparability or in the evaluation of the outcome. The representativeness of the

studied populations was not achieved by one study[15] and another limitation was the small sample size of some studies[14,37,38], which limits the validity of the studies and their ability to generalize their results. Blinding, which is an important tool to ensure that clinical judgement does not influence the outcome measurement, was not achieved in any study. Even if the assessment of the outcome (presence of PEB) and the exposure (opacity col) had been done by different examiners, blinding would be questionable because both conditions are present in the same site of interest, i.e. the tooth surface. Moreover, three[38,39] out of eight studies were designed as cross-sectional and it is not possible to attest a cause-effect relationship between the exposure factor and the outcome in cross-sectional studies.

Age was considered one of the critical confounder factors because teeth are exposed to masticatory forces for a longer period of time in older children. Additionally, the location of the opacity was also considered of major importance because tooth surfaces not exposed to masticatory attrition would be probably more preserved. Thus, age of the participants and the location of the opacities were considered relevant, since they may influence the occurrence of the outcome. Most of the studies did not used any approach to control none of these confounding factors in the comparability between groups [12,14,38–40]. Therefore, further studies controlling these confounding factors are still necessary to a better understanding of the relationship between the color of opacity and the outcome and improve the certainty of evidence.

Although, based on clinical[12–15,37–39] and in vitro[11,20,21] studies, it seems plausible to state that darker demarcated opacities in MIH patients brake more often than light ones, based on this systematic review of the literature, the certainty of the available evidence about this association is still very low. We suggest that further primary studies monitoring MIH opacities consider the tooth surface as the unit of analysis of the outcome and control the location of the opacity and age of the participants. Hence, more reliable and valid results may be obtained in order to support the recommendation that MIH children who present dark opacities (yellow, yellow-brownish and/or brown) should be monitored at shorter intervals compared to those who present only light opacities (white and/or white-creamy).

Table 1 – Search of eletronic databases

MedLine	((dental enamel hypoplasia[MeSH Terms] OR molar incisor hypomineralization[MeSH Terms] OR “dental enamel hypoplasia”[Title/Abstract] OR “agenesis enamel”[Title/Abstract] OR “hypoplasias enamel”[Title/Abstract] OR enamel hypoplas*[Title/Abstract] OR “molar incisor hypomineralization”[Title/Abstract] OR mih[Title/Abstract] OR “molar incisor”[Title/Abstract] OR hypomineral*[Title/Abstract] OR “cheese molar”[Title/Abstract] OR demarcated opacit*[Title/Abstract] OR “defect demarcated”[Title/Abstract]) AND (tooth fractures[MeSH Terms] OR tooth fracture*[Title/Abstract] OR breakdown[Title/Abstract] OR break[Title/Abstract] OR breakage[Title/Abstract] OR “post-eruptive breakdown”[Title/Abstract] OR “structural integrity”[Title/Abstract] OR teeth fracture*[Title/Abstract] OR dental fracture*[Title/Abstract] OR micro-fracture*[Title/Abstract])
Lilacs/BBO	(tw:((mh:(dental enamel hypoplasia OR hipoplasia do esmalte dentário OR molar incisor hypomineralization OR hipomineralização molar incisivo)) OR (tw:("dental enamel hypoplasia" OR "hipoplasia do esmalte dentário" OR "agenesis enamel" OR "agenesia de esmalte" OR "hypoplasias enamel" OR "hipoplasias de esmalte" OR "enamel hypoplas*" OR "hipoplas de esmalte" OR "molar incisor hypomineralization" OR "hipomineralização molar incisivo" OR mih OR hmi OR "molar incisor" OR "molar incisivo" OR “hypomineral*” OR "cheese molar" OR "molar de queijo" OR "demarcated opacit*" OR "opacid demarcada" OR "defect demarcated" OR "opacidade demarcada"))) AND tw:((mh:(tooth fractures)) OR (mh:(fraturas de dente)) OR (tw:("tooth fracture*" OR “fratura* dente” OR breakdown OR break OR breakage OR quebra OR "post-eruptive breakdown" OR “quebra pós-eruptiva” OR "structural integrity" OR “integridade estrutural” OR "teeth fracture*" OR "dental fracture*" OR “fratura* dos dentes” OR micro-fracture* OR micro-fratura*))))
Cochrane	***ID Search Hits*** ***#1 MeSH descriptor: [Dental Enamel Hypoplasia]*** ***#2 ("dental enamel hypoplasia" OR enamel defect* OR enamel opacit* OR enamel hypoplas* OR "molar incisor hypomineralization" OR mih OR "molar incisor" OR hypomineral* OR cheese molar* OR demarcated opacit* OR demarcated defect*)*** ***#3 #1 OR #2*** ***#4 MeSH descriptor: [Tooth Fractures]*** ***#5 (tooth fracture* OR breakdown OR break OR breakage OR "post-eruptive breakdown" OR "structural integrity" OR teeth fracture* OR dental fracture* OR micro-fracture*)*** ***#6 #4 OR #5*** ***#7 #3 AND #6***
Web of Science	(TOPIC: ("dental enamel hypoplasia" OR "molar incisor hypomineralization" OR "agenesis enamel" OR "hypoplasias enamel" OR enamel hypoplas* OR mih OR “molar incisor” OR hypomineral* OR "cheese molar" OR demarcated opacit* OR "defect demarcated") AND TOPIC: ("tooth fractures" OR tooth fracture* OR breakdown OR break OR breakage OR "post-eruptive breakdown" OR "structural integrity" OR teeth fracture* OR dental fracture* OR micro-fracture*))
Scopus	(TITLE-ABS-KEY (“dental enamel hypoplasia” OR “molar incisor hypomineralization” OR “agenesis enamel” OR “hypoplasias enamel” OR “enamel hypoplas*” OR mih OR “molar incisor” OR hypomineral* OR “cheese molar” OR “demarcated opacit*” OR “defect demarcated”) AND TITLE-ABS-KEY ("tooth fractures" OR "tooth fracture*" OR breakdown OR break OR breakage OR "post-eruptive breakdown" OR "structural integrity" OR "teeth fracture*" OR "dental fracture*" OR micro-fracture*))
Embase	(('enamel hypoplasia'/exp OR 'molar incisor hypomineralization'/exp OR 'agenesis enamel':ab,ti OR 'hypoplasias enamel':ab,ti OR 'enamel hypoplas*':ab,ti OR mih:ab,ti OR 'molar incisor':ab,ti OR hypomineral*:ab,ti OR 'cheese molar':ab,ti OR 'demarcated opacit*':ab,ti OR 'defect demarcated':ab,ti) AND ('tooth fractures'/exp OR 'tooth fracture':ab,ti OR 'break':ab,ti OR 'breakage':ab,ti OR 'breakdown':ab,ti OR 'post-eruptive breakdown':ab,ti OR 'structural integrity':ab,ti OR 'teeth fracture*':ab,ti OR 'dental fracture*':ab,ti OR 'micro-fracture*':ab,ti))

Table 2 – Characteristics and results of the studies.

Author; Year; Study location	*Study design*	*Participants' characteristics at baseline*	*Sample size (subject, tooth or tooth surface)*	*Diagnostic criteria for HSPM/ MIH*	*Diagnostic criteria for PEB*	*Follow-up period*	*Frequency of PEB*		*Effect estimates and Authors' Comment/Conclusion*	*Critical appraisal*
Arslanagic et al. (2020) Sarajevu, Bosnia and Herzegovina	Longitudinal	25 children Age: 6 to 9 years	14 molars 29 incisors	EAPD criteria [9]	Presence / Absence (Assessed by MAT-LAB computer program using clinical photographs)	12 months	MOLARS/INCISORS Light OP: 2/35 (5.7%) Dark OP: 5/8 (62.5%)		Positive correlations observed: - color of the opacity (light or dark) and PEB (Pearson's r = 0.599; p = 0.000 – Log Regression); - localization of the demarcated opacity (exposed to masticatory pressure or no) and PEB (Pearson's r = 0.752; p = 0.000). Logistic regression model: dark opacities predicted PEB (p = 0.011; 95% CI: 0.000 – 0.310). Conclusion: *"dark color and localization of demarcated opacity should be determined as significant factors, which could have an impact in predicting demarcated opacity progression within molar incisor hypomineralization"*.	Despite the small sample size and the low percentage of PEB, it was possible to detect statistical difference between dark and light opacities.
Cabral et al. (2019) Brasília, Brazil	Longitudinal	181 children Age: 7 to 12 years	356 molars 147 incisors	EAPD criteria [9]	Presence (enamel or dentine) / Absence (Assessed by clinical examination)	12 months 18 months 24 months 36 months	MOLARS 12 Months White-creamy OP: 39/226 (17.3%) Yellow-brownish OP: 45/130 (34.6%) 18 Months White-creamy OP: 46/223 (20.6%) Yellow-brownish OP 51/126 (40.5%) 24 Months White-creamy OP: 51/215 (23.7%) Yellow-brownish OP: 58/123 (47.2%) 36 Months White-creamy OP: 54/192 (28.1%) Yellow-brownish OP: 59/112 (52.7%)	INCISORS 12 Months White-creamy OP: 2/111 (1.8%) Yellow-brownish OP: 6/36 (16.7%) 18 Months White-creamy OP: 3/111 (2.7%) Yellow-brownish OP: 7/36 (19.4%) 24 Months White-creamy OP: 3/108 (2.8%) Yellow-brownish OP: 8/35 (22.9%) 36 Months White-creamy OP: 3/93 (3.2%) Yellow-brownish OP: 7/29 (24.1%)	Yellow-brown OP had a significantly greater chance of PEB over 36-month (incisors OR = 2.54, 95% CI 1.60–4.01; molars OR = 10.28; 95% CI 2.56–41.31). Survival analysis: the occurrence of PEB was more frequent in the first 12 months. Incisors presented higher survival rates than molars, for both white/creamy (p < 0.01) and yellow/brown opacities (p < 0.008). Conclusion: *"PEB is more likely to occur in teeth presenting darker opacities than in teeth with white opacities"*.	Study with the longer follow-up period (36 months) and relatively large sample. Confounder factors such age and localization of the OP (exposed or not to masticatory forces) were not controlled. A dropout rate of 17.1% in 36 months (31/181 children).

Da Costa-Silva et al. (2011) Botelhos, Brazil	Longitudinal	182 children Age: 6 to 12 years	262 molars 136 incisors	EAPD criteria [9]	Presence (enamel or dentine) / Absence (Assessed by clinical examination)	18 months	MOLARS White OP: 4/83 (4.8%) Yellow OP: 28/148 (18.9%) Brown OP: 10/31 (32.25%)	INCISORS White OP: 0/71 (0%) Yellow OP: 1/43 (2.1%) Brown OP: 5/22 (20.8%)	Brown OP (RR = 10.9; CI: 03.78 – 31.38) and yellow OP (RR = 5.84; 95% CI: 2.10-16.27) were at higher risk of PEB ($p < 0.0001$). Children ≤ 10-year-old were at higher risk of PEB (RR = 1.94, 95% CI 1.13-3.35; $p = 0.01$). Poisson regression also showed that brown OP (RR = 9.46, 95% CI: 2.94 – 30.44) and yellow OP (RR = 5.37; 95% CI: 1.72-16.76) were at higher risk of PEB ($p < 0.004$). Conclusion: *"the color of enamel opacity seems to be a good predictor for future PEB and atypical restorations"*.	Study with relatively large sample. Confounder factors such age of the OP (exposed or not to masticatory forces) were controlled in the statistical analysis. Higher prevalence of PEB in occlusal surfaces (exposed to masticatory forces) was reported in the results. A dropout rate of 19.2% in 18 months (35/182 children).
Fragelli et al. (2015) Araraquara, Brazil	Longitudinal	45 children Age: 6 to 9 years	83 molars 102 incisors	EAPD criteria [9]	Presence / Absence (Assessed by clinical examination and photographs)	6 months 12 months	MOLARS/INCISORS 6 Months White OP: 1/116 (0.86%) Yellow OP: 1/41 (2.4%) Brown OP: 4/28 (14.3%) 12 Months White OP: --- Yellow OP: --- Brown OP: 1/28 (3.5%)		Brown OP showed a higher percentage of PEB (17.9%) compared with white OP (0.86%) and yellow OP (2.4%). Comment: *"The yellow and brown enamel opacities and molar teeth increased the risk of enamel breakdown, suggesting that these areas are defective enamel with low resistance and greater susceptibility to breakdown and dental caries"*.	The study observed a very low percentage of PEB. No test of statistical significance was performed. A dropout rate of 15.6% in 12 months (7/45 children).

Table 2 (contd.)

Author; Year; Study location	***Study design***	***Participants' characteristics at baseline***	***Sample size (subject, tooth or tooth surface)***	***Diagnostic criteria for HSPM/ MIH***	***Diagnostic criteria for PEB***	***Follow-up period***	***Prevalence of PEB (Summarized data for each group of opacities)***	***Effect estimates and Authors' Comment/Conclusion***	***Critical appraisal***
Ghanim et al. (2013) Mosul, Iraq	Cross-sectional	53 children Age: 7 to 9 years	83 second primary molars	EAPD criteria [9]	Presence / Absence (Assessed by clinical examination)	N/A	SECOND PRIMARY MOLARS WITH PEB 18/83 (21.7%) White-creamy OP: 2/39 (5,12%) Yellow-brownish OP: 16/3 (42,10%)	From the 18 teeth with PEB, 16 were associated to yellow-brown OP and only 2 to white-creamy OP. The occlusal surface was the site most affected by PEB. Comment: *"No significant differences existed between opacities and PEB by their distribution on tooth surface"*.	As a cross-sectional study the higher occurrence of PEB in yellow-brown OP is strongly suggested but it is not possible to assure causality in terms of risk.

Mittal et al. (2013) Chandigarh, India	Cross-sectional	113 children Age: 6 to 9 years.	113 Subjects	EAPD criteria [9]	Presence / Absence (Assessed by clinical examination)	N/A	SUBJECTS WITH MOLARS/INCISORS WITH PEB 51/113 (45.1%) White-creamy: 6/102(5,8%) Yellow-brownish: 45/99 (45,5%)	A total of 51/113 subjects presented molars and/or incisors with PEB due to MIH. From the 51 subjects, 45 presented PEB associated to yellow-brown OP and 6 to white-creamy OP. A mean of 1.18 (SD 2.080) tooth surfaces presented PEB associated to yellow-brown OP and 0.11 (SD 0.488) to white-creamy OP. Comment: *"White/creamy opacities without PEB were the most prevalent lesions"*.	Different from most of other studies, this study expressed data related to PEB in the individual level. Also, as a cross-sectional study the higher occurrence of PEB in yellow-brown OP is suggested but it is not possible to assure causality in terms of risk.
Neves et al. (2018) Rio de Janeiro, Brazil	Longitudinal	65 children Age: 6 to 12 years	209 tooth surfaces	EAPD criteria [9]	Presence (enamel or dentine) / Absence (Assessed by clinical examination)	12 months	TOOTH SURFACES OF MOLARS/INCISORS White-creamy: 14/86 (16.3%) Yellow-brownish: 38/91 (41.8%)	GEE analysis and estimated OR adjusted for age and gender showed that yellow-brown OP had 2.67 more chance to aggravate to PEB (p = 0.05). Being located under masticatory forces did not increase the chance of breakdown significantly (OR= 1.46; p =0.25). Conclusion: *"Color of the opacity seems to play an important role on the occurrence of fracture and should be considered as a potential predictor. The location of the opacity, however, did not influence in aggravation to breakdown.*	Confounder factors such age and localization of the OP (exposed or not to masticatory forces) were controlled in the statistical analysis. A dropout rate of 10.8% in 12 months (7/65 children).
Rai et al. (2019) *Virajpet, India*	Cross-sectional	210 children Age: 9 to 12 years	210 Subjects	EAPD criteria [9]	Presence / Absence (Assessed by clinical examination)	N/A	SUBJECTS WITH MOLARS/INCISORS WITH PEB 33/210 (15.7%) White-creamy: 7/22 (31,8%) Yellow-brownish: 26/96 (27,1%)	From 210 subjects, 33 presented molars and/or incisors with PEB due to MIH. In 26 subjects the PEB was associated to yellow-brown OP and in 7 to white-creamy OP. Comment: *"Majority of children with MIH have lesions in both molars and incisors with demarcated opacities and atypical restorations being the most frequent defect type"*.	Different from most of other studies, this study expressed data related to PEB in the individual level. A high percentage of children with atypical restorations was reported (probably related to the inclusion of older children) suggesting a high frequency of PEB. But the presence and color of opacities around the restorations was not evaluated.

M: male; F: female; MIH: molar-incisor hypomineralization; PEB: post-eruptive enamel breakdown; OP: opacity
N/A: not applicable; CI: confidence intervals; RR: relative risk; OR: odds ratio; p: p value; SD: standard deviation. EAPD: European Academy of Paediatric Dentistry

Table 3 - Quality Assessment (NOS)

Authors/ Year	Country	Newcastle-Ottawa Scale (NOS)							
		Selection				Comparability		Outcome	
Longitudinal studies		Max. 4 stars				Max. 2 stars		Max. 3 stars	
Respective NOS questions[23]		1	2	3	4	5	6	7	8
Arslanagic et al. 2020	Bosnia-Herzegovina	★	★		★	★		★	
Cabral et al. 2020	Brazil	★	★	★	★			★	★
Costa-Silva et al. 2011	Brazil	★	★	★	★	★		★	★
Fragelli et al. 2015	Brazil	★	★	★	★			★	★
Neves et al. 2019	Brazil		★	★	★	★ ★		★	★
Cross-seccional studies		Max. 5 stars				Max. 2 stars		Max. 3 stars	
Respective NOS questions[24]		1	2	3	4	5		6	7
Ghanin et al. 2013	Iraq	★	★	★	★ ★				
Mittal et al. 2012	India	★	★	★	★ ★				
Rai et al. 2019	India	★	★	★	★ ★				

Table 4 - Certainty of evidence (GRADE).

Certainty assessment							Overall certainty
N° of datasets	**Design of the studies**	**Risk of bias**	**Inconsistency**	**Indirectness**	**Imprecision**	**Other considerations**	
Post eruptive fracture (longitudinal designs - 6 months of follow-up)							
1	Observational studies	Serious [a]	Not serious	Not serious	Very serious [b, c]	None	⊕◯◯◯ VERY LOW
Post eruptive fracture (longitudinal designs - 12 months of follow-up)							
4	Observational studies	Serious [a]	Not serious	Not serious	Serious [b]	None	⊕◯◯◯ VERY LOW
Post eruptive fracture (longitudinal designs - 18 months of follow-up)							
2	Observational studies	Serious [a]	Not serious	Not serious	Serious [b]	None	⊕◯◯◯ VERY LOW
Post eruptive fracture (longitudinal designs - 24 months of follow-up)							
1	Observational studies	Serious [a]	Not serious	Not serious	Serious [b]	None	⊕◯◯◯ VERY LOW
Post eruptive fracture (longitudinal designs - 36 months of follow-up)							
1	Observational studies	Serious [a]	Not serious	Not serious	Serious [b]	None	⊕◯◯◯ VERY LOW
Post eruptive fracture (cross-sectional designs)							
3	Observational studies	Serious [a]	Serious [d]	Not serious	Serious [b]	None	⊕◯◯◯ VERY LOW

a. The certainty of evidence was downgraded in one level because the included studies provide results with risk of bias for one or more relevant criteria and are likely to seriously alter the evidence.
b. The certainty of evidence was lowered by one level because the amount of data was limited (the required minimum sample size of 1000 was not reached).
c. The certainty of evidence was downgraded by one level because the confidence interval of the study included no effect and meaningful effect in one direction.
d. The certainty of evidence was downgraded in one level because there was no overlap between the confidence intervals. The magnitude of the effects across the studies is inconsistent.

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1.3.2 Retention rate of fissures sealants in MIH molars: randomized clinical trial (manuscrito)

Retention rate of fissures sealants in MIH molars: randomized clinical trial.

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ABSTRACT

Fissure sealants represent a non-invasive alternative already established to prevent and control carious in populations at high risk for caries. The hypomineralized tooth is more porous and less mineralized than the healthy enamel, making it more susceptible to post-eruptive breakdown and consequently to the development of caries. This study aims to evaluate the retention of a glass ionomer sealant (GIC) and a resinous sealant (RES) in hypomineralized first permanents molars (FPM). This clinical trial with two parallel arms performed with healthy children previously diagnosed with MIH in an epidemiological survey. Inclusion was the presence of at least one FPM with white-creamy or yellow-brownish opacity without enamel breakdown or cavitated caries. The initial clinical examination was carried out by two previously trained and calibrated examiners assessing caries (Nyvad et al. 1999) and MIH (Weerheijm et al 2003). Patients were randomized into test (GIC sealant) or control (RES sealant) by block randomization. The interventions were done by a single operator. The retention of the sealants was evaluated after six months and 12 months. Pearson Chi-square test, Mann-Whitney test and Kaplan-Meier Log Rank survival analysis were used in the statistical analysis. The sample comprised 42 children, with mean age of 8.48, 20 girls (47.6%) and 22 boys (52.4%). A total of 79 FPM were treated, 41 in the Group GIC and 38 in the Group RES. In both groups, GIC and RES, most of the teeth were upper molars (58.5 and 55.3%, respectively), had white-creamy opacity (63.4 and 50.0%, respectively), and had no signs of active or inactive caries lesion (61.0 and 55.3%, respectively) with no significant difference between groups. From the 79 treated molars, 72 (91.1%) were available for the survival analysis. The survival rate of the sealants was 0.81 and 0.89 after 6 months and 0.72 and 0.83 after 12 months for Groups RES and GIC, respectively. No significant difference between groups was observed (p=0.148, Pearson Chi-Square). In bivariate analysis, no influence of type of tooth, color of the opacity, or caries score was seen. Within the limitations of the present study, it can be concluded that the GIC and the RES sealants in MIH molars presented a similar retention rate after 12 months.

Keywords: Preventive Dentistry; Pit and Fissure Sealants; Dental Caries; Molar Incisor Hypomineralization; Dental Enamel Hypoplasia; Enamel Opacities; Child;

BACKGROUND

Molar Incisor Hypomineralization (MIH) is a qualitative developmental defect of enamel affecting first permanent molars and often permanent incisors, characterized by demarcated opacities with color ranging from white-creamy to yellow-brownish(1,2). Prematurity and low birth weight, high fever, infections, and antibiotics intake in the first two years of life and genetic factors are investigated as possible causes of MIH. It is supposed that a combination of factors would cause an imbalance in the function of ameloblasts during the period of mineralization and maturation of the enamel.(3–7) The global prevalence of MIH has been estimated as 13,1%(8), varying among the prevalence studies from 2.8 to 40.2%(9–15). Eight years of age has been recommended as the best age for the diagnosis of the defect, because at this age, most children have all four permanent molars, as well as the eight permanent incisors(2).

The hypomineralized enamel is more porous and less mineralized, presenting a lower content of phosphorus and calcium when compared to normal enamel. The more fragile enamel tends to fracture soon after the establishment of masticatory contact(16–19). MIH opacities have distinct borders being clearly differentiated from the surrounding sound enamel and in vitro studies showed that yellow-brownish are more porous than white-creamy opacities(20,21). Clinical studies(19,22–24) have shown that yellow-brownish opacities tend to fracture more frequently than white opacities, corroborating studies that have suggested a greater severity of first ones(17,20). The post-eruptive enamel breakdown (PEB) exposes the underlying dentin and acts as a niche for biofilm deposition, favoring the development of caries(25–27). Patients affected by enamel hypomineralization often complain of thermal and mechanical sensitivity to brushing, making the proper control of plaque more difficult, which is another factor that contributes to the development of tooth decay(22,28–30). In children, a significant association has been observed

between the occurrence of caries and MIH, resulting in a significant higher caries index and a greater need for restorative treatment in these children(15,27,31–33).Therefore, preventive measures that postpone or prevent the occurrence of PEB and dental caries are necessary (22,34,35).

The use of fissure sealants is a non-invasive measure recommended for the management of the carious process that acts as a physical barrier capable of preventing the contact of biofilm with the enamel, hampering caries development or controlling the progression of mineral loss on the enamel surface(36–38). Although the retention rate of the resin-based sealants are significantly higher in comparison with the glass ionomer sealants (39,40), a similar caries preventive effect is observed (39–41) . High viscosity glass ionomer-based sealant is a material less sensitive to moisture, being recommended, for example, for teeth where the placement of the clamp for absolute isolation is not possible, either due to the difficulty of collaboration of the patient or due to incomplete eruption of the tooth(42). Additionally, it is a material widely used in school programs where the dental equipment is usually not available and the dental care follow the atraumatic restorative treatment strategy(43).

The evidence of the retention of fissure sealants in MIH molars is still scarce (27,44). In the first study(27) 8 in 35 (22.9%) of the molars with sealed MIH were resealed (on average after 33 months), while in teeth without MIH, only 16 in 90 (17.7%) had to be resealed (on average after 55 months). In the second study(44), in 47 MIH molars, 21% of the sealants failed after 12 months, 53% and 28% after 2 and 3-years, respectively. A higher retention rate was observed in the more recent study(45), 83% after 12 months, probably due to improved characteristics of the glass ionomer used. The greater organic content, areas of aprismatic enamel, and increased porosity of the hypomineralized enamel compared to normal enamel probably influences sealant retention(17,46). Hence, more studies are still necessary to assess the retention rate and other outcomes related to the effectiveness of sealing MIH molars in order to support treatment decisions based on clinical evidence (47).

Objective

This study aimed to evaluate the retention rate of two types of fissure sealants, a resinous sealant and a high viscosity glass ionomer sealant, in hypomineralized first permanent molars.

METHODS

This randomized clinical trial followed the CONSORT recommendations (REF) and is registered in Brazilian Clinical Trials Registry (ReBec). The study was approved by the Research Ethics Committee (CAAE 18266919.6.0000.5259). The children and their parents or legal guardians signed an informed consent. The study presented minimal risk, because the application of pit and fissure sealant is a non-invasive treatment, established in the literature as a safe clinical procedure. It does not affect the physical integrity of the participants and biosafety measures were strictly followed. In addition to the dental treatment carried out through the study, the patients were offered dental treatment according to their individual needs.

Trial design

This trial was designed as a randomized controlled clinical trial with two parallel arms. One group was treated with a high viscosity glass ionomer cement as sealant and the other group was treated with a resinous sealant.

Setting

The present study was a randomized controlled clinical trial, with semiannual evaluations and duration of 12 months, carried out at the Children's Clinic of Faculdade Arthur Sá Earp Neto, Petrópolis - RJ. Petrópolis is a city located in the mountainous region of the State of Rio de Janeiro, with a population of 295,917 inhabitants, according to the last Census of 2010, with an IDHM (Municipal Human Development Index) of 0.745. Access to basic sanitation is 82.1% and the average infant mortality rate in the city is 19.39 per 1,000 live births. The schooling rate of children in the municipality is from 6 to 14 years old is 97.4% (29). The population benefits from the supply of treated and fluoridated water (30).

Sample size

The 129 children diagnosed with MIH from an epidemiological survey, that evaluated 450 children, were invited to participate in this study and after meeting the inclusion and exclusion criteria, were randomly allocated among the treatment groups (Figure 1).

Recruitment

Recruitment was done through an invitation sent to the patients diagnosed with MIH in an Epidemiological Survey carried out in September-December 2018.

Participants

Inclusion criteria

Healthy children, 8-10 years-old, with molar incisor hypomineralization diagnosed according to the European Academy of Pediatric Dentistry criteria. Patients should present at least one first permanent molar with white-creamy or yellow-brownish demarcated opacity without post-eruptive breakdown or dentin caries.

Exclusion criteria

Children with other enamel developmental defects than molar incisor hypomineralization, with fixed orthodontic appliance or who were unable to cooperate during dental treatment were excluded.

Randomization

Patients were randomly randomized into one of the respective groups: Test GIC - sealing with glass ionomer cement, Equia Forte® (GC Europe, Leuven, Belgium) and Control Res - sealing with resin, FluroShield® (Dentisply Sirona, São Paulo, Brazil). Randomization was performed in blocks of 6 participants, by a research assistant responsible for randomly selecting the sealing procedure to be carried out on participants scheduled for the day, to guarantee equal daily distribution between the procedures (3 Test GIC and 3 Control Res) and informing the operator about the treatment to be performed.

Blinding

Only the children and their parents were blind regarding the allocation group. The operator and the examiner who evaluated the outcome during the follow-up were not blind regarding the allocation group because the materials are clearly different.

Interventions allocation

Both test and control interventions were done in a dental setting by a single trained operator assisted by a trained assistant.

In the test group (Group GIC), the first permanent molars were sealed with a high viscosity glass ionomer cement, Equia Forte® (GC, Europe), and in the control group (Group RES), the first permanent molars were sealed with resinous fissure sealant, FluroShield® (Dentisply Sirona Brazil). For both interventions, the manufacture's instructions were followed strictly as described below.

Group GIC:

- tooth surface (pit and fissures) cleaning with rubber cup and pumice;
- rinsing thoroughly with water followed by air-drying;
- isolation with cotton rolls and suction;
- surface conditioning with 10% poliacrylic acid, Cavity Conditioner® (GC America), for 10 seconds;
- rinsing throughly with water followed by air-drying;
- capsule activation and mixing in an amalgamator for 10 seconds;
- dispensation of the high viscosity glass ionomer cement on the tooth surface sealing all the pits and fissures completely;
- finger pressure to ensure the complete filling of the pits and fissures;
- occlusal contacts checking with a carbon paper;
- removal of the excess using an instrument and/or finishing burr;
- application of the finishing coat, Equia Coat® (GC Europe);
- light curing for 20 seconds.

Group RES:

- papilla local anesthesia using lidocaine 2% 1:100.000 followed by isolation with clamps and rubber dam;
- tooth surface (pit and fissures) cleaning with rubber cup and pumice;
- rinsing thoroughly with water followed by air-drying;
- surface conditioning with 37% phosphoric acid gel for 30 seconds;
- rinsing throughly with water followed by air-drying;
- dispensation of the resin fissure sealant FluoroShield® (Dentisply Sirona Brasil) on the tooth surface sealing all the pits and fissures completely;
- lightcuring for 40 seconds;
- removal of the rubber dam;
- occlusal contacts checking with a carbon paper;
- when necessary, removal of the excess using a finishing burr.

Outcome and follow-up

The outcome was the retention rate after 6 and 12 months assessed by tactile-visual examination and scored as:

Retention rate of the sealants (according to Oulis and Berdouses, 2009(48) *scored as):*

Score 1: totally retained

Score 2: partially retained

Score 3: totally lost

Data analysis

The data was analyzed in the SPSS version 20.0 statistical program. Comparisons between test and control groups were done using Pearson Chi-square test and Mann-Whitney test. The retention of the test and control sealants was assessed comparing the proportion of teeth with totally retained sealant between groups. The survival rate of the sealants was analyzed using the Kaplan-Meier Log Rank analysis. The level of significance was set at 0.05.

RESULTS

The sample comprised 42 children with MIH, 20 girls (47.6%) and 22 boys (52.4%), with mean age of 8.48 (±0.55) (ranging from 8 to 11 years-old), living in a fluoridated area. Mild MIH represented 64.3% (n = 27) of the sample while 35.7% (n = 15) had severe MIH. Table 1 shows the data regarding age, gender, plaque index, gingival bleeding index, DMF-T, def-t, MIH severity, and number of treated molars of the full sample at baseline, 6-months and 12-months follow-up and the dropouts during this period. No significant difference was observed between groups neither in the baseline nor in the follow-up periods.

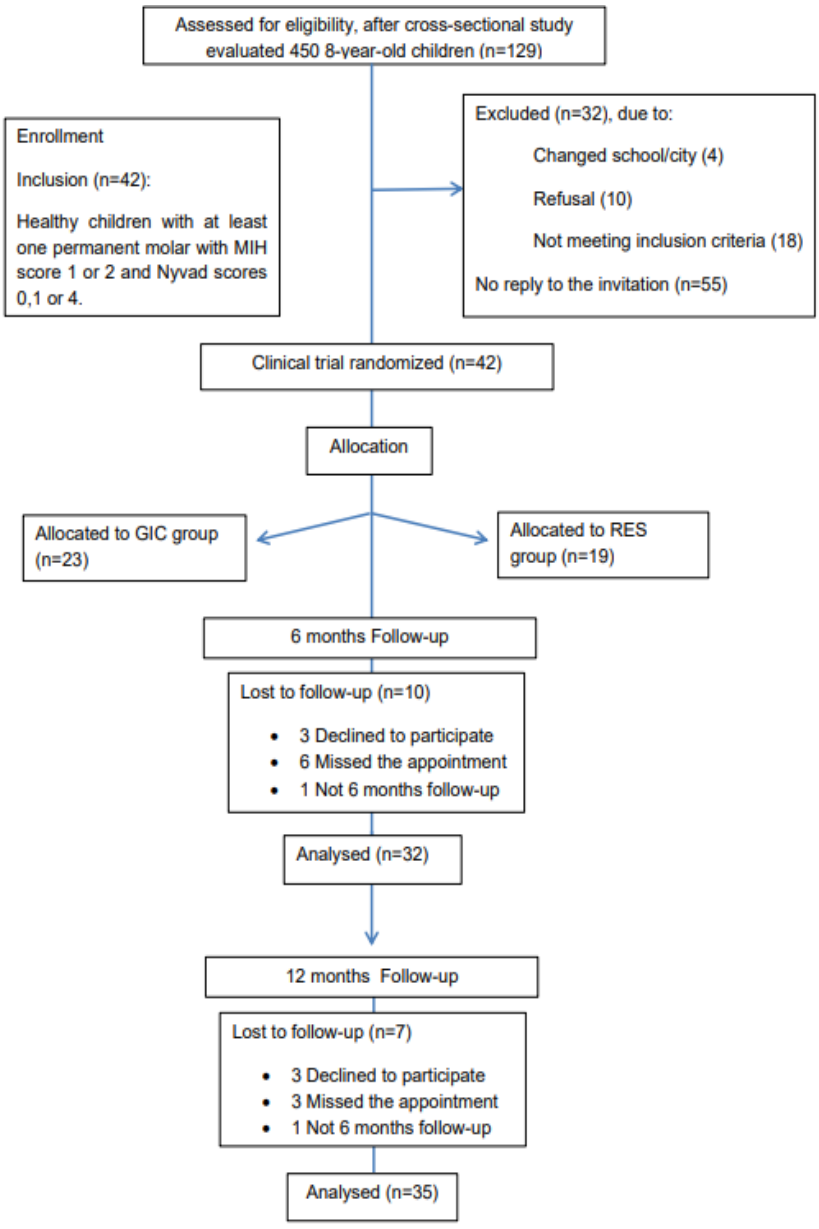

Figure 1- Study flow diagram.

Table 1: Variables at baseline of the full sample (n=42), patients evaluated after 6 months (n=32) and after 12 months (n=35), and dropouts.

	Baseline			6 months			12 months		
Baseline variables	Full sample	Group GIC	Group RES	Group GIC	Group RES	Drop-outs*	Group GIC	Group RES	Drop-outs
	n=42	n=23	n=19	n=16	n=16	n=10	n=19	n=16	n=7
Age (mean (SD))	8.48 (0.55)	8.52 (0.59)	8.42 (0.51)	8.44 (0.63)	8.38 (0.50)	8.70 (0.48)	8.53 (0.61)	8.44 (0.51)	8.43 (0.53)
Gender (n (%))									
Girls	20 (47.6%)	11 (47.8)	9 (47.4)	9 (56.3)	8 (50)	3 (30)	9 (47.4)	8 (50)	3 (42.9)
Boys	22 (52.4%)	12 (52.2)	10 (52.6)	7 (43.7)	8 (50)	7 (70)	10 (52.6)	8 (50)	4 (57.1)
Plaque Index (mean (SD))	62.9 (28.2)	46.04 (22.34)	40.41 (25.51)	45.4 (22.9)	36.9(24.4)	50.9 (23.2)	44.2 (23.8)	40.9 (27.7)	47.3 (13.2)
Proximal GB (mean (SD))	38.1 (19.6)	38.55 (16.33)	38.26 (16.22)	40.0 (18.5)	36.6 (16.5)	38.7 (11.9)	39.3 (17.1)	40.3 (16.9)	31.6 (10.6)
DMF-T (mean (SD))	0.52 (0.89)	0.78 (1.09)	0.21 (0.42)	0.94 (1.18)	0.19 (0.40)	0.40 (0.70)	0.89 (1.15)	0.25 (0.45)	0.14 (0.38)
def-t (mean (SD))	1.52 (1.95)	1.57 (1.90)	1.47 (2.06)	1.31 (1.74)	1.75 (2.14)	1.50 (2.12)	1.74 (1.97)	1.69 (2.18)	0.57 (1.13)
MIH severity									
Mild (n (%))	27 (64.3)	13 (56.5)	14 (73.7)	8 (50)	12 (75)	7 (70)	10 (52.6)	11 (68.8)	6 (85.7)
Severe (n (%))	15 (35.7)	10 (43.5)	5 (26.3)	8 (50)	4 (25)	3 (30)	9 (47.4)	5 (31.3)	1 (14.3)
Number of treated molars (mean (SD))	1.88 (0.94)	1.83 (0.94)	1.95 (0.97)	1.81 (0.91)	2.00 (1.03)	1.80 (0.92)	1.79 (1.03)	2.00 (0.97)	1.86 (0.69)

DMF-T/def-t: carie index at tooth level, considering decayed, missing due to caries, and filled teeth; GB: gingival bleeding.
* Dropouts at 6 months: 7 from Group GIC and 3 from Group RES.

A total of 79 permanent first molars were treated, 41 in the Group GIC and 38 in the Group RES. Each patient contributed with one to four molars with a mean number of treated teeth per patient of 1.83 (±0.93) in Group GIC and 1.95 (±0.97) in the Group RES. Table 2 shows the characteristics of the treated teeth at baseline, 6 months, and 12-months follow-up. In both groups, GIC and RES, most of the teeth were upper molars (58.5 and 55.3%, respectively), had white-creamy opacity (63.4 and 50.0%, respectively), and had no signs of active or inactive caries lesion (61.0 and 55.3%, respectively) with no significant difference between groups.

From the 79 treated molars, 72 (91,1%) were available for the survival analysis. The survival rate of the sealants was 0.81 and 0.89 after 6 months and 0.72 and 0.83 after 12 months for Groups RES and GIC, respectively (Figure 2). No significant difference between groups was observed (p=0.148, Pearson Chi-Square). In bivariate analysis, no influence of type of tooth, color of the opacity, or caries score was seen (Table 3).

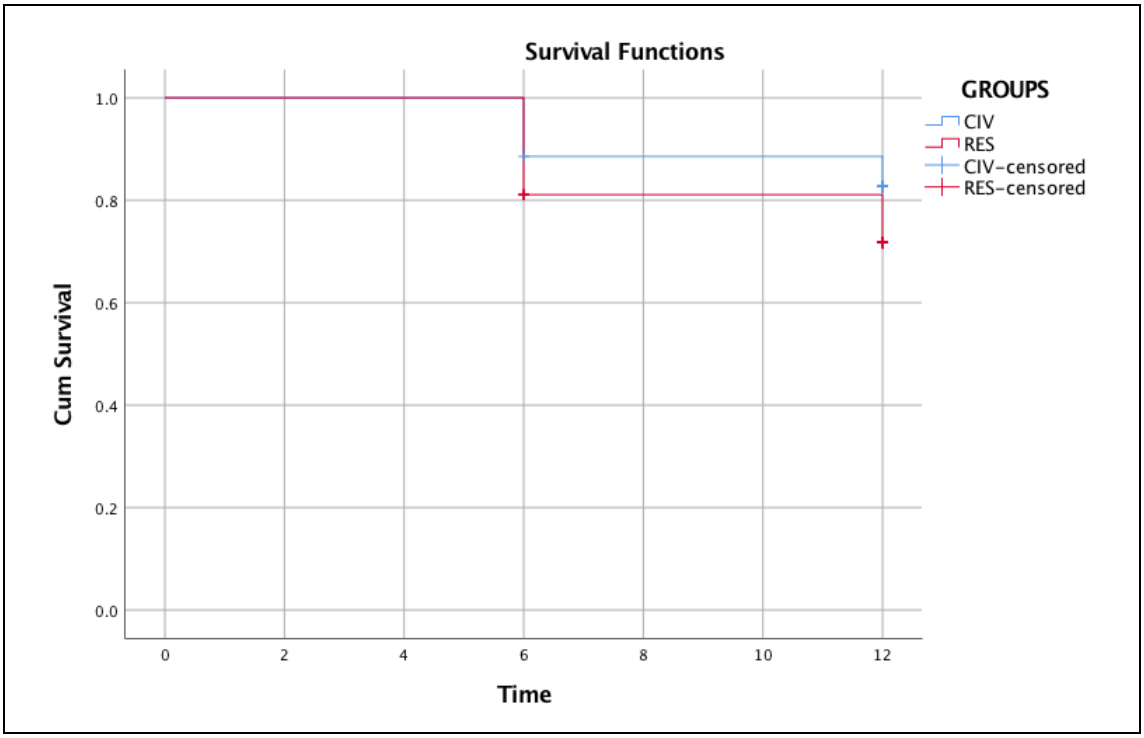

Figure 2: Comparison of the cumulative survival rate of GIC and RES sealants over a period of 12 months (Kaplan-Meier Log-Rank test).

Table 2: Baseline data of type of tooth, color of the opacity and caries score (Nyvad et al. 1999) of the full sample (n=79), 6 months (n=61) and 12 months (n=66).

	Baseline			6 months			12 months		
Baseline variables	GIC n=41	RES n=38	*p* value*	GIC n=28	RES n=33	*p* value*	GIC n=33	RES n=33	*p* value*
Type of tooth									
Upper molars	24 (58.5%)	21 (55.3%)	0.823*	16 (57.1%)	18 (52.9%)	1.00*	20 (60.6%)	18 (54.5%)	0.629*
Lower molars	17 (41.5%)	17 (44.7%)		12 (42.9%)	15 (45.5%)		13 (39.4%)	15 (45.5%)	
Color opacity									
White-creamy	26 (63.4%)	19 (50%)	0.262*	15 (53.6%)	16 (48.5%)	0.799*	18 (54.5%)	15 (45.5%)	0.623*
Yellow-brownish	15 (36.6%)	19 (50%)		13 (46.4%)	17 (51.5%)		15 (45.5%)	18 (54.5%)	
Caries score									
0 (sound)	25 (61%)	21 (55.3%)	0.864**	19 (67.9%)	18 (54.5%)	0.372**	21 (63.6%)	17 (51.5%)	0.416**
1 (active non-cavited)	8 (19.5%)	8 (21.1%)		6 (21.4%)	7 (21.2%)		8 (24.2%)	8 (24.2%)	
4 (inactive non cavited)	8 (19.5%)	9 (23.7%)		3 (10.7%)	8 (24.2%)		4 (12.1%)	8 (24.2%)	

*Fisher's Exact Test
**Chi-quadrado de Pearson

Table 3: Proportion of retention of sealants after 12 months in relation to the type of tooth, color of the opacity, and caries score at baseline.

Baseline	Follow-up			
	Sealant retention – n (%)			
	Total	Partial	Loss	P value*
Type of tooth				
Upper molars	36 (85.7%)	5 (11.9%)	1 (2.4%)	p=0.157
Lower molars	20 (66.7%)	8 (26.7%)	2 (6.7%)	
Color of the opacity				
White-creamy	30 (78.9%)	6 (15.8%)	2 (5.3%)	p=0.789
Yellow-brownish	26 (76.5%)	7 (20.6%)	1 (2.9%)	
Caries score				
Sound	26 (51%)	9 (75%)	3 (100%)	p=0.111
Non-cavitated lesion	25 (49%)	3 (25%)	0 (0%)	

*Chi-quadrado de Pearson

DISCUSSION

The present study aimed to evaluate the retention rate of two fissure sealants in MIH Molars. Hypomineralized teeth are less mineralized, more porous and consequently, have more chance to fracture (17,18,20,23). Therefore, even in cases where the enamel does not show visible signs of caries activity, such as active white spot or initial enamel discontinuity, the use of pit and fissure sealants could be adopted as a preventive measure. The use of sealants have been recommended as one of the non-invasive treatments for MIH molars affected by mild hypomineralization as a protective strategy against enamel breakdown and caries(49) .

Particularly for resinous sealants, the caries preventive effect is related to the retention rate. If the sealant is partially or totally lost, its performance on preventing or controlling caries is reduced(39) . In general, clinical studies with no MIH molars have observed higher retention rates for the resinous sealants when compared with glass

ionomer sealants(39,40,50) . After two years, the retention rate estimated for light-curing resinous sealants is between 63 and 68% and around only 14% for glass ionomer sealants(40) .

When dealing with hypomineralized enamel, it must be kept in mind that the high protein content in the enamel might hinder proper adhesion of resins(18) . Despite that, in a previous study with hypomineralized molars and resinous sealant, a cumulative survival rate of 76% was observed after 12 months(47). Similarly, in the present study, 72% of the resinous sealants were totally retained after the same period of time. Retention even higher was achieved by Lygidakis et al (2009)(44) combining the fissure sealant with an adhesive system. After 12 months, the retention rate was 100% compared to 79% of the sealants conventionally applied.

Advantages usually attributed to glass ionomer are the continuous fluoride releasing and less susceptibility to moisture during application(51). High viscosity glass ionomer cements represent a breakthrough in physical properties, such as higher abrasion resistance, fracture toughness, flexural strength and moisture sensitivity compared to conventional glass ionomer cements (GIC)(52). These properties are of particular interest in case of MIH patients whose permanent first molars have the indication for sealants before complete eruption. In these cases, the glass ionomer cement could be a more appropriate choice than resinous sealants. Recently, a variety of modifications in high viscosity glass ionomer cements have been tested in order to improve chemical and mechanical properties.

One example is the glass ionomer used in the present study, Equia Forte® (GC, Europe), where ultrafine and highly reactive glass particles were added in the attempt to enhance wear resistance and reduce solubility of the material. The glass ionomer surface is reinforced with a resin coat, forming a more resistant hybrid structure. Moreover, the encapsulated system avoids inaccurate dispensation guaranteeing the correct powder/liquid ratio and the quality of the material(53) The higher retention rate, 83% after 12 months, of the glass ionomer sealant observed in the present study with MIH molars in comparison with previous studies with no MIH molars(40) might be a result of the improved quality of the material. A recent study that used a similar encapsulated glass ionomer sealant in MIH molars also observed a retention rate of 83% after 12 months. Additionally, authors report a significant protective effect against dentin caries(45)

To the best of our knowledge, no study has been done so far using the same high viscosity glass ionomer used in the present study as sealant in hypomineralized molars. Two clinical trials that evaluated the survival rate of restorations performed with this material in MIH molars also observed a high success rate over 90% after 12 months(54) and over 87% after 24 months(55) .

The present study aimed to compare two different materials in MIH molars and did not include no MIH molars because the retention rate in sound teeth are already known in the literature (36,39,40,56–60). The understanding about the greater porosity and lower mineral content of the enamel in MIH teeth and the consequent higher risk of caries and occurrence of fractures, already presented by several clinical studies (19,22–24,61–63), supported our decision on not including a control group with no intervention in the design of the present study. Based on longitudinal studies that followed molars with MIH(19,22–24), if no preventive intervention is performed, after 12-18 months, it is expected that 7 to 25%percent of the teeth will suffer from PEB or need restorative treatment.

Within the limitations of the present study, it can be concluded that the glass ionomer sealant and the resinous sealant in MIH molars presented a relatively high and similar retention rate after 12 months. Long term follow-up and larger samples are necessary to confirm these findings. Studies combining the retention rate with more relevant outcomes as caries prevention, effect on hypersensitivity, and enamel breakdown prevention are recommended.

DECLARATIONS

Ethics approval and consent to participate.

Ethical approval has been taken from the Comitê de Ética em Pesquisa do Hospital Universitário Pedro Ernesto/UERJ (Number: 3.621.906). All procedures that were performed are in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards. All patients must consent to participate in the study and their guardians sign the Informed Consent Form.

Competing interests

The author(s) declare that they have no competing interests.

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Author’s contributions

RCJ, CCB, and VMS contributed to the conception of this trial. VMS is the responsible for its design and the trial coordinator. RCJ and PPGR are charge of participants’ recruitment, RCJ is the principal investigator, responsible for examination, treatment plan, organizing and monitoring dental treatments. RCJ and VMS drafted the protocol. All authors critically reviewed and approved the final manuscript as submitted.

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CONCLUSÃO

A certeza da evidência científica atual ainda é baixa para afirmar que existe um maior risco a fratura pós-eruptiva do esmalte (PEB) em opacidades amarelo-amarronzadas em comparação a opacidades brancas. A influência da cor da opacidade demarcada e a ocorrência de PEB ainda carece de novos estudos. No presente ensaio clínico onde foi testada a taxa de retenção do selamente de fóssulas e fissuras em primeiros molares hipomineralizados (HMI), o selamento feito com ionômero de vidro de alta viscosidade e com selante resinosa apresentam taxa de retenção semelhante após 12 meses.

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APENDICE A – Estratégia de busca nas Bases de Dados

Cochrane	ID Search Hits #1 MeSH descriptor: [Dental Enamel Hypoplasia] #2 ("dental enamel hypoplasia" OR enamel defect* OR enamel opacit* OR enamel hypoplas* OR "molar incisor hypomineralization" OR mih OR "molar incisor" OR hypomineral* OR cheese molar* OR demarcated opacit* OR demarcated defect*) #3 #1 OR #2 #4 MeSH descriptor: [Tooth Fractures] #5 (tooth fracture* OR breakdown OR break OR breakage OR "post-eruptive breakdown" OR "structural integrity" OR teeth fracture* OR dental fracture* OR micro-fracture*) #6 #4 OR #5 #7 #3 AND #6
Embase	'enamel hypoplasia'/exp OR 'molar incisor hypomineralization'/exp OR 'agenesis enamel':ab,ti OR 'hypoplasias enamel':ab,ti OR 'enamel hypoplas*':ab,ti OR mih:ab,ti OR 'molar incisor':ab,ti OR hypomineral*:ab,ti OR 'cheese molar':ab,ti OR 'demarcated opacit*':ab,ti OR 'defect demarcated':ab,ti AND 'tooth fractures'/exp OR 'tooth fracture':ab,ti OR 'break':ab,ti OR 'breakage':ab,ti OR 'breakdown':ab,ti OR 'post-eruptive breakdown':ab,ti OR 'structural integrity':ab,ti OR 'teeth fracture*':ab,ti OR 'dental fracture*':ab,ti OR 'micro-fracture*':ab,ti
Lilacs/BBO	tw:((mh:(dental enamel hypoplasia OR hipoplasia do esmalte dentário OR molar incisor hypomineralization OR hipomineralização molar incisivo)) OR (tw:("dental enamel hypoplasia" OR "hipoplasia do esmalte dentário" OR "agenesis enamel" OR "agenesia de esmalte" OR "hypoplasias enamel" OR "hipoplasias de esmalte" OR "enamel hypoplas*" OR "hipoplas de esmalte" OR "molar incisor hypomineralization" OR "hipomineralização molar incisivo" OR mih OR hmi OR "molar incisor" OR "molar incisivo" OR “hypomineral*” OR "cheese molar" OR "molar de queijo" OR "demarcated opacit*" OR "opacid demarcada" OR "defect demarcated" OR "opacidade demarcada"))) AND tw:((mh:(tooth fractures)) OR (mh:(fraturas de dente)) OR (tw:("tooth fracture*" OR “fratura* dente” OR breakdown OR break OR breakage OR quebra OR "post-eruptive breakdown" OR “quebra pós-eruptiva” OR "structural integrity" OR “integridade estrutural” OR "teeth fracture*" OR "dental fracture*" OR “fratura* dos dentes” OR micro-fracture* OR micro-fratura*)))

MedLine	(dental enamel hypoplasia[MeSH Terms] OR molar incisor hypomineralization[MeSH Terms] OR “dental enamel hypoplasia”[Title/Abstract] OR “agenesis enamel”[Title/Abstract] OR “hypoplasias enamel”[Title/Abstract] OR enamel hypoplas*[Title/Abstract] OR “molar incisor hypomineralization”[Title/Abstract] OR mih[Title/Abstract] OR “molar incisor”[Title/Abstract] OR hypomineral*[Title/Abstract] OR “cheese molar”[Title/Abstract] OR demarcated opacit*[Title/Abstract] OR “defect demarcated”[Title/Abstract]) AND (tooth fractures[MeSH Terms] OR tooth fracture*[Title/Abstract] OR breakdown[Title/Abstract] OR break[Title/Abstract] OR breakage[Title/Abstract] OR “post-eruptive breakdown”[Title/Abstract] OR “structural integrity”[Title/Abstract] OR teeth fracture*[Title/Abstract] OR dental fracture*[Title/Abstract] OR micro-fracture*[Title/Abstract])
Scopus	TITLE-ABS-KEY (“dental enamel hypoplasia” OR “molar incisor hypomineralization” OR “agenesis enamel” OR “hypoplasias enamel” OR “enamel hypoplas*” OR mih OR “molar incisor” OR hypomineral* OR “cheese molar” OR “demarcated opacit*” OR “defect demarcated”) AND TITLE-ABS-KEY ("tooth fractures" OR "tooth fracture*" OR breakdown OR break OR breakage OR "post-eruptive breakdown" OR "structural integrity" OR "teeth fracture*" OR "dental fracture*" OR micro-fracture*)
Web of Science	TOPIC: ("dental enamel hypoplasia" OR "molar incisor hypomineralization" OR "agenesis enamel" OR "hypoplasias enamel" OR enamel hypoplas* OR mih OR “molar incisor” OR hypomineral* OR "cheese molar" OR demarcated opacit* OR "defect demarcated") AND TOPIC: ("tooth fractures" OR tooth fracture* OR breakdown OR break OR breakage OR "post-eruptive breakdown" OR "structural integrity" OR teeth fracture* OR dental fracture* OR micro-fracture*)

APENDICE B - Termo de Consentimento Livre e Esclarecido

Este termo de consentimento pode conter palavras que você não entenda. Peça ao pesquisador que explique as palavras ou informações não compreendidas completamente.

Você, na condição de responsável legal de (nome da criança) _____está sendo convidado(a) a participar da pesquisa de cunho terapêutico**,** intitulada

"Efetividade do selamento de fóssulas e fissuras em primeiros molares permanentes hipomineralizados"

Este estudo se justifica pela importância de prevenir o desenvolvimento de cárie dentária em molares permanentes hipomineralizados. O trabalho está sendo realizado sob a responsabilidade da Profa. Dra. Vera Mendes Soviero, com a participação da Doutoranda e Profa. Roberta da Costa Jorge, da Mestranda e Profa. Patrícia Papoula G. dos Reis, juntamente com os alunos do Curso de Odontologia da Faculdade Arthur Sá Earp Neto (FASE).

Se decidir participar do estudo, é importante que leia estas informações sobre o estudo e o seu papel nesta pesquisa.

Se concordar em participar deste estudo você será solicitado a responder a uma ficha clínica com informações sobre a condição de saúde do seu filho. Seu filho será examinado no Ambulatório Escola da FASE para avaliação de cárie dentária e do defeito de esmalte chamado hipomineralização. Caso haja necessidade de tratamento odontológico além do selamento dentário oferecido por esta pesquisa, o paciente será atendido gratuitamente na Clínica Odontológica Infantil da Faculdade Arthur Sá Earp Neto. Nas consultas de revisão semestral e no exame inicial, fotografias dos dentes serão realizadas para acompanhando das opacidades.

Os dados de identificação serão confidenciais e os nomes reservados. As mesmas informações que estão sendo fornecidas a você serão repassadas à criança e a pesquisa somente será realizada se a mesma concordar em participar. Os dados obtidos serão utilizados somente para este estudo, sendo os mesmos armazenados pelo(a) pesquisador(a) principal durante 5 (cinco) anos e após totalmente destruídos (conforme preconiza a Resolução 466/12).

A qualquer momento você pode desistir de participar e retirar seu consentimento. Sua recusa não trará nenhum prejuízo em sua relação com o pesquisador ou com a instituição a ele vinculada. É preciso entender a natureza e os riscos da sua participação e dar o seu consentimento livre e esclarecido por escrito.

Essa pesquisa apresenta risco mínimo, pois o questionário e o exame não afetam a integridade física dos participantes. O procedimento terapêutico que será realizado (selamento da superfície dentária oclusal) é amplamente conhecido e recomendado, e todas as medidas serão tomadas para reduzir o desconforto inerente ao procedimento.

Você ou seu filho não serão identificados quando as informações coletadas forem utilizadas, seja para propósitos de publicação científica ou educativa. Saiba que sua participação é voluntária e que você pode recusar-se a participar ou sair do estudo a qualquer momento.

Você receberá uma cópia deste termo onde consta o telefone e o endereço do pesquisador principal, podendo tirar suas dúvidas sobre o projeto e sua participação, agora ou a qualquer momento. Caso você tenha mais perguntas sobre o estudo, por favor, ligue para **Dra. Vera Soviero,** no telefone 2244-6465 **(FASE - Avenida Barão do Rio Branco 1003, Petrópolis).**

Se você tiver perguntas com relação aos seus direitos como participante do estudo, você também poderá contatar uma terceira parte/pessoa, que não participa desta pesquisa, o Coordenador do **Comitê de Ética em Pesquisa Do Hospital Universitário Pedro Ernesto (UERJ)** ou um de seus membros, **situado na Av. Boulevard Vinte e Oito de Setembro 77, Térreo, Vila Isabel/Rio de Janeiro.** Outros esclarecimentos ainda podem ser obtidos pelo telefone **(21) 2868-8253** ou pelo e-mail: **cep-hupe@uerj.br**

Declaração de consentimento

Eu,_____, (pai/mãe ou representante legal) da criança acima descrita, recebi as informações sobre os objetivos e a importância desta pesquisa de forma clara e autorizo a participação da mesma(o) na pesquisa. Declaro que também fui informado:

• Da garantia de receber resposta a qualquer pergunta ou esclarecimento acerca dos assuntos relacionados a esta pesquisa;

• De que a participação da criança é voluntária e terei a liberdade de retirar o meu consentimento, a qualquer momento, sem que isto traga prejuízo para a minha vida pessoal e nem para o atendimento prestado a criança/adolescente.

• Da garantia que não serei identificado quando da divulgação dos resultados e que as informações serão utilizadas somente para fins científicos do presente projeto de pesquisa.

Sobre o projeto de pesquisa e a forma como será conduzido e que em caso de dúvida ou novas perguntas poderei entrar em contato com a pesquisadora **Prof. Dra. Vera Soviero**, no telefone **(24) 2244-6497** ou no endereço: **Avenida Barão do Rio Branco 1003, Petrópolis (FASE)**

Se você tiver perguntas com relação aos seus direitos como participante do estudo, você também poderá contatar uma terceira parte/pessoa, que não participa desta pesquisa, o Coordenador do **Comitê de Ética em Pesquisa Do Hospital Universitário Pedro Ernesto (UERJ)** ou um de seus membros, **situado na Av. Boulevard Vinte e Oito de Setembro 77, Térreo, Vila Isabel/Rio de Janeiro.** Outros esclarecimentos ainda podem ser obtidos pelo telefone **(21) 2868-8253** ou pelo e-mail: **cep-hupe@uerj.br**

Declaro que recebi cópia deste Termo de Consentimento Livre e Esclarecido, ficando outra via com a pesquisadora.

Petrópolis, ___, de _____ de 2019.

_____ _____

Assinatura do entrevistado Assinatura da pesquisadora

Li as informações contidas neste documento antes de assinar este termo de consentimento. Declaro que entendi as informações acima e que recebi respostas para todas as minhas dúvidas. Confirmo também que recebi uma cópia deste formulário de consentimento. Compreendo que sou livre para me retirar do estudo em qualquer momento, sem perda de benefícios ou qualquer outra penalidade.

Dou meu consentimento de livre e espontânea vontade e sem reservas para participar deste estudo.
Nome do participante: _____
Assinatura do representante legal _____
Data__/__/2019.

Atesto que expliquei cuidadosamente a natureza e o objetivo deste estudo, os possíveis riscos e benefícios da participação no mesmo, junto ao participante e/ou seu representante autorizado. Acredito que o participante recebeu todas as informações necessárias, que foram fornecidas em uma linguagem adequada e compreensível e que ele/ela compreendeu essa explicação.

Assinatura do pesquisador _____
Data__/__/2019.

APÊNDICE C – Termo de Assentimento

Este termo de assentimento pode conter palavras que você não entenda. Peça ao pesquisador que explique as palavras para você.

Você está sendo convidado(a) a participar da pesquisa **"Efetividade do selamento de fóssulas e fissuras em primeiros molares permanentes hipomineralizados"**

Vou explicar o seu papel nesta pesquisa e você decidirá se quer participar.

A qualquer momento você pode desistir de participar sem ter nenhum problema com isso.

A pesquisa vai avaliar o quanto o selamento de superfícies oclusais pode prevenir o desenvolvimento de cárie dentária. Se concordar em participar, um dentista examinará seus dentes usando um pequeno espelho. O exame será feito no Ambulatório Escola da Faculdade Arthur Sá Earp Neto (FASE) por uma dentista experiente no atendimento a crianças e o tratamento proposto, selamento, é simples e seguro. No máximo você pode achar que a consulta demora um pouco. Durante a consulta, a dentista precisará tirar uma foto dos seus dentinhos.

Caso você precise de outro tratamento odontológico, além do selamento, oferecemos atendimento gratuito na Clínica Odontológica Infantil da FASE.

Seu nome não aparecerá em nenhum momento em que as informações coletadas sejam utilizadas, seja em textos ou em aulas. Saiba que você pode recusar-se a participar ou sair do estudo a qualquer momento.

Você receberá uma cópia deste texto com o telefone e o endereço do pesquisador, podendo tirar suas dúvidas a qualquer momento. Caso você tenha mais perguntas peça seu responsável para ligar para **Dra. Vera Soviero,** no telefone **2244-6465 (Avenida Barão do Rio Branco 1003, Petrópolis).**

Se você tiver perguntas com relação aos seus direitos como participante do estudo, você também poderá contatar uma terceira parte/pessoa, que não participa desta pesquisa, o Coordenador do **Comitê de Ética em Pesquisa Do Hospital Universitário Pedro Ernesto (UERJ)** ou um de seus membros, **situado na Av. Boulevard Vinte e Oito de Setembro 77, Térreo, Vila Isabel/Rio de Janeiro.** Outros esclarecimentos ainda podem ser obtidos pelo telefone **(21) 2868-8253** ou pelo e-mail: **cep-hupe@uerj.br**

Declaração de assentimento

Li o texto deste documento antes de assinar. Entendi as informações e recebi respostas para todas as minhas dúvidas. Confirmo também que recebi uma cópia deste formulário. Sei que sou livre para sair do estudo em qualquer momento, sem ter nenhum problema ou prejuízo.

Concordo em participar deste estudo.

Nome do participante: _____

Assinatura do participante: _____

Data__/__/2019.

Atesto que expliquei cuidadosamente a natureza e o objetivo deste estudo, os possíveis riscos e benefícios da participação no mesmo, junto ao participante e/ou seu representante autorizado. Acredito que o participante recebeu todas as

informações necessárias, que foram fornecidas em uma linguagem adequada e compreensível e que ele/ela compreendeu essa explicação.

Assinatura do pesquisador _____

Data__/__/2019.

Nº no Banco de Dados:

APÊNDICE D – Questionário de saúde e ficha do exame clínico

DADOS PESSOAIS

Data: / /	Escola:

Nome:		
Sexo: (1) Masculino (2) Feminino	Data nascimento: / /	
Nome Responsável:	Grau de parentesco ( )Mãe ( )Pai ( )Outro ____	
Endereço:		
Bairro:	Cidade:	CEP
Telefone fixo ( )	Telefone celular ( )	
Telefone fixo 2 ( )	Telefone cellular 2 ( )	
E-mail:		

GRUPO

( ) RES ( ) GIC

DENTES TRATADOS

( ) 16 ( ) 26 ( ) 36 ( ) 46

Data:
/ /

Nº no Banco de Dados:

PLACA + SANGRAMENTO

PLACA: _____%

17	16	15 55	14 54	13 53	12 52	11 51		21 61	22 62	23 63	24 64	25 65	26	27
							D							
							B							
							M							
							L							
47	46	45 85	44 84	43 83	42 82	41 81		31 71	32 72	33 73	34 74	35 75	36	37
							D							
							B							
							M							
							L							

SANGRAMENTO GENGIVAL: _____%

17/16	16/ 5	5/ 4	4/ 3	3/ 2	2/ 1	1/ 1	1/ 2	2/ 3	3/ 4	4/ 5	5/26	26/27
47/46	46/ 5	5/ 4	4/ 3	3/ 2	2/ 1	1/ 1	1/ 2	2/ 3	3/ 4	4/ 5	5/36	36/37

ESCORE
(0) Ausência
(1) Presença

HIGIENIZAÇÃO: remoção de placa com escova dental

Data:
/ /

Nº no Banco de Dados:

HIPOMINERALIZAÇÃO DE ESMALTE

HMI

17	16	15	14	13	12	11		21	22	23	24	25	26	27
							D							
							B							
							M							
							L							
							O							
47	46	45	44	43	42	41		31	32	33	34	35	36	37
							D							
							B							
							M							
							L							
							O							

ESCORE (EAPD)
(0) Ausência de HMI
(1) Opacidade demarcada branca-creme
(2) Opacidade demarcada amarela-amarronzada
(3) Fratura dentária em esmalte
(4) Fratura dentária em dentina
(5) Restauração atípica satisfatória
(6) Restauração atípica insatisfatória
(7) Extração devida a HMI

Data:
/ /

Nº no Banco de Dados:

CÁRIE DENTÁRIA

17	16	15	14	13	12	11		21	22	23	24	25	26	27
							D							
							B							
							M							
							L							
							O							
47	46	45	44	43	42	41		31	32	33	34	35	36	37
							D							
							B							
							M							
							L							
							O							

55	54	53	52	51		61	62	63	64	65
					D					
					B					
					M					
					L					
					O					
85	84	83	82	81		71	72	73	74	75
					D					
					B					
					M					
					L					
					O					

ESCORE (Nyvad)
(0) Ausência de cárie
(1) Mancha branca ativa
(2) Descontinuidade em esmalte ativa
(3) Cavidade em dentina ativa
(4) Mancha branca inativa
(5) Descontinuidade em esmalte inativa
(6) Cavidade em dentina inativa
(7) Restauração satisfatória
(8) Restauração insatisfatória com cárie ativa
(9) Restauração insatisfatória com cárie inativa

DESCRIÇÃO DO ATENDIMENTO

DATA	DENTE/REGIÃO	PROCEDIMENTO

DATA	DENTE/REGIÃO	PROCEDIMENTO

Data: / /

Nº no Banco de Dados:

ACOMPANHAMENTO

(Verso `

DESFECHO - Fratura de Esmalte (Critério EAPD)

(0) Ausência de HMI
(1) Opacidade demarcada branca-creme
(2) Opacidade demarcada amarela-amarronzada
(3) Fratura dentária em esmalte
(4) Fratura dentária em dentina
(5) Restauração atípica satisfatória
(6) Restauração atípica insatisfatória
(7) Extração devida a HMI

16		26
	D	
	B	
	M	
	P	
	O	
46		36
	D	
	B	
	M	
	L	
	O	

DESFECHO – Cárie Dentária (Critério Nyvad)

(0) Ausência de cárie
(1) Mancha branca ativa
(2) Descontinuidade em esmalte ativa
(3) Cavidade em dentina ativa
(4) Mancha branca inativa
(5) Descontinuidade em esmalte inativa
(6) Cavidade em dentina inativa
(7) Restauração satisfatória
(8) Restauração insatisfatória com cárie ativa
(9) Restauração insatisfatória com cárie inativa

16		26
	D	
	B	
	M	
	P	
	O	
46		36
	D	
	B	
	M	
	L	
	O	

DESFECHO – Retenção do Selante (Critério de Oulis and Berdouses)

(1) Totalmente retido
(2) Parcialmente retido
(3) Totalmente perdido

16		26
	D	
	B	
	M	
	P	
	O	
46		36
	D	
	B	
	M	
	L	
	O	

ANEXO A - Aprovação do Comitê de Ética em Pesquisa da Instituição Proponente

UERJ - HOSPITAL UNIVERSITÁRIO PEDRO ERNESTO/ UNIVERSIDADE DO ESTADO DO RIO DE JANEIRO

Plataforma Brasil

PARECER CONSUBSTANCIADO DO CEP

DADOS DO PROJETO DE PESQUISA

Título da Pesquisa: Efetividade do selamento de fóssulas e fissuras em primeiros molares permanentes hipomineralizados.

Pesquisador: VERA LIGIA VIEIRA MENDES SOVIERO

Área Temática:

Versão: 1

CAAE: 18266919.6.0000.5259

Instituição Proponente: Hospital Universitário Pedro Ernesto/UERJ

Patrocinador Principal: Financiamento Próprio

DADOS DO PARECER

Número do Parecer: 3.621.906

Apresentação do Projeto:

Transcrição editada do conteúdo do registro do protocolo e dos arquivos anexados à Plataforma Brasil.

O selamento de molares permanentes é uma alternativa não invasiva já estabelecida no tratamento para controle do processo carioso em
populações de alto risco à cárie. O dente hipomineralizado é mais poroso e menos mineralizado do que o esmalte sadio, tornando-se mais
suscetível à fratura e consequentemente ao desenvolvimento de lesões de cárie. Uma associação significativa tem sido observada entre a
ocorrência de cárie dentária e a hipomineralização molar incisivo (HMI). A presente pesquisa tem o objetivo de realizar um ensaio clínico
randomizado sobre a efetividade do selamento de molares hipomineralizados em estudantes de 8 anos de idade matriculados nas Escolas
Municipais de Petrópolis, RJ, participantes do levantamento epidemiológico realizado na cidade em 2018 e diagnosticados com hipomineralização
molar incisivo (HMI). Essa efetividade será avaliada através de dois desfechos: fratura pós eruptiva em esmalte e desenvolvimento de lesão de carie
em dentina. Pretende-se também avaliar comparativamente a taxa de retenção de dois materiais

Endereço: Avenida 28 de Setembro 77 - Térreo
Bairro: Vila Isabel **CEP:** 20.551-030
UF: RJ **Município:** RIO DE JANEIRO
Telefone: (21)2868-8253 **E-mail:** cep.hupe.interno@gmail.com

recomenda ao Pesquisador: Comunicar toda e qualquer alteração do projeto e no termo de consentimento livre e esclarecido, para análise das mudanças; Informar imediatamente qualquer evento adverso ocorrido durante o desenvolvimento da pesquisa; O Comitê de Ética solicita a V. Sª., que encaminhe relatórios parciais de andamento a cada 06 (seis) Meses da pesquisa e ao término, encaminhe a esta comissão um sumário dos resultados do projeto; Os dados individuais de todas as etapas da pesquisa devem ser mantidos em local seguro por 5 anos para possível auditoria dos órgãos competentes.

Este parecer foi elaborado baseado nos documentos abaixo relacionados:

Tipo Documento	Arquivo	Postagem	Autor	Situação
Informações Básicas do Projeto	PB_INFORMAÇÕES_BÁSICAS_DO_PROJETO_1283021.pdf	17/07/2019 23:46:46		Aceito
Folha de Rosto	FolhadeRosto_assinada.pdf	10/06/2019 11:43:22	ROBERTA COSTA JORGE	Aceito
Projeto Detalhado / Brochura Investigador	Projeto_de_Pesquisa.docx	10/06/2019 11:19:45	ROBERTA COSTA JORGE	Aceito
TCLE / Termos de Assentimento / Justificativa de Ausência	TCLE_TA.docx	10/06/2019 11:19:30	ROBERTA COSTA JORGE	Aceito
Declaração de Pesquisadores	Pesquisadores.docx	09/06/2019 14:53:52	ROBERTA COSTA JORGE	Aceito
Cronograma	CRONOGRAMA.docx	09/06/2019 14:50:13	ROBERTA COSTA JORGE	Aceito

Situação do Parecer:
Aprovado

Necessita Apreciação da CONEP:
Não

ANEXO B - Aprovação do Comitê de Ética em Pesquisa da Instituição Coparticipante

FACULDADE DE MEDICINA DE PETRÓPOLIS E FACULDADE ARTHUR SÁ EARP NETO/ FMP/ FASE

Plataforma Brasil

PARECER CONSUBSTANCIADO DO CEP

Elaborado pela Instituição Coparticipante

DADOS DO PROJETO DE PESQUISA

Título da Pesquisa: Efetividade do selamento de fóssulas e fissuras em primeiros molares permanentes hipomineralizados.

Pesquisador: VERA LIGIA VIEIRA MENDES SOVIERO

Área Temática:

Versão: 2

CAAE: 18266919.6.3001.5245

Instituição Proponente: Faculdade de Medicina de Petrópolis e Faculdade Arthur Sá Earp Neto/ FMP/

Patrocinador Principal: Financiamento Próprio

DADOS DO PARECER

Número do Parecer: 4.579.026

Apresentação do Projeto:

Os autores fazem apresentação do tema/objeto, com fundamentação teórica consistente e contribuições pertinentes.

Objetivo da Pesquisa:

Os objetivos foram descritos adequadamente.

Avaliação dos Riscos e Benefícios:

Os Riscos e Benefícios foram descritos adequadamente.

Comentários e Considerações sobre a Pesquisa:

O projeto é relevante para o campo e traz substantivos benefícios aos participantes.

Considerações sobre os Termos de apresentação obrigatória:

Os termos foram elaborados adequadamente.

Recomendações:

Não há

Conclusões ou Pendências e Lista de Inadequações:

Todas as pendências foram atendidas.

Endereço: Av. Barão do Rio Branco, 1003
Bairro: Centro **CEP:** 25.680-120
UF: RJ **Município:** PETROPOLIS
Telefone: (24)2244-6497 **Fax:** (24)2244-6464 **E-mail:** cep@fmpfase.edu.br

FACULDADE DE MEDICINA DE PETRÓPOLIS E FACULDADE ARTHUR SÁ EARP NETO/ FMP/ FASE

Continuação do Parecer: 4.579.026

Considerações Finais a critério do CEP:

A equipe de pesquisa deverá, uma vez concluída a mesma, anexar na Plataforma Brasil, o "RELATÓRIO FINAL DE PESQUISA".

Na ocasião, deverá também encaminhar a este CEP, e-mail com tais informações.

Os autores têm o compromisso em manter atualizados os dados da execução desse projeto, na Plataforma Brasil; inclusive quanto ao término do mesmo – em conformidade com o cronograma apresentado e aprovado, neste Parecer.

Este parecer foi elaborado baseado nos documentos abaixo relacionados:

Tipo Documento	Arquivo	Postagem	Autor	Situação
Informações Básicas do Projeto	PB_INFORMAÇÕES_BÁSICAS_DO_PROJETO_1687681.pdf	04/03/2021 11:09:45		Aceito
Cronograma	CRONOGRAMA.docx	04/03/2021 11:06:38	VERA LIGIA VIEIRA MENDES SOVIERO	Aceito
Projeto Detalhado / Brochura Investigador	Projeto_Pesquisa.docx	04/03/2021 11:04:54	VERA LIGIA VIEIRA MENDES SOVIERO	Aceito
TCLE / Termos de Assentimento / Justificativa de Ausência	TCLE.docx	04/03/2021 11:01:48	VERA LIGIA VIEIRA MENDES SOVIERO	Aceito
Projeto Detalhado / Brochura Investigador	Projeto_de_Pesquisa.docx	10/06/2019 11:19:45	ROBERTA COSTA JORGE	Aceito
TCLE / Termos de Assentimento / Justificativa de Ausência	TCLE_TA.docx	10/06/2019 11:19:30	ROBERTA COSTA JORGE	Aceito

Situação do Parecer:

Aprovado

Necessita Apreciação da CONEP:

Não

Endereço: Av. Barão do Rio Branco, 1003
Bairro: Centro **CEP:** 25.680-120
UF: RJ **Município:** PETROPOLIS
Telefone: (24)2244-6497 **Fax:** (24)2244-6464 **E-mail:** cep@fmpfase.edu.br