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Orientador: Prof. Dr. Paulo Vinícius Soares

Banca Examinadora:
Prof. Dr. Paulo Vinícius Soares, UFU
Profa. Dra. Maria Antonieta Veloso Carvalho de Oliveira, UFU
Profa. Dra. Ana Cecília Correa Aranha, USP
Profa. Dra. Fabrícia Araújo Pereira, UFMS
Profa. Dra. Joana Cunha-Cruz, University of Washington, USA

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UNIVERSIDADE FEDERAL DE UBERLÂNDIA
Coordenação do Programa de Pós-Graduação em Odontologia
Av. Pará, 1720, Bloco 4L, Anexo B, Sala 35 - Bairro Umuarama, Uberlândia-MG, CEP 38400-902
Telefone: (34) 3225-8115/8108 - www.ppgoufu.com - copod@umuarama.ufu.br

ATA

Ata da defesa de TESE DE DOUTORADO junto ao Programa de Pós-graduação em Odontologia da Faculdade de Odontologia da Universidade Federal de Uberlândia.

Defesa de: Tese de Doutorado nº 028 - COPOD

Data: 11/02/2019

Discente: **Lívia Fávaro Zeola (11513ODO009)**

Título do Trabalho: Hipersensibilidade dentinária: prevalência, fatores de risco e protocolos de tratamento. Uma avaliação laboratorial, transversal, clínica e revisões sistemáticas da literatura

Área de concentração: Clínica Odontológica Integrada.

Linha de pesquisa: Biomecânica aplicada à Odontologia.

Projeto de Pesquisa de vinculação: Biomecânica aplicada à Odontologia.

As **quatorze horas** do dia **onze de fevereiro de 2019** no Anfiteatro Bloco 4L Anexo A, sala 23 Campus Umuarama da Universidade Federal de Uberlândia, reuniu-se a Banca Examinadora, designada pelo Colegiado do Programa de Pós-graduação em dezembro de 2018, assim composta: Professores Doutores: Maria Antonieta Veloso Carvalho de Oliveira (UFU); Ana Cecília Correa Aranha (USP); Joana Cunha-Cruz (University of Washington); Fabrícia Araújo Pereira (UFMS); orientador(a) do(a) candidato(a) **Paulo Vinícius Soares.** A professora Joana Cunha-Cruz da University of Washington - Seattle, USA, participará da defesa de Tese por meio de videoconferência desde a cidade de Seattle - USA e os demais membros da Banca participarão *in loco*.

Iniciando os trabalhos o(a) presidente da mesa Dr. Paulo Vinicius Soares apresentou a Comissão Examinadora e o candidato(a), agradeceu a presença do público, e concedeu ao Discente a palavra para a exposição do seu trabalho. A duração da apresentação do Discente e o tempo de argüição e resposta foram conforme as normas do Programa.

A seguir o senhor(a) presidente concedeu a palavra, pela ordem sucessivamente, aos (às) examinadore (as), que passaram a argüir o(a) candidato(a). Finalizada a argüição, que se desenvolveu dentro dos termos regimentais, a Banca, em sessão secreta, atribuiu os conceitos finais.

Em face do resultado obtido, a Banca Examinadora considerou o(a) candidato(a) (A)provado(a).

Esta defesa de Tese de Doutorado é parte dos requisitos necessários à obtenção do título de Doutor. O competente diploma será expedido após cumprimento dos demais requisitos, conforme as normas do Programa, a legislação pertinente e a regulamentação interna da UFU.

Nada mais havendo a tratar foram encerrados os trabalhos às 19 horas e 30 minutos. Foi lavrada a presente ata que após lida e achada conforme foi assinada eletronicamente pela Banca Examinadora.

Documento assinado eletronicamente por **Paulo Vinícius Soares**, **Professor(a) do Magistério Superior**, em 15/02/2019, às 16:12, conforme horário oficial de Brasília, com fundamento no art. 6º, § 1º, do Decreto nº 8.539, de 8 de outubro de 2015.

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DEDICATÓRIA

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"Não existem sonhos impossíveis para aqueles que realmente acreditam que o poder realizador reside no interior de cada ser humano"

Albert Einstein

SUMÁRIO

RESUMO

RESUMO

A hipersensibilidade dentinária (HD) é uma alteração que possui altos índices de prevalência e incidência e que influencia de maneira expressiva a qualidade de vida da população mundial. A proposta desse estudo foi avaliar a prevalência e fatores de risco envolvidos no desenvolvimento da HD, bem como, a percepção de dentistas brasileiros a respeito desta condição e a eficácia de protocolos clínicos de dessensibilização. Esse estudo foi dividido em seis capítulos; ***capítulo 1:*** revisar sistematicamente estudos transversais para estimar a prevalência da HD em várias populações e investigar os fatores que podem influenciar na variação dessas prevalências; ***capítulo 2:*** avaliar, por meio de estudo transversal, os fatores de risco associados com as lesões cervicais não cariosas (LCNCs), HD, recessão gengival, além da relação entre essas condições em um amostra específica da população brasileira; ***capítulo 3:*** investigar por meio de questionário, a percepção e as rotinas clínicas para o manejo da HD adotadas pelos dentistas brasileiros; ***capítulo 4:*** conduzir uma revisão sistemática para avaliar o efeito dessensibilizante de lasers de gálio-alumínio-arsênio (GaAlAs) comparados com placebo/ausência de tratamento ou agentes tópicos aplicados em consultório, considerando diferentes tempos de acompanhamento; ***capítulo* 5:** avaliar por meio de estudo clínico randomizado, a eficácia de diferentes concentrações de oxalato de potássio (5 e 10%) na redução da HD, após um protocolo de quatro sessões de aplicação, com acompanhamento de 12 meses; ***capítulo* 6:** avaliar, por meio de ensaio mecânico de microtração e análise do padrão de falha, a influência de agentes dessensibilizantes na resistência de união de adesivos autocondicionantes a dentina submetida ao desafio corrosivo/abrasivo. Após a análise dos resultados, pode-se concluir que a melhor estimativa da prevalência de HD foi de 11,5% (IC95%: 11,3% - 11,7%) e a média de todos os estudos foi de 33,5% (IC95%: 30,2% -36,7%). As LCNCs, recessão gengival (RG) e a HD apresentaram correlação positiva entre si e foram influenciadas por fatores como idade, sexo, doenças gástricas e trauma oclusal. Independente da experiência clínica, os dentistas brasileiros ainda consideram o manejo da HD um desafio em sua prática odontológica

diária. Além disso, os resultados sugerem a necessidade do desenvolvimento de diretrizes para disseminar o conhecimento atual sobre essa condição. Evidências disponíveis sugerem que o uso do laser GaAlAs promoveu melhores resultados do que quando comparado ao placebo / nenhum tratamento (independentemente do período de acompanhamento) e agentes a base de flúor (para acompanhamentos de curto, médio e longo prazo). Ambas as concentrações de oxalato de potássio (5 e 10%) testadas podem ser consideradas um tratamento eficaz para HD por pelo menos 6 meses. Entretanto, após 9 meses de acompanhamento, a maior concentração apresentou melhores resultados. O tipo de agente dessensibilizante parece ser fator determinante para promover alteração na resistência de união de adesivos autocondicionantes a dentina. Dessa forma, os resultados dessa tese sugerem que é possível realizar o manejo da HD com sucesso. Para tanto, é necessário o controle dos fatores etiológicos e a utilização de protocolos de dessensibilização específicos, com o objetivo de conseguir maior longevidade para o tratamento.

PALAVRAS-CHAVE: hipersensibilidade da dentina; testes laboratoriais; estudos transversais; ensaio clínico controlado randomizado; metanálise

ABSTRACT

ABSTRACT

Dentin hypersensitivity (DH) is a condition with high prevalence and incidence rates, which influences the quality of life of the world population. The proposal of this study was to assess the prevalence and risk factors involved in the development of DH, as well as, the perception of Brazilian dentists about this condition and the efficacy of desensitizing clinical protocols. This study was divided into six chapters; **chapter 1:** to systematically review cross-sectional studies to estimate the prevalence of DH in various populations and to investigate factors that might influence variation in the prevalence; **chapter 2:** to evaluate, by means of a cross-sectional study, the risk factors associated with noncarious cervical lesions (NCCLs), DH, gingival recession, and the relationship among these conditions in a specific Brazilian sample population; **chapter 3**: to investigate by means of a questionnaire, the perception and the clinical routine for DH management among Brazilian dentists; **chapter 4:** to conduct a systematic review to evaluate the desensitizing effect of gallium-aluminium-arsenide (GaAlAs) lasers compared to placebo / no treatment or topical agents applied in the office, considering different follow-up times; **chapter 5:** to evaluate, by means of a randomized clinical study, the efficacy of different concentrations of potassium oxalate (5 and 10%) in the relieving of DH, after a protocol of four sessions; **chapter 6:** to evaluate the influence of desensitizing agents on bond strength of self-etch adhesives to dentin submitted to acid-abrasive challenge, using the microtensile bond strength test and analysis of the failure mode. After analyzing the results, it can be concluded that the best estimate of DH prevalence was 11.5% (95%CI:11.3%-11.7%) and the average from all studies was 33.5% (95%CI: 30.2%-36.7%). The NCCLs and gingival recession (GR) distributions increased with age; NCCLs, DH, and GR had positive correlation and were influenced by factors as age, gender, gastric disease, and occlusal trauma. Regardless of clinical experience, dentists in Brazil still considered the management of DH a challenge in their daily dental practice. In addition, the results suggest a need for the development of guidelines to disseminate the current knowledge about this condition.

Available evidence suggests that the use of GaAlAs lasers promote better outcome for in-office treatment of DH than placebo/no treatment (regardless the follow-up period) and fluoride-based agents (for short, mid and long-term follow-ups). Both concentrations of potassium oxalate (10 and 5%) tested can be considered an effective treatment for DH for at least 6 months. However, after 9 months of follow-up, the higher concentration presented better results. The desensitizing agent type seems to be a determining factor to promote changes in bond strength of self-etch adhesives to dentin. Thus, the results of this thesis suggest that it is possible to perform a successful management of DH. Therefore, it is necessary to control the etiological factors and to use specific desensitization protocols, in order to achieve longevity for the treatment.

KEYWORDS: dentin sensitivity; laboratory test; cross-sectional studies; randomized controlled trial; meta-analysis

INTRODUÇÃO E REFERENCIAL TEÓRICO

1. INTRODUÇÃO E REFERENCIAL TEÓRICO

O surgimento das políticas públicas de saúde e a conscientização da população a respeito da importância da saúde bucal, associados ao aumento da expectativa de vida, a industrialização da sociedade, mudança de hábitos (dietas ricas em alimentos processados e ácidos e estresse devido as atividades profissionais) e o crescente culto pela beleza promoveram uma alteração no cenário odontológico (Hawkins et al., 2004). Nas últimas décadas, a população procurava os serviços do cirurgião-dentista principalmente para o tratamento de doenças relacionadas a microrganismos, como a cárie e a doença periodontal (West & Joiner, 2014). No entanto, com o passar dos anos, as pessoas passaram a ir aos consultórios odontológicos também em busca de procedimentos relacionados principalmente a estética e para resolução de problemas que apresentam causa não dependente da ação de microrganismos e da condição de higiene bucal (Garone Filho & Abreu e Silva, 2008).

Dentre essas alterações se destaca o aumento na incidência dos desgastes dentais, disfunção temporo-mandibular, lesões cervicais não cariosas e hipersensibilidade dentinária (HD) (Orchardson et al., 1994). A HD é caracterizada como uma dor aguda e provocada, de curta duração originária da dentina exposta a estímulos térmicos, evaporativos, táteis, osmóticos e/ou químicos e que não pode ser atribuída a outra forma de defeito ou patologia dental (Canadian Advisory Board on Dentin Hypersensitivity, 2003). Essa condição ganhou destaque e preocupação nos últimos tempos quando as pesquisas passaram a demostrar um aumento em seus índices de prevalência, os quais variam de 1,3 a 92,1 % (Chabanski et al.,1996; Bamise et al., 2007) em diferentes populações ao redor do mundo e mais especificamente, no Brasil, os valores ficam entre 17% a 89,1% (Fischer et al., 1992; Costa et al., 2014; Scaramucci et al., 2014; Yoshizaki et al., 2017; Teixeira et al., 2018). Esta grande variação ocorre devido as características do estudo (como idade dos pacientes, região do país, tipo de clínica e de recrutamento) e hábitos das populações avaliadas, além da

dificuldade de diagnóstico e falta padronização da coleta de dados (Davari et al., 2013). Outro fato importante é que o estabelecimento da HD tem sido cada vez mais precoce, atingindo adolescentes e adultos jovens e está relacionada a presença de lesões cervicais não cariosas e recessão gengival (Teixeira et al., 2018).

Independente das variações nos índices de prevalência, a dor gerada pela HD pode vir a limitar o desenvolvimento de atividades diárias do paciente (como comer, beber, escovar os dentes e em alguns casos até falar) (Boiko et al., 2010) e causar um impacto negativo na sua qualidade de vida (Douglas-de-Oliveira et al., 2018).

1.1. Hipersensibilidade Dentinária - Fatores Etiológicos

A HD tem sido considerada um desafio na prática clínica odontológica por apresentar uma etiologia multifatorial, envolvendo a associação dos fatores biocorrosão, tensão e fricção (Grippo et al., 2012). O estilo de vida contemporâneo parece ser o principal motivo que favorece e intensifica a presença de todos esses fatores na cavidade bucal população. Assim, o entendimento do papel de cada um deles se torna essencial para o sucesso da prevenção e controle da HD (LittleStar & Summitt, 2003).

1.1.1. Fator Biocorrosão

O mecanismo de biocorrosão é um processo complexo que envolve reações químicas entre ácidos derivados de diferentes origens e os componentes das estruturas dentais e que resultam na degradação do dente (Featherstone & Lussi, 2006). De maneira geral, o que ocorre é que os íons liberados pelas substâncias ácidas (H+) quando em meio aquoso, atacam os componentes da hidroxiapatita dental, resultando na degradação de seus cristais minerais (Featherstone & Lussi, 2006). Os ácidos responsáveis por este processo podem ser derivados de fontes de origem endógena (distúrbios alimentares – bulimia e anorexia, doenças gástricas – gastrite, regurgitação e doença do refluxo gastroesofágico) (Scheutzel, 1996) ou exógena (hábitos alimentares, estilo de vida, medicamentos e exposição ocupacional aos ácidos) (Zero, 1996). Esses ácidos, possuem ação mais

lenta ou mais agressiva, de acordo com suas características específicas (como por exemplo pH e titulação) e da estrutura dental (esmalte ou dentina) com a qual está em contato. Independente da capacidade de degradação de um ácido, a sua ação irá favorecer a exposição (abertura) dos túbulos dentinários na cavidade oral e aumentará o risco de desenvolvimento da HD (Choi et al., 2012). Durante o processo biocorrosivo, a saliva possui grande efeito protetor, devido a sua capacidade de indução de formação da película aderida na superfície dental, capacidade de tamponamento e manutenção do equilíbrio do pH oral (em cerca de 6,9) (Holbrook & Ganss, 2008). Por esse motivo, nos casos em que ocorram variações de pH, devido a presença do ácido, há um aumento no fluxo salivar, justamente com o objetivo de elevar o efeito tamponante e reduzir a ação biocorrosiva (Campisi et al., 2008).

1.1.2. Fator Tensão

O segundo fator que compõe a tríade é o acúmulo de tensões na região cervical do dente. Esse acúmulo ocorre devido a energia gerada durante a força oclusal, que se propaga no interior da estrutura (Lee & Eakle 1984; Andreaus et al., 2011). Desta forma, a presença da tensão é algo fisiológico e recorrente. No entanto, ela deve ser dissipada uniformemente, para que não haja sobrecarga no dente e periodonto (Grippo et al., 2012). Diferentes tipos de força podem atuar no elemento dental durante as atividades diárias do paciente, como as advindas de parafunção, deglutição, mastigação, hábitos ocupacionais e de movimentos ortodônticos (Grippo et al., 2004).

Ao receber um contato oclusal no longo eixo do dente (oclusão equilibrada e mutuamente protegida), o ligamento periodontal consegue exercer o seu papel de dissipar a tensão de maneira mais homogênea (sem sobrecarregar o dente e suas estruturas de suporte) (Soares et al., 2015; Pereira et al., 2016; Zeola et al., 2016; Machado et al., 2018). Entretanto, a presença de carga mastigatória excessiva e fora do longo eixo do dente, como nos casos de interferência oclusal ou durante hábitos parafuncionais (apertamento dentário e bruxismo), gerará concentrações de tensão

excessivas em regiões específicas, como a cervical (Soares et al., 2015; Pereira et al., 2016; Zeola et al., 2016; Duangthip et al., 2017; Machado et al., 2018). Como as forças não são efetivamente dissipadas, poderá ocorrer a quebra das ligações entre os cristais de hidroxapatita do esmalte, bem como microfraturas na estrutura do cemento (Lee & Eakle. 1996; Rees, 2002), favorecendo a exposição dentinária e consequentemente a HD, principalmente na região cervical.

1.1.3. Fator Fricção

O último fator envolvido no processo de desenvolvimento da HD é a fricção. Ela é caracterizada pelo desgaste mecânico por atrito anormal da estrutura dentária (Grippo et al., 2004), que pode ocorrer por mecanismos exógenos (objetos ou substâncias externas frequentemente em contato com os dentes – como a abrasão pela escovação) e/ou endógenos (contato entre os próprios dentes – conhecido como atrição) (Oginni & Adeleke, 2014). Estudos mostraram que a escovação isolada não promove desgaste em esmalte e também não resulta em perda de estrutura clinicamente significativa em dentina (Ganss et al., 2009). A escova de dente pode agir de formas diferentes de acordo com o tamanho e a quantidade de filamentos e das cerdas existentes. As cerdas duras são mais prejudiciais aos tecidos duros e moles, podendo causar recessão gengival que gera exposição de tecido dentinário e predispõe a HD quando associada a outros fatores (Ganss et al., 2009; Tellefsen et al., 2011). Os dentifrícios, por sua vez, variam quanto a sua abrasividade e seu pH e o desgaste gerado por eles depende também da sua relação com a escovação (Tellefsen et al., 2011).

Assim, a fricção tem papel importante como fator colaborador para a degradação da estrutura dental e, por esse motivo, pode ser considerado como um mecanismo potencializador do processo (Eisenburger et al., 2003; Grippo et al., 2013). Como exemplo dessa atuação pode-se citar os casos em que se realiza a escovação dos dentes imediatamente após o consumo de substâncias ácidas ou episódios de refluxo ou que se promove atrito em uma região de estrutura dentária previamente fragilizada devido ao acúmulo de tensão (Eisenburger et al., 2003).

Após essa breve descrição dos fatores envolvidos no desenvolvimento da HD, o que deve ser enfatizado é que eles não atuam de maneira isolada, mas sim associados (Grippo et al., 2012). Nos mais diversos perfis de pacientes encontrados em nossa sociedade, um ou outro fator etiológico poderá atuar de maneira mais intensa, no entanto, pelo menos dois deles estarão envolvidos no processo e cabe ao cirurgião-dentista identificá-los.

2. Teoria Hidrodinâmica da Dor e Protocolos de Manejo para a HD

Diversas teorias foram escritas na tentativa de explicar o mecanismo para a ocorrência da HD e a mais aceita mundialmente é a teoria hidrodinâmica (Brannstrom, 1966). De acordo com esse conceito, quando os túbulos dentinários estiverem expostos (e abertos) na cavidade bucal e sofrerem algum tipo de estímulo externo, ocorrerá a movimentação do fluido no interior do túbulo, que levará a excitação de receptores específicos (fibras de dor, principalmente fibras A-delta da polpa) e resultará em estímulo doloroso para o paciente (Brannstrom, 1966; Rosing et al., 2009). O movimento hidráulico poderá ocorrer tanto em direção à polpa quanto em sentido contrário, conforme se dá a contração ou a dilatação do fluido, dependendo da natureza do estímulo (Brannstrom, 1966; Rosing et al., 2009). Assim, quando o paciente possuir dentina exposta na cavidade oral, seja ela supra ou sub-gengival, qualquer evento que estimule esta dentina (como alteração de temperatura produzida, atrito das cerdas de escovas dentais ou abrasivos da pasta dental), podem provocar HD de intensidade variada (West, 2008; Thanatvarakorn et al., 2013).

O diagnóstico da HD deve ser realizado a fim de excluir a possibilidade de outras doenças e envolve várias etapas, iniciando por anamnese detalhada do paciente até a análise oclusal, roteiro de dieta e identificação de hábitos (Canadian Advisory Board on Dentin Hypersensitivity, 2003). Como a HD está intimamente ligada aos hábitos

do paciente, avaliar a história médica-odontológica e entender a queixa principal são requisitos muito importantes a serem investigados. Além disso, deve-se registrar a frequência (intervalo dos acontecimentos), duração (em frações de segundo) e severidade da dor com o objetivo de realizar o diagnóstico diferencial com outras alterações, com a pulpite. Fatores como o estado emocional e psicológico do paciente, hábitos ocupacionais e de higienização, informações sobre doenças gástricas, distúrbios temporomandibulares, hábitos parafuncionais e medicamentos utilizados também devem ser registrados (Grippo et al., 2012). Exames complementares de imagem também precisam ser executados a fim de favorecer o correto diagnóstico da HD.

Diante desse contexto, o tratamento da HD consiste primeiramente no controle/eliminação dos agentes causais (Shiau, 2012) e em seguida, baseia-se na redução do movimento do fluido dentro dos túbulos dentinários, através do uso dos chamados agentes dessensibilizantes (Canadian Advisory Board on Dentin Hypersensitivity, 2003). De maneira geral, esses agentes podem ser divididos em: agentes de ação neural, obliteradora ou mista. Os agentes neurais atuam diretamente nas terminações nervosas da dentina exposta, promovendo a despolarização dos elementos neurais e prevenindo a repolarização, como os agentes a base de potássio e a laserterapia de baixa intensidade). Por outro lado, os obliteradores de túbulos atuam no vedamento dos túbulos dentinários, impedindo a micro movimentação do fluido no interior dos túbulos, como glutaraldeídos, fluoretos, agentes a base de cálcio, oxalatos, selantes resinosos, vernizes e laserterapia de alta intensidade. E por fim, os agentes de ação mista atuam simultaneamente nas terminações nervosas e na obliteração dos túbulos, como os oxalatos de potássio (Al-Sabbagh et al., 2009; Porto et al., 2009; Shiau, 2012).

Diversos protocolos de manejo para a HD ainda são discutidos na literatura. No entanto, na maior parte das situações, os melhores resultados são obtidos quando é realizado um protocolo com a associação de agentes dessensibilizantes com diferentes mecanismos para redução da dor oriunda da HD (Soares & Grippo, 2017). Entretanto, independente do tipo de situação encontrada, o primeiro passo para o sucesso no manejo é a

a investigação aprofundada dos fatores etiológicos envolvidos, visando o controle e/ou eliminação de todos eles (Soares & Grippo, 2017).

A HD é uma alteração que possui altos índices de prevalência e incidência e que influencia de maneira expressiva a qualidade de vida da população mundial. Muitas questões relacionadas a esse tema ainda precisam ser esclarecidas, uma vez que a HD ainda é um desafio na prática clínica odontológica. Por esse motivo, a execução de pesquisas científicas para entendimento dos fatores envolvidos no desenvolvimento da HD, bem como para a melhoria dos protocolos dessensibilizantes é justificada. Dessa forma, será possível promover a educação continuada dos profissionais, visando a prevenção e diagnóstico precoce da HD e protocolos de tratamento mais efetivos e de maior longevidade. Assim, a proposta desse estudo foi avaliar a prevalência e fatores de risco envolvidos no desenvolvimento da HD, bem como, a percepção de dentistas brasileiros a respeito desta condição e a eficácia de protocolos clínicos de dessensibilização.

CAPÍTULOS

2. CAPÍTULOS

2.1. CAPÍTULO 1

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Review article

Prevalence of dentin hypersensitivity: Systematic review and meta-analysis

Livia Favaro Zeola[a,b], Paulo Vinícius Soares[a,*], Joana Cunha-Cruz[b]

[a] NCCL Research Group and Reference Center to Treatment NCCL and CDH, Department of Operative Dentistry and Dental Materials, School of Dentistry, Federal University of Uberlândia, Uberlândia, Minas Gerais, 38400-902, Brazil
[b] Department of Oral Health Sciences, School of Dentistry, University of Washington, Seattle, WA, 98195-7475, USA

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ABSTRACT

Objectives: The purpose of this study was to estimate the prevalence of dentin hypersensitivity in various populations. Sources: Four electronic databases (Medline via PubMed, Cochrane Library, Wiley Online Library and Web of Science) were searched until June 2018.
Study selection: Cross-sectional studies on the prevalence of dentin hypersensitivity were included. Meta-analysis were conducted and meta-regression models were used to explain the variation of the prevalence measures. Data were extracted, and the studies were assessed for quality. Data: A total of 65 papers (reporting on 77 studies) met the inclusion criteria and were included in the meta-analysis. The prevalence range was observed to be as low as 1.3% and as high as 92.1%. Effect modifiers for dentin hypersensitivity prevalences were the type of participants included in the study, age range, recruitment strategy and number of study sites. Higher prevalences were observed in studies involving specialty practice patients, younger adults, convenience sample and those characterized as single-site. Conclusion: The best estimate of dentin hypersensitivity was 11.5% (95%CI:11.3%–11.7%) and the average from all studies was 33.5% (95%CI: 30.2%–36.7%). The extremely high degree of heterogeneity among studies can only be partially explained by characteristics of the studies.
Clinical significance: Dentin hypersensitivity is a persistent clinical problem that poses significant challenge for clinicians and affects patients' quality of life. Better understanding of the dentin hypersensitivity burden and its associated factors can assist on resource planning for reducing/preventing any discomfort arising from this condition and will aid in the decision-making process.

1. Introduction

Dentin hypersensitivity (DH) is a frequently chronic finding and a challenging condition to treat in dental clinical practice [1]. Dentin hypersensitivity can be defined as a short sharp pain that arises from the exposed dentin in response to thermal, tactile, osmotic, chemical, or evaporative stimuli that cannot be attributed to any other form of dental defect or pathology [2]. This condition impacts oral health-related quality of life [3,4], producing significant impairment on patients' daily life such as speaking, eating, drinking and toothbrushing [5,6].

Prevalence studies reported in literature have resulted in unpredictable data, ranging from 1.3% [7] to 92.1% [8]. This heterogeneity has been associated to the population screened, recruitment process, study setting, and the different diagnostic criteria used to collect data [9,10]. Dentin hypersensitivity is measured by clinical exam and self-reported questionnaire, evaluation of a person's response to stimulus, and by excluding other dental and periodontal conditions [11]. However, the wide diversity of current diagnostic criteria suggests considerable uncertainty and lack of confidence among dental practitioners about how to diagnose and manage this condition [2,12].

Knowledge of the prevalence of a condition is used to guide diagnosis under the maxim "common things commonly occur." Therefore, uncertainty about the prevalence of dentin hypersensitivity has significant consequences for patients and dental practitioners. Epidemiology, etiology and clinical features have been described in a number of papers but to our knowledge none of these have used a detailed systematic methodology to estimate the prevalence of dentin hypersensitivity worldwide. Therefore, the aim of this study was to systematically review cross-sectional studies to estimate the prevalence of dentin hypersensitivity in various populations and to investigate factors that might influence variation in the prevalence.

* Corresponding author at: Department of Operative Dentistry and Dental Materials, School of Dentistry, Federal University of Uberlândia, Uberlândia, Minas Gerais, 38400-902, Brazil.
E-mail addresses: liviazeola@gmail.com (L. Favaro Zeola), paulovsoares@yahoo.com.br (P.V. Soares), silvajcc@uw.edu (J. Cunha-Cruz).

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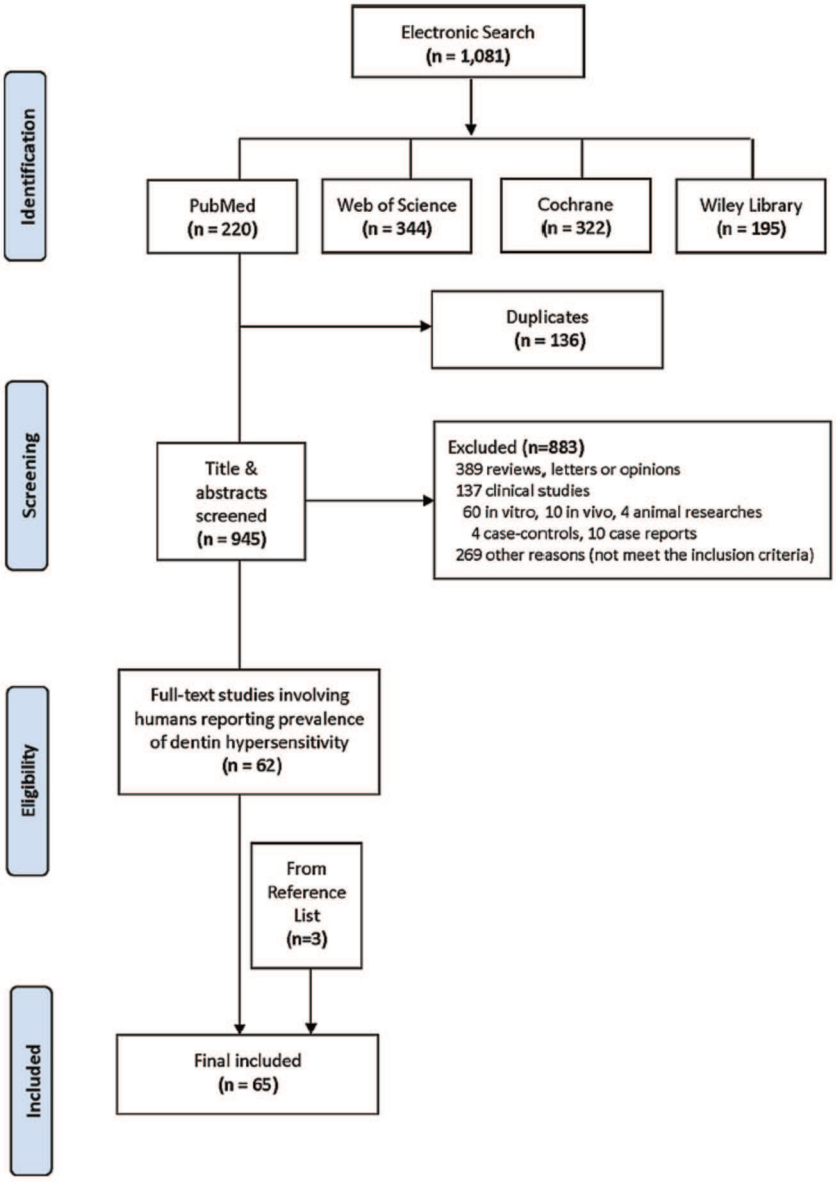

Fig. 1. Flow diagram of the selection of studies.

2. Materials and methods

Methods of this systematic review followed recommendations from the Cochrane Collaboration [13] and its reporting followed the guidelines for Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) [14].

2.1. Search strategy to identify studies

An electronic search of the literature was performed on the following databases: Medline via PubMed, Cochrane Library, Wiley Online Library and Web of Science until June 2018 to identify the studies. MeSH terms, keywords and other free terms related to "dentin hypersensitivity", and "prevalence" were used with Boolean operators (OR, AND) to combine searches (see Appendix A). No limitations to the publication time, language or quality were imposed. In addition, hand-searching to check reference lists of included articles was performed.

2.2. Eligibility criteria and study selection

Only studies conducted in humans, and that had specifically reported the prevalence of dentin hypersensitivity were included. Those studies which included very specific populations such as patients with periodontal problems with a small convenience sample and patients with fluorosis or those involving only children were excluded.

Titles and abstracts of the identified articles were independently screened by two reviewers to determine whether they met the inclusion criteria. Whenever discrepancies occurred between the evaluators, they

were solved by discussion and mutual agreement.

2.3. Data extraction and methodological quality assessment

The selected studies were evaluated by using full text copies, after de-duplication. Both reviewers independently performed data extraction and quality assessment using standardized extraction spreadsheets. Any discrepancies were solved by discussion and agreement between the reviewers. The information extracted included the study characteristics (e.g. year, study design, country, number of participants, age, number of sites, recruitment process), dentin hypersensitivity measurement methods, non-response rate and prevalence based on clinical exam and/or questionnaire. In addition, the reviewers screened the quality of the selected studies. The quality assessment of the cross-sectional studies was conducted by using modified Newcastle-Ottawa Quality Assessment Scale which includes the eight items mentioned below:

- Selection (composed of three items) - representativeness of the sample, sample size and non-response rate
- Comparability (one item) between respondents and non-respondents
- Outcome and Analysis (four items) - assessment of outcome of hypersensitivity, reporting of point estimate (prevalence), reporting of the measure of variability for the point estimate and accounting for correlation between multilevel units.

2.4. Data synthesis

Fixed-effects and random-effects meta-analysis were performed by combining the results of all studies. The degree of heterogeneity between studies was calculated (I^2-statistic) [15]. When studies reported the prevalence of DH by using different methods, just one prevalence estimate from each study was selected, giving preference to those based on clinical examinations rather than questionnaires and, among the former, those based on thermo-evaporative stimulus. Because there was a high degree of heterogeneity, random-effects meta-regression models with study characteristics as covariates were fitted to understand the impact of such characteristics as modifiers of the study effect size.

In addition, the predictive interval for a future study was calculated to present the expected range of true effect in a new study, given the data [16]. Statistical analyses were conducted using STATA (Stata Statistical Software, Version 15.1, Stata Corp, College Station, TX, USA).

3. Results

3.1. Search results

The preliminary search of electronic databases yielded 1081 potentially relevant articles (Fig. 1). After the review of study title, keywords and abstracts, 62 papers were retrieved for full-text evaluation. Four studies that met our inclusion criteria were published as full text articles in Chinese [17–20] and 1 in Russian [21]. In addition to the 62 studies, 3 studies [22–24] were included after searching the references lists of included studies and related reviews. Thus, 65 published studies met the selection criteria reporting on 77 cross-sectional studies (see Appendix B for reference list of included studies).

3.2. Characteristics of included studies

Most of the studies were conducted in Europe (40%) and Asia (38%), on or after the year 2010 (51%), in a university clinic or campus (40%) or community setting (39%) and not reported the type of funding received (65%) (Table 1). A total of 97,845 participants were evaluated in the 77 studies. The median number of participants was 700 (range: 40 – 12,692). The participants were mostly adults (65%), from general dental practices (either at University clinics or private practices) (43%), sampled in one site (52%) by convenience of investigators in 40% studies and randomly in 39%. Investigators in the majority of the studies reported only the sample actually enrolled, without mentioning the number of people in the eligible population (intended sample) or the target (external) population (to which results may be generalized). Of the 20 (26%) studies that reported some type of non-response rate, 9 exceeded the widely accepted rate of less than 20% of non-respondents.

The methods for the measurement and diagnosis involved response to stimulation during clinical exam (48%), and the remaining relied on questionnaire only (30%) or questionnaire and clinical exam only upon

Table 1
Description of the studies included in the systematic review of prevalence of dentin hypersensitivity.

	N	%
Total of studies	77	100%
Decade of publication		
1960	1	1%
1980	3	4%
1990	16	21%
2000	18	23%
2010	39	51%
Continent		
Africa	5	6%
Americas	10	13%
Asia	29	38%
Europe	31	40%
Oceania	2	3%
Multiple study sites		
No	40	52%
Yes	37	48%
Funding source		
Not reported	50	65%
Industry	20	25%
Non-profit	7	10%
Type of participants included in the study		
General population	29	38%
Specific groups of general population (e.g. university students)	9	12%
General practice patients	33	43%
Specialty practice patients (e.g. periodontal practice)	6	8%
Age groups		
Adults	50	65%
Young adults	18	23%
Adults and adolescents with or without children	9	12%
Recruitment		
Convenience sample	31	40%
Random sample	30	39%
Consecutive sample	16	21%
Non-response rate		
< 20%	11	14%
20% or greater	9	12%
Not reported	57	74%
Measurement method of dentin hypersensitivity		
Clinical exam	37	48%
Questionnaire only	23	30%
Questionnaire and clinical exam for those positive to self-report questionnaire	17	22%
Stimuli during clinical exam		
Thermo-evaporative only	35	45%
Thermo-evaporative and Tactile	13	17%
Thermo-evaporative and Thermal	3	4%
Tactile only	1	1%
Thermal only	1	1%
Tactile and Thermal	1	1%
None (self-reported questionnaire only)	23	30%
Clinical exam to exclude other causes of dentin hypersensitivity		
No	28	36%
Yes	49	64%
Assessment of the risk of bias		
High	52	68%
Moderate	17	22%
Low	8	10%

a positive response to the questionnaire (22%). Whereas most of the studies relying on self-reports did not mention the questions used, they ranged from non-specific questions such as presence of pain or discomfort to more specific questions mentioning the presence of sensitive teeth.

The majority of studies used only a thermo-evaporative stimulus (air blast) to assess DH (45%) and to measure the intensity, duration and tolerability of the pain. Several scales have been utilized. Verbal rating scale (VRS) scored from 0 to 3, 1 to 3 and 1 to 5 were reported. In addition, visual analog scale (VAS) along with a labeled magnitude scale (Seattle scale), VAS (0–100 mm line) and segmented numeric version of the VAS (numeric rating scales from 0 to 10) were used. Severity of the sensitivity has also been recorded using the semi-subjective scales like ordinal scale and Schiff pain scale. The table with detailed characteristics of each included study is available upon request.

3.3. Risk of bias assessment

The quality assessment of the selected papers indicated that 52 studies (68%) presented a high risk of bias (Appendix C). Common limitations were found in recruitment processes (the majority of studies did not mention the eligible and target population and nonresponse rate), description of sample size calculation (not reported property), measurement processes (clinical exams without independent validation) and analyses (not reported the measure of variability for prevalence).

3.4. Synthesis of the results

The wide range of prevalences reported in the included studies varied from 1.3% to 92.1%. Fixed-effect meta-analysis resulted in a summary estimate of the prevalence of dentin hypersensitivity of 11.5% (95% Confidence Interval: 11.3%–11.7%). The random-effects meta-analysis resulted in a summary estimate of 33.5% (95%CI: 30.2–36.7) (Fig. 2). The predictive interval (applicable for a future study based on past experience) was wide ranging from 4.8% to 62.3%.

3.4.1. Effect modifiers

The results obtained from meta-regressions showed that no statistically significant differences in prevalence among studies were observed by study decades, continents, funding sources or non-response rates. Surprisingly, characteristics of the diagnostic methods used also did not explain the variability in prevalence estimates. Additionally, there were no differences in prevalence among studies when compared by the method of diagnosis (self-reports vs. clinical exam), the method of stimulation during clinical exam (none vs. thermo-evaporative vs. other) or performing a clinical exam to exclude other causes of sensitivity.

On the other hand, effect modifiers that were significant included the type of participants included in the study, age range, recruitment strategy and number of study sites. Studies among specialty practice patients [mean prevalence: 61.2% (95%CI: 37.0–85.4)] and specific subgroups of the general population [mean: 43.3% (95%CI: 22.9–63.6)] had higher prevalence than general population [mean: 30.3% (95%CI: 27.0–33.7)] and general practice [mean: 28.1% (95%CI: 25.0–31.1)] studies. Studies including only young adult patients [mean: 43.9% (95%CI: 32.9–54.9)] reported higher prevalence of DH than those including other age groups, such as older adults [mean: 32.1% (95%CI: 28.1–36.1)] or adults and adolescents with or without children [mean: 20.4% (95%CI: 15.5–25.3)]. In situations in which participants were recruited using a consecutive sample [15.2% (95%CI: 12.4–17.9)] prevalences were lower, when compared with those using random [30.0% (95%CI: 26.6–33.4)] or convenience [46.3% (95%CI: 38.5–54.2)] sampling methods. Finally, studies that involved multiple sites [27.6% (95%CI: 23.6–31.5)] had lower prevalence than single-site studies [39.2% (95%CI: 32.8–45.7)].

4. Discussion

The purpose of this systematic review was to synthesize and integrate the existing information related to prevalence of dentin hypersensitivity. Even though some studies have been done reporting prevalence, we are not aware of reviews that have compiled data from studies conducted in different countries and different populations. The results of this study indicated an estimate of the dentin hypersensitivity of 11.5% (95%CI: 11.3%–11.7%) and 33.5% (95%CI: 30.2–36.7) for the fixed and random-effects meta-analysis models, respectively. The lower summary prevalence from the fixed-effect model can be interpreted as the "best estimate" or the "best guess" for the prevalence in the absence of heterogeneity, whereas the higher summary prevalence from the random-effects model can be interpreted as the average prevalence from all studies [13].

A predictive interval was calculated to quantify the extent of existing heterogeneity and in contrast to a confidence interval, which quantifies the precision of an estimated effect, a prediction interval covers the true effect of a single (new) study with probability $1 - \alpha$ [25]. In this study the predictive interval ranged from 4.8% to 62.3% and includes the possibility that a new study would observe a prevalence of DH as low as 5%, but also the possibility of observing prevalence much greater than the expected average of 33.5%.

To explore these findings further, the effects of different variables on the prevalence of DH were analyzed. The literature [26–28] frequently suggested that self-reported dentin hypersensitivity is likely to overestimate the prevalence in comparison with clinical exams. However, in this study, the meta-regression did not identify the method of diagnosis as an influential factor in the variation of prevalence estimates among studies. A possible explanation for this result is the wide variability in both methods of measurement. The methods for querying participants varied from specific questions on "sensitive teeth" to general questions on "pain or discomfort in teeth", and the methods for clinical exam varied from eliciting pain to all teeth present to eliciting pain only after a positive self-report. For these reasons, the reporting of these methods of data collection can be improved in future studies by stating the question used for the self-reports and describing in detail the clinical exam (e.g. number of teeth and surfaces tested, amount of time, distance and force used for the stimulus, characteristics of the probe used, protection of adjacent teeth, room temperature during the evaluation, assessment of the participant's response to the stimulus and clinical experience of assessors).

On the other hand, some significant effect modifiers on the dentin hypersensitivity prevalence were found. The higher prevalence found among specialty practice patients when compared with the other groups could suggest that some specific clinical conditions (e.g. gingival recession, noncarious cervical lesions and tooth wear) [8,29,30] may play a role in the occurrence of dentin hypersensitivity. Studies including only young adults reported higher prevalence. The reduction of dentin hypersensitivity with aging [30,31] has been explained by the obliteration of dentinal tubules and deposition of secondary and tertiary dentin over lifetime, resulting in a thick and protective layer of dentin between the pulp and the external environment [32]. In addition, the habits and lifestyle of young adults increase the vulnerability to an acidic diet and parafunctional habits, favoring the development of dentin hypersensitivity [33]. The number of study sites was another effect modifier found; studies that included multiple sites had lower prevalence than single-site studies. This variation probably happens due to different socio-cultural, lifestyles and dietary habits between the population in studies involving more than one site [10].

High risk of bias of the studies included in this systematic review may in part explain the wide range of prevalences found. Better reporting is needed to allow more accurate evaluation. When describing the recruitment strategy, reference to the target population to which

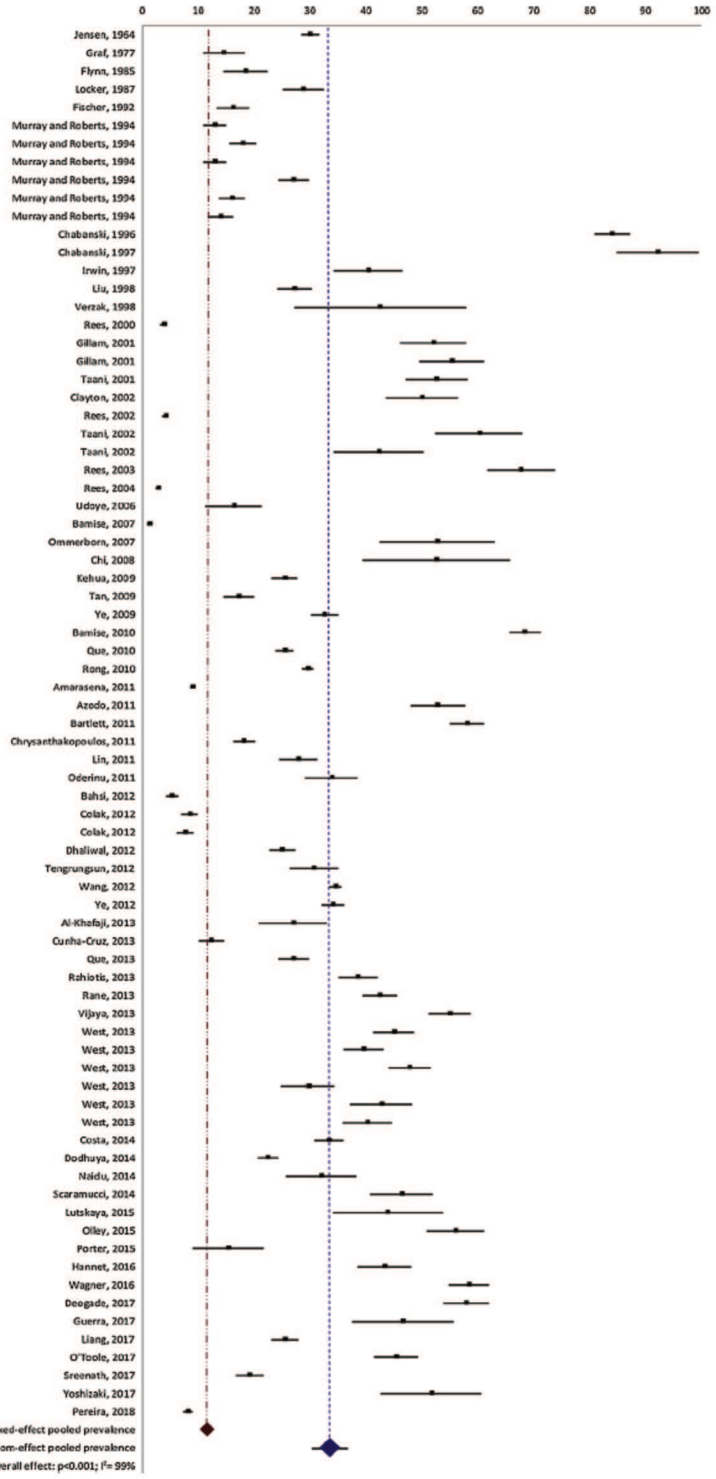

Fig. 2. Forest plot of studies on prevalence of dentin hypersensitivity. Prevalence (95%CI) for individual studies and fixed- (red, narrow dash) and random-effects (blue, wide dash) summary prevalences. (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article).

the investigators intend to generalize the results should be provided as well as the number of potential participants who were approached to participate but declined. For the sample size calculation and analyzes of results, the clustering of participants within communities or practices and of teeth within participants should be considered through the use of appropriate statistical methods. Associated to this, new studies should employ systematic (e.g. consecutive) or random sampling schema and consider reporting the comparability between the respondents and non-

respondents, which will yield a better knowledge of how representative is the sample and to ensure more accurate results.

Overall, research in this area would benefit from adherence to the STROBE statement on strengthening the reporting of observational studies in epidemiology [34]. For the future, rather than reporting only the exact prevalence, studies considering the development and severity of hypersensitivity over time are needed.

The information collected in this review are an alert for future generations of professionals about a clinical manifestation increasingly prevalent in the dental practice. Dentin hypersensitivity is a persistent problem that affects quality of life and understanding the burden of dentin hypersensitivity can assist on resource planning for reducing or preventing any discomfort arising from the condition. In addition, this study can serve to improve the quality and reporting of research studies on prevalence of oral diseases.

5. Conclusion

Within the limitations of this study, we can conclude that the best estimate of dentin hypersensitivity is about 11.5%, and the average from all studies is 33.5%. The extremely high degree of heterogeneity among studies can only be partially explained by characteristics of the studies; a new prevalence study could expect to find a prevalence of dentin hypersensitivity anywhere from 4.8% to 62.3%.

Conflict of interest

The authors declare no conflict of interest.

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Appendix A. Supplementary data

Supplementary material related to this article can be found, in the online version, at doi:https://doi.org/10.1016/j.jdent.2018.12.015.

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APPENDICES

Appendix A. Details on Search Methods to Identify Studies (searched on 05/24/2018)

MEDLINE *via* PubMed

Queries
#1 Search “dentin sensitivity”[MeSH Terms] OR “dentin hypersensitivity” OR "dentinal hypersensitivity"[text] OR "dentinal sensitivity"[text] OR "sensitive teeth"[text] OR "sensitive tooth"[text] OR "dentine sensitivity"[text] OR "dentinal hypersensitivity"[text] OR "dentine hypersensitivity"[text]
#2 Search prevalence OR incidence
#3 Search (#1 AND #2)

Cochrane Library

Queries
#1 Search MeSH descriptor: [Dentin Sensitivity] explode all trees
#2 Search dentinal hypersensitivity
#3 Search dentinal sensitivity
#4 Search sensitive teeth
#5 Search sensitive tooth
#6 Search dentine sensitivity
#7 Search dentinal hypersensitivity
#8 Search dentine hypersensitivity
#9 Search dentin hypersensitivity
#10 Search dentin sensitivity
#11 Search prevalence
#12 Search incidence
#13 Search (#1 or #2 or #3 or #4 or #5 or #6 or #7 or #8 or #9) and (#11 or #12)

Wiley Online Library

Queries
#1 Search dentinal hypersensitivity OR dentinal sensitivity OR sensitive teeth OR sensitive tooth OR dentine sensitivity OR dentine hypersensitivity OR dentin hypersensitivity OR dentin sensitivity
#2 Search prevalence OR incidence
#3 Search (#1AND #2)

Web of Science

Queries
#1 Search TS=((dentinal hypersensitivity OR dentinal sensitivity OR sensitive teeth OR sensitive tooth OR dentine sensitivity or dentinal hypersensitivity OR dentine hypersensitivity OR dentin hypersensitivity OR dentin sensitivity) AND (prevalence OR incidence)) OR TI=((dentinal hypersensitivity OR dentinal sensitivity OR sensitive teeth OR sensitive tooth OR dentine sensitivity or dentinal hypersensitivity OR dentine hypersensitivity OR dentin hypersensitivity OR dentin sensitivity)
#2 Search prevalence OR incidence
#3 Search (#1AND #2)

Appendix B. Reference list of the studies included in the systematic review of prevalence of dentin hypersensitivity

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Appendix C. Summary of the assessment of risk of bias of the included studies (Newcastle-Ottawa Scale adapted for cross-sectional studies)

Author, year	Representativeness of the sample	Sample size	Non-response rate	Comparability between respondents and non-respondents	Assessment of the outcome	Reporting of point estimate (prevalence)	Reporting of the measure of variability	Accounting for correlation between multilevel units
Jensen, 1964	U	NR	NR	NR	U	A	U	A
Graf, 1977	U	NR	NR	NR	U	A	U	A
Flynn, 1985	A	NR	NR	NR	U	A	U	A
Locker, 1987	A	NR	U	NR	A	A	U	A
Fischer, 1992	A	NR	NR	NR	U	A	U	A
Murray and Roberts, 1994	A	NR	NR	NR	U	A	U	U
Murray and Roberts, 1994	A	NR	NR	NR	U	A	U	U
Murray and Roberts, 1994	A	NR	NR	NR	U	A	U	U
Murray and Roberts, 1994	A	NR	NR	NR	U	A	U	U
Murray and Roberts, 1994	A	NR	NR	NR	U	A	U	U
Murray and Roberts, 1994	A	NR	NR	NR	U	A	U	U
Chabanski, 1996	U	NR	A	NR	U	A	U	A
Chabanski, 1997	U	NR	NR	NR	A	A	U	A
Irwin, 1997	U	NR	A	NR	U	A	U	U
Liu, 1998	A	NR	NR	NR	U	A	U	A
Verzak,1998	A	NR	NR	NR	U	A	U	A
Rees, 2000	A	NR	NR	NR	U	A	U	U
Gillam, 2001	U	NR	U	NR	U	A	A	U
Gillam, 2001	U	NR	U	NR	U	A	A	U
Taani, 2001	U	NR	NR	NR	U	A	U	A
Clayton, 2002	U	NR	A	NR	U	A	U	A

Rees, 2002	A	NR	NR	NR	U	A	U	U
Taani, 2002	U	NR	NR	NR	U	A	A	A
Taani, 2002	U	NR	NR	NR	U	A	A	A
Rees, 2003	U	NR	NR	NR	U	A	U	A
Rees, 2004	A	NR	NR	NR	U	A	U	U
Udoye, 2006	A	NR	A	NR	U	A	U	A
Bamise, 2007	A	NR	NR	NR	U	A	A	A
Ommerborn, 2007	U	NR	NR	NR	U	A	U	A
Chi, 2008	A	NR	A	NR	U	A	U	A
Kehua, 2009	A	NR	NR	NR	U	A	U	U
Tan, 2009	A	NR	NR	NR	U	A	U	A
Ye, 2009	A	NR	NR	NR	A	A	U	A
Amarasena, 2011	A	NR	U	NR	U	A	A	U
Bamise, 2010	A	NR	U	NR	U	A	A	A
Que, 2010	A	A	NR	NR	A	A	U	U
Rong, 2010	A	NR	NR	NR	A	A	U	U
Azodo, 2011	A	NR	NR	NR	U	A	U	A
Bartlett, 2011	A	NR	NR	NR	A	A	U	A
Chrysanthakopoulos, 2011	U	NR	NR	NR	A	A	A	A
Lin, 2011	A	NR	NR	NR	U	A	U	U
Oderinu, 2011	A	NR	A	NR	U	A	U	A
Bahsi, 2012	A	NR	NR	NR	A	A	U	U
Colak, 2012	A	NR	U	NR	U	A	U	A
Colak, 2012	U	NR	NR	NR	U	A	U	A
Dhaliwal, 2012	A	NR	NR	NR	U	A	U	U
Tengrungsun, 2012	U	NR	NR	NR	U	A	U	A
Wang, 2012	A	A	NR	NR	A	A	U	U
Ye, 2012	A	NR	NR	NR	U	A	U	U

Al-Khafaji, 2013	U	NR	NR	NR	U	A	U	U
Cunha-Cruz, 2013	A	A	U	A	U	A	A	A
Que, 2013	A	NR	NR	NR	A	A	U	U
Rahiotis, 2013	U	NR	A	NR	A	A	A	A
Rane, 2013	U	NR	NR	NR	U	A	U	A
Vijaya, 2013	U	NR	NR	NR	U	A	U	A
West, 2013	A	A	NR	NR	A	A	A	A
West, 2013	A	A	NR	NR	A	A	A	A
West, 2013	A	A	NR	NR	A	A	A	A
West, 2013	A	A	NR	NR	A	A	A	A
West, 2013	A	A	NR	NR	A	A	A	A
West, 2013	A	A	NR	NR	A	A	A	A
Costa, 2014	A	A	U	A	A	A	A	A
Dodhiya, 2014	A	NR	NR	NR	U	A	U	A
Naidu, 2014	U	NR	NR	NR	U	A	U	A
Scaramucci, 2014	U	A	NR	NR	A	A	A	A
Lutskaya, 2015	U	NR	NR	NR	U	A	A	A
Olley, 2015	U	NR	NR	NR	A	A	U	A
Porter, 2015	A	NR	A	NR	U	A	U	A
Hannet,2016	A	NR	NR	NR	U	A	U	U
Wagner,2016	A	A	U	A	A	A	U	A
Deogade, 2017	U	NR	NR	NR	U	A	U	A
Guerra, 2017	A	NR	NR	NR	A	A	U	A
Liang, 2017	A	A	NR	NR	A	A	U	U
O'Toole, 2017	U	NR	NR	NR	U	A	U	A
Sreenath, 2017	U	NR	NR	NR	U	A	U	U
Yoshizaki, 2017	U	NR	NR	NR	U	A	A	A
Pereira,2018	U	NR	NR	NR	A	A	U	A

CAPÍTULO 2

2.2. CAPÍTULO 2

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Relationship between noncarious cervical lesions, cervical dentin hypersensitivity, gingival recession, and associated risk factors: A cross-sectional study

Daniela Navarro Ribeiro Teixeira[a,b], Livia Fávaro Zeola[a], Alexandre Coelho Machado[a], Rafaella Rodrigues Gomes[a], Paola Gomes Souza[a], Danilo Cangussu Mendes[c], Paulo Vinícius Soares[d,*]

[a] School of Dentistry of Federal, University of Uberlandia, Brazil, Av. Pará, 1720, Umuarama, Uberlândia, Minas Gerais, 38400-902, Brazil
[b] University Medical Center Groningen, Center for Dentistry and Oral Hygiene, The University of Groningen, Groningen, Netherlands
[c] Department of Restorative Dentistry at the University of Montes Claros, Brazil, Av. Dr. Ruy Braga, s/n, Vila Mauriceia, Montes Claros, Minas Gerais, 39401-089, Brazil
[d] Director of NCCL Research Group and Reference Center to Treatment NCCL and CDH, Department of Restorative Dentistry and Dental Materials at School of Dentistry of Federal University of Uberlandia, Brazil, Av. Pará, 1720, Umuarama, Uberlândia, Minas Gerais, 38400-902, Brazil

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ABSTRACT

Objectives: The aim of this study was to evaluate the risk factors associated with noncarious cervical lesions (NCCLs), cervical dentin hypersensitivity (CDH), and gingival recession (GR), besides the relationship among these conditions in a specific Brazilian sample population.

Methods: 185 patients who attended the "Ambulatory Program for Rehabilitation of Patients with Noncarious Cervical Lesions and Cervical Dentin Hypersensitivity" were evaluated, and 5180 teeth were analyzed. The subjects filled out a form and a calibrated examiner performed the clinical exams to determine the presence of NCCLs, CDH, and GR. NCCLs were classified according to their morphology and depth, CDH levels were evaluated according to air stimuli response, and GRs were categorized according to Miller's classification. The association of the risk factors with NCCLs, CDH, and GR was determined with the Mann-Whitney U test and multiple linear regression. For the correlations, the Spearman test was used with a 95%-confidence level.

Results: The NCCLs, CDH, and GR distributions within the study were 88.1%, 89.1%, and 59.4%, respectively. Maxillary premolars were the most affected by all three conditions. A positive correlation was found between age, NCCLs, and GR; between NCCLs and CDH; CDH and GR; GR and NCCLs. Age, gender, oral hygiene, gastroesophageal diseases, and occlusal trauma were significantly associated with the presence of all three conditions.

Conclusions: The NCCLs and GR distributions increased with age; NCCLs, CDH, and GR had positive correlation; the lesions' depth and morphology contributed to high levels of sensitivity and severity of recessions; age, gender, gastric disease, and occlusal trauma were relevant factors for the occurrence of NCCLs, CDH, and GR.

Clinical significance: The increasing distribution of NCCLs, CDH, and GR is closely associated with people's lifestyles. Thus, it is important for the clinicians to recognize the etiological factors and their most relevant associations to prevent and control such alterations, in order to improve the population's quality of life.

1. Introduction

The tooth structure loss at the cementum-enamel junction that is not associated to the presence of caries has been identified as noncarious cervical lesions (NCCLs) [1], with 5%–85% prevalence rate variation [2]. Current studies suggest that the formation and/or progression of NCCLs have multifactorial etiology [3,4], i.e. the association between factors such as erosion (chemical or electrochemical dental tissue degradation), friction, attrition (endogenous mechanical wear), and abrasion (exogenous mechanical wear) (4–6), besides occlusal stress [7].

However, the different lesion morphologies are usually related to

* Corresponding author at: Department of Operative Dentistry and Dental Materials, Av. Para, 1720 - Campus Umuarama - Bloco 4LA, Sala 4LA42, Uberlândia, Minas Gerais, CEP: 38400-902, Brazil.
E-mail addresses: dnrteixeira@gmail.com (D.N.R. Teixeira), liviazeola@gmail.com (L.F. Zeola), alexandrecoelhomachado@gmail.com (A.C. Machado), rafaella_rg@hotmail.com (R.R. Gomes), paolagomessouza@gmail.com (P.G. Souza), danilocangussuodonto@yahoo.com.br (D.C. Mendes), paulovsoares@yahoo.com.br (P.V. Soares).

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the prevalence of a specific etiological factors in the cervical area [5,8], resulting in wedge-shaped or concave lesions [9].

The increased prevalence of cervical tooth wear with aging implies that NCCLs are probably a result of a time-dependent progression process [1]. In addition, considering the combined effects of all potential etiological factors, the NCCLs presence may contribute to dentin exposure and biofilm accumulation in the cervical site. As a consequence, NCCLs has been associated with other conditions, such as cervical dentin hypersensitivity (CDH) [10] and gingival recession (GR) [11] affecting the same tooth.

Still, epidemiological studies that correlate the presence of NCCLs, CDH, GR, and risk factors are not common, due to the difficulty in obtaining and comparing data from different populations [12]. Even within the same population, the differences in clinical characteristics and risk factors involving these conditions have to be further explored.

Therefore, the aim of this study was to evaluate the risk factors associated with NCCLs, CDH, and GR, apart from the relationship amongst these conditions in a specific Brazilian sample population.

2. Materials and methods

2.1. Subjects

The research protocol for the present study was first submitted to the Ethical Committee of the Federal University of Uberlândia (#1.373.058). After approval, the details of the investigation and procedures were explained to each subject. The population included in the current study were patients from the "Ambulatory Program for the Rehabilitation of Patients with Noncarious Cervical Lesions and Cervical Dentin Hypersensitivity", located at the Dental Hospital of the Federal University of Uberlândia, Brazil. The investigation occurred from August 2013 to August 2016. To be considered for this study, the subjects should be more than 18 years old and present at least one of the three alterations (NCCLs, CDH and/or GR), isolatedly or combined. Patients with any missing teeth (except for third molars), diseases requiring analgesic drugs or anything that could mask the sensitivity symptoms were excluded. In addition, teeth with or under endodontic treatment (only for CDH), under orthodontic treatment, with marginal restorations that could interfere in the evaluation, with marginal leakage, pulpitis, dental caries, and fractures were also excluded.

2.2. Assessments

The form and clinical examination data sheets were designed for data collection and included about the following queries: participant's name, place of birth, medical history, hygiene quality evaluated by the examiner, and tooth-brushing type according to the patient's self-perception. Then, a sheet of paper was delivered to each patient so that they could fill out with a description of what their eating habits would be for one week. The diet would be considered acidic when the number of acidic drinks and/or food incidence was greater than two. Participants were also questioned about the presence of parafunctional habits and gastroesophageal diseases. Patients that were previously diagnosed with gastroesophageal diseases were only accepted if under controlled stage or when the disease was excluded by the specialist.

A clinical examination was individually performed. Occlusal trauma was accessed with the use of carbon tape (*AccuFilm II* - Edgewood, NY, USA), to identify patients' premature contacts in centric relation, in all movements.

NCCLs were classified according to their morphology type, in concave [1] or wedge-shaped [2]. Then, the depth of each lesion was evaluated through NCCL impression with polyvinyl siloxane (PVS) elastomeric material. The impressions were measured by means of a digital caliper and the lesions were classified as shallow (00.9 mm), medium (1–1.9 mm), or deep (greater than 2 mm).

The subjects who reported sensitivity were clinically evaluated for confirmation of CDH presence. An evaporative stimulus (controlled air blast) generated by an air-water syringe was used to determine the tooth sensitivity level. The air jet was perpendicularly directed to the cervical buccal surface of the hypersensitive tooth for two seconds at approximately 1 cm-distance. The adjacent teeth were protected with a polyester strip to avoid false-positive results. The operator requested the participants to rate their pain according to a 10-point visual analog scale (VAS) and the value was recorded. The recorded values were distributed according to their level: 0 – no pain; 2 – mild pain [1–4]; 3 – moderate pain [5–7]; 4 – severe pain [8–10].

GR presence was also checked and classified according to Miller [13] in I, II, III or IV Class, considering the amount of keratinized tissue, the mucogingival junction location related to the recession and the presence or absence of interproximal bone loss.

2.3. Data analysis and statistical tests

Data collected at the anamnesis questionnaire and clinical examinations were classified per patients and per number of teeth. As data did not present normal distribution, the bivariate analysis of dependent variables (NCCL, HD, GR) and the risk factor analysis were performed by Mann-Whitney U test. To verify the study hypothesis, all independent variables that showed association (p-value < .25) were subjected to a multivariate (multiple linear regression) model, following a backward technique. The Spearman correlation test was used to analyze the correlation between the morphology and the depth of NCCLs with CDH level. All analyses were performed with 95%-significance level.

3. Results

3.1. Age

185 individuals (age19 - 7, mean: 41.9 years old) were included in the present study. The male:female ratio was 0.68:1. After clinical examination, 163 out of the 185 subjects were diagnosed with NCCL, 165 with CDH, and 110 with GR, resulting in a distribution of 88.1%, 891%, and 59.4%, respectively. From the 163 subjects with NCCLs, 161 (98.7%) also presented CDH, and 106 (57.2%) presented all three conditions, concomitantly. 5180 teeth were examined. 1308 (25.2%) were diagnosed with NCCLs, 1613 (31.1%) with CDH, and 1334 (25.7%) with GR. Within the teeth with NCCLs, 810 (61.9%) also presented CDH, and 479 (36.6%) exhibited all three conditions, concomitantly.

The distribution of the conditions within different age groups is shown in Fig. 1. NCCLs, CDH, and GR showed similar distribution increase, the higher the age. A larger number of subjects with NCCLs, CDH or GR was found in the > 50 age group, whereas concentration smaller number was found within the 19–30 age group. The trend of NCCLs curve presented faster increase than the CDH or the GR curves

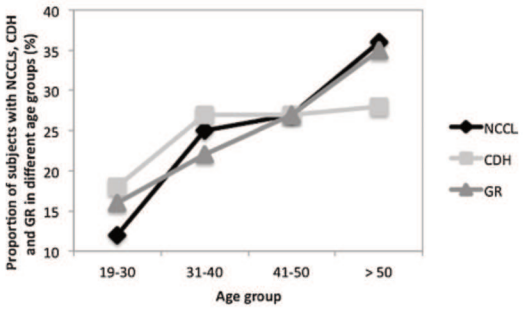

Fig. 1. Subjects distribution per age with isolated incidence of NCCLs, CDH and GR.

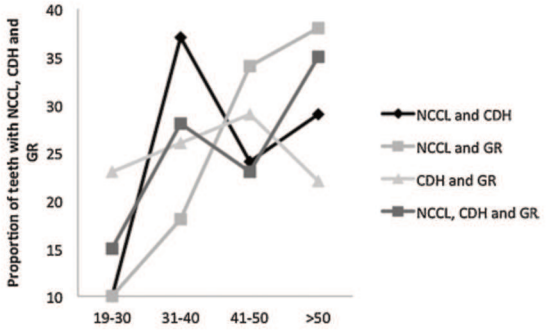

Fig. 2. Subject distribution per age with combined incidence of NCCL + CDH, NCCL + GR, GR + CDH, and NCCL + CDH + GR.

when age was concerned.

The results also showed that in the 19–30 age group, the association of CDH and GR was the most common condition (Fig. 2). On the other hand, in the 31–40 group, the association of NCCLs and CDH were more frequent. In the 41–50 age group, there was an incidence confluence of all three conditions. In the group of subjects older than 50, CDH seemed to decrease and the NCCLs and GR association turn out to be more frequent (Fig. 2).

3.2. Tooth type

Maxillary teeth were more affected than mandible teeth, considering all three conditions. The presence of NCCLs, CDH, and GR per tooth type showed that premolars were the most commonly affected teeth, followed by the first molars and the canines. The second molars were the least affected.

3.3. Correlations

A weak or moderate correlation between the presence of NCCLs and CDH ($p = 0.008$); NCCLs and GR ($p < 0.001$); CDH and GR ($p < 0.001$) were found, with correlation coefficients of 0.19, 0.49 and 0.26, respectively.

The correlation between NCCLs depth and CDH level was also positive ($p < 0.001$), with a 0.47 correlation coefficient. For the morphology, a positive correlation ($p = 0.006$) of wedge-shaped lesions and CDH levels was verified, though its strength was low ($r = 0.07$).

Similarly, there was a moderate correlation ($p < 0.001$) between the level of sensitivity and the GRs classification ($r = 0.47$). The same result was found regarding GRs classification compared to the depth of the lesions ($p < 0.001$), with a low strength coefficient of 0.32.

3.4. Risk factors

The possible risk factors of NCCLs, CDH and GR are shown in Table 1. All the independent variables that demonstrated an association with a p-value < 0.25 in this bivariate analysis were submitted to the multivariate model. The linear regression in Table 2 shows that the most important risk factors for NCCL were age, gender, and occlusal trauma; for CDH, gender and gastric diseases; for GR, age, and occlusal trauma. Brushing, acid diet and parafunctional habits did not present significant statistically differences for any of the alterations to be regarded as relevant risk factors.

4. Discussion

In the present study, a standardized questionnaire was used to assess the risk factors associated with NCCLs, CDH and GR in a specific population of patients. The distribution of NCCLs, CDH, and GR found was 88.1%, 89.1%, and 59.4%, respectively. These values are higher than the range reported in previous studies [14,15], and it may be due to the fact that the examined subjects were patients of a specific clinic for the treatment of these specific conditions.

This study's findings corroborate with the ones from previous studies, which reported that the prevalence of NCCLs and GR increases with age [1,12,16–18], most probably because older people are exposed to the etiological factors for longer periods than the youngsters. On the other hand, CDH levels seem to decrease with age, and it could be due to the continued dentin deposition and subsequent pulp atrophy during lifetime [19].

The most NCCLs and CDH susceptible teeth [1,2,12,17,20] were the maxillary premolars. These teeth show less crown volume, a considerably thinner buccal bone plate, and receive excessive lateral load during mandible excursive movements. These may lead to higher flexion of the tooth to the buccal direction, amplifying deformations in the cervical region [21,22], which could explain the higher NCCLs prevalence and distribution.

In this regard, some studies have shown that eccentric occlusal loads are associated with the presence of NCCLs [23–26], and it corroborates with the findings of this study. However, data is still insufficient and/or inconclusive, as most studies that confirm such association have no robust evidence base. This has been addressed by two systematic reviews, which showed no evidence for this correlation [22,27]. In contrast, the main association that most studies have made between occlusion and NCCLs is through the presence of occlusal wear facets [28–31], and these were often made only by a single, non-blinded examiner, leading to possible bias results, which reduces their reliability [27]. Thus, stronger evidence-based and standardized studies should be carried out for more conclusive results.

A study in China [20] showed that the NCCLs presence was strongly associated with CDH. Nonetheless, the relationship between NCCLs' depth and CDH levels is still scarce in literature. In this study, a positive correlation was found for this association and also between wedge-shaped lesions and CDH levels. These findings could be attributed to the proximity of the lesion bottom wall with the pulp (in deeper lesions) and by the amount of exposed dentinal tubules, which increases the painful reaction [32]. Likewise, the positive correlation between severe GRs and high levels of CDH are in line with the theory that root exposition makes the tissue more vulnerable to the influence of CDH risk factors [1].

The difference in the NCCLs distribution between men and women could be explained by the greater masticatory strength (greater occlusal loads generate higher stress concentrations), which makes the dental structure more susceptible to other risk factors [4]. Interestingly, women showed greater chances of presenting CDH, which may be associated with healthy oral habits or with the frequent acidic foods intake and the presence of lower pain threshold than that of men [33,34]. There was no statistically difference regarding the presence of GRs as far as genders were concerned.

Regarding specific risk factors, according to some authors, the biofilm acidity, which is considered a triggering aspect for GR, acts as an endogenous biocorrosive factor [3] and may also contribute to NCCLs progression. However, this differs from the findings of this study; therefore, this study does not present evidence to conclusively acknowledge the association between the biofilm and NCCLs.

In this context, the influence of toothbrushing, which is considered an abrasion event, remains controversial on the influence of NCCLs progression. According to some authors, under normal and adequate use, brushing with toothpaste would only cause minimal dentin wear throughout life [35]. Other studies state that the high prevalence of lesions on the buccal aspect of the teeth automatically imply the influence of toothbrushing in NCCLs formation [36], which goes in line with a Chinese study, in which it was found that the power of toothbrushing was a predictor of NCCLs presence [37]. On the other hand, a recent systematic review [38] suggested that the data to support the

Table 1
Bivariate analysis (Mann Whitney) between NCCL, CDH and GR and risk factors in overall sample (n = 185).

Variables		NCCL			CDH			GR		
		Mean	SE	p value	Mean	SE	p value	Mean	SE	p value
Gender	Female	6.27	0.47	0.026*	9.84	0.67	0.004*	6.67	0.55	0.521
	Male	8.24	0.68		7.08	0.74		8	0.92	
Oral hygiene	Without visible plaque	6.15	0.49	0.002*	8.12	0.62	0.135	6.32	0.61	0.013*
	With visible plaque	8.59	0.64		9.7	0.86		8.67	0.82	
Brushing with excessive force	No	6.55	0.59	0.337	8.32	0.75	0.586	6.95	0.79	0.497
	Yes	7.43	0.54		9	0.68		7.39	0.64	
Acid diet	No	6.96	1.22	0.746	8.16	1.41	0.594	7.68	1.48	0.788
	Yes	7.09	0.42		8.81	0.54		7.14	0.53	
Gastric diseases	No	6.81	0.48	0.210	7.97	0.56	0.032*	6.64	0.552	0.116
	Yes	7.76	0.72		10.74	1.08		8.76	1.07	
Parafunctional habits	No	7.14	0.57	0.606	7.74	0.73	0.104	6.96	0.79	0.652
	Yes	7.02	0.55		9.43	0.69		7.39	0.64	
Premature contacts	No	4.61	1.10	0.008*	6.65	1.29	0.110	3.91	0.94	0.014*
	Yes	7.42	0.42		9.01	0.55		7.68	0.54	

SE = Standard Error.
* = significant statistic difference.

association between toothbrushing and NCCL/GR remain largely inconclusive and that long-term projects need to be carried out to determine, with confidence, whether this factor consists of predisposition, or is just associated with the mentioned alterations. Other reports also showed that there are patients with NCCLs in non-brushing populations [39,40], which could indicate that toothbrushing is not an NCCLs triggering element, but rather an intensifying or accelerating influence in the process. Yet, none of these studies have shown a clear or standardized evaluation method. Thus, since the methods are limited and the results found in this population were not sufficient for conclusion, more studies are essential, so that the role of toothbrushing in the progression of lesions may be duly clarified. Similarly, the association and clinical relevance of GR development after brushing remains uncertain and unproven [38,41,42].

Previous literature showed that the consumption of citrus fruits and juices, soft drinks, alcohol, and vitamin C tablets is recognized as a source of dental structure aggression, which is associated with the presence of NCCLs [43]. Similarly, an earlier European study with a large sample of 3187 subjects used descriptors to measure how high the patient's acid consumption was [44] and found that fresh fruit and juice intake was positively associated with tooth wear. However, no statistically significant difference was found between the acid diet and the presence of any of the alterations in this study, even though the authors truly believe that it plays a very important role on the development of NCCLs and CDH. In another study [45], no significant association between NCCLs and the consumption of acidic fruits and soft drinks was found, and such discrepant results may be explained by the current eating habits within the population, in which food of acidic nature is very common, despite subjects sample sizes and the differences between the studied populations regarding diet, oral hygiene habits, and

Table 2
Multivariate analysis (linear regression) of factors associated with NCCL, CDH and GR in overall sample (n = 185).

NCCL				
		Estimate (B)	95%CI	p
Age		0.131	0.074– 0.189	< 0.001*
Gender	Female	Reference		
	Male	1.669	0.170– 3.167	0.029*
Premature contacts	No	Reference		
	Yes	2.999	0.774– 5.223	0.009*
CDH				
		Estimate (B)	95%CI	p
Gender	Female	Reference		
	Male	−2.624 to −4.621	−4.621 to −.626	0.010*
Gastric diseases	No	Reference		
	Yes	2.606	0.– 4.815	0.021*
GR				
		Estimate (B)	95%CI	p
Age		0.116	0.043–0.190	0.002*
Premature contacts	No	Reference		
	Yes	3.956	1.072– 6.840	0.007*

* = significant statistic difference.

socio-economic status. Furthermore, there are no literature-standardized methods to properly evaluate an acid diet, which configures another limitation in this study.

The role of gastroesophageal diseases in the progression of teeth surface loss is already proven. Studies have shown that repeated or prolonged exposure of the teeth to gastric acids leads to the selective dissolution of dental surface's specific components, causing structure loss and dentin hypersensitivity. The severity of dental wear and chemical degradation of structures due to gastroesophageal reflux, for example, is correlated to the disease's duration and frequency, pH, acid type, salivary quality and quantity, and buffer effect capacity [46,47].

Regarding parafunctional habits, occlusal parafunction is more likely to favor the dental substance loss in the cervical region than physiological processes [3,4], as the force magnitudes during bruxism are much greater than the loads of normal functional activity [48]. The opposite result found in the present study may be associated with the applied methodology, which used a questionnaire and clinical examination to detect any occlusal wear [23] rather than a laboratorial strength trial.

It has been suggested that the association of the risk factors should be considered, as the events seldom occur alone [3]. Also, an effective approach to the prevention and treatment of NCCLs, CDH, and GR should encompass risk factors management, since alterations may be associated, facilitating its progression. Still, additional information and future studies in this area may allow better comprehension and management of findings.

Lastly, this study confirms, within its limitations, that NCCLs and GR distributions increased with age; NCCLs, CDH, and GR had positive correlations; the lesions' depth and morphology contributed to different levels of recession sensitivity and severity, and age, gender, gastric disease, and occlusal trauma were relevant factors for NCCL, CDH, and GR occurrence.

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CAPÍTULO 3

2.3. CAPÍTULO 3

Artigo enviado para publicação no periódico Brazilian Oral Research

Brazilian Dentists' Perception Regarding Dentin Hypersensitivity Management

Livia Fávaro Zeola[1], Daniela Navarro Ribeiro Teixeira[1], Alexia da Mata Galvão[1], Paola Gomes Souza[1], Paulo Vinícius Soares[1]

[1] Research Group and Reference Center to Treatment NCCL and CDH, Department of Operative Dentistry and Dental Materials, School of Dentistry, Federal University of Uberlandia, Brazil

Corresponding author:

Dr. Paulo Vinícius Soares

School of Dentistry, Department of Operative Dentistry and Dental Materials, Federal University of Uberlandia

Av. Pará 1720, - Campus Umuarama - Bloco 4L, Sala 4L42

Uberlândia - Minas Gerais, 38400-902 – Brazil

E-mail: paulovsoares@yahoo.com.br

Telephone number: 55 34 3225 8106; Fax: 55-34 3218 2279

Brazilian Dentists' Perception Regarding Dentin Hypersensitivity Management

ABSTRACT

The aim of this study was to investigate the perception and clinical routine for dentin hypersensitivity (DH) management among dentists working in Brazil. A 13-item questionnaire-based survey was developed and sent electronically to a convenience sample of dentists. The questionnaire assessed the personal and dental practice characteristics of the sample, the presence of DH in their daily clinical practice and management strategies. Data were analyzed descriptively and by using chi-square test (α=0.05). A total of 353 responses were obtained from September 2017 to March 2018. Of all respondents, 62% were females, 49.9% reported less than five years in dental practice and 70.5% self-identified as private practice practitioners. Most dentists reported an estimated frequency (30-60%) of patients with DH in their practice. The use of airblast and/or scratching with a probe was the most frequently cited way (91.79%) of trigger DH. The use of dentin desensitizers was chosen (48.16%) as the first-choice strategy to manage DH. The number of years in clinical practice was not found to significantly influence the frequency of DH relapse ($p = 0.76$) and to consider the treatment of DH a problem ($p = 0.22$). The present findings indicate that regardless of clinical experience, dentists in Brazil still considered the management of DH a challenge in their daily dental practice. In addition, the results suggest a need for the development of guidelines to disseminate the current knowledge about this condition in ways which may influence decision-making process amongst practitioners.

Keywords: dentin sensitivity, perception, surveys and questionnaires

INTRODUCTION

The research carried out on dentin hypersensitivity (DH) has been pointing not only to widespread occurrence of this condition but also to it unclear nature.[1, 2] The prevalence rates of DH varies from 1.3%[3] to 84%,[4] with differences depending on population settings and the diagnostic criteria used among studies.[5-7] The pain generated from DH is characterized as short and sharp, arising when dentin is exposed to external (chemical, thermal, tactile, evaporative or osmotic) stimuli, which cannot be attributed to any other dental defect or disease.[8] According to the hydrodynamic theory, the stimulation of baroreceptors due to fluid flow movement within dentin tubules leads to neural discharge and is transmitted as a painful sensation.[9] DH presence tends to cause a negative impact in oral health-related routines,[10] producing significant impairment on patients' daily oral activities like eating, drinking, toothbrushing and breathing.[11] This undesirable influence[12] is the main motivation that led individuals to seek dental assistance in order to improve their quality of life.[13]

The treatment of DH is based on etiological factors control/removal, such as occlusal adjustment, dietary advice, toothbrushing instruction and use of desensitizing agents.[1, 14] To date, a large number of in-office options for DH treatment have been reported, such as fluoride cavity varnishes, potassium-based agents, glutaraldehyde-based agents, oxalates, calcium phosphates, strontium or acetate chlorides, resin-based sealants and laser therapy.[15] However, despite the wide diversity of agents available and approaches described in the literature, surveys worldwide[16-21] suggest knowledge gaps and lack of confidence by dental professionals when managing DH.

This situation turns the decision-making into a challenge for dental practitioners[1, 8, 22] and the question that arises is how they effectively manage DH in their daily practice. To the best of the author's knowledge, to date, there is absence data in the literature on the Brazilian dentists' opinions regarding DH. Therefore, the aim of this study was to investigate the perception and clinical routine for DH management among Brazilian dentists.

METHODOLOGY

Questionnaire Elaboration

The approval for this study was obtained from the Institutional Ethics Research Committee (protocol 2.138.939). An electronic questionnaire was developed based on previous studies that have conducted similar surveys[3, 16-22] to investigate dentists' perception and clinical routine regarding DH. The first version of the questionnaire was piloted amongst a focus group comprising ten dentists to assess content validity. Feedback from the group included identifying ambiguous items and suggesting additional items. These aspects were not evaluated quantitatively, but items were edited to eliminate unclear questions and possible bias and resulted in the final version.

Survey Structure

The final questionnaire consisted of 13 multiple choice questions organized in three sets, seeking information on dentists' (i) personal (e.g. sex, level of education, and time in dental practice) and dental practice characteristics (public or private) (ii) DH in daily clinical practice (estimated frequency, predisposing factors and methods of assessment) and (iii) management strategies for DH.

Recruitment Strategy

The final questionnaire was sent electronically to a convenience sample of dental practitioners registered to a regional dental council in Brazil, using the Google Forms tool. The dentist was requested to click on the link to access the survey. Informed consent was obtained from participants by including information concerning the purpose of the study, the promise of confidentiality and its voluntary nature on the first page of the form. Dentists did not receive training to complete the questionnaire, which was estimated to be answered in 10 minutes. Data were collected electronically between September 2017 and March 2018.

Data Analysis

The collected data were downloaded into an Excel spreadsheet (Microsoft, Redmond, WA, USA) to facilitate organization and analyses of the responses. A specially devised coding system was used to preserve confidentiality and to keep the answers to the questionnaire anonymous. The findings were calculated as frequencies of responses returned by dental practitioners. Statistical analyses were performed by using descriptive statistics and chi-square test. A significance level of 5% was set and all analyses were performed using Sigma Plot, version 12.0.

RESULTS

A total of 353 dentists properly filled the questionnaire and the response rate was not determinate because it was not possible to establish exactly the number of dentists that received and opened the e-mails. The findings of the study were divided according to the three sections of the form.

Personal and Dental Practice Characteristics

The details about absolute and relative frequencies for personal and dental practice characteristics are shown in Table 1. The sample was composed mostly by females (62%) with less than five years working in dental practice (49.9%) and presented the specialization (40.2%) as their highest level of education. The majority of dentists self-identified as private practice (70.5%) practitioners.

DH in daily clinical practice

According to dentists' replies, about 48% of respondents reported that the estimated frequency of patients complaining about DH in their clinical practice ranged from 30 to 60%. Interestingly, this percentage did not differ significantly across the practice category (Chi-square test: p=0.61).

As summarized in Figure 1A, practitioners indicated the main predisposing factors related to DH in their opinion. Presence of occlusal prematurity was the main chosen factor, followed by an acidic diet, parafunctional habits, and gastroesophageal disorders. Regarding the assessment methods, it appears from the response received that the use of airblast and/or scratching the tooth with a dental probe was the most frequently cited way (91.79%) of trigger DH clinically, according to the respondents. The least common used method of assessment was vertical and horizontal percussion (0.85%) (Fig. 1B).

Management Strategies for DH

Regarding the strategies used to manage DH, most dentists (48.16%) reported the use of dentin desensitizers as their first choice, followed by the association of dentin desensitizers with laser therapy (26.63%) and use of desensitizing toothpaste alone (14.73%). Interestingly, 32 dentists (almost 10%) reported that they did not perform the treatment of DH in their clinical practice (Fig. 2A). In addition, the majority (45%) of respondents informed that they recommend the use of desensitizing toothpaste during and after all the period of treatment (Fig. 2B). When asked about the action mechanisms of dentin desensitizers, respondents cited the neural and occlusion desensitizers (39.86%) as the most known. However, and surprisingly, 29% of the dentists reported that they did not know different classifications of dentin desensitizers and 3.4% did not know any type of desensitizing agents (Fig. 2C). When questioned about what kind of advice/recommendations they offered to their patients, the answers mostly chosen were toothbrushing education, parafunctional habits control and acidic diet changes (Fig. 2D).

Finally, the number of years in clinical practice was not found to significantly influence the frequency of DH relapse after treatment conclusion (Chi-square test: p = 0.76) (Table 2). In addition, the dentists still considered the management of DH a challenge in their clinical practice, regardless the professional experience time (Chi-square test: p = 0.22) The main reported reason for this discomfort were the fact that pain is subjective and there is not a consolidated protocol for DH treatment (Fig.3).

DISCUSSION

There is growing awareness that DH is an increasingly important issue, affecting the quality of life[13] of many individuals worldwide, that needs to be addressed from both diagnostic and management perspective.[23] Previous studies developed in different regions of Brazil, showed

DH prevalence rates varying from 17% to 89.1%.[24-28] This report was the first to investigate the state of the current practice of Brazilian dental practitioners regarding DH management. Such knowledge can be valuable as a basis for the development of continuing professional educational strategies to help clinicians in the decision-making process and to guide researchers to design future epidemiological, clinical studies and prevention strategies. [29, 30]

The findings of this study showed that regardless practice category (public or private), for 48% of the respondents, DH is a common condition (an overall estimated prevalence range of 30-60%) in their clinical practice. These findings are of significant concern and are in agreement with rates found in previous epidemiological studies.[24-28] In addition, the majority of Brazilian dentists were aware of predisposing factors importance like stress, corrosion and friction[31] in the etiology of DH and believe that is necessary to consider them in management strategies.[1, 8] For the accurate diagnosis of DH it is important for dental professionals to exclude any confounding factors from other orofacial pain conditions such as dental caries, pulpitis, fractured restorations, post-operative sensitivity, marginal leakage and gingival inflammation.[8] In this study, to help in the diagnosis process, almost 92% of dentists cited the use of airblast and/or scratching the tooth with a dental probe to trigger DH clinically, in the same way as recommended in the literature.[1,8]

Regarding management strategies, although there a large number of agents and materials available on the market, the issues associated with DH in general dental practice can be very challenging.[30] Different action mechanisms of desensitizers are identified and the overall aim is to reduce fluid flow within dentinal tubules by obliterating them or blocking neural responses triggering the pain response.[15] Nowadays, however, there is not currently one ideal desensitizing agent or one management strategy approach to reduce/eliminate DH for all patients that can be used as gold standard treatment.[32] This fact still generates confusion among clinicians as to which of these products may give clinical benefits to their patients.

In this survey, when asked about the action mechanisms of dentin desensitizers, respondents cited the neural and occlusion agents (39.86%) as the most known. On the other hand, 29% of the dentists reported not recognizing the different classifications of desensitizers and 3.4% did not know any type of desensitizing agents, which was a concerning finding. To conduct a proper management of a condition, the clinician should be aware and comprehend the variety of approaches and agents available in order to have confidence in their ability to treat the problem and to employ the best strategy in each clinical situation. An important issue is that generally, the information about these DH products is received from the manufacturing companies[1] and the use of scientific evidence to change their clinical practice is a challenge for some dentists,[33] that still make decisions based on their previous experiences or opinions from colleagues.[34] Furthermore, there is often a tendency for the clinician simply to recommend a treatment (as the application of desensitizing agents) without first modify/eliminate any etiological and predisposing factors

involved in the process. In this phase, the joint working relationship between the professional and the patient is essential, since behavior changes in diet, dental hygiene (e.g. use of specific toothpaste) and control of parafunctional habits could be necessary.[35, 36]

In the same context, regardless the years in dental practice, more than 80% of dentists included in this study, seem to have concerns about issues involving DH and consider the management of this condition a challenge in their daily dental practice. This situation is an alert to the fact that the transfer of knowledge from research to clinical dental practice is not achieving the dentists properly.[37] It is a call for the necessity to the communication/dissemination of scientific evidence to dentists in order to turn them capable to provide their patients with the best possible treatment.[38, 39] For this reason, the conduction of continuing training education programs should be encouraged to update dental clinicians and to prepare future professionals to seek out the best available scientific evidence on the issues and challenges associated to DH. In addition, the authors recommend that efforts should be taken to develop practical and simple guidelines [8, 29] in Portuguese, to help the clinicians successfully manage DH in their daily clinical practice to give a better quality of life for their patients.[8, 40]

Although this survey was carried out using a convenience sample of dentists, the study included professionals from private and public practice and with different clinical experience. The findings presented here, might not be generalized to all dentists, but it was a first attempt to investigate the Brazilian dentists' perception and management strategies related to DH. Further investigations, involving larger samples sizes should be conducted to support these findings and to increase our knowledge about this issue in Brazil.

CONCLUSION

Within the limitations of this study, the present findings indicate that regardless of their clinical experience, dentists in Brazil still considered the management of DH a challenge in their daily dental practice. The results also suggest a need for the development of guidelines to disseminate the current knowledge about DH in ways which may influence decision-making process amongst practitioners. Given the increasing prevalence of DH in clinical practice, efforts should be taken to educate undergraduate students and to update dental professionals regarding the management of this condition.

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Tables

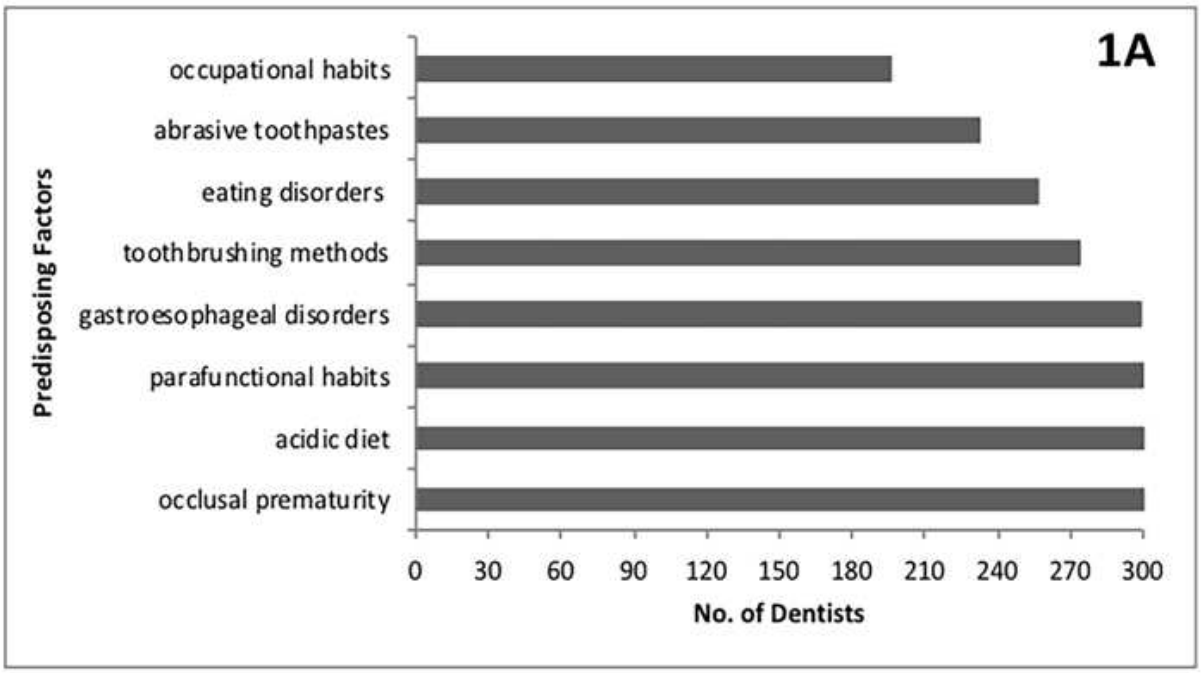
Table 1. Personal and practice characteristics of Brazilian dentists participating in the study, by number and percentage of respondents to each item (N=353)

Characteristic	Number	Percentage
Sex		
Female	219	62%
Male	134	38%
Time in clinical practice (years)		
Up to 5	176	49.9%
Between 6-10	45	12.7%
Between 11-20	80	22.7%
Between 21-30	37	10.5%
More than 30	15	4.2%
Highest level of education		
Graduate	87	24.7%
Dental Specialization	142	40.2%
MSc	83	23.5%
Ph.D.	41	11.6%
Practice Category		
Private practice	249	70.5%
Public practice	104	29.5%

Table 2. Analysis between years in clinical practice and frequency of dentin hypersensitivity relapse after treatment conclusion (N=353)

Variable		DH frequency of relapse			
		<30%	30-50%	>50%	P value
Years in dental practice	Up to 5	82	78	16	0.76
	6-10	22	20	3	
	11-20	41	36	3	
	21-30	22	13	2	
	>30	7	6	2	
	Total	174 (49.2%)	153 (43.3 %)	26 (7.3%)	

Figures



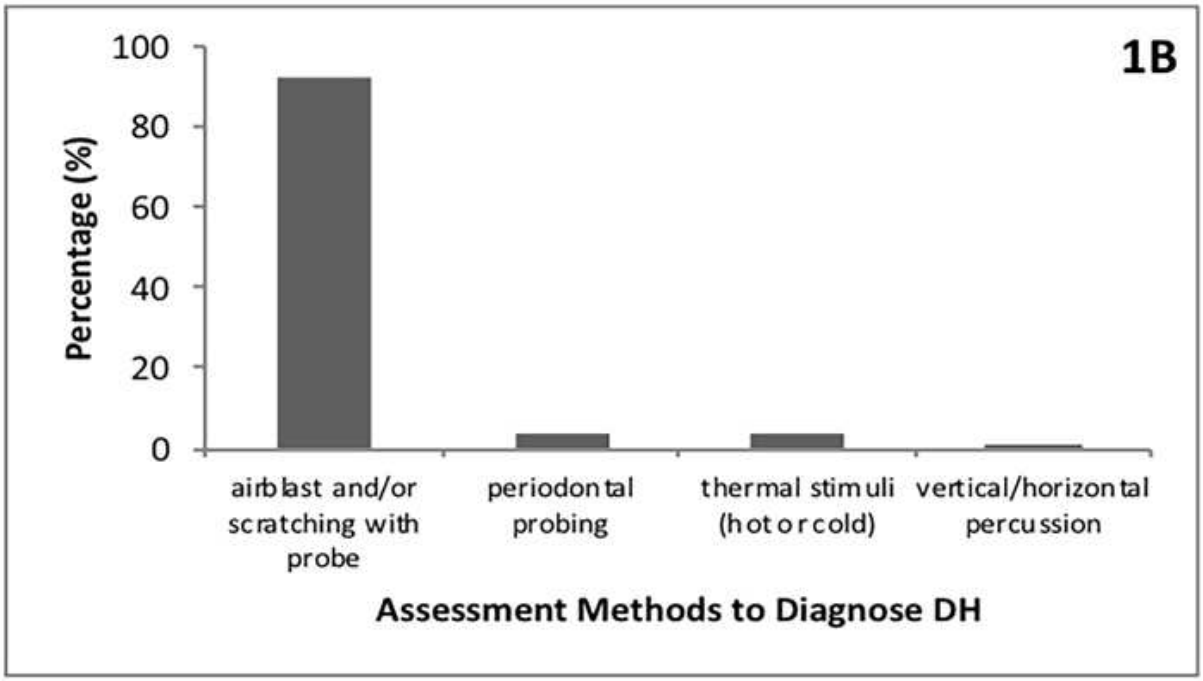
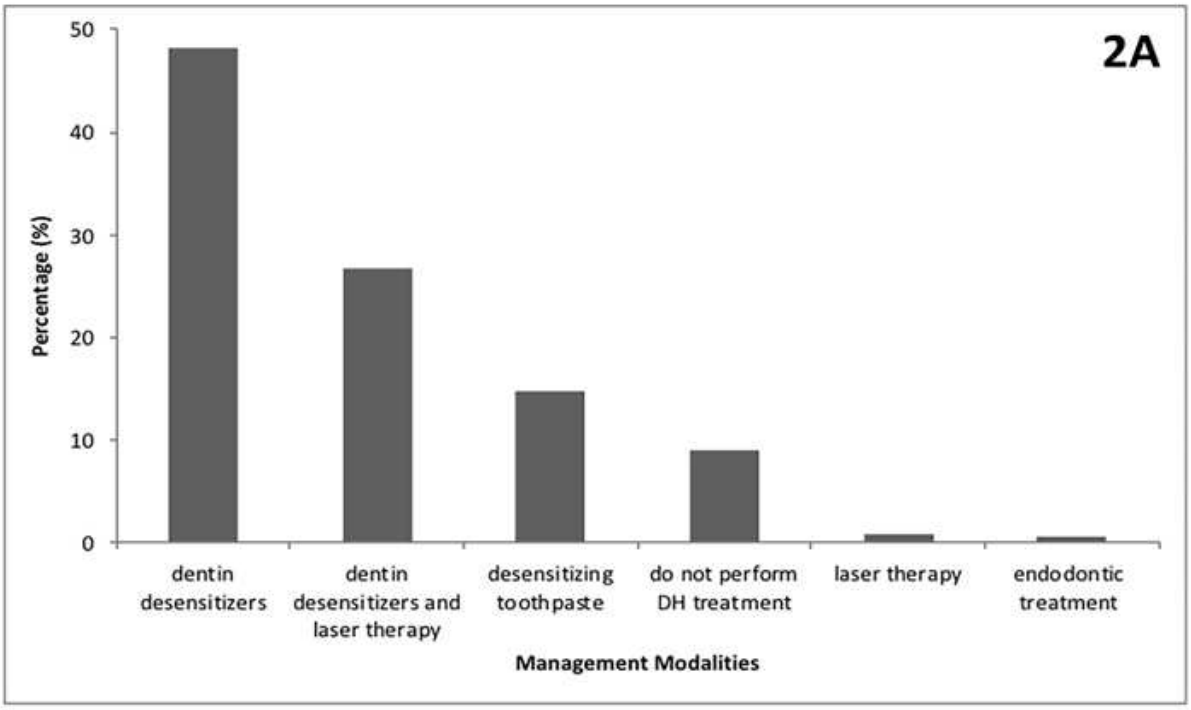
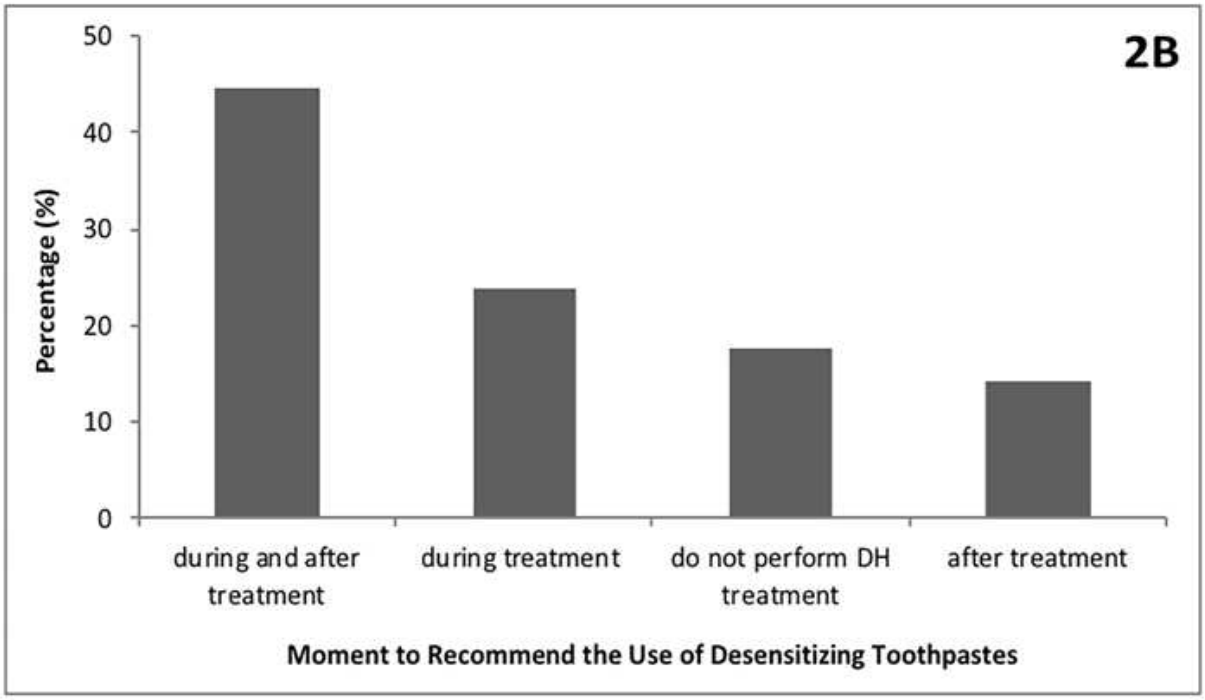
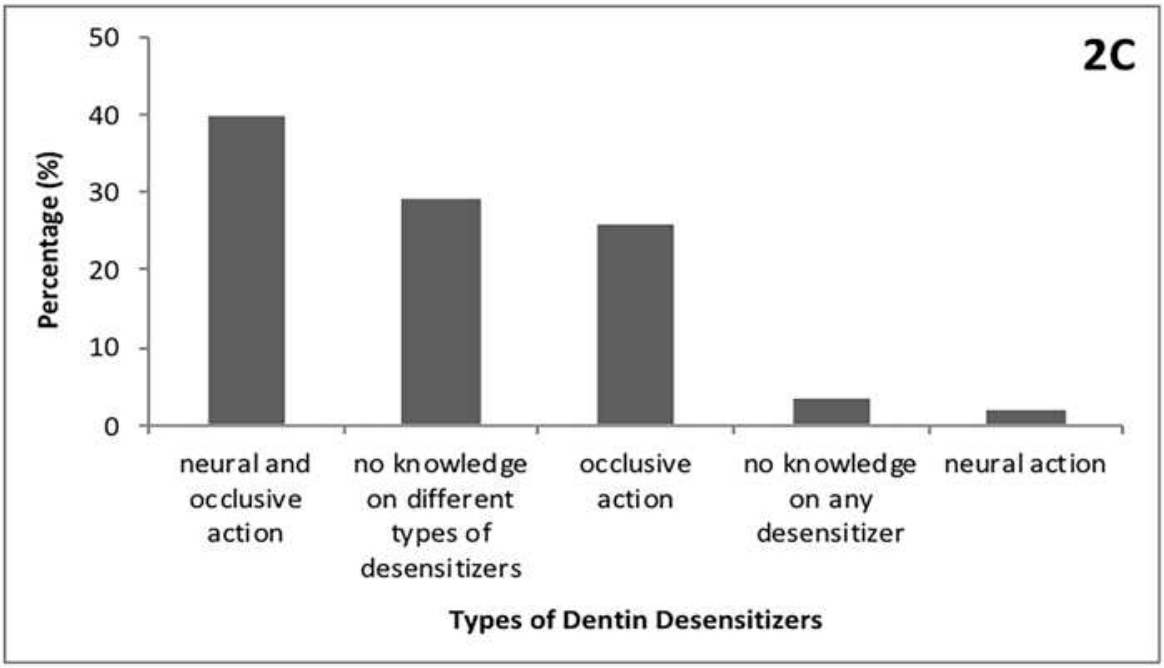


Figure 1. A.* Most frequent predisposing factors of DH, according to respondents; B. Assessing methods used to diagnose DH, as indicated by the practitioners.

*Note: Participants had the option to choose more than one answers.


2A
50
40
30
20
10
0
Percentage (%)
dentin desensitizers
dentin desensitizers and laser therapy
desensitizing toothpaste
do not perform DH treatment
laser therapy
endodontic treatment
Management Modalities


2B
50
40
30
20
10
0
Percentage (%)
during and after treatment
during treatment
do not perform DH treatment
after treatment
Moment to Recommend the Use of Desensitizing Toothpastes



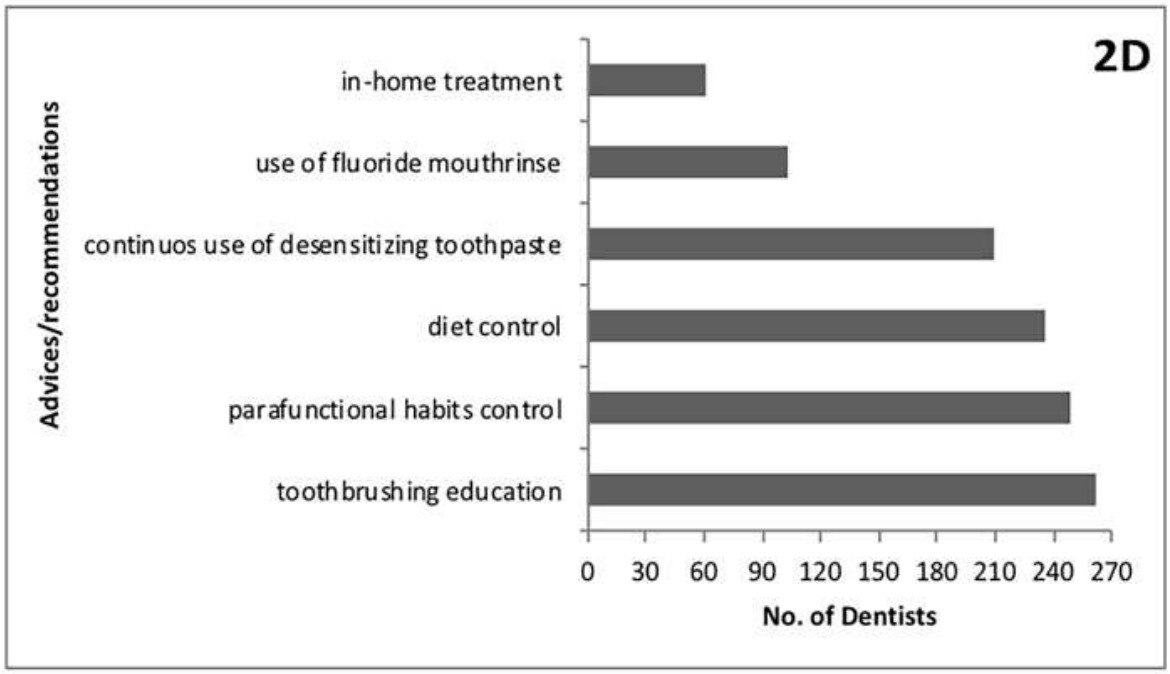


Figure 2. A. Management modalities routinely used when treating DH; B. Moment to recommend the use of desensitizing toothpastes; C. Types of dentin desensitizers known by the respondents; D.* Advices/recommendations offered to patients during DH management, according to surveyed dentists.

*Note: Participants had the option to choose more than one answers.

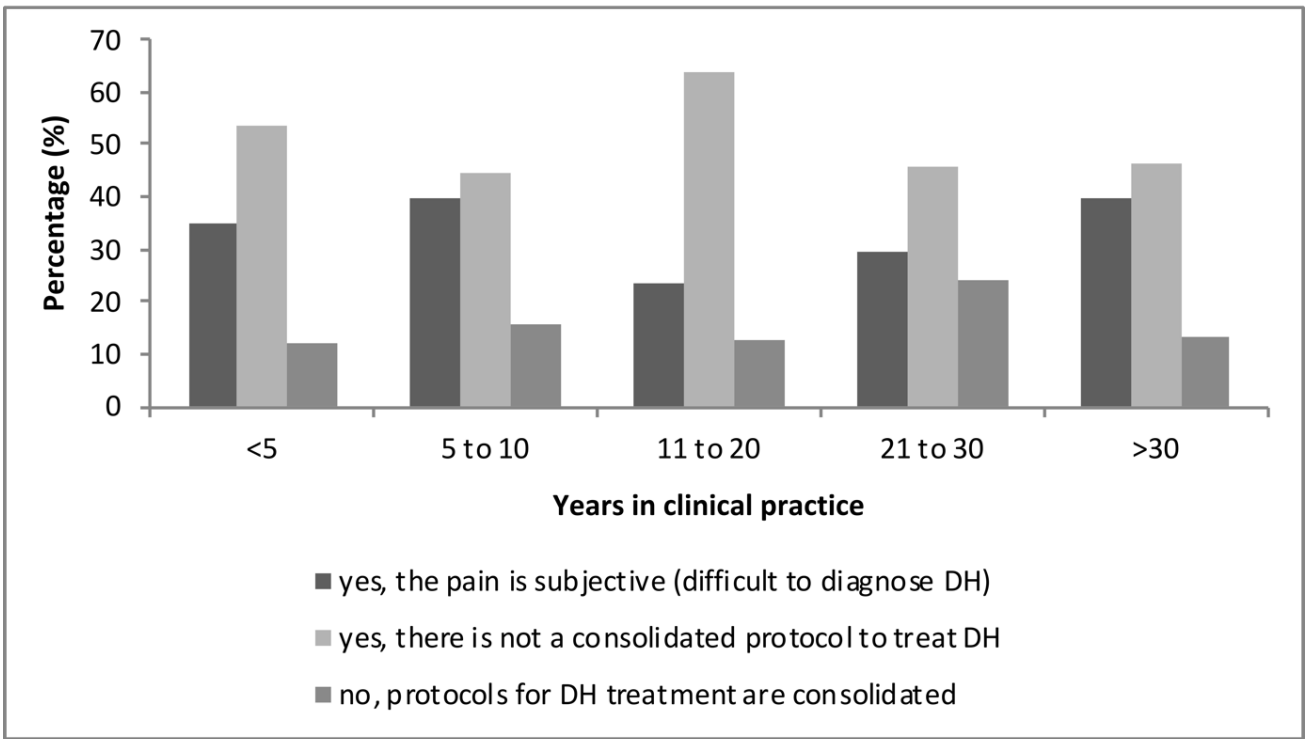


Figure 3. Dental practitioners' responses to the question: "Do you consider the management of dentin hypersensitivity a challenge in your daily clinical practice?", presented according to their years in dental practice.

CAPÍTULO 4

2.4.CAPÍTULO 4

Artigo a ser enviado para publicação no periódico Clinical Oral Investigations

Effect of GaAlAs lasers on dentin hypersensitivity treatment for different follow-up lengths: a systematic review and meta-analysis

Livia Favaro Zeola[a,b] Paulo Vinícius Soares[a], Daniela Navarro Ribeiro Teixeira[a], Nazifa Fatima Rai[b], Joana Cunha-Cruz[d]

[a] Department of Operative Dentistry and Dental Materials, School of Dentistry, Federal University of Uberlândia, Uberlândia, Minas Gerais, 38400-902, Brazil.

[b] Visiting Student, Department of Oral Health Sciences, School of Dentistry, University of Washington, Seattle, WA, 98195-7475, USA.

[c] Department of Oral Health Sciences, School of Dentistry, University of Washington, Seattle, WA, 98195-7475, USA.

Correspondence: Dr. Paulo Vinicius Soares, Department of Operative Dentistry and Dental Materials, School of Dentistry, Federal University of Uberlândia, Uberlândia, Minas Gerais, 38400-902, Brazil, paulovsoares@yahoo.com.br

Effect of GaAlAs lasers on dentin hypersensitivity treatment for different follow-up lengths: a systematic review and meta-analysis

Abstract

Objectives: The aim of this study was to conduct a systematic review to evaluate the desensitizing effects of gallium-aluminium-arsenide (GaAlAs) lasers compared with placebo/no treatment or in-office topical agents, considering different follow-up times. Materials and Methods: An electronic search without restriction on dates or languages was performed in three electronic databases (Cochrane - Central Register of Controlled Trials, MEDLINE and LILACS) to identify relevant articles published up to October 2018. Randomized controlled trials comparing GaAlAs lasers with placebo/no treatment or in-office topical agents to treat dentin hypersensitivity in adult patients were included. In addition, hand-searches in reference lists of articles and in the gray literature were also conducted. The risk of bias was assessed according to the Cochrane guidelines, and the quality of the evidence was evaluated using the GRADE tool. Inverse variance random-effects meta-analysis of standardized mean differences (SMDs) and 95% confidence intervals (CIs) were calculated. Results: Twenty-three studies were ultimately included in the meta-analysis. Treatment with GaAlAs laser resulted in lower DH levels when compared with placebo/no treatment controls, regardless the follow-up time. On the other hand, for comparison between GaAlAs laser and topical desensitizer agents, the laser had better results only when compared with fluoride-based agents, for the short, mid, and long-term follow-up times. Conclusions: available evidence suggests that the use of GaAlAs laser promoted better outcome for in-office treatment of dentin hypersensitivity than placebo/no treatment (regardless the follow-up period) and fluoride-based agents (for short, mid and long-term follow-ups). However, the evidence was considered moderate and low, highlighting a need for the conduction of more high-quality clinical trials with longer follow-up times.

Key words: dentin hypersensitivity; desensitizing agents; GaAlAs laser; placebo; systematic review; meta-analysis

1. Introduction

Dentin hypersensitivity is defined as a short and sharp pain, resulting from exposed dentin in response to external (thermal, evaporative, tactile, osmotic or chemical) stimuli, which cannot be attributed to any other form of dental defect or pathology [1, 2]. Dentin hypersensitivity has become a frequent oral health problem due to changing of habits (acidic diet and healthy lifestyle), more retaining of vital teeth, and the increase in population's life expectancy [3, 4]. The pain generated from this condition tends to cause a negative impact on patient's daily life and a reduction in oral health-related quality of life [5-7], which is a strong reason that led individuals to seek for dental assistance [8]. The reported prevalence rates has been ranged from 1.34% [9] to 92.1%[10] among the adults, depending on the population screened and the design of the studies [11-13].

The mechanism of dentin hypersensitivity has not been completely elucidated yet, however, the hydrodynamic theory proposed by Brännström is the most widely accepted in the literature [14]. According to this concept, when the exposed dentin is stimulated, the fluid flow movement is increased within the open dentin tubules. This movement triggers nerve fibers present at the dentin-pulp interface and is transmitted as a painful sensation to the individual [14]. For this reason, the ideal agent for the relief of dentin hypersensitivity should be able to reduce the fluid flow into dentin tubules (by tubular occlusion), blockage of pulpal nerve activity or both [1]. To date, a large number of in-office treatments for dentin hypersensitivity have been reported, such as fluoride gels and varnishes, potassium-based agents, glutaraldehyde-based agents, oxalates, calcium phosphates, strontium or acetate chlorides, resin-based sealants and different types of lasers [13, 15, 16].

Among these therapies, lasers was introduced as a potential alternative treatment for dentin hypersensitivity in 1985 with the application of a Nd:YAG laser [17]. Since that time, the use of lasers has been widely reported in randomized clinical trials, mainly due to their possible reliable, immediate, reproducible, analgesic effects and for being simple to operate [17, 18]. Five types of lasers, with different settings and protocols, have been cited in literature for dentin hypersensitivity treatment, the low-power lasers: He-Ne (helium-neon) and GaAlAs (gallium aluminum arsenide); and the high-power: Nd:YAG (neodymium-doped yttrium aluminum garnet), Er:YAG (erbium-doped yttrium aluminum garnet laser), Er,Cr:YSGG (erbium, chromium-doped yttrium scandium gallium garnet), CO2 (carbon dioxide) and GaAlAs.

The range of reported effectiveness depends on the laser type and parameters adopted [18, 19]. However, among the lasers, the GaAlAs seems to be the most commonly applied in clinical practice, presenting satisfactory results, without side effects to the pulp or dentin [20, 21]. The GaAlAs mechanism of action remains unclear, but appears to be related to the blockage of

the depolarization of afferent C fibers, increase of blood flow and inflammation reduction [22] and action on cellular activity (increasing the deposition of tertiary dentin)[23, 24].

Although previous systematic reviews and meta-analysis [19, 21, 25, 26] have been conducted comparing specifically the effectiveness of laser therapy with placebo or other desensitizing agents, they were not conclusive yet. Furthermore, some of these studies were conducted with language limitation, without inclusion of appropriate analyses according to different laser types and mainly considering just the longest follow-up time of each study in their evaluation. Given the limited amount of information available, the value of using GaAlAs lasers to manage DH is still considered inconsistent to support the decision-making process in clinical practice. Therefore, the aim of this study was to conduct a systematic review of controlled trials on adults with dentin hypersensitivity to evaluate the desensitizing effects of GaAlAs lasers compared with placebo/no treatment or in-office topical agents, considering different follow-up lengths.

2. Methods

2.1. Protocol registration

This systematic review was conducted following recommendations from the Cochrane Collaboration [27]. The study protocol was registered at International Prospective Register of Systematic Reviews - PROSPERO database (CRD42018083838) and it is reporting followed the guidelines for Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement [28].

2.2. Search Strategy to Identify Studies

The specific vocabulary (mesh terms) and additional keywords in the search strategy were determined, according to the PICOS questions:

- Participants (P): adults with dentin hypersensitivity
- Intervention (I): treatment of dentin hypersensitivity with low and high-power GaAlAs laser applied at any settings
- Comparisons (C): other topical agents applied in-office or placebo/no treatment controls
- Outcomes (O): dentin hypersensitivity pain response to stimuli
-Studies (S): randomized controlled trial (RCT) or clinical controlled trial (CCT)

A sensitive search protocol, modified for different electronic databases, was developed to identify trials to be included in this review. The concepts from the PICOS question were combined using the Boolean operators “OR” (within each concept) and “AND” (between the concepts) (Appendix 1).

The articles were obtained through an electronic search of the following databases (up to October 2018): MEDLINE via PubMed, Latin America and Caribbean Health Sciences Literature

database (LILACS) and The Cochrane Central Register of Controlled Trials (CENTRAL), without languages or date of publication restrictions. Other sources were also screened in order to identify registers of ongoing trials, dissertation and theses, and further studies (Appendix 2). Additional relevant publications were obtained through hand-searching of reference lists of included studies.

2.3. Eligibility criteria

All the obtained records were transferred to a database and coded, using EndNote X7 (Thomson Reuters, San Francisco, USA). We included parallel or split-mouth randomized or controlled clinical trials that compared GaAlAs laser therapy and other topical agents applied in-office or placebo/no treatment controls for dentin hypersensitivity treatment. Due to the heterogeneity of methods used to assess dentin hypersensitivity, no a priori outcome measure was required. Non-controlled clinical trials, letters, opinions, reviews, in vitro, cohort, observational and descriptive studies, such as case reports, were excluded. Additionally, studies were excluded if (1) other types of lasers were used to treat dentin hypersensitivity rather than GaAlAs; (2) evaluated postoperative, post-periodontal therapy and post-bleaching sensitivity; (3) presented no comparison group (placebo or topical agents applied in-office).

2.4. Study selection and data extraction

Two independent reviewers examined the title and abstracts of all records that remained after duplicates removal, taking into account the eligibility criteria, and agreement was calculated with the Kappa statistic. In cases in which there were not enough information in the title and abstract, the full reports were obtained to make a correct decision. Disagreements between the reviewers were solved with the involvement of a third reviewer. Japanese and Chinese studies were evaluated with the support of experts in those languages. Then, full-text articles were obtained, and two reviewers extracted relevant information, using specific data forms. The extraction forms were pre-designed, and pilot tested using a sample of study to confirm its applicability. The dentin hypersensitivity levels (means and standard deviations) and number of observations were extracted in different time points and were grouped according to the following criteria: (1) initial evaluation (from 1 week to 2 weeks), (2) short-term (1 to 2 months), (3) mid-term (3 months) and (4) long-term (6 months or more). When more than one setting of laser application was included in the study, the lower dosage was used. In addition, when relevant data were not reported, authors were contacted by e-mail to request missing information and/or the values were estimated based on the reported data.

2.5. Risk-of-Bias Assessment and Evaluation of the Quality of Evidence Using GRADE

Two reviewers independently read the studies selected and assessed the risk of bias of all the included trials by using the Cochrane Collaboration's tool [27]. The judgment for each domain of potential source of bias involved the grading as "YES" (low risk of bias) "UNCLEAR"' (absence of information or uncertainty related to the potential for bias and "NO" (high risk of bias), as described in the Cochrane Handbook for Systematic Reviews and Interventions. Disagreements in specific studies were resolved by consensus with involvement of a third review author. The overall strength of evidence of the meta-analysis was evaluated using the GRADEpro (Grading of Recommendations Assessment, Development and Evaluation) Guideline Development Tool. For RCTs, the GRADE approach addresses five aspects (risk of bias, inconsistency, indirectness, imprecision and other considerations) to possibly rate down the quality of the evidence in 1 or 2 levels. Each specific domain was graded as "not serious limitations", "serious", and "very serious", in order to categorize the strength of the evidence as high, moderate, low, or very low [29].

2.6. Synthesis of Results

The information about the continuous outcome of this study (number of participants, means and standard deviations values of pain levels) were extracted from the reports. For studies in which two or more types of stimuli were applied to assess pain levels, the values were combined and a mean between them were used. Standardized weighted-mean differences (SMD) with 95% confidence interval (CI) were calculated based on random-effects models [30]. A subgroup analysis was performed for different types of topical agents applied in-office and for placebo/no treatment, considering the different follow-ups evaluations. For split-mouth trials, a within-patient correlation coefficient equal to 0 was assumed. Heterogeneity between studies, were assessed with the I^2-statistic [31]. Because there was a high degree of heterogeneity, random-effects meta-regression models with study characteristics as covariates were fitted to understand the impact of such characteristics as modifiers of the study effect size. Statistical analyses were conducted using RevMan (Review Manager version 5.3 software, The Cochrane Collaboration, Copenhagen, Denmark) and STATA software (Stata Statistical Software, Version 15.1, Stata Corp, College Station, TX, USA).

3. Results

3.1. Search results

The preliminary search of electronic databases yielded 737 potentially relevant articles (Fig. 1). After the review of study title, keywords and abstracts, 85 papers were retrieved. We reviewed the full text of the selected articles, after which 64 were excluded according to the predetermined criteria. Two articles not previously found through electronic search were discovered in the

references of citations, resulting in 23 included in qualitative synthesis and meta-analysis (Fig. 1). The agreement between the two reviewers was considered excellent (kappa=0.93).

3.2. Characteristics of Included Studies

Studies included in the systematic review were diverse and their characteristics are described in Table 1. Of the 23 studies selected, 11 were designed as parallel and 12 as split-mouth and were conducted in Brazil (10), Turkey (5), India (3), Italy (2) and 1 each in Australia, Thailand, and Spain. Twenty of the studies were conducted in university settings, 2 at private practice and 1 at military installations. All articles were published in English between 1994 and 2018, 20 of them were published in the most recent 10 years and 8 were published in the last 5 years.

Eleven studies compared the effectiveness between GaAlAs laser and placebo/no treatment. The placebo groups were diverse. Five studies used laser device without activation [32-36], two applied no treatment [37, 38], one each used curing light [39], carbomer gel [40], physiological saline solution [41] and commercial toothpaste [42]. For the comparison GaAlAs laser vs topical desensitizers, were evaluated different agents applied in-office, such as fluoride (9), glutaraldehyde (4), potassium based-agents (4), dentin bond agent (2) and cyanoacrylate glue (1). The settings for the laser application varied for the parameters such as power output, wavelength, irradiation time, mode of application, energy density, and number of points and application sessions (Table 1).

The assessment of dentin hypersensitivity differed among the final included studies, involving response to evaporative (exposing the teeth to a blast of air), thermal (exposing the teeth to a cold water), and tactile stimulation (applying pressure with a standardized probe). Of the 23 studies, 12 used more than one stimulator to elicit pain. To quantify dentin hypersensitivity levels, several scales were used, such as visual analog scale (VAS) of 0-10 or 0-100, Uchida criteria (0-3), verbal rating scale (VRS) of 0-5 and numeric rating scale (NRS). The follow-up periods were diverse as well, which ranged from immediate evaluation to 18 months. For the most of studies, adverse events were not observed, except for 2 studies that reported presence of sensitivity/spontaneous pain [43] and temporary/reversible pain sensation [34] after the treatment with laser (Table 1).

3.3. Risk of Bias Assessment

The assessment of risk for bias revealed that most of studies had a moderate risk of bias (Fig. 2). Common limitations were lack of information about how the randomization sequence generation was undertaken, lack of sufficient allocation concealment and blinding process of participants, personal and outcome assessors. In addition, in some studies a high risk of bias for the incomplete outcome item was found. The quality of evidence was considered moderate for GaAlAs laser vs placebo/no treatment for the initial, short and mid-term evaluation and low for

the long-term follow-up (Table 2). On the other hand, for the comparison between GaAlAs and topical agents, the evidence was considered moderate for the initial and short-term evaluations and low for the mid and long-term (Table 3).

3.4. Synthesis of the Results

Treatment with GaAlAs laser resulted in less dentin hypersensitivity levels when compared with placebo/no treatment controls, regardless the follow-up time (Fig 3). The statistical heterogeneity of these comparisons was high, I^2 ranged from 96% to 98%. On the other hand, for comparison between GaAlAs laser and topical desensitizers agents, the laser had better results only when compared with fluoride-based agents, for the short, mid, and long-term follow-up times. For all the other evaluations no statistical differences were found ($p>0.05$). The degree of heterogeneity varied according to the agents and periods of time analyzed (Fig 4).

Meta-regressions (for GaAlAs laser vs placebo/no treatment comparison) (n=11) with covariates including the study design, decades, setting, number of application sessions and laser parameters (power output and wavelength) were tested and none of the results was significant ($p > 0.05$).

4. Discussion

The purpose of this systematic review was to synthesize the existing information related to the effectiveness of GaAlAs lasers in the reduction of dentin hypersensitivity. Even though some articles have been published in this issue, we are not aware of reviews that have compiled data from studies taking to account the follow-up length.

The results from this review showed that regardless of the follow-up length, the GaAlAs laser treatment were significantly more effective than placebo, which is in consistency with the findings obtained from previous meta-analysis [25, 44]. However, in some cases it was found that patients undergoing placebo groups still presented benefits with a reduction of the VAS values, which could be explained by the psychosomatic component of dentin hypersensitivity [20]. On the other hand, in the comparison between GaAlAs vs topical desensitizers, many different active ingredients were evaluated, and the laser showed a greater treatment efficacy only when compared with the fluoride-based agents, for the short, mid and long-term follow-ups times. The mechanisms of action analyzed were multiple and the number of studies testing the effect of same topical agent vs GaAlAs laser was small, which could have influenced the results. In addition, fluoride-based agents have demonstrated positive effects in blocking dentinal tubules and offering clinical dentin hypersensitivity relief [45]. They promote the precipitation of calcium fluoride crystals inside the dentinal tubules, thereby decreasing dentin permeability and as consequence the pain levels. However, it has been demonstrated that saliva or mechanical abrasion can remove

the precipitate formed [46], resulting in a reduction of the effect in short periods of time, which could explained the results found in this review.

The good results achieved for GaAlAs laser are in consistency with the findings obtained from previous systematic reviews [16, 26] and could be associated to its mechanism of action. The desensitization effect (photobiomodulating effect) is based on the stimulation of nerve cells, interfering with the polarity of the cell membrane (at Na+/K+ pump) by increasing the amplitude of the action potential and blocking the transmission of painful stimuli [24]. The laser also leads to an increase in the cellular metabolic activity of the odontoblasts and promotes the obliteration of dentine tubules with the intensification of tertiary dentine production [23], without cause pulp damage [21]. In addition, the placebo effect in dentin hypersensitivity laser therapy has been discussed in the literature [19, 21, 25]. This has been described as a complex physiological and psychological interaction that depends on the relationship between patients and professional with both needing to believe that the treatment is valuable [18], which could influence the results obtained for the therapy.

A fact that deserves some attention was a large discrepancy with regard to the trial characteristics, such as study design, laser parameters/settings, methods of stimulation and scales to assess pain levels, which lead to a high heterogeneity detected. To minimize the differences, we calculated a mean of dentin hypersensitivity levels, taking into account all the methods of assessment applied in each study, for each agent and timepoint and used standardized mean difference (SMD) [30] to report the results. However, the results still showed relatively high statistical heterogeneity. For the comparison between GaAlAs laser vs placebo/no treatment we explored the heterogeneity by undertaking meta-regression with covariates such as study design, decades, setting, number of application sessions and laser parameters (power output and wavelength), but none of the results was significant ($p > 0.05$). Other types of laser parameters that could influence the effect size, such as irradiation time, mode of application, energy density and number of points were not considered in the meta-regressions due to the lack of data in the studies. This lack of important information due to unclear report of the methods and results, makes difficult the discussion of the possible influence of each covariate on the effect size and on determination of parameters to be used in clinical practice. The same type of meta-regressions was not conducted for the comparison GaAlAs laser vs topical desensitizers, due to the inadequate number of studies (less than 10 for each subgroup of agents) [27].

The majority of studies included in this review have focused in the evaluation of the immediate or short-term effects of GaAlAs laser for the dentin hypersensitivity treatment, not allowing a properly evaluation about the desensitizing effect and pulp damage in longer periods. Although this systematic review was conduct following standard guidelines, the results found should be interpreted with caution. The high degree of heterogeneity and risk of bias among the

included reports, may affect the reliability of data. For this reason, the conduction of further studies, adopting standard procedures and following the CONSORT guidelines to report their findings is necessary [47] to improve the quality of evidence. The researchers should make efforts to conduct randomized clinical trials with larger and adequate sample size and properly report the characteristics of their studies as randomization, allocation, blinding process and description of protocols/settings used for the GaAlAs application. Furthermore, there is a need for the conduction of investigations with longer follow-up times, with more than 6 months of observation period.

Dentin hypersensitivity is a condition with increasing incidence rates, that affects the quality of life of the population. The information collected in this review can serve as a motivation for the researchers to improve the quality of design and report of their clinical trials in order to obtain accurate results to maximize the likelihood of appropriate GaAlAs laser application protocols for the treatment of dentin hypersensitivity in clinical practice.

4. Conclusion

Within the limitations of this study, available evidence suggests that the use of GaAlAs laser promoted better outcome for in-office treatment of dentin hypersensitivity than placebo/no treatment (regardless the follow-up period) and fluoride-based agents (for short, mid and long-term follow-ups). However, the evidence was considered moderate and low, highlighting a need for the conduction of more high-quality clinical trials with longer follow-up times.

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Tables

Table 1. Characteristics of the studies included in the systematic review

Author, year	Study Design	Country	N of teeth by group (Laser/ Comparator)	Age (range)	Gender distribution	Experimental Intervention (GaAlAs laser Settings)	Comparators	Number of Applications Interval between session	Stimuli Pain scale	Follow-up Timepoints	Adverse events
Osmari et al., 2018[48]	Split-mouth	Brazil	19/19	21-48	6M/13F	810 nm, 1 W, 100 J/cm^2, non-contact mode for 20s, with horizontal scanning movements	5% sodium fluoride varnish; 3% potassium oxalate; dentin bond agent	1	Evaporative VAS (0-100)	IAT, 2 weeks, 1 and 2 months	NR
Praveen et al., 2018[49]	Parallel	India	25/25	20-50	NR	904 nm, 60 mW 9 J/cm^2, spot size 0.8 cm^2, non-contact mode, 3 points, 1 min per point	glutaraldehyde desensitizer gel	1	Evaporative and thermal VAS (0-10)	IAT, 1 week, 3 months	NR
Tevatia et al, 2017[42]	Parallel	India	30/30	18-55	69M/51F	980 nm, 0.5 W, 62.2 J/cm^2, non-contact mode for 1 min, with horizontal scanning movements	5% potassium nitrate; placebo (commercial toothpaste)	3 same session	Evaporative, thermal and tactile VAS (0-10)	IAT, 2, 4 and 6 weeks	None
Lopes et al, 2017[50]	Parallel	Brazil	13/13	22-53	NR	810 nm, 30 mW, 10 J/cm^2, spot size of 0.023 cm^2 contact mode, 4 points, 9s per point	glutaraldehyde desensitizer gel	3 72h	Evaporative, tactile VAS (0-10)	5 min, 12 months, 18 months	NR
Dantas et al, 2016[51]	Parallel	Brazil	46/40	NR	NR	4 J/cm^2, applied punctually to the cervical region on the buccal face	5% sodium fluoride varnish	4 72-96h	Evaporative, tactile VAS (0-10)	IAT, 12 days	NR
Soares et al, 2016[52]	Split-mouth	Brazil	29/27	20-65	3M/20F	40 mW, 4 J/cm^2, spot size 0.028 cm^2, contact mode, 4 points, 15s per point	2% fluoride gel	1	Evaporative VAS (0-10)	IAT, 1 week	NR

Suri et al, 2016[53]	Split-mouth	India	30/30	20-59	17M/13F	980 nm, 2 W, non-contact mode, 40s	5% sodium fluoride varnish	1	Evaporative, tactile VAS (0-10)	24h, 1 week, 1 and 2 months	None
Bal et al, 2015[41]	Split-mouth	Turkey	41/22	19-60	5M/16F	685 nm, 25 mW, 2 J/cm^2, non-contact mode, 3 points, 100s	placebo (physiological saline solution)	1	Evaporative VAS (0-100)	10 days, 1,2 and 3 months	None
Lopes et al, 2013[54]	Parallel	Brazil	11/11	22-53	NR	810 nm, 30 mW, 10 J/cm^2, 4 points, 9s per point	glutaraldehyde desensitizer gel	3 72 h	Evaporative, tactile VAS (0-10)	5 min, 1 week, 1, 3 and 6 months	None
Lund et al, 2013[40]	Split-mouth	Brazil	54 laser/ 32 placebo/ 31 sodium fluoride gel	19-58	5M/8F	780 nm, 20 mW, 5 J/cm^2, 4 points, 40s	2% sodium fluoride gel; placebo (carbomer 940 gel)	3 72 h	Evaporative VAS (0-10)	5 min, 1 and 2 weeks, 1 and 3 months	NR
Femiano et al, 2013[55]	Split-mouth	Italy	69 laser /65 sodium fluoride/ 67 glutaraldehyde	21-64	8M/16F	808 nm, 0.2W, non-contact mode, 1 min, performing scanning movements	2% sodium fluoride solution; glutaraldehyde desensitizer gel	3 weekly	Evaporative VAS (0-10)	IAT, 1 and 6 months	None
Flecha et al., 2013[43]	Split-mouth	Brazil	216/218	12-60	15M/47F	795 nm, 120mW, 2.88 J/cm^2, spot size 0.031cm^2, 3 points, 24s	cyanoacrylate glue	3 48 h	Evaporative, thermal NRS	24 h, 1,3, 6 months	A single tooth presented acute sensitivity and spontaneous pain
Umberto et al, 2012[56]	Parallel	Italy	33/34	25-60	2M/8F	980 nm, 0.5 W, 62.2 J/cm^2, contact mode, 1 min	1.25% sodium fluoride gel	3 weekly	Evaporative, tactile NRS (0-10)	IAT, 1 month	NR
Orhan et al, 2011[32]	Parallel	Turkey	16/16/16	21-51	8M/8F	655 nm, 25 mW, 4 J/cm^2, contact mode, 160s, on exposed dentin area in a scanning motion	glutaraldehyde desensitizer gel; placebo (laser device without activation)	6 consecutive days	Evaporative VAS (0-100)	24h, 1 week	None
Yilmaz et al, 2011 (a)[35]	Split-mouth	Turkey	58 laser, 64 placebo, 58 sodium fluoride varnish	18-58	22M/26F	810 nm, 500 mW, 8.5 J/cm^2, non-contact mode, 1 min	sodium fluoride varnish; placebo (laser device	1	Evaporative VAS (0-10)	IAT, 1 week, 1, 3, 6 months	None

							without activation)				
Yilmaz et al, 2011 (b)[38]	Split-mouth	Turkey	58/58	18-60	22M/29F	810 nm, 8.5 J/cm^2, non-contact mode, 1 min	No treatment	1	Evaporative VAS (0-10)	IAT, 1 week, 1 and 3 months	None
Dilsiz et al, 2010[37]	Parallel	Turkey	24/24	18-52	11M/13F	808 nm, 100mW, non-contact mode, with scanning movements, twice, 20s	No treatment	3 2 weeks	Evaporative VAS (0-10)	30 min, 2 weeks, 1 and 2 months	None
Sicilia et al, 2009[33]	Parallel	Spain	15/15/15	19-70	18M/27F	810 nm, 2.5 mW, 1 min	10% potassium nitrate gel; placebo (laser device without activation and placebo gel)	1	Evaporative, tactile VRS (0-3)	15, 30 min, 2, 4 days; 1, 2 weeks; 1, 2 months	None
Vieira et al, 2009[36]	Split-mouth	Brazil	58 laser/51 placebo/55 potassium oxalate gel	24-68	7M/23F	660 nm, 30 mW, 4 J/cm^2, contact mode, 4 points, 2 min	3% potassium oxalate gel; placebo (laser device without activation)	4 1 week	Evaporative, tactile VAS (0-10)	IAT, 3 months	None
Tengrungsun et al, 2008[57]	Split-mouth	Thailand	70/70	21-62	15M/55F	790 nm, 30 mW, 1 min	dentin bond agent	1	Evaporative Uchida criteria (0-3)	IAT, 2 weeks, 1 month	None
Gentile et al, 2004[39]	Parallel	Brazil	35/33	20-52	10M/22F	670 nm, 15mW, 4 J/cm^2 , 3 points, 2 min	placebo (curing light)	6 48 to 72h	Evaporative, tactile VAS (0-10)	IAT, 6 to 8 weeks	NR
Corona et al, 2003[58]	Split-mouth	Brazil	30/30	20-30	NR	606 nm, 15 mW, 4 J/cm^2, contact mode, 3 points, 30s	sodium fluoride varnish	5 72h	Evaporative Uchida criteria (0-3)	IAT, 2 weeks, 1 month	NR
Gerschman et al., 1994[34]	Parallel	Australia	21/28	15-65	NR	830 nm, 30 mW, non-contact, 2 points, 1 min	placebo (laser device without activation)	4 at least 1 week	Evaporative, tactile VAS (0-100)	1,2 weeks, 2 months	Two patients reported a temporary, reversible pain sensation

IAT: immediately after treatment; VAS: visual analog scale; VRS: verbal rating scale; NRS: numeric rating scale; NR: Not reported

Table 2. GRADE summary of randomized controlled clinical trials included in the analysis for comparison between GaAlAs vs placebo/no treatment.

Certainty assessment							N° of teeth		Effect	Certainty	Importance
N° of studies	Study design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations	GaAlAs laser	Placebo/no treatment	Absolute (95%CI)		
INITIAL											
9	randomized trials	serious[a]	not serious	not serious	not serious	none	317	289	SMD **2.63 lower** (3.72 lower to 1.54 lower)	⨁⨁⨁◯ MODERATE	CRITICAL
SHORT-TERM											
9	randomized trials	serious[a]	not serious	not serious	not serious	none	337	306	SMD **2.07 lower** (3.18 lower to 0.96 lower)	⨁⨁⨁◯ MODERATE	CRITICAL
MID-TERM											
5	randomized trials	serious[a]	not serious	not serious	not serious	none	269	227	SMD **1.79 lower** (3.57 lower to 0.02 lower	⨁⨁⨁◯ MODERATE	CRITICAL
LONG-TERM											
1	randomized trials	serious[a]	not serious	not serious	serious[b]	none	58	64	SMD **3.74 lower** (4.33 lower to 3.14 lower)	⨁⨁◯◯ LOW	CRITICAL

CI: Confidence interval; **SMD:** Standardized mean difference

Explanations

a. The risk of bias assessment showed that most of the studies had a moderate or high risk

b. The number of studies and/or the sample size is small.

Table 3. GRADE summary of randomized controlled clinical trials included in the analysis for comparison between GaAlAs vs topical desensitizers.

Certainty assessment							N° of teeth		Effect	Certainty	Importance
N° of studies	**Study design**	**Risk of bias**	**Inconsistency**	**Indirectness**	**Imprecision**	**Other considerations**	**GaAlAs laser**	**Topical agents**	**Absolute (95%CI)**		
INITIAL											
13	randomized trials	serious[a]	not serious	not serious	not serious	none	471	440	SMD **0.21 lower** (0.68 lower to 0.26 higher)	⊕⊕⊕◯ MODERATE	CRITICAL
SHORT-TERM											
12	randomized trials	serious[a]	not serious	not serious	not serious	none	742	716	**SMD 0.20 lower** (0.57 lower to 0.17 higher)	⊕⊕⊕◯ MODERATE	CRITICAL
MID-TERM											
6	randomized trials	serious[a]	not serious	not serious	serious[b]	none	422	398	SMD **0.36 lower** (0.73 lower to 0.01 higher)	⊕⊕◯◯ LOW	CRITICAL
LONG-TERM											
5	randomized trials	serious[a]	not serious	not serious	serious[b]	none	436	432	SMD **0.46 lower** (0.95 lower to 0.02 higher)	⊕⊕◯◯ LOW	CRITICAL

CI: Confidence interval; **SMD:** Standardized mean difference

Explanations
a. The risk of bias assessment showed that most of the studies had a moderate or high risk
b. The number of studies and/or the sample size is small.

Figures

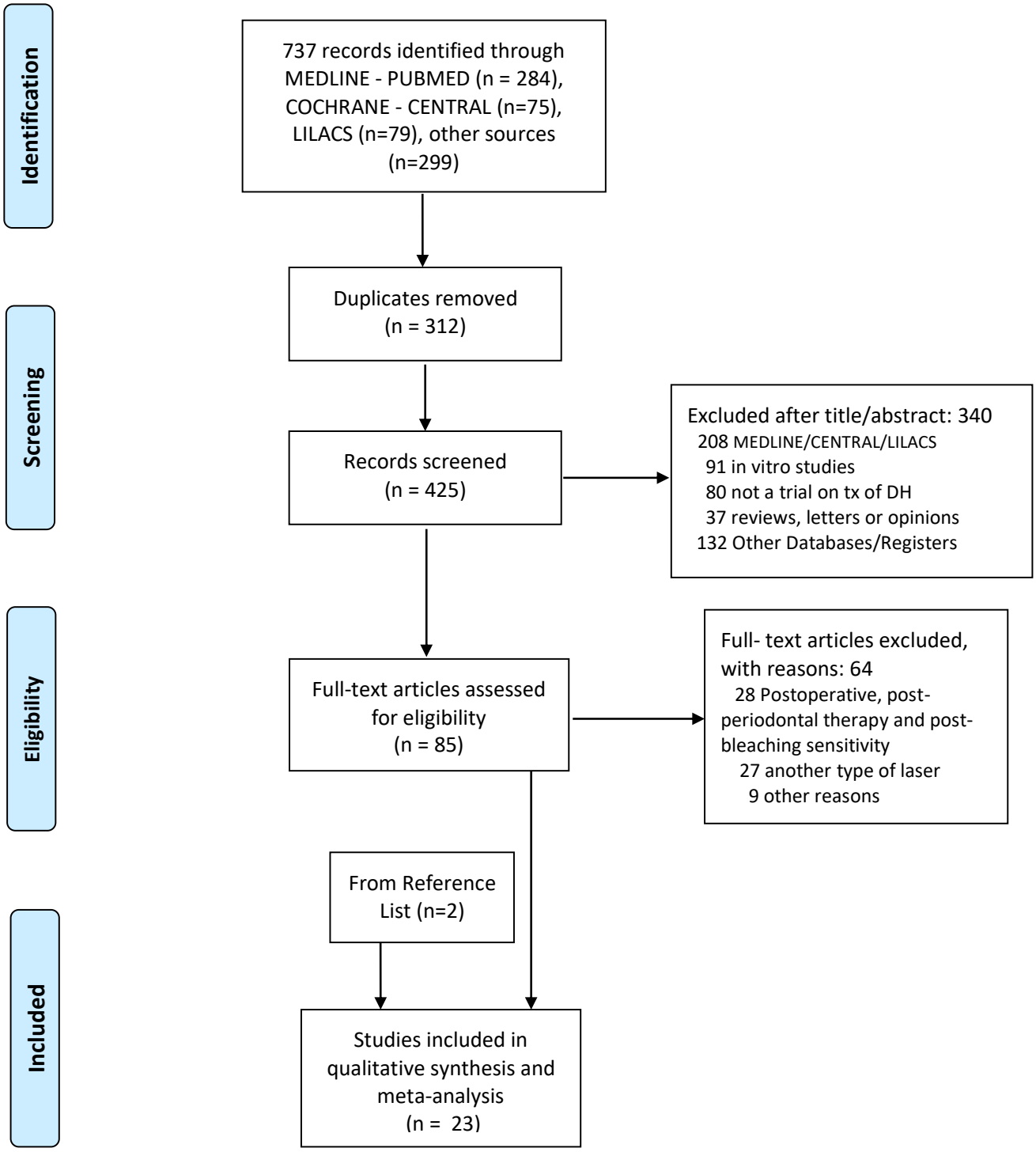

Figure 1. Flow-chart of the selection of studies for the systematic revi

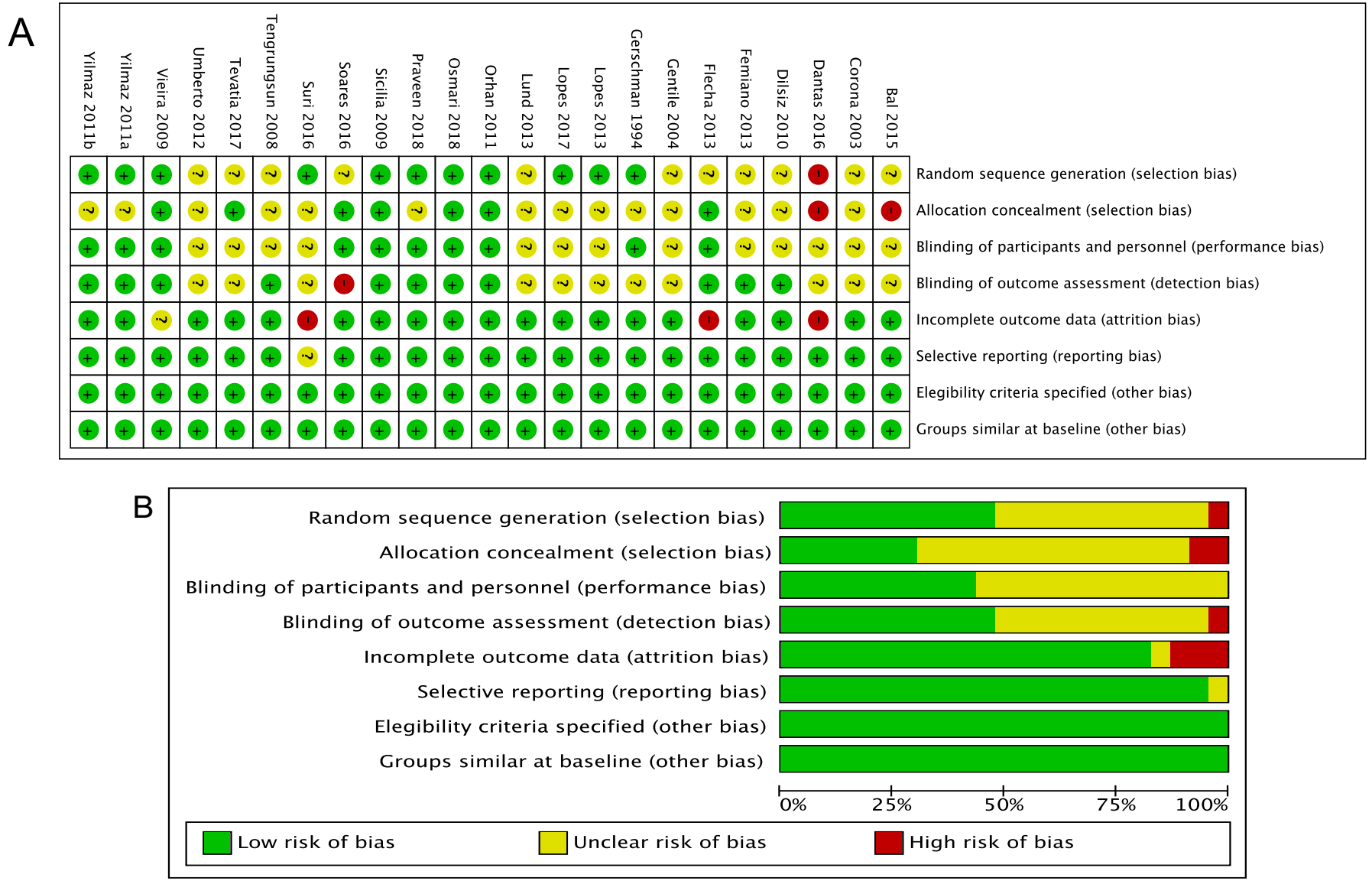

Figure 2. Risk of bias assessment according to the Cochrane Collaboration tool. A. Risk of bias summary for each included study; B. Graph about each risk of bias item presented as percentages across all included studies

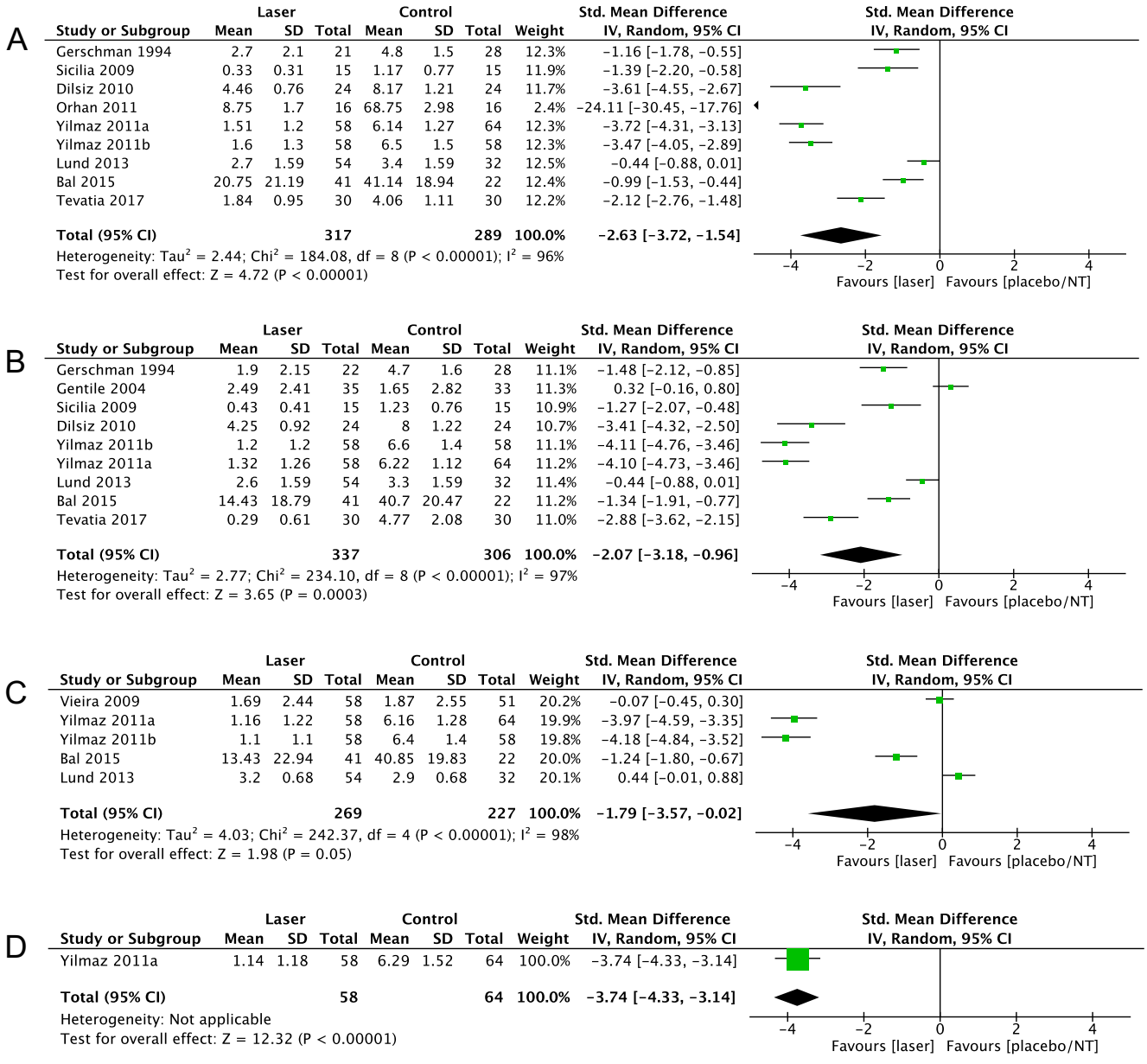

Figure 3. Forest plot of standardized mean differences between GaAlAs laser and placebo groups, according to duration of follow-up. A. Initial assessment; B. Short-term; C. Mid-term; D. Long-term.

A

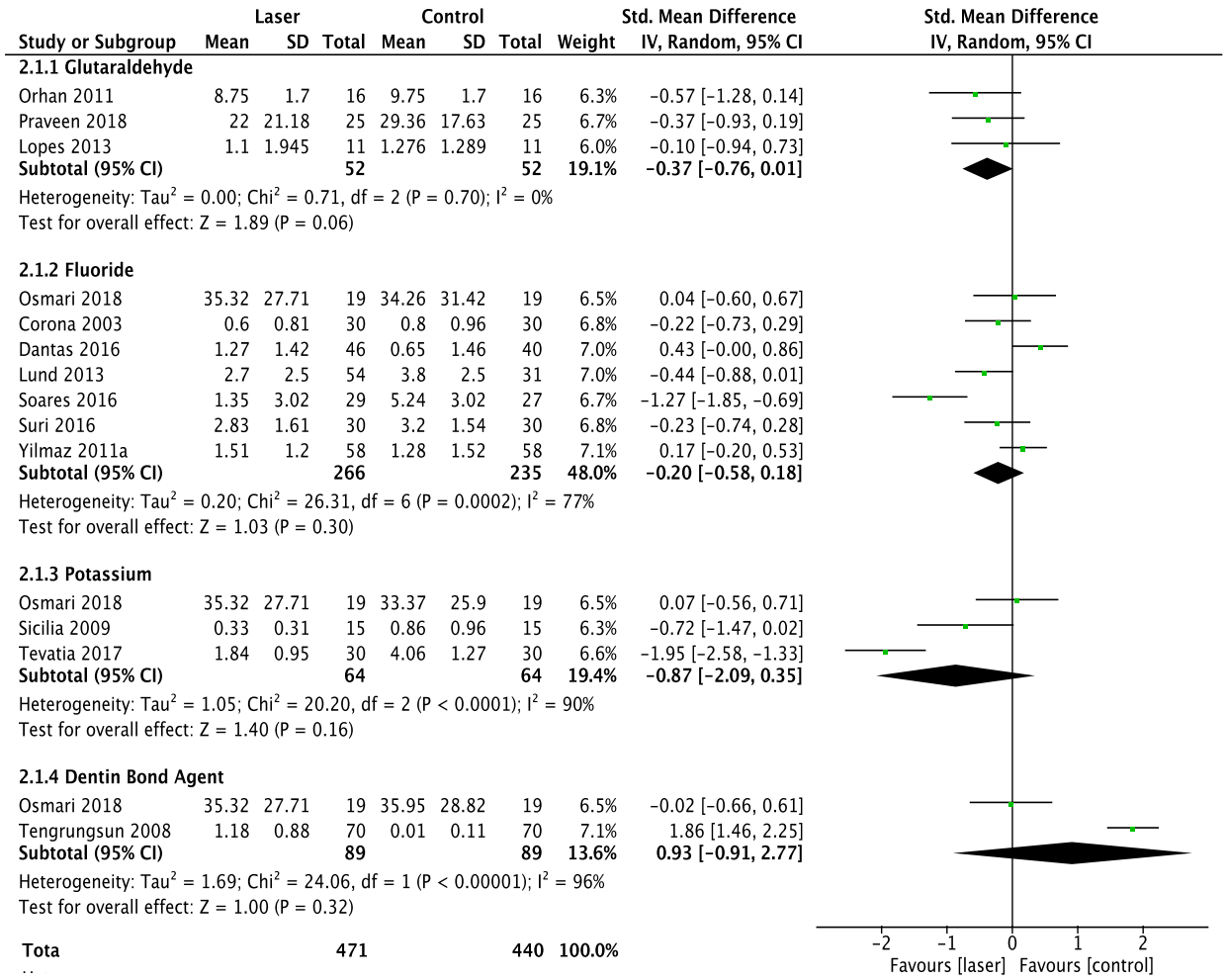

Figure 4. Forest plot of standardized mean differences between GaAlAs laser and topical desensitizers agents, according to duration of follow-up. A. Initial assessment; B. Short-term; C. Mid-term; D. Long-term.

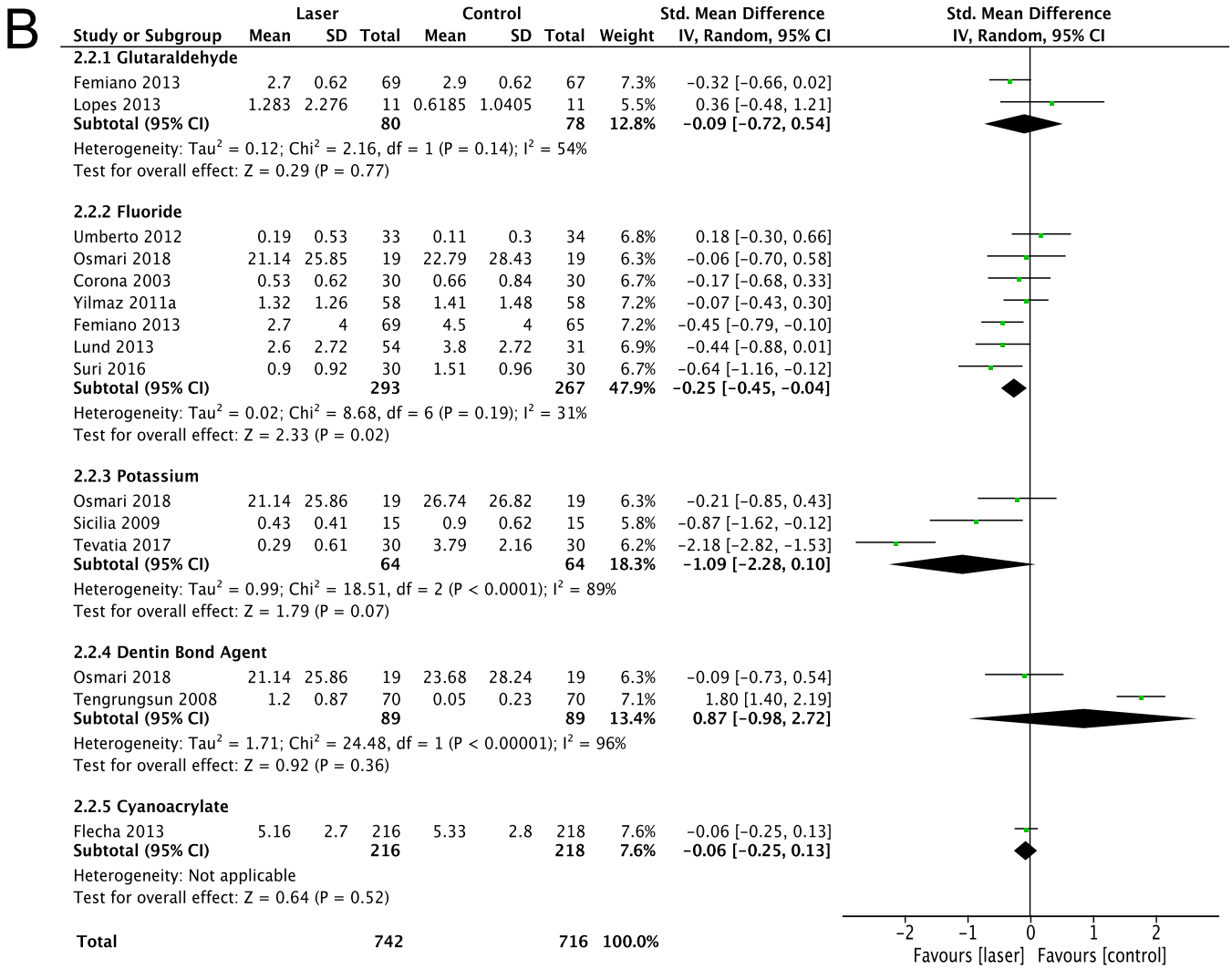

Figure 4. Forest plot of standardized mean differences between GaAlAs laser and topical desensitizers agents, according to duration of follow-up. A. Initial assessment; B. Short-term; C. Mid-term; D. Long-term.

C

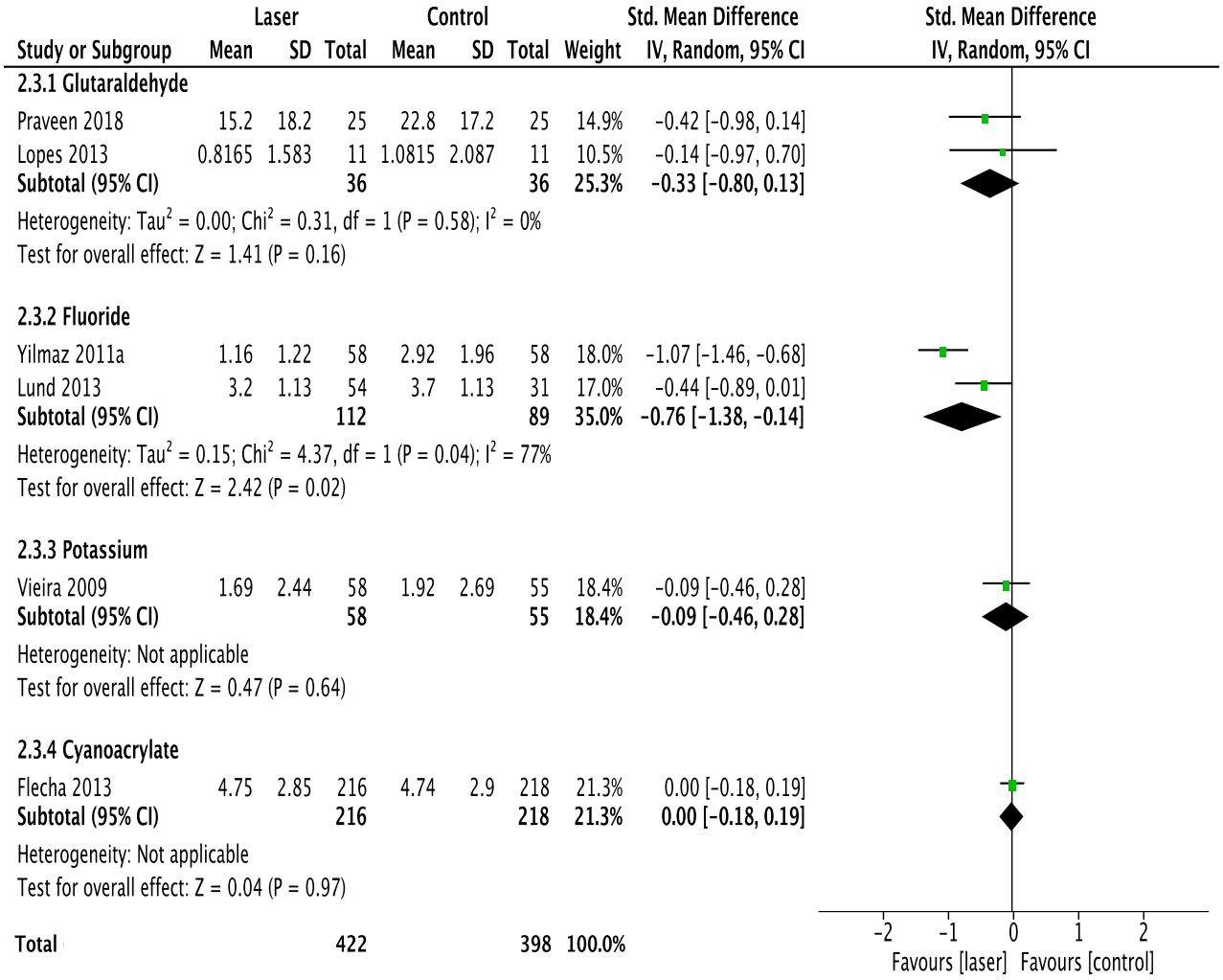

Figure 4. Forest plot of standardized mean differences between GaAlAs laser and topical desensitizers agents, according to duration of follow-up. A. Initial assessment; B. Short-term; C. Mid-term; D. Long-term.

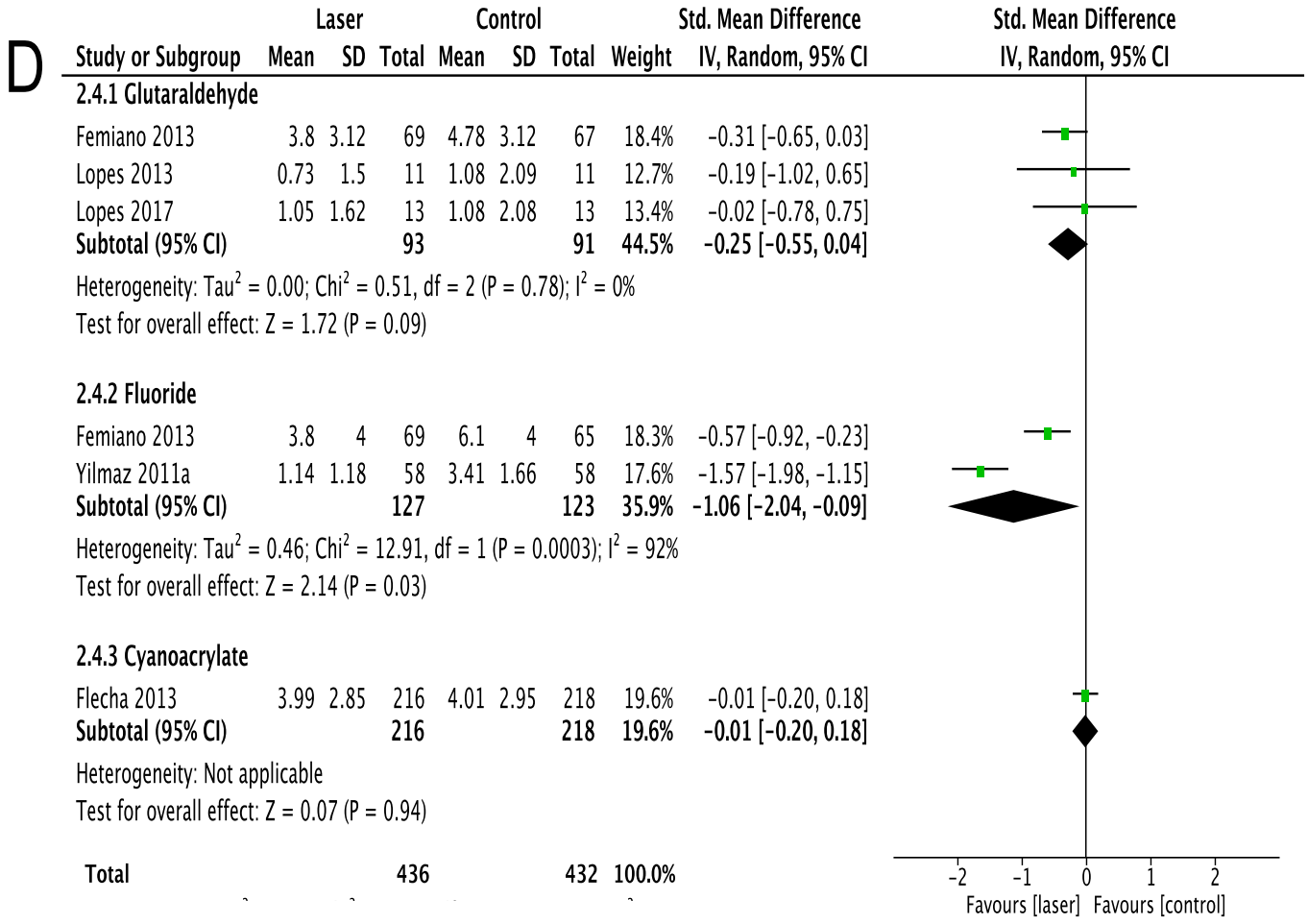

Figure 4. Forest plot of standardized mean differences between GaAlAs laser and topical desensitizers agents, according to duration of follow-up. A. Initial assessment; B. Short-term; C. Mid-term; D. Long-term.

Appendices

Appendix 1. Details on Search Strategy (10/2018) for Each Database

MEDLINE-PUBMED

#1: Dentin Sensitivity [Mesh] OR “Dentin Sensitivities”[tiab] OR “Dentine Hypersensitivity”[tiab] OR “Dentine Hypersensitivities”[tiab] OR “Dentine Sensitivity”[tiab] OR “Dentine Sensitivities”[tiab] OR “Tooth Sensitivity”[tiab] OR “Tooth Sensitivities”[tiab] OR “Dentin Hypersensitivity”[tiab] OR “Dentin Hypersensitivities”[tiab] OR Dentin Desensitizing Agents[Mesh] OR “Dentin Desensitizing Agents”[tiab] OR ((“teeth”[tiab] OR “tooth”[tiab] OR “dentin”[tiab] OR “dentine”[tiab] OR “dentinal”[tiab]) AND (“sensitive”[tiab] OR “sensitivity”[tiab] OR “hypersensitive” OR “hypersensitivity”[tiab]))

#2: "Laser Therapy"[Mesh] OR "Laser Therapy"[tiab] OR "Lasers, Semiconductor"[Mesh] OR “Semiconductor Laser” [tiab] OR "Lasers" [Mesh] OR "Lasers"[tiab] OR “Laser”[tiab] OR "Low-Level Light Therapy"[Mesh] OR "Low-Level Light Therapy"[tiab] OR “LLLT”[tiab] OR “diode”[tiab] OR “Semiconductor Diode Laser”[tiab] OR “Diode Laser”[tiab] OR “carbon dioxide”[tiab] OR “CO2”[tiab] OR “Erbium-Doped Yttrium Aluminum Garnet”[tiab] OR “Erbium YAG Laser”[tiab] OR “Er-YAG Laser”[tiab] OR “ErYAG”[tiab] OR ”Neodymium-Doped Yttrium Aluminum Garnet”[tiab] OR “Nd-YAG Laser”[tiab] OR “NdYAG”[tiab] OR “Gallium Aluminum Arsenide”[tiab] OR “GaAlAs Laser”[tiab] OR “GaAlAs”[tiab]

#3: ((randomized controlled trial[pt] OR controlled clinical trial[pt] OR randomized controlled trials[mh] OR random allocation[mh] OR double-blind method[mh] OR single-blind method[mh] OR clinical trial[pt] OR clinical trials[mh] OR ("clinical trial"[tw]) OR ((singl*[tw] OR doubl*[tw] OR trebl*[tw] OR tripl*[tw]) AND (mask*[tw] OR blind*[tw])) OR ("latin square"[tw]) OR placebos[mh] OR placebo*[tw] OR random*[tw] OR research design[mh:noexp] OR follow-up studies[mh] OR prospective studies[mh] OR cross-over studies[mh] OR control*[tw] OR prospectiv*[tw] OR volunteer*[tw]) NOT (animal[mh] NOT human[mh]))

#4: #1 AND #2 AND #3

CENTRAL – COCHRANE LIBRARY

#1: [Dentin Sensitivity] explode all trees

#2: [Dentin Desensitizing Agents] explode all trees

#3: “Dentine Hypersensitivity”:ti,ab,kw OR “Dentine Sensitivity”:ti,ab,kw OR “Tooth Sensitivity”:ti,ab,kw OR “Dentin Hypersensitivity”:ti,ab,kw

#4: #1 OR #2 OR #3

#5: [Lasers, Solid-State] explode all trees

#6: [Lasers, Semiconductor] explode all trees

#7: [Low-Level Light Therapy] explode all trees

#8: [Laser Therapy] explode all trees

#9: "Erbium YAG Lasers" :ti,ab,kw OR "Erbium YAG Laser" :ti,ab,kw OR "Er-YAG Lasers" :ti,ab,kw OR "Er-YAG Laser" :ti,ab,kw OR "Nd-YAG Lasers" :ti,ab,kw OR "Nd-YAG Laser" :ti,ab,kw OR "Semiconductor Laser":ti,ab,kw or "Diode Lasers":ti,ab,kw or "Diode Laser":ti,ab,kw or "GaAlAs Laser":ti,ab,kw or "Laser Therapies":ti,ab,kw or "Low Level Light Therapy":ti,ab,kw or "Low-Power Laser Therapy":ti,ab,kw or "Low-Level Laser Therapy":ti,ab,kw

#10: #5 OR #6 OR #7 OR #8 OR #9

#11: #4 AND #10

LILACS

#1: MH:"Dentin Sensitivity" OR MH:"Dentin Desensitizing Agents" OR "Dentine Hypersensitivity" OR "Dentine Sensitivity" OR "Tooth Sensitivity" OR "Dentin Sensitivities" OR "Dentine Sensitivities" OR "Hipersensibilidade da Dentina" OR "Hipersensibilidad de la Dentina" OR "Agentes Desensibilizantes de la Dentina" OR "Agentes Desensibilizantes Dentinarios" OR "Agentes Dessensibilizantes Dentinários"

#2: MH:"Laser Therapy" OR MH:"Lasers, Solid-State" OR MH:"Lasers, Semiconductor" OR MH:"Low-Level Light Therapy" OR "Erbium YAG Lasers" OR "Er YAG Lasers" OR "Er-YAG Laser" OR "Erbium YAG Laser" OR "Nd YAG Lasers" OR "Nd-YAG Laser" OR "Neodymium Doped Yttrium Aluminum Garnet Lasers" OR "Láseres de ND-YAG" OR "Lasers de Er-YAG" OR "Lasers de Nd-YAG" OR "GaAlAs Lasers" OR "Diode Laser" OR "GaAlAs Laser" OR "Diode Lasers" OR "Low-Level Laser Therapy" OR "Low-Power Laser Therapy" OR "Low Level Light Therapy" OR "Low-Level Laser Therapies" OR "LLLT" OR "Terapia por Láser de Baja Intensidad" OR "Terapia a Laser de Baixa Intensidade" OR "Terapia a Laser de Baixa Potência"

#3: ((PT:"randomized controlled trial" OR PT:"controlled clinical trial" OR PT:"multicenter study" OR MH:"randomized controlled trials as topic" OR MH:"controlled clinical trials as topic" OR MH:"multicenter study as topic" OR MH:"random allocation" OR MH:"double-blind method" OR MH:"single-blind method") OR ((ensaio$ OR ensayo$ OR trial$) AND (azar OR acaso OR placebo OR control$ OR aleat$ OR random$ OR enmascarado$ OR simpleciego OR ((simple$ OR single OR duplo$ OR doble$ OR double$) AND (cego OR ciego OR blind OR mask))) AND clinic$)) AND NOT (MH:animals OR MH:rabbits OR MH:rats OR MH:primates OR MH:dogs OR MH:cats OR MH:swine OR PT:"in vitro")

#4: #1 and #2 and #3

Appendix 2. List of Web sites searched for the systematic review. Searches were performed through September 2018

Database of Abstracts of Reviews of Effects (DARE)	Eli Lilly and Company Clinical Trial Registry
Health Technology Assessment (HTA)	GlaxoSmithKline clinical trial register
Index Medicus for the South-East Asia Region (IMSEAR)	African Index Medicus
Ukraine and the Russian Federation Panteleimon	Australasian Medical Index
Western Pacific Western Pacific Region Index Medicus (WPRIM)	World Health Organization, Regional Office for the Eastern Mediterranean
Turning Research into Practice (TRIP) database	The Institute for Scientific and Technical Information (Institut de 'Information Scientifique et Technique) of the French National
ProQuest Dissertation & Theses Database	Center for Scientific Research
National Technical Information Service (NTIS)	IndMED
Conference abstracts Biosis.org	KoreaMed
Australian National Health and Medical Research Council Clinical Practice Guidelines	OpenSIGLE
Canadian Medical Association—Infobase Clinical Practice Guidelines	NHS Evidence—National Library of Guidelines
National Guideline Clearinghouse (US)	New Zealand Guidelines Group
Hong Kong clinical trials register—HKClinicalTrials.com	NICE; National Institute for Health and Clinical Excellence (UK)
Indian clinical trials registry—Clinical Trials Registry-India (CTRI)	The Australian New Zealand Clinical Trials Registry
International Clinical Trials Registry Platform Search Portal	CenterWatch
International Federation of Pharmaceutical Manufacturers and Associations (IFPMA) Clinical Trials Portal	ClinicalTrials.gov
International Standard Randomised Controlled Trial Number Register	CORDIS: Community Research and Development Information Service
Netherlands trial register	European Medicines Agency
South African National Clinical Trial Register	World Health Organization (WHO) International Clinical Trials
UK Clinical Research Network Portfolio Database	GlaxoSmithKline (GSK) Clinical Study Register
UK Clinical Trials Gateway	Registry Novartis Clinical Trials
UK National Research Register (NRR)	Roche trials database
University Hospital Medical Information Network (UMIN) Clinical Trials Registry (for Japan)—UMIN CTR	Wyeth (formerly Pfizer) clinical trials registry
AstraZeneca Clinical Trials Web site	Bristol-Myers Squibb clinical trials database
Bristol-Myers Squibb Clinical Trial Registry	

CAPÍTULO 5

2.5.CAPÍTULO 5

Artigo a ser enviado para publicação no periódico Journal of Dentistry

A Long-term Evaluation of Different Potassium Oxalate Concentrations on Dentin Hypersensitivity Treatment: A Triple-Blind Randomized Clinical Trial

Alexia da Mata Galvão[a], Lívia Fávaro Zeola[b], Guilherme Faria Moura[b], Daniela Navarro Teixeira[b], Ramon Corrêa de Queiroz Gonzaga[a], Gisele Rodrigues da Silva[c], Paulo Vinícius Soares[c]

[a] DDS, Postgradued student; NCCL Research Group, Department of Operative Dentistry and Dental Materials, School of Dentistry, Federal University of Uberlândia

[b] DDS, MS, PhD student, NCCL Research Group, Department of Operative Dentistry and Dental Materials, School of Dentistry, Federal University of Uberlândia

[c] DDS, MS, PhD, Department of Operative Dentistry and Dental Materials, and Dental Materials, School of Dentistry, Federal University of Uberlandia, Uberlândia, Brazil.

[c] DDS, MS, PhD, NCCL Research Group Coordinator, Department of Operative Dentistry and Dental Materials, School of Dentistry, Federal University of Uberlandia, Uberlândia, Brazil.

Corresponding author: Paulo Vinícius Soares

DDS, MS, PhD, NCCL Research Group Coordinator, Department of Operative Dentistry and Dental Materials, School of Dentistry, Federal University of Uberlandia, Uberlaandia, Brazil.

Av. Pará, 1720 Campus Umuarama, Bloco 4LA, Sala 4LA32, Uberlândia, MG, 38405-902,, Brazil; e-mail: paulovsoares@yahoo.com.br

A Long-term Evaluation of Different Potassium Oxalate Concentrations in Dentin Hypersensitivity Treatment: A Triple-Blind Randomized Clinical Trial

ABSTRACT

Objective: To evaluate the long-term clinical efficacy of potassium oxalate in different concentrations (10% and 5 %) in relieving dentin hypersensitivity (DH), after a four-session application protocol.

Methods: A triple-blind, split-mouth randomized clinical trial (RCT) was conducted on 31 patients, which received both concentrations (10 and 5%) of potassium oxalate agent, applied in 4 different session with a 48-hour interval between them. The DH level was assessed through the 0-10 visual analog scale, at baseline, immediately after each desensitizing session, and after 7 days, 1,3,6, 9 and 12 months treatment in response to evaporative stimulus. Statistical analyses were performed using Friedman repeated measures and Wilcoxon signed rank tests ($\alpha = 0.05$).

Results: For both groups, the DH reduced significantly and at least three sessions were required to achieve the lower levels found in the study. On the other hand, after the end of treatment and regardless the concentration used, the desensitizing effect was maintained until the 6-month follow-up evaluation. In addition, the group treated with potassium oxalate 10%, showed better effects for both 9 and 12-months timepoints ($p<0.001$). No complications and adverse effects were observed throughout the study.

Conclusions: When a four-session protocol is applied, both concentrations of potassium oxalate (10 and 5%) tested in this study can be considered an effective treatment for DH for at least 6 months. However, after 9 months of follow-up, the higher concentration presented better results.

Clinical Relevance: DH is an increasing condition in clinical practice. To the best of the authors knowledge, this is the first RCT evaluating a long-term efficacy of potassium oxalate in differents concentrations after a protocol of multiple sessions. This study provides initial clinical evidence to suggest that multiple application sessions and higher concentrations of potassium oxalate may results in maintenance of the desensitizing effect for longer periods. Further clinical studies are required to confirm these findings.

Keywords: dentin sensitivity, desensitizing agents, potassium oxalate, randomized clinical trial

1. INTRODUCTION

The public health strategies over the last decades and technological improvements had led to a better quality of life of the individuals and increase in life expectancy [1, 2]. This situation associated with the awareness of the population to take care of oral hygiene is promoting an increase of individuals keeping their natural teeth in oral cavity for a longer period of time [1, 2]. In addition, the reduction in the incidence of caries disease (due to successful oral health prevention strategies), daily stressful routine and new eating habits (acidic and industrialized products) have led patients to seek treatment for diseases not related to microorganisms, such as noncarious cervical lesions and dentin hypersensitivity (DH)[3].

DH is characterized as a brief and sharp pain caused by thermal, chemical, tactile and evaporative stimuli. To date, several data supports a theory (called hydrodynamic) that these stimuli can induce the fluid flow inside the dentinal tubules, which triggers receptors near the pulp (mainly A-delta fibers) and results in painful sensation for the patient [4, 5]. The prevalence of DH is considerably wide in adult populations, ranging from 1.3%[6] to 92.1%[7] and its etiology is multifactorial, involving mainly an association of factors: tension (promoted by parafunctional habits and traumatic occlusion), friction (by attrition or abrasion) and biocorrosion (chemical, biochemical and electrochemical degradation caused by acid of intrinsic and extrinsic sources) [3, 8].

A plenty of agents with different mechanisms of action have been described and evaluated in the literature for DH treatment. The dentin desensitizers can be classified according to their action as neural (blocking neural responses, e.g. potassium nitrate and low-power lasers), tubule-blocking (obliterating the dentinal tubules, e.g. oxalates, glutaraldehyde and high-power lasers) and finally mixed agents with both actions (e.g. potassium oxalate) [9-11].

Among the desensitizers, the potassium oxalate has been widely used in clinical practice, presenting satisfactory results, without side effects [12-14]. The action mechanism of this agent appears to be related to an obliteration of exposed dentin tubules (through the precipitation of calcium oxalate crystals) [15] and depolarization of the nerve endings [9]. Although a few studies have been conducted evaluating different concentrations of potassium oxalate [16, 17], to the extent of the author's knowledge, no information is currently available about the long-term effect of these agents when a protocol of multiple sessions is applied.

The DH is a clinical condition that affect the population's quality of life [18, 19]. Even though there are a large number of therapies for the relief of DH, there is still no established protocol for an effective long-term treatment [20, 21]. Thus, the objective of this study was to evaluate the long-term efficacy of potassium oxalate in different concentration in reduction of DH, after a four-session protocol treatment.

MATERIALS AND METHODS

2.1. Ethics approval and protocol registration

The clinical investigation was approved by the local Ethics Committee (#108076/2016). The research protocol was registered at clinicaltrials.gov (#NCT03083496) and conducted according to Consolidated Standards of Reporting Trials (CONSORT) guidelines with an extension for within-person designs [22].

2.2. Study design

This study was designed as an intervational, single-center, triple-blind (operators, patients, and evaluator were blinded to the group assignment), split-mouth randomized clinical trial. The study was conducted in the clinics of "Ambulatorial Program for the Rehabilitation of Patients with Non-Carious Cervical Lesions and Cervical Dentin Hypersensitivity" of the School of Dentistry from the local university, from March 2017 to August 2018.

2.3. Recruitment

Recruitment was performed by posting written advertisements on the local university walls. Patients were recruited in the order they presented for screening session, thus forming a convenience sample. Before being enrolled in the study, all individuals were informed about the nature and objectives of the study and signed a written consent form.

2.4. Eligibility criteria

Participants included in this study, should be at least 18 years old and in good general and oral health. The participants were required to have two teeth with DH in different quadrants. Teeth with presence of dental caries and restorations or fractures were excluded. Participants who underwent to recent periodontal surgery or desensitizing treatment in the last three months and those with dental prostheses and orthodontics apparatus or with symptoms of pulpits were not included. In addition, pregnant and lactating women, participants with bruxism or any systemic/psychological diseases, anti-inflammatory or analgesic drug users, smokers or patients undergoing tooth-whitening procedures were also excluded.

2.5. Sample size calculation

The primary outcome of this study was the level of DH. A sample size calculation was performed on the website www.sealedenvelop.com, using an alpha of 0.05, 80% power. Thus, the minimum sample size in this equivalence trial was 31 patients in order to detect a 30% difference in DH level between groups [23]**.** The sample size calculation was performed without accounting for the potential correlation coefficient between the paired treatment outcomes. Published within-person trials do not report this correlation coefficient and for this reason we chose for being conservative.

2.6. Randomization and allocation concealment

The randomization process was conducted using computer-generated tables in a software available on the website www.sealedenvelope.com by a researcher who was not involved in the evaluation process. The allocation of the group to be first assigned was recorded on cards (coded as treatment A or B), placed in sequentially numbered, opaque and sealed envelopes. The information contained in the envelope determined the treatment to be assigned in the upper or lower right arch, while the other arch received the other treatment. The allocation assignment was revealed by opening the envelope before carrying out the treatment procedures, guaranteeing the allocation concealment.

2.7. Blinding

This was a triple-blind clinical trial in which the patient, operator and evaluator were blinded to the group assignment. The randomization process, delivery and guidance on the administration of the gel were conducted by a researcher not involved in the execution and evaluation process. Both desensitizing gels (potassium oxalate 5 and 10%) had similar color and consistency and were delivered in identical tubes coded as “A” and “B”. Only the research coordinator knew the coding structure.

2.8. Study intervention

The desensitizing procedure was carried out by one researcher with clinical experience. The desensitizing agents used in this study were potassium oxalate 5 and 10% (Homeocenter, Ribeirão Preto, Brazil) and the protocol for the gel’s application was the same. The teeth were cleaned with pumice and a rotary brush using a low-speed handpiece. The operating field was isolated by means of cotton rolls, suction, and a retraction cord #000 (Ultrapak, Ultradent, South Jordan) inserted into the gingival sulcus of the hypersensitivity tooth. Gels were applied in the cervical area of the teeth during 1 min with friction movements. The agent was maintained in contact with the teeth for 10 min and then was removed with abundant water (Table 1). Applications were performed in four sessions, with 48-hours intervals between them. All participants received oral hygiene recommendations and were request not to use desensitizing or bleaching toothpastes during the course of the study.

2.9. Dentin hypersensitivity level

An evaporative stimulus (controlled blast of air), generated by a three-way syringe, was used to determine dentin hypersensitivity levels. The air was directed perpendicularly to the cervical buccal surface of the hypersensitive tooth for two seconds from a distance of ~ 1cm. Adjacent teeth were protected, with cotton rolls to avoid false positive results. After the stimulus, the evaluator requested the participants to quantify their pain, according to a visual analog scale (VAS)[24]. VAS scale is a 10-cm horizontal line, where 0=no sensitivity and 10=severe sensitivity. To ensure the aplication of the same stimuls during the study, the three-way syringe

used was constantly calibrated for an air pressure of 25–28 psi and evaluator was previously calibrated to apply the same pressure during the assessments. The efficacy of agents was measured at baseline and immediately after the fourth application session (AT). The participants were recalled at 1 week, 1, 3,6,9 and 12 months after treatment and the VAS levels were measured using the same procedures previously described. All measurements were conduct by the same evaluator.

2.10. **Statistical Analyses**

Normality of data distribution was checked by the Kolmogorov-Smirnov test. In this study, nonparametric tests were chosen, as the data did not present normal distribution. Therefore, within groups comparisons for different timepoints were analysed using the Friedman repeated measures test and post hoc Tukey test. For comparisons between groups, the Wilcoxon sign-rank test was applied. The data analysis were performed by using the statistical software Sigma Plot version 12.0, and the level of significance was determined as $\alpha = 0.05$.

3. **RESULTS**

Thirty-one subjects were enrolled in this study and their baseline characteristics are presented in Table 2. All participants attended the recall visits, completed the 12-month trial period and details of in each phase of the study are described in the flow diagram (Fig 1). For both groups, only one session was necessary to promote a significant DH reduction in comparison with the baseline and at least three sessions were required to achieve the lower levels of DH. No significant difference in the DH levels was observed between the groups (Table 3). On the other hand, after the end of treatment (four application sessions) and regardless potassium oxalate concentration, the desensitizing effect was maintained until the 6-month follow-up evaluation (Table 4). In addition, the group treated with potassium oxalate 10% showed better desensitizing effects for both 9 and 12-months points timepoints when compared with 5% concentration ($p<0.001$) (Table 4). No complications such as presence of spontaneous pain and allergic reactions were observed throughout the study.

4. **DISCUSSION**

The present clinical trial was designed to evaluate the clinical effect of different concentrations of potassium oxalate, in an attempt to find an effective long-term treatment for DH relief.

Oxalates-based agents were introduced as desensitizing agents between the 1970s and 1980s [5, 25-27] and since then have been well accepted by practitioners[28], demonstrating satisfactory results in the reduction of DH [16, 26, 27, 29, 30]. Several in vitro studies reported

significant decreases in hydraulic conductance across dentinal tubules treated with oxalates, suggesting that this kind of agent limit fluid flow in exposed dentin due to their ability to promote the precipitation of insoluble calcium oxalate crystals on the surface and inside dentin tubules walls [31-33]. The literature has been described that oxalates have ability to block more than 98% of the dentin permeability [34, 35] and the formation of calcium oxalate crystals occurs 30 seconds after their application [27], which promotes an immediate relief of DH levels [16, 17]. When oxalates (oxalic acid) are associated with potassium (potassium hydroxide)[36] their becomes a combined agent, with mixed action. Therefore, the potassium oxalate presents the capabilities of neural as well as tubule-blocking agent in a single product. In this situation, the oxalate acts initially as a carrier, enabling the potassium to contact and promotes the depolarization of the odontoblast endings, favoring the long-term effectiveness of the agent [9].

In this study, both concentrations of potassium oxalate presented a desensitizing effect until the 6-month evaluation, which can be explained by the action mechanism described above. In addition, it is worthy of note that calcium oxalate crystals appear among the less soluble salts, with relative insolubility in acid and solubility almost comparable with the one of dentin hydroxyapatite [15], making them resistant to dissolution after treatment [15, 17]. Another fact that deserves attention is that at least three sessions were necessary to achieve the lowest levels of DH in the study. Probably, only a single application may not be sufficient to induce the adequate precipitation of calcium oxalate crystals, which suggest that a multiple sessions approach can promote better results in a long-term evaluation [37, 38]. Even though a four-session protocol has been applied in this study, for the timepoints 9 and 12 months, the 10% potassium oxalate promoted better results when compared with the 5%. The literature reported that size and area of crystals precipitated depends on the concentration of the active agent, which may subsequently affect the occlusive power of the desensitizer in a long-term evaluation, supporting the results found in this study [16, 26].

In order to assess the DH level, at the baseline and in follow-ups, this study used an evaporative stimulus (air blast). This type of stimulus has been recommended in the literature for years [37, 39-42] and acts promoting the evaporation of the fluid inside the tubules and reducing the temperature at the dentin surface. This fact reduces the difference of pressure inside the tubule and consequently triggers the receptors in the pulp, causing the painful sensation [43]. After stimulus, DH level were determined by using VAS. This evaluation type was used as it has been considered an adequate and reproducible method that is easily understood by patients [44, 45]. The advantage of this method is to be a continuous numerical scale with easy application that allows the conversion of the subjective response into objective data [41].

This RCT was performed under rigorous control of randomization and blinding. This avoids the conscious or subconscious choice of the intervention and prevents allocation bias.

Adequate blinding was also conducted to avoid performance and detection bias by both operators and participants. We selected a split-mouth design so that within-patient, tooth-related and patient-habit variables, which are commonly observed in the desensitizing treatment and are difficult to balance even in randomized designs, can be controlled, as the two treatments are simultaneously applied in the same patient. Within-paired designs allows the use of powerful statistical methods of analysis which take advantage of repeated measures within a subject with reduction of within subject variability [46].

In this study only one type of desensitizer (potassium oxalate) and two concentrations were tested. For this reason, future studies evaluating the number of application sessions with larger sample size for differents agents and concentrations are required in order to confirm the findings of this study and to clarify the stability and longevity of each agent.

5. CONCLUSION

Within the limitations of this study, it can conclude that when a four-session protocol is applied, both concentrations of potassium oxalate (10 and 5%) tested can be considered an effective treatment for DH reduction for at least 6 months. However, after 9 months of follow-up, the higher concentration promoted the maintenance of results.

CONFLICT OF INTEREST

The authors of this manuscript certify that they have no proprietary, financial or other personal interest of any nature or kind in any product, service and/or company that is presented in this article.

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TABLES

Table 1. Composition and application methods of the desensitizer agents used in this study

Agents	Composition	Application Method
Potassium Oxalate 5%	Potassium oxalate monohydrate 2.266g; lauryl sulfate 0.299g; glycerin 4.989g; sorbitol 7.484; benzoate sodium 0.125; sucralose 0.050g; aristoflex gel 36,947g	1- Prophylaxis with oil-free product 2- Application of the agent uniformly on the cervical region of the tooth (using a microapplicator), friction for 10s and wait 10 min. 3- Removal of the gel from the teeth with cotton and plenty of water
Potassium Oxalate 10%	Potassium oxalate monohydrate 5.252g; lauryl sulfate 0.284g; glycerin 4.972g; sorbitol 7.090; benzoate sodium 0.118; sucralose 0.047g; aristoflex gel 35.003g	

Table 2. Characteristics of the participants and distribution of teeth included in this study, bygroup

Characteristic	Total
Sex	
Male	12
Female	19
Age (years)	
18-25	10
26-35	9
36-45	4
>45	8
Tooth type by group	A/B
Central incisors	3/7
Lateral incisors	4/3
Canines	3/2
First premolars	10/10
Second premolars	3/5
First molars	5/3
Second molars	3/2

Table 3. Dentin hypersensitivity levels for baseline and after each application session.

Treatment/ Assessment point	Potassium oxalate 10%		Potassium oxalate 5%		*p*-value**
	Mean (±SD)	Median (interquartile range)	Mean (±SD)	Median (interquartile range)	
Baseline	8.16±1.65	8 (7-10) Aa	7.93±1.73	8 (7-10) Aa	0.46
Session 1	5.03±2.54	5 (4-8) Ab	4.65±3.14	5 (2-7) Ab	0.43
Session 2	3.00±2.72	3 (0-6) Abc	3.03±3.27	2 (0-6) Abc	0.95
Session 3	1.77±2.34	1 (0-3) Acd	2.32±3.07	0 (0-5) Ac	0.45
Session 4	0.83±1.69	0 (0-2) Ad	1.80±2.82	0 (0-3) Ac	0.12
p*-value		<0.001		<0.001	

*Friedman Repeated Measures and Tukey test for comparison of pain levels between assessment points, for the same group of treatment. Values followed by the same lower case letter (collumns) are statistically similar (p>0.05).

** Wilcoxon sign-rank test for comparison of pain levels between groups of treatments, in each assessment point. Values followed by the same upper case letter (lines) are statistically similar (p>0.05).

Table 4. Dentin hypersensitivity levels for each follow-up timepoint, according to each group.

Treatment/ Assessment point	Potassium oxalate 10%		Potassium oxalate 5%		*p*-value**
	Mean (±SD)	Median (interquartile range)	Mean (±SD)	Median (interquartile range)	
AT	0.83±1.69	0 (0-2) Aa	1.80±2.82	0 (0-3) Aa	0.12
1 week	0.90±1.70	0 (0-2) Aa	2.19±2.99	0 (0-5) Ab	0.045
1 month	1.00±1.73	0 (0-2) Aa	2.25±3.07	0 (0-5) Abc	0.074
3 months	1.01±1.73	0 (0-2) Aa	2.26±3.07	0 (0-5) Ac	0.074
6 months	1.01±1.73	0 (0-2) Aa	2.26±3.07	0 (0-5) Ac	0.074
9 months	2.74±1.21	2 (2-3) Ab	4.93±1.80	5 (4-6) Bb	<0.001
12 months	3.32±1.35	3 (2-4) Ab	6.80±1.74	7 (5-8) Bb	<0.001
p*-value		<0.001		<0.001	

AT. After treatment
*Friedman Repeated Measures and Tukey test for comparison of pain levels between assessment points, for the same group of treatment. Values followed by the same lower-case letter (collumns) are statistically similar (p>0.05).

** Wilcoxon sign-rank test for comparison of pain levels between groups of treatments, in each assessment point. Values followed by the same upper-case letter (lines) are statistically similar (p>0.05).

FIGURES

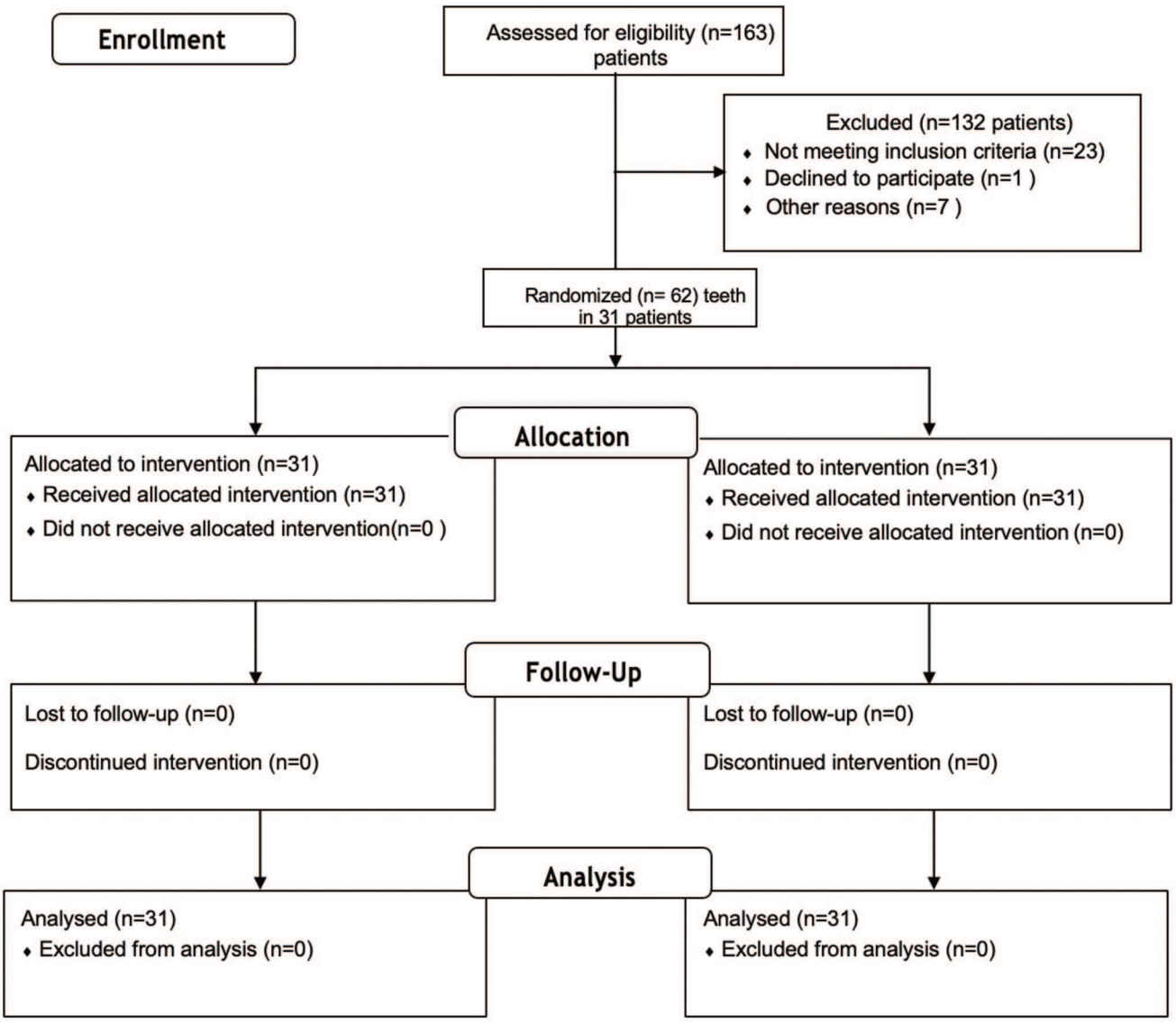

Fig 1. CONSORT flow diagram of the clinical trial.

CAPÍTULO 6

2.6.CAPÍTULO 6

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Influência de Agentes Dessensibilizantes na Resistência de União de Adesivos Autocondicionantes a Dentina

Livia Fávaro Zeola[a], Michele Borges Silva[a], Guilherme Faria Moura[a], Alexia da Mata Galvão[a], Tiago Augusto Quirino Barbosa[a], Paulo Vinícius Soares[a]

[a] Grupo de Pesquisa de Lesões Cervicais Não Cariosas e Hipersensibilidade Dentinária, Departamento de Dentística e Materiais Odontológicos, Faculdade de Odontologia, Universidade Federal de Uberlândia, Brasil.

Autor Correspondente: Paulo Vinícius Soares
Grupo de Pesquisa de Lesões Cervicais Não Cariosas e Hipersensibilidade Dentinária, Departamento de Dentística e Materiais Odontológicos, Faculdade de Odontologia, Universidade Federal de Uberlândia, Brasil.
Av. Pará, 1720 Campus Umuarama, Bloco 4LA, Sala 4LA32, Uberlândia, MG, 38405-902,, Brasil; e-mail: paulovsoares@yahoo.com.br

Influência de Agentes Dessensibilizantes na Resistência de União de Adesivos Autocondicionantes a Dentina

RESUMO

O objetivo desse estudo foi avaliar a influência de agentes dessensibilizantes na resistência de união de adesivos autocondicionantes a dentina submetida ao desafio corrosivo/abrasivo, por meio de ensaio mecânico de microtração (μTBS) e análise do padrão de falha. Métodos: Sessenta terceiros molares humanos foram selecionados e seccionados na coroa, raiz e proximais, a fim de expor a área de dentina a ser utilizada. Cada amostra foi submetida a ciclos de desafio corrosivo (imersão em coca-cola/10 segundos) e abrasivos (escovação - 300g/20 segundos), por um período de cinco dias. As amostras foram divididas em seis grupos (n=10): Adesivo Single Bond Universal (AU), Teethmate Desensitizer + Adesivo Single Bond Universal (TU), Gluma + Adesivo Single Bond Universal (GU), Adesivo Clearfil SE Bond (AC), Teethmate + Adesivo Clearfil SE Bond (TC) e Gluma + Adesivo Clearfil SE Bond (GC) e em seguida, foram restauradas com resina composta convencional. Palitos de resina/dentina de ±1 mm^2 foram obtidos e foram utilizados no μTBS. Os dados foram analisados por teste de ANOVA, teste de Tukey e de qui-quadrado ($\alpha = 0,05$). Resultados: A presença do dessensibilizante Teethmate (grupos TU e TC) promoveu redução nos valores de resistência de união. No entanto, houve diferença estatisticamente significante somente para o grupo TU ($p<0.05$), o qual apresentou os menores valores (16,5 ± 5,7 MPa). As falhas do tipo adesivas e mistas foram as mais encontradas em todos os grupos. Conclusões: O uso do agente Teethmate associado ao adesivo Single Bond Universal foi a combinação que promoveu os resultados menos favoráveis. O tipo de agente dessensibilizante parece ser fator determinante para promover alteração na resistência de união.

Palavras chave: Adesivos Autocondicionantes. Agentes Dessensibilizantes. Hipersensibilidade Dentinária. Resistência de União

ABSTRACT

The aim of this study was to evaluate the influence of desensitizing agents on bond strength of self-etch adhesives to dentin submitted to acid-abrasive challenge, using the microtensile bond strength (μTBS) test and analysis of the failure mode. Methods: Sixty human molars were selected. The teeth were sectioned at the crown and roots and then in the proximal aspects, to expose the area of dentine. Each sample was submitted to acid (immersion in Coca-Cola-10s) and abrasive (brushing - 300g /20s) challenges cycles performed 2x/day for 5 days. The samples were divided into six groups (n=10): Clearfil SE Bond Universal (C); Teethmate Desensitizer + Clearfil SE Bond (TC); Gluma Desensitizer + Clearfil SE Bond (GC); Single Bond Universal (U); Teethmate Desensitizer + (TU); Gluma Desensitizer + Single Bond Universal (GU). Restorations

were made using the conventional composite resin. Rectangular sticks were obtained for each tooth, and each one was used for μTBS testing. The data were analyzed statistically using a one-way analysis of variance (ANOVA) test, Tukey post hoc and chi-square test (α=0.05). Results: The presence of Teethmate Desensitizer (groups TU and TC) promoted reduction in bond strength values. However, there was a statistically significant difference for group TU ($p < 0.05$), presenting the lowest bond strength value (16.5±5.7 MPa). Adhesive and mixed failures were prevalent for all tested groups. Conclusions: The use of the Teethmate Desensitizing agent in association with Single Bond Universal adhesive was the association that most negatively affected the bond strength. The desensitizing agent type seems to be a important factor to promote changes on bond strength.

Key words: Self-etch Adhesives. Desensitizing Agents. Dentin Hypersensitivity. Bond Strength

1.INTRODUÇÃO

As concepções modernas da odontologia associadas a melhoria no padrão de higienização bucal do paciente e o aumento da expectativa de vida da população mundial, fizeram com que houvesse uma redução na perda precoce dos dentes, principalmente por processos cariosos.[1] Como consequência, ocorreu o aumento da frequência de alterações não relacionadas a bactérias, como as lesões cervicais não cariosas (LCNCs) e a hipersensibilidade dentinária (HD) na prática clínica.[2,3]

A HD é definida como uma dor aguda e de curta duração, decorrente da exposição de dentina, após estímulos térmicos, táteis, osmóticos ou químicos, não podendo ser atribuída a qualquer outra forma de defeito ou patologia dentária.[4] A prevalência dessa condição na população adulta apresenta taxas de que variam de 1,3[5] a 92,1%,[6] devido principalmente as características do estudo (como idade dos pacientes, região do país, tipo de clínica e tipo de recrutamento) e hábitos das populações avaliadas, além da dificuldade de diagnóstico e falta padronização da coleta de dados.[7] A dor gerada pela HD pode vir a limitar o desenvolvimento de hábitos diárias (como comer, beber, escovar os dentes e em alguns casos até falar), causando assim impacto negativo na qualidade de vida do paciente.[8]

Várias teorias foram apresentadas a fim de explicar o mecanismo da HD, sendo a teoria hidrodinâmica a mais aceita atualmente. Essa teoria basea-se no princípio de que quando os túbulos dentinários expostos na cavidade bucal sofrerem algum tipo de estímulo externo, ocorrerá a movimentação do fluido no interior do túbulo que levará a excitação de receptores específicos (fibras de dor, principalmente fibras A-delta da polpa) e resultará em sensação dolorosa para o paciente.[9]

De maneira geral, o tratamento da HD consiste primeiramente no controle/eliminação dos agentes causais,[10] seguido do uso de agentes dessensibilizantes.[4] No entanto, existem

situações clínicas em que a HD ocorre associada a perda de estrutura dental, como aquela resultante da presença de LCNCs.[11,12] Nesses casos, tem sido recomendado que além da dessensibilização dentinária seja realizada a susbtituição da estrutura dental perdida, na maioria das vezes por restaurações adesivas diretas e utilizando sistemas adesivos auto-condicionantes. [13] O que se deve destacar é que o sucesso clínico das restaurações diretas depende da efetividade e durabilidade da interface de união entre substrato e material, promovendo o selamento das margens do preparo cavitário.[14,15] Diante desse contexto, o objetivo deste estudo foi avaliar a influência de agentes dessensibilizantes na resistência de união de adesivos autocondicionantes a dentina submetida a desafios corrosivos/abrasivos, por meio de ensaio mecânico de microtração e análise do padrão de falha.

2. MATERIAIS E MÉTODOS

2.1. Seleção dos Dentes

Previamente ao início do estudo, o projeto foi enviado ao Comitê de Ética em Pesquisa da universidade local e só foi iniciado após a sua aprovação (# 1.348.700).

Os pacientes atendidos nas Clínicas de Cirurgia da Faculdade de Odontologia da universidade local que apresentaram indicação de exodontia de terceiros molares por motivo não relacionado a essa pesquisa, foram convidados a participar da pesquisa, doando os dentes extraídos após assinatura do Termo de Consentimento Livre e Esclarecido (TCLE).

Foram coletados 60 dentes terceiros molares humanos, livres de cáries e trincas, defeitos estruturais ou restaurações. Após a limpeza, todos os dentes foram armazenados em água destilada e em geladeira até o início da execução das etapas laboratoriais propriamente ditas.

2.2. Preparo das amostras

O terço oclusal das coroas foi seccionado (Figs 1A e 1B) com disco diamantado dupla face (Extec, Enfield, CT, EUA) montado em cortadeira de precisão (Isomet 1000, Buehler, Lake Bluff, IL, EUA), em velocidade de 250 rpm e constante irrigação. Em seguida, as raízes e as faces proximais foram seccionadas, com o objetivo de expor o tecido dentinário desta região (Figs 1C e 1D). A superfície da dentina proximal foi regularizada com lixa de carbeto de silício de granulação 600 por 60 segundos, para padronizar a camada smear layer. As amostras foram então divididas aleatoriamente em quatro grupos (n=10): AU - Adesivo Single Bond Universal; GU - Gluma + Adesivo Single Bond Universal; TU - Teethmate + Adesivo Single Bond Universal; AC - Adesivo Clearfil SE Bond; GC - Gluma + Adesivo Clearfil SE Bond; TC - Teethmate + Adesivo Clearfil SE Bond.

2.3. Simulação da Degradação Dentinária

Todas as amostras foram submetidas a desafios corrosivos/abrasivos (Figs 1E e 1F), realizados em forma de ciclos. Um ciclo completo correspondia a três desafios corrosivos, seguidos de um desafio abrasivo, com intervalos de uma hora entre cada um deles. Durante cada dia, dois ciclos completos foram realizados e esta sequência foi repetida por 5 dias consecutivos.

Cada desafio corrosivo consistiu na imersão das amostras em frascos contendo Coca-Cola®, por um período de 20 segundos, seguidos pela lavagem em água destilada e armazenamento em saliva artificial (Cálcio -0.1169g de hidróxido de cálcio/L de água deionizada; 0.9 mM de fósforo e potássio-0.1225g de fosfato de potássio monobásico/L de água deionizada; 20 mM tampão TRIS -2.4280g tampão TRIS/L água deionizada). Os desafios abrasivos, foram realizados por meio de um dispositivo de escovação desenvolvido pelo grupo de Lesão Cervical Não Cariosa e Hipersensibilidade Dentinária – FOUFU (Universidade Federal de Uberlândia, Uberlândia, Minas Gerais, Brasil). Esse processo foi realizado através do posicionamento da amostra no dispositivo, abaixo da cabeça de escova. Em seguida, com a utilização de escova dental elétrica (Oral-B® Pró-Saúde, Oral-B, Brasil), associada a mistura de água destilada e dentifrício (Colgate Total 12, Palmolive, Brasil), uma força de 300g foi aplicada e a escova foi ativada por um período de 10 segundos, com posterior lavagem em água destilada. Após a realização dos dois ciclos diários, as amostras foram então armazenadas em saliva artificial e mantidas em estufa a 37ºC, durante a noite.

2.4. Tratamento e Restauração das Amostras

Os agentes dessensibilizantes e sistemas adesivos foram aplicados de acordo com as recomendações específicas dos fabricantes (Tabela 1). Os agentes dessensibilizantes foram aplicados previamente aos sistemas adesivos (Fig 1G). Em seguida, foram confeccionadas restaurações de resina composta (Filtek Z350 XT, 3M ESPE, St. Paul, MN, EUA) com espessura de 4,0 mm (2 incrementos de 2,0 mm), com fotoativação por 40 segundos usando aparelho de led (Radii Plus, SDI) (Fig 1H). Durante todo o procedimento e após sua finalização foram realizadas mensurações com paquímetro digital (#500-171-20B, Mitutoyo, Suzano, SP, Brasil).

2.5. Ensaio mecânico de microtração

Após a confecção das restaurações, as amostras foram armazenadas em saliva artificial e em estufa a 37ºC, por 24 horas (Fig 1I). Após esse período, as amostras foram fixadas em uma base de acrílico com cera pegajosa em bastão (Asfer Indústria Química Ltda., São Paulo, SP, Brasil) e seccionadas em cortadeira de precisão nos planos X e Y (Fig 1J), obtendo assim amostras em forma de palito, com aproximadamente 1,0 mm^2 de área de união (Fig 4K). As dimensões dos palitos foram então avaliadas com paquímetro digital (#500-171-20B, Mitutoyo, Suzano, SP,

Brasil) para assegurar uma área de secção transversal de 1,0 mm^2 ± 0,05 mm^2. Os palitos foram fixados com cola de cianoacrilato (Loctite Original, Henkel, Alemanha) em dispositivo de Geraldeli para a posterior inserção na máquina de ensaio mecânico**.** Na sequência, as amostras foram submetidas ao ensaio de microtração, utilizando equipamento específico (Microtensile OM100, Odeme Dental Research, Luzerna, SC, Brasil), com célula de carga de 20 kgf e velocidade de 1 mm/min até que a amostra apresentasse falha (FIG 1L). Por fim, a resistência adesiva, em MPa, foi calculada dividindo a força (N) no momento da falha pela sua área de secção transversal (em mm^2).

2.6. Análise do Padrão de Falha

A classificação do padrão de falha foi realizada em estereomicroscópio (Mitutoyo, Suzano, SP, Brasil), acoplado a uma câmera específica (AxioCam ERc5s, Zeiss Oberkochen, Alemanha), com aumento de 40X. As falhas foram classificadas como "coesivas" (falha no substrato dentina ou resina); "adesiva" (na interface de união dentina-resina) ou "mista" (na interface dentina-resina incluindo falha em um dos substratos). A porcentagem de cada tipo de falha foi calculada de acordo com a frequência observada em cada grupo experimental.

2.7. Análise Estatística

Os dados foram primeiramente submetidos ao teste de normalidade de Kolmogorov-Smirnov e após a sua confirmação, foram realizados o teste de ANOVA de um fator e o teste de Tukey. A distribuição das frequências do padrão de falha foi avaliada utilizando o teste de qui-quadrado. Todas as análises foram realizadas no software SigmaPlot, versão 12.0, considerando nível de significância de 5%.

3. RESULTADOS

Os resultados referentes a resistência de união encontrados para cada grupo de tratamento estão demonstrados na Tabela 2. O grupo TU apresentou menor valor de resistência de união, em comparação com demais grupos ($p<0.05$). Por outro lado, o grupo AU apresentou o maior valor, sendo estatisticamente semelhante a GU, AC, GC e TC. As frequências de distribuição do padrão de falha estão demonstradas na figura 2. Nesta análise, verificou-se que o grupo AU apresentou a maior porcentagem de falha do tipo adesiva (49%) e a menor porcentagem para a falha coesiva (5,9%). Por outro lado, o grupo TU apresentou a maior porcentagem de falha do tipo coesiva (22,3%) quando comparado aos demais.

4. DISCUSSÃO

A HD e LCNCs são condições que ocorrem na maioria dos casos associadas, devido a proximidade de seus fatores etiológicos.[11,12] Essa situação clínica é cada vez mais comum nos consultórios odontológicos e sua resolução ainda é um grande desafio para os cirurgiões-dentistas.

A dentina de uma LCNC, é uma região exposta ao meio oral e sofre a atuação de agentes corrosivos (principalmente advindos da alimentação ácida) e abrasivos (principalmente da escovação),[16] tornando-se uma dentina para adesão diferente de uma dentina não exposta. Por este motivo, as amostras utilizadas neste estudo passaram por degradação corrosiva/abrasiva previamente a realização dos diferentes tipos de tratamento, visando a simulação mais próxima do que ocorre na cavidade bucal. Uma das principais estratégias clínicas a ser utilizada nas situações em que há associação de LCNCs e HD seria a aplicação de agentes dessensibilizantes, previamente ao procedimento restaurador utilizando sistemas adesivos autocondicionantes.[13] No presente estudo foi encontrada diferença estatisticamente significante nos dados de resistência de união para o grupo TU quando comparado aos demais, demonstrando que o tipo de agente dessensibilizante parece ser fator determinante para a promoção de alterações na resistência de união. A eficiência e a qualidade da adesão a dentina depende de uma hibridização homogênea e completa entre as fibrilas colágenas expostas e os polímeros da resina.[17] Para tanto, torna-se essencial conhecer a composição dos agentes dessensibilizantes utilizados neste estudo para entender o efeito que podem causar na adesão.

O agente dessensibilizante Gluma Desensitizer (Heraeus Kulzer, CA, USA), está comercialmente presente na formulação aquosa de glutaraldeído a 5 % com 35 % de hidroxi-etil-metacrilato (HEMA).[18-21] O mecanismo de ação do glutaraldeído envolve uma reação com albumina de soro presente no fluido dentinário, levando a formação de precipitado[23] e subsequente estreitamento ou bloqueio do orifício do túbulo.[10] Caracterizado como um composto fixador biológico, o glutaraldeído reage fazendo com que os grupos de dois aldeídos se entrelacem com os grupos amino do colagéno exposto da dentina e esta fixação das proteínas forma uma barreira proteica uniforme que oblitera os túbulos.[20] Todas estas características fazem com que haja um aumento na resistência de união, devido a difusão dos monômeros ser acelerada pela presença do HEMA na composição. Além disso, quando utilizado com sistemas adesivos que contêm HEMA em sua formulação apresentam aumento na molhabilidade e boa infiltração nos túbulos dentinários, formando por sua vez uma camada reforçada sobre a dentina,[21] o que favorece a resistência de união, em conformidade com os resultados desse estudo.

Por outro lado, o Teethmate Desensitizer (Kuraray, Tokyo, Japan) é um agente a base de fosfato de cálcio, composto de cálcio, fósforo, sódio, silício e oxigênio, que tem seu mecanismo de ação caracterizado pela precipitação de íons Ca^{+} sobre a estrutura dentinária.[23] Dessa forma, ocorrerá a reação entre o cálcio e fosfato presentes no dessensibilizante com os íons OH^{-} presentes na dentina. Além disso, os íons de sódio reagem com o hidrogênio presente na saliva, causando

um aumento do pH na região.[23] O cálcio e o fosfato subsequentemente migram do agente formando uma camada superficial na dentina rica em fosfato de cálcio e promovendo a obliteração dos túbulos.[23] Diante deste fato, acredita-se que o agente Teethmate Desensitizer promova uma obliteração efetiva que pode prejudicar a penetração do sistema adesivo, levando a uma adesão instável. Além disso, a presença das partículas de Ca+ torna o composto básico, que em contato com o ácido presente na formulação do sistema adesivo, pode neutralizar a reação, prejudicando ainda mais a adesão a dentina, o que pode explicar os resultados desfavoráveis encontrados neste estudo.

Com base nos resultados obtidos nesse estudo, sugere-se que o tipo de agente dessensibilizante empregado parece ser um fator determinante na alteração dos valores de resistência de união. No entanto, esta análise foi realizada através de uma avaliação inicial (imediata) e *in vitro,* limitada a utilização de apenas dois tipos de agentes dessensibilizantes. Estudos futuros são necessários para analisar outros tipos de agentes dessensibilizantes e em diferentes tempos de avaliação para complementar os achados obtidos neste estudo. Estudos clínicos randomizados referentes a este tema deverão ser desenvolvidos a fim de verificar os resultados encontrados e favorecer o desenvolvimento de protocolos clínicos.

5. CONCLUSÃO

Com base nas limitações deste estudo, pode-se concluir que:

- o tipo de agente dessensibilizante empregado parece ser um fator que influencia na resistência de união de adesivos condicionantes a dentina;
- o uso do agente dessensibilizante Teethmate Desensitizer em associação com o adesivo Single Bond Universal promoveu maior redução nos valores de resistência de união a dentina.

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Tabelas

Tabela 1. Agentes dessensibilizantes e sistemas adesivos utilizados e seus protocolos de aplicação.

Produto	Fabricante	Protocolo de Aplicação
Agentes Dessensibilizantes		
TeethMate Dessensitizer	Kuraray	1. Manipulação do pó e líquido por 15 segundos; 2. Aplicação ativa do produto por 60 segundos; 3. Lavagem dos excessos com água
Gluma Dessensitizer	Heraeus Kulzer	1. Aplicação ativa com microaplicador por 60 segundos; 2. Secar a superfície com jato de ar até a perda completa do brilho; 3. Lavar com água
Sistemas Adesivos		
Single Bond Universal	3M ESPE	1. Aplicação por 20 segundos; 2. Jato de ar por 5 segundos; 3. Fotoativação por 10 segundos
Clearfil SE Bond	Kuraray	1. Aplicação do primer por 20 segundos; 2. Leve jato de ar; 3. Aplicação do Bond; 4. Leve jato de ar; 3. Fotoativação por 10 segundos

Tabela 2. Média e desvio padrão dos valores de resistência de união (MPa), de acordo com os diferentes grupos.

GRUPO	RESISTÊNCIA DE UNIÃO (MPa)*
AU	26,8±4,9 A
GU	26,6±4,8 A
AC	24,9±6,4 A
GC	21,4±6,6 A
TC	19,6±6,2 A
TU	16,5±5,7 B

AU. Adesivo Single Bond Universal; TU. Teethmate Desensitizer + Adesivo Single Bond Universal; GU. Gluma + Adesivo Single Bond Universal; AC. Adesivo Clearfil SE Bond; TC.Teethmate + Adesivo Clearfil SE Bond; GC.Gluma + Adesivo Clearfil SE Bond.

*Letras maiúsculas representam diferenças estatisticamente significantes ($p<0,05$).

Figuras

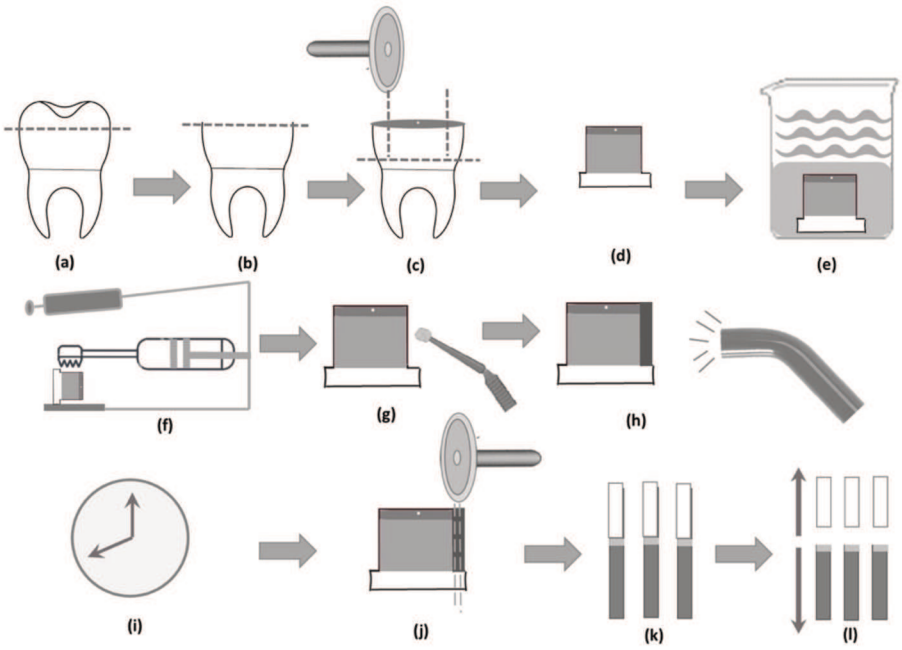

Figura 1. Figura ilustrativa representando o preparo das amostras e as etapas do estudo. (a,b,c) Secção dos terços oclusal, raízes e faces proximais das amostras; (d) Preparo finalizado; (e-f) Desafios corrosivos/abrasivos; (g) Realização dos tratamentos; (h) Restauração das amostras com resina composta; (i) Armazenamento por 24h após a restauração; (j) Secção nos planos X e Y; (k) Obtenção das amostras em forma de palitos; (l) Execução do ensaio de microtração.

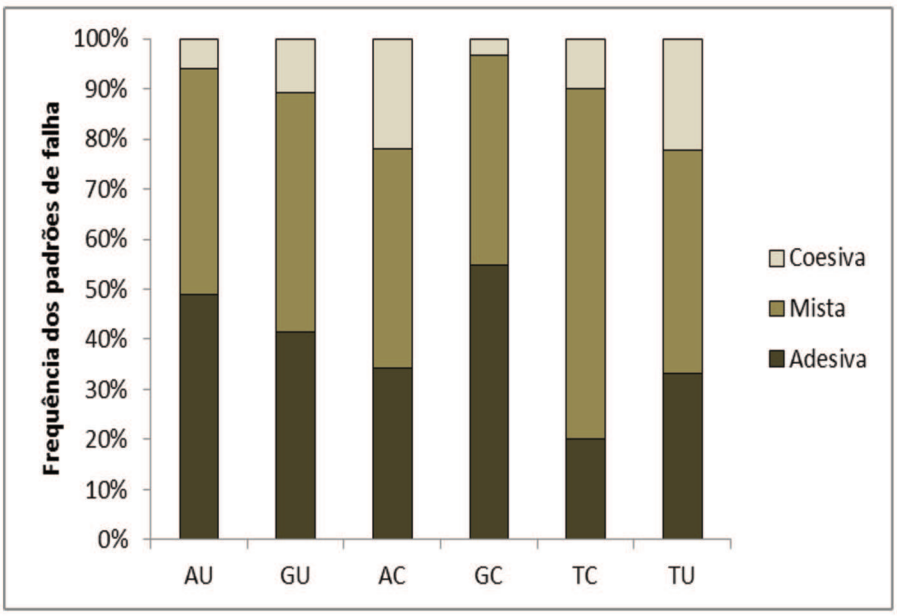

Figura 2. Frequências (%) do padrão de falha de acordo com os diferentes grupos

CONCLUSÃO

3. CONCLUSÃO

Dentro das limitações metodológicas impostas pelo delineamento experimental deste estudo que envolveu, 1 estudo laboratorial, 2 estudos transversais, 1 estudo clínico randomizado e 2 revisões sistemáticas, pode-se concluir-se que:

- A estimativa da prevalência de HD foi de 11,5% (IC95%: 11,3% - 11,7%) e a média a partir de todos os estudos avaliados foi de 33,5% (IC95%: 30,2% -36,7%). Os índices de prevalência foram influenciados pelos seguintes fatores: tipo de participante, idade, estratégia e número de áreas de recrutamento;
- Os índices de LCNCs e RG aumentaram com a idade; LCNCs, RG e HD apresentaram correlação positiva entre si. A profundidade das LCNCs influenciou nos níveis de HD e gênero e presença de doenças gástricas foram fatores relevantes para a ocorrência de HD;
- Para os dentistas participantes deste estudo, o método de diagnóstico da HD mais utilizado foi o jato de ar e sonda exploradora. Além disso, o uso de agentes dessensibilizantes (neural e obliteradores) associados ou não a laserterapia foram as estratégias de manejo mais citados pelos dentistas. Independente da experiência clínica, os dentistas brasileiros ainda consideram o manejo da HD um desafio em sua prática odontológica diária e existe a necessidade do desenvolvimento de diretrizes para disseminar o conhecimento atual sobre a HD;
- Evidências disponíveis sugerem que o uso do laser GaAlAs promoveu melhores resultados para o tratamento da HD do que quando comparado ao placebo / nenhum tratamento (independentemente do período de acompanhamento) e a agentes à base de flúor (para acompanhamento de curto, médio e longo prazo);
- Ambas as concentrações de oxalato de potássio (10 e 5%) testadas podem ser consideradas um tratamento eficaz para HD por pelo menos 6 meses. Entretanto, após 9 meses de acompanhamento, a maior concentração apresentou melhores resultados.

- O tipo de agente dessensibilizante parece ser fator que influencia na resistência de união de adesivos autocondicionantes a dentina.
- É possível realizar o manejo da HD com sucesso. Para tanto, é necessário o controle dos fatores etiológicos e a utilização de protocolos de dessensibilização específicos, com o objetivo de conseguir maior longevidade para o tratamento.

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* De acordo com a Norma da FOUFU, baseado nas Normas de Vancouver. Abreviaturas dos periódicos com conformidade com Medline (PubMed).

ANEXOS

ANEXOS

Anexo I- Parecer Comitê de Ética – Capitulo 2

UFU Comitê de Ética em Pesquisa — UNIVERSIDADE FEDERAL DE UBERLÂNDIA/MG — Plataforma Brasil

PARECER CONSUBSTANCIADO DO CEP

DADOS DO PROJETO DE PESQUISA

Título da Pesquisa: Aspectos clínicos e epidemiológicos de lesões cervicais não cariosas e hipersensibilidade dentinária - Estudo transversal

Pesquisador: Paulo Vinícius Soares

Área Temática:

Versão: 1

CAAE: 50035015.0.0000.5152

Instituição Proponente: FACULDADE DE ODONTOLOGIA

Patrocinador Principal: Financiamento Próprio

DADOS DO PARECER

Número do Parecer: 1.373.058

Apresentação do Projeto:

Segundo apresenta o protocolo:

Desenho: A proposta do estudo é caracterizar a prevalência e o perfil de pacientes acometidos por lesões cervicais não cariosas (LCNC) e hipersensibilidade dentinária (HD) atendidos no "Programa de reabilitação de pacientes com lesões cervicais não-cariosas e hipersensibilidade dentinária", bem como correlacionar tais alterações com recessão gengival (RG), através da análise dos prontuários desses pacientes (150 ao todo). Os dados serão analisados estatisticamente.

Objetivo da Pesquisa:

o objetivo geral da pesquisa é caracterizar a prevalência e o perfil de pacientes acometidos por lesões cervicais não cariosas e hipersensibilidade dentinária atendidos no "Programa de reabilitação de pacientes com lesões cervicais não-cariosas e hipersensibilidade dentinária", bem como correlacionar tais alterações com a presença de recessão gengival.

Os específicos são:

1. Caracterizar o perfil dos pacientes atendidos no "Programa de reabilitação de pacientes com lesões cervicais não-cariosas e hipersensibilidade dentinária".

Endereço: Av. João Naves de Ávila 2121- Bloco "1A", sala 224 - Campus Sta. Mônica
Bairro: Santa Mônica **CEP:** 38.408-144
UF: MG **Município:** UBERLANDIA
Telefone: (34)3239-4131 **Fax:** (34)3239-4335 **E-mail:** cep@propp.ufu.br

2. Verificar correlação existente entre presença de lesões cervicais não cariosas, hipersensibilidade dentinária e recessões gengivais.

Avaliação dos Riscos e Benefícios:

Os autores apontam o risco sempre presente da quebra do sigilo e se comprometem a tomar as medidas para evitá-lo. Os benefícios apontados pelos autores são indiretos, ou seja, os resultados ajudarão a identificar e caracterizar o perfil dos pacientes acometidos por lesão cervical não cariosa, hipersensibilidade dentinária e recessão gengival, auxiliando, assim, no melhor diagnóstico e tratamento de futuros pacientes.

Comentários e Considerações sobre a Pesquisa:

Materiais e métodos:

O delineamento experimental deste trabalho ocorrerá em duas etapas:

Primeira etapa: investigação em 150 prontuários de pacientes atendidos no "Programa de reabilitação de pacientes com lesões cervicais não-cariosas e hipersensibilidade dentinária", de pacientes atendidos do período de janeiro de 2010 a junho de 2016; sobre os aspectos:: idade, gênero, qualidade de higiene oral, presença de doenças do trato gastrointestinal, presença de dieta ácida, presença de hábitos parafuncionais, presença de interferência oclusal, padrão de escovação, presença e nível de hipersensibilidade dentinária; presença, dimensão e morfologia da lesão cervical não cariosa; presença e dimensão da recessão gengival; relacionado aos grupos etários (Idade: 20 a 30 anos; 30 a 40 anos; 40 a 50 anos; 50 a 60 anos; 60 a 70 anos; sexo, qualidade de higiene oral, doenças do Trato Gastro-Intestinal, Dieta ácida, Hábitos parafuncionais, Interferência oclusal, padrão de escovação, presença ou ausência de : LCNC, HD, RG: e avaliação da presença, além da descrição da morfologia Segunda etapa: Novamente analisando os prontuários os fatores Fatores em estudo: lesão cervical não cariosa, hipersensibilidade dentinária e recessão gengival em busca da presença ou ausência dos fatores em estudos tais como: LCNC, HD, RG.

Seleção dos prontuários: duas etapas:

Piloto: Será feito teste piloto com trinta prontuários para análise e certificação do método a ser empregado.

Amostra final: Cento e cinquenta prontuários serão analisados para tabulação dos dados e posterior análise estatística. Os prontuários pertencem ao banco de pacientes do Hospital

Odontológico, localizado na Faculdade de Odontologia da Universidade Federal de Uberlândia, e fazem parte do "Programa de reabilitação de pacientes com lesões cervicais não-cariosas e hipersensibilidade dentinária".

Critérios de inclusão:
Prontuários de pacientes que tenham participado do programa dos anos de agosto de 2012 a agosto de 2015 que apresentem lesão cervical não cariosa e/ou hipersensibilidade dentinária e/ou recessão gengival.

Critérios de exclusão: Prontuários com ausência de dados ou dados incompletos.

Considerações sobre os Termos de apresentação obrigatória:
Os termos são devidamente apresentados e estão de acordos com as orientações do CEP.
Há cópia do projeto completo. Não há TCLE, que no caso da pesquisa não se aplica.

O Cronograma está adequado, com previsão de coleta de dados no primeiro semestre de 2016.
A planilha de custa, no valor de 43 reais.

Recomendações:
Não se aplica.

Conclusões ou Pendências e Lista de Inadequações:
De acordo com as atribuições definidas na Resolução CNS 466/12, o CEP manifesta-se pela aprovação do protocolo de pesquisa proposto.
O protocolo não apresenta problemas de ética nas condutas de pesquisa com seres humanos, nos limites da redação e da metodologia apresentadas.

Considerações Finais a critério do CEP:
Data para entrega de Relatório Final ao CEP/UFU: março de 2017.

OBS.: O CEP/UFU LEMBRA QUE QUALQUER MUDANÇA NO PROTOCOLO DEVE SER INFORMADA IMEDIATAMENTE AO CEP PARA FINS DE ANÁLISE E APROVAÇÃO DA MESMA.

O CEP/UFU lembra que:
a- segundo a Resolução 466/12, o pesquisador deverá arquivar por 5 anos o relatório da pesquisa e os Termos de Consentimento Livre e Esclarecido, assinados pelo sujeito de pesquisa.

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Telefone: (34)3239-4131 **Fax:** (34)3239-4335 **E-mail:** cep@propp.ufu.br

b- poderá, por escolha aleatória, visitar o pesquisador para conferência do relatório e documentação pertinente ao projeto.
c- a aprovação do protocolo de pesquisa pelo CEP/UFU dá-se em decorrência do atendimento a Resolução CNS 466/12, não implicando na qualidade científica do mesmo.

Orientações ao pesquisador :
• O sujeito da pesquisa tem a liberdade de recusar-se a participar ou de retirar seu consentimento em qualquer fase da pesquisa, sem penalização alguma e sem prejuízo ao seu cuidado (Res. CNS 466/12) e deve receber uma via original do Termo de Consentimento Livre e Esclarecido, na íntegra, por ele assinado.
• O pesquisador deve desenvolver a pesquisa conforme delineada no protocolo aprovado e descontinuar o estudo somente após análise das razões da descontinuidade pelo CEP que o aprovou (Res. CNS 466/12), aguardando seu parecer, exceto quando perceber risco ou dano não previsto ao sujeito participante ou quando constatar a superioridade de regime oferecido a um dos grupos da pesquisa que requeiram ação imediata.
• O CEP deve ser informado de todos os efeitos adversos ou fatos relevantes que alterem o curso normal do estudo (Res. CNS 466/12). É papel de o pesquisador assegurar medidas imediatas adequadas frente a evento adverso grave ocorrido (mesmo que tenha sido em outro centro) e enviar notificação ao CEP e à Agência Nacional de Vigilância Sanitária – ANVISA – junto com seu posicionamento.
• Eventuais modificações ou emendas ao protocolo devem ser apresentadas ao CEP de forma clara e sucinta, identificando a parte do protocolo a ser modificada e suas justificativas. Em caso de projetos do Grupo I ou II apresentados anteriormente à ANVISA, o pesquisador ou patrocinador deve enviá-las também à mesma, junto com o parecer aprobatório do CEP, para serem juntadas ao protocolo inicial (Res.251/97, item III.2.e).

Este parecer foi elaborado baseado nos documentos abaixo relacionados:

Tipo Documento	Arquivo	Postagem	Autor	Situação
Informações Básicas do Projeto	PB_INFORMAÇOES_BASICAS_DO_PROJETO_606087.pdf	13/10/2015 15:42:59		Aceito
Outros	Curriculo_Lattes.docx	13/10/2015 15:42:28	Paulo Vinícius Soares	Aceito
Outros	Ficha_Prontuarios_CEP.docx	13/10/2015 15:34:56	Paulo Vinícius Soares	Aceito

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Projeto Detalhado / Brochura Investigador	Projeto_CEP.docx	10/10/2015 16:57:14	Paulo Vinicius Soares	Aceito
Declaração de Instituição e Infraestrutura	Declaracao_Intituicao_Coparticipante.pdf	10/10/2015 16:52:21	Paulo Vinicius Soares	Aceito
Declaração de Pesquisadores	Declaracao_Equipe_Executora.pdf	10/10/2015 16:51:35	Paulo Vinicius Soares	Aceito
Declaração de Instituição e Infraestrutura	Declaracao_Instituicao.pdf	10/10/2015 16:49:38	Paulo Vinicius Soares	Aceito
Folha de Rosto	Folha_de_Rosto.pdf	10/10/2015 16:47:57	Paulo Vinicius Soares	Aceito

Situação do Parecer:
Aprovado

Necessita Apreciação da CONEP:
Não

UBERLANDIA, 17 de Dezembro de 2015

Assinado por:
Sandra Terezinha de Farias Furtado
(Coordenador)

Anexo II- Parecer Comitê de Ética – Capitulo 3

UFU Comitê de Ética em Pesquisa — UNIVERSIDADE FEDERAL DE UBERLÂNDIA/MG — Plataforma Brasil

PARECER CONSUBSTANCIADO DO CEP

DADOS DO PROJETO DE PESQUISA

Título da Pesquisa: Percepção do Cirurgião Dentista sobre a Hipersensibilidade Dentinária no Brasil
Pesquisador: Paulo Vinícius Soares
Área Temática:
Versão: 2
CAAE: 68968517.2.0000.5152
Instituição Proponente: Universidade Federal de Uberlândia/ UFU/ MG
Patrocinador Principal: Financiamento Próprio

DADOS DO PARECER

Número do Parecer: 2.138.939

Apresentação do Projeto:
Conforme apresenta o protocolo:
O protocolo propõe uma pesquisa do tipo survey dirigida a cirurgiões dentistas no Brasil. O instrumento será aplicado por meio de um formulário que será inserido no website Google Formulários para coletar dados sociodemográficos e conhecimentos específicos sobre o tema dos respondentes. O TCLE será assinado eletronicamente.
De acordo com o protocolo: "A hipersensibilidade dentinária (HD) é caracterizada como uma dor aguda e provocada, de curta duração originária da dentina cervical exposta a estímulos térmicos, evaporativos, táteis, osmóticos e/ou químicos e que não pode ser atribuída a outra forma de defeito ou patologia dental. Devido ao fato de apresentar etiologia multifatorial, ainda hoje o tratamento e manejo dessa alteração ainda é muito discutido e gera dúvidas na prática clínica odontológica. Sendo assim, o objetivo deste estudo será avaliar o entendimento do cirurgião dentista acerca do tema hipersensibilidade dentinária, envolvendo fatores causais e protocolos de tratamento. Após a devida aprovação do Comitê de Ética em Pesquisa com Seres Humanos, serão elaborados questionamentos referentes ao tema para a criação de um formulário que será inserido no website Google Formulários. As perguntas contidas no formulário incluirão a obtenção de dados sociodemográficos (isto é,
anos de formado,região e setor de atuação), conhecimento sobre os fatores predisponentes da

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condição hipersensibilidade dentinária, diagnóstico diferencial, procedimentos preventivos e de tratamento. O formulário será então disparado para preenchimento. Todos os dados obtidos serão coletados e inseridos em planilhas para geração de gráficos no próprio website Google Formulários e posteriormente tabulados para análise descritiva e de correlação, de acordo com a sua distribuição".

Objetivo da Pesquisa:
Segundo o projeto:

Objetivo Primário:
Avaliar o entendimento do cirurgião dentista acerca do tema hipersensibilidade dentinária, envolvendo fatores causais e protocolos de tratamento.

Objetivo Secundário:
• Caracterizar o perfil sociodemográfico de cirurgiões dentistas atuantes em território nacional e sua experiência com casos de hipersensibilidade dentinária.
• Estimar a prevalência clínica de quadros de hipersensibilidade em consultórios públicos e particulares no país.
• Discernir a percepção clínica e conhecimentos sobre hipersensibilidade nas distintas regiões do Brasil.
• Verificar distinções entre os conhecimentos referentes ao assunto entre profissionais e graduandos.
• Entender a influencia da formação continuada sobre o conhecimento dessa condição clínica.
• Compreender o real entendimento dos profissionais sobre os fatores etiológicos e mecanismo da hipersensibilidade dentinária.

Avaliação dos Riscos e Benefícios:
Segundo os pesquisadores:
Riscos: O único risco consiste na quebra de sigilo quanto à identificação do participante, que será minimizado pela codificação proposta pelo próprio sistema do website Survey Monkey.

Benefícios: Não há benefícios diretos na participação desse estudo, mas os resultados obtidos contribuirão para o planejamento e criação de medidas que preparem o cirurgião-dentista para o tratamento mais efetivo de pacientes com hipersensibilidade dentinária. Dessa forma, o benefício indireto dessa avaliação será que os resultados gerados contribuirão para a melhoria na qualidade

de vida da população e servirão como base
para que novas pesquisas sejam desenvolvidas sobre essa temática.

Comentários e Considerações sobre a Pesquisa:

Metodologia Proposta:

"O presente estudo passará pela análise da Comissão de Ética em Pesquisa com Seres Humanos (CEP – UFU), e após a devida aprovação do Comitê, será aplicado um questionário eletrônico visando caracterizar a percepção do cirurgião-dentista sobre a hipersensibilidade dentinária. Todas as etapas do presente estudo serão executadas na Faculdade de Odontologia da Universidade Federal de Uberlândia.A primeira etapa será a elaboração dos questionamentos referentes ao tema para a criação de um formulário. As perguntas contidas no formulário incluirão a obtenção de dados sociodemográficos (isto é, anos de formado, região e setor de atuação), conhecimento sobre os fatores predisponentes da condição hipersensibilidade dentinária, diagnóstico diferencial, procedimentos preventivos e de tratamento. Em seguida, o questionário será inserido no website Google Formulários e a versão final será disponibilizada para os pesquisadores, objetivando a realização de um teste de verificação. Após o teste, todas as alterações necessárias serão efetuadas e o questionário estará pronto para ser aplicado. Posteriormente, o formulário será disparado via e-mail pessoal, mídias sociais e e-mails corporativos e institucionais. Esse questionário será distribuído em todas as regiões do país com o objetivo de abrangência nacional, sem delimitação de setores públicos ou privados. O tamanho da amostra foi determinado através da ferramenta sample size, presente no programa estatístico Sigma Plot 12.0. Assim, baseado no teste de Proporções, utilizando um poder de teste de 80%, alpha = 0,05, proporção do grupo 1 de 45% e do grupo 2 de 55%, o tamanho mínimo da amostra foi de 412 participantes da pesquisa para responderam o questionário. O questionário será acompanhado de um termo de consentimento livre e esclarecido garantindo a confidencialidade dos dados obtidos e o participante só será
direcionado a iniciar o preenchimento do formulário se estiver de acordo com o referido Termo. Todos os dados serão obtidos por meio da codificação da identidade do participante no website Google Formulários, evitando sua identificação. Os questionamentos poderão ser respondidos no momento e local de preferência do profissional e o tempo médio de para sua realização será de 10 minutos. Os dados obtidos serão coletados e inseridos em planilhas para geração de gráficos no próprio website Google Formulários e posteriormente tabulados para análise descritiva e de correlação".

Critério de Inclusão: "Os critérios para inclusão neste estudo serão profissionais cirurgiões dentistas atuantes em território brasileiro, nos setores privados e particulares em diferentes níveis de educação continuada, com faixa etária entre 22 e 70 anos".

Critério de Exclusão: "Serão excluídos profissionais da área da saúde, exceto cirurgiões-dentistas".

Considerações sobre os Termos de apresentação obrigatória:
Os termos de apresentação obrigatória estão presentes.

Recomendações:
Não há.

Conclusões ou Pendências e Lista de Inadequações:
Análise de respostas às pendências:

1) Embora os participantes da pesquisa sejam os cirurgiões dentistas e estudantes de último período de graduação em odontologia, o TCLE está dirigido explicitamente aos cirurgiões dentistas. É necessário ajustar o texto de TCLE aos dois tipos de participantes.

PENDÊNCIA RESOLVIDA. Conforme os pesquisadores "Os estudantes de último período de graduação em odontologia seriam participantes do projeto inicialmente, mas por decisão da equipe, foram removidos. Portanto, os únicos participantes efetivos serão os cirurgiões dentistas, não sendo necessário o ajuste do TCLE".

2) Explicar como irão obter os e-mails pessoais dos participantes.
PENDÊNCIA RESOLVIDA. De acordo com os pesquisadores "O questionário será enviado somente através de mídias pessoais e e-mails corporativos, não sendo possível a coleta prévia de emails pessoais dos participantes".

3) Explicar o objetivo: "Discernir a percepção clínica e conhecimentos sobre hipersensibilidade nas distintas regiões do Brasil".
PENDÊNCIA RESOLVIDA. De acordo com os pesquisadores "Através das respostas de cada participante acerca de seu local/região de trabalho, poderemos avaliar, ao final, se os conhecimentos que chegam ao cirurgião dentista de diferentes localidades são distintos
ou semelhantes".

4) O objetivo : "Planejar medidas que preparem o cirurgião-dentista para o tratamento mais efetivo de pacientes com hipersensibilidade dentinária", trata-se na verdade de melhorias/benefícios que podem ser implementados após o término da pesquisa. Adequar.
PENDÊNCIA RESOLVIDA. De acordo com os pesquisadores "O objetivo mencionado foi realocado para o item 10 (benefícios) do projeto".

5) Explicar quantos indivíduos terão em cada grupo no universo de 412. Justificar.
PENDÊNCIA RESOLVIDA. De acordo com os pesquisadores "Os alunos de graduação foram excluídos como participantes do projeto, portanto não haverá a divisão em grupos".

==========

De acordo com as atribuições definidas na Resolução CNS 466/12, o CEP manifesta-se pela aprovação do protocolo de pesquisa proposto.
O protocolo não apresenta problemas de ética nas condutas de pesquisa com seres humanos, nos limites da redação e da metodologia apresentadas.

Considerações Finais a critério do CEP:
Data para entrega de Relatório Final ao CEP/UFU: maio/junho de 2018.

OBS.: O CEP/UFU LEMBRA QUE QUALQUER MUDANÇA NO PROTOCOLO DEVE SER INFORMADA IMEDIATAMENTE AO CEP PARA FINS DE ANÁLISE E APROVAÇÃO DA MESMA.

O CEP/UFU lembra que:
a- segundo a Resolução 466/12, o pesquisador deverá arquivar por 5 anos o relatório da pesquisa e os Termos de Consentimento Livre e Esclarecido, assinados pelo Participante da pesquisa.
b- poderá, por escolha aleatória, visitar o pesquisador para conferência do relatório e documentação pertinente ao projeto.
c- a aprovação do protocolo de pesquisa pelo CEP/UFU dá-se em decorrência do atendimento a Resolução CNS 466/12, não implicando na qualidade científica do mesmo.

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Orientações ao pesquisador :

• O Participante da pesquisa tem a liberdade de recusar-se a participar ou de retirar seu consentimento em qualquer fase da pesquisa, sem penalização alguma e sem prejuízo ao seu cuidado (Res. CNS 466/12) e deve receber uma via original do Termo de Consentimento Livre e Esclarecido, na íntegra, por ele assinado.

• O pesquisador deve desenvolver a pesquisa conforme delineada no protocolo aprovado e descontinuar o estudo somente após análise das razões da descontinuidade pelo CEP que o aprovou (Res. CNS 466/12), aguardando seu parecer, exceto quando perceber risco ou dano não previsto ao participante da pesquisa ou quando constatar a superioridade de regime oferecido a um dos grupos da pesquisa que requeiram ação imediata.

• O CEP deve ser informado de todos os efeitos adversos ou fatos relevantes que alterem o curso normal do estudo (Res. CNS 466/12). É papel de o pesquisador assegurar medidas imediatas adequadas frente a evento adverso grave ocorrido (mesmo que tenha sido em outro centro) e enviar notificação ao CEP e à Agência Nacional de Vigilância Sanitária – ANVISA – junto com seu posicionamento.

• Eventuais modificações ou emendas ao protocolo devem ser apresentadas ao CEP de forma clara e sucinta, identificando a parte do protocolo a ser modificada e suas justificativas. Em caso de projetos do Grupo I ou II apresentados anteriormente à ANVISA, o pesquisador ou patrocinador deve enviá-las também à mesma, junto com o parecer aprobatório do CEP, para serem juntadas ao protocolo inicial (Res.251/97, item III.2.e).

Este parecer foi elaborado baseado nos documentos abaixo relacionados:

Tipo Documento	Arquivo	Postagem	Autor	Situação
Informações Básicas do Projeto	PB_INFORMAÇÕES_BÁSICAS_DO_PROJETO_918716.pdf	14/06/2017 14:56:50		Aceito
Recurso Anexado pelo Pesquisador	Resposta_Parecer.pdf	14/06/2017 14:56:29	Paulo Vinícius Soares	Aceito
Projeto Detalhado / Brochura Investigador	Projeto.pdf	14/06/2017 14:52:28	Paulo Vinícius Soares	Aceito
Folha de Rosto	Folha_de_Rosto_.pdf	24/05/2017 19:04:49	Paulo Vinícius Soares	Aceito
Declaração de Pesquisadores	Equipe_Executora.pdf	17/05/2017 15:18:37	Paulo Vinícius Soares	Aceito
TCLE / Termos de Assentimento /	TCLE_.pdf	17/05/2017 15:10:27	Paulo Vinícius Soares	Aceito

Continuação do Parecer: 2.138.939

Justificativa de Ausência	TCLE_.pdf	17/05/2017 15:10:27	Paulo Vinícius Soares	Aceito
Outros	Declaracao_Pesquisador.pdf	12/05/2017 10:57:17	Paulo Vinícius Soares	Aceito
Outros	Instrumento_Coleta_de_Dados.pdf	12/05/2017 10:52:49	Paulo Vinícius Soares	Aceito
Outros	Lattes_dos_Pesquisadores.pdf	12/05/2017 10:51:58	Paulo Vinícius Soares	Aceito
Declaração de Instituição e Infraestrutura	Co_participante.pdf	12/05/2017 10:50:43	Paulo Vinícius Soares	Aceito

Situação do Parecer:
Aprovado

Necessita Apreciação da CONEP:
Não

UBERLANDIA, 26 de Junho de 2017

Assinado por:
Sandra Terezinha de Farias Furtado
(Coordenador)

Anexo III- Parecer Comitê de Ética – Capitulo 5

UFU Comitê de Ética em Pesquisa — UNIVERSIDADE FEDERAL DE UBERLÂNDIA/MG — Plataforma Brasil

PARECER CONSUBSTANCIADO DO CEP

DADOS DO PROJETO DE PESQUISA

Título da Pesquisa: Avaliação Clínica de Diferentes Concentrações de Oxalato de Potássio no Tratamento de Hipersensibilidade Dentinária

Pesquisador: Paulo Vinícius Soares

Área Temática:

Versão: 1

CAAE: 61102016.0.0000.5152

Instituição Proponente: FACULDADE DE ODONTOLOGIA

Patrocinador Principal: Financiamento Próprio

DADOS DO PARECER

Número do Parecer: 1.833.526

Apresentação do Projeto:

Conforme apresenta o protocolo: A hipersensibilidade dentinária (HD) caracteriza-se como uma dor de curta duração, intensa e súbita, provocada por estímulo térmicos, químicos e evaporativos. Existem vários tipos de agentes dessensibilizantes, usados para auxiliar no controle dessa patologia, porém pouco eficazes e com longevidade curta. Os agentes a base de oxalato de potássio vem sendo utilizados pelos cirurgiões dentistas por apresentarem ação mista, tanto neural quanto obliteradora. Entretanto, existem relatos na literatura com diferentes concentrações de oxalato de potássio, utilizadas em agentes dessensibilizantes no mercado odontológico.

Objetivo da Pesquisa:

O estudo clínico tem como objetivo avaliar a eficácia e longevidade de diferentes concentrações de oxalato de potássio no tratamento da hipersensibilidade dentária.

Avaliação dos Riscos e Benefícios:

Segundo os pesquisadores: Os riscos envolvidos são de identificação mas os pesquisadores tomarão as medidas necessárias para manter o sigilo. Os pacientes serão beneficiados com a melhora da dor pelo uso do agente dessensibilizante.

Comentários e Considerações sobre a Pesquisa:

O estudo apresentado para avaliação é um estudo clinico randomizado em que serão recrutados

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31 pacientes de acordo com o calculo amostral apresentado. Em cada paciente serão tratados 2 dentes com hipersensibilidade com diferentes concentrações de oxalato de potássio. A forma de randomização é adequadamente descrita. A sensibilidade será avaliada utilizando escala visual analógica. Um comitê de monitoramento acompanhará os procedimentos de aplicação e fará a avaliação inicial e final. Os pacientes deverão ser avaliados quatro vezes mas serão agendas de acordo com sua ida para outros procedimentos aos quais estão sendo submetidos nas clinicas ambulatoriais da graduação.

Considerações sobre os Termos de apresentação obrigatória:
Os termos obrigatórios são apresentados de forma adequada.

Recomendações:
Não há.

Conclusões ou Pendências e Lista de Inadequações:
De acordo com as atribuições definidas na Resolução CNS 466/12, o CEP manifesta-se pela aprovação do protocolo de pesquisa proposto.
O protocolo não apresenta problemas de ética nas condutas de pesquisa com seres humanos, nos limites da redação e da metodologia apresentadas.

Considerações Finais a critério do CEP:
Data para entrega de Relatório Final ao CEP/UFU: Outubro de 2017.

OBS.: O CEP/UFU LEMBRA QUE QUALQUER MUDANÇA NO PROTOCOLO DEVE SER INFORMADA IMEDIATAMENTE AO CEP PARA FINS DE ANÁLISE E APROVAÇÃO DA MESMA.

O CEP/UFU lembra que:
a- segundo a Resolução 466/12, o pesquisador deverá arquivar por 5 anos o relatório da pesquisa e os Termos de Consentimento Livre e Esclarecido, assinados pelo sujeito de pesquisa.
b- poderá, por escolha aleatória, visitar o pesquisador para conferência do relatório e documentação pertinente ao projeto.
c- a aprovação do protocolo de pesquisa pelo CEP/UFU dá-se em decorrência do atendimento a Resolução CNS 466/12, não implicando na qualidade científica do mesmo.

Orientações ao pesquisador :
• O sujeito da pesquisa tem a liberdade de recusar-se a participar ou de retirar seu consentimento

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UF: MG **Município:** UBERLANDIA
Telefone: (34)3239-4131 **Fax:** (34)3239-4335 **E-mail:** cep@propp.ufu.br

em qualquer fase da pesquisa, sem penalização alguma e sem prejuízo ao seu cuidado (Res. CNS 466/12) e deve receber uma via original do Termo de Consentimento Livre e Esclarecido, na íntegra, por ele assinado.

• O pesquisador deve desenvolver a pesquisa conforme delineada no protocolo aprovado e descontinuar o estudo somente após análise das razões da descontinuidade pelo CEP que o aprovou (Res. CNS 466/12), aguardando seu parecer, exceto quando perceber risco ou dano não previsto ao sujeito participante ou quando constatar a superioridade de regime oferecido a um dos grupos da pesquisa que requeiram ação imediata.

• O CEP deve ser informado de todos os efeitos adversos ou fatos relevantes que alterem o curso normal do estudo (Res. CNS 466/12). É papel de o pesquisador assegurar medidas imediatas adequadas frente a evento adverso grave ocorrido (mesmo que tenha sido em outro centro) e enviar notificação ao CEP e à Agência Nacional de Vigilância Sanitária – ANVISA – junto com seu posicionamento.

• Eventuais modificações ou emendas ao protocolo devem ser apresentadas ao CEP de forma clara e sucinta, identificando a parte do protocolo a ser modificada e suas justificativas. Em caso de projetos do Grupo I ou II apresentados anteriormente à ANVISA, o pesquisador ou patrocinador deve enviá-las também à mesma, junto com o parecer aprobatório do CEP, para serem juntadas ao protocolo inicial (Res.251/97, item III.2.e).

Este parecer foi elaborado baseado nos documentos abaixo relacionados:

Tipo Documento	Arquivo	Postagem	Autor	Situação
Informações Básicas do Projeto	PB_INFORMAÇÕES_BÁSICAS_DO_PROJETO_797851.pdf	14/10/2016 11:48:24		Aceito
Projeto Detalhado / Brochura Investigador	Projeto_detalhado.pdf	14/10/2016 11:47:16	Paulo Vinícius Soares	Aceito
TCLE / Termos de Assentimento / Justificativa de Ausência	Modelo_TCLE_.pdf	10/10/2016 20:48:10	Paulo Vinícius Soares	Aceito
Folha de Rosto	Folha_Rosto.pdf	27/09/2016 11:35:10	Paulo Vinícius Soares	Aceito
Outros	Instrumento_Coleta_de_Dados.pdf	21/09/2016 18:54:19	Paulo Vinícius Soares	Aceito
Outros	Lattes.pdf	21/09/2016 18:53:33	Paulo Vinícius Soares	Aceito

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Bairro: Santa Mônica **CEP:** 38.408-144
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Telefone: (34)3239-4131 **Fax:** (34)3239-4335 **E-mail:** cep@propp.ufu.br

Continuação do Parecer: 1.833.526

Outros	Calculo_Amostral.pdf	21/09/2016 18:51:09	Paulo Vinicius Soares	Aceito
Declaração de Pesquisadores	Termo_de_Compromisso_da_Equipe_Executora.pdf	21/09/2016 18:50:15	Paulo Vinicius Soares	Aceito
Declaração de Pesquisadores	Solicitacao_do_pesquisador_para_instituicao.pdf	21/09/2016 18:49:23	Paulo Vinicius Soares	Aceito
Declaração de Instituição e Infraestrutura	Declaracao_de_instituicao_coparticipante_2.pdf	21/09/2016 18:48:13	Paulo Vinicius Soares	Aceito

Situação do Parecer:
Aprovado

Necessita Apreciação da CONEP:
Não

UBERLANDIA, 21 de Novembro de 2016

Assinado por:
Sandra Terezinha de Farias Furtado
(Coordenador)

Anexo IV- Parecer Comitê de Ética – Capitulo 6

UFU Comitê de Ética em Pesquisa — UNIVERSIDADE FEDERAL DE UBERLÂNDIA/MG — Plataforma Brasil

PARECER CONSUBSTANCIADO DO CEP

DADOS DO PROJETO DE PESQUISA

Título da Pesquisa: Efeito de agentes dessensibilizantes mistos na resistência de união de adesivos autocondicionantes e da resina composta a dentina

Pesquisador: Paulo Vinícius Soares

Área Temática:

Versão: 1

CAAE: 49257315.0.0000.5152

Instituição Proponente: Universidade Federal de Uberlândia/ UFU/ MG

Patrocinador Principal: Financiamento Próprio

DADOS DO PARECER

Número do Parecer: 1.348.700

Apresentação do Projeto:

Conforme apresenta o protocolo: O PROJETO INTITULADO "EFEITO DE AGENTES DESSENSIBILIZANTES MISTOS NA RESISTÊNCIA DE UNIÃO DE ADESIVOS AUTOCONDICIONANTES E DA RESINA COMPOSTA A DENTINA" argumenta que as concepções modernas da odontologia associadas a melhoria no padrão de higienização bucal do paciente e aumento da expectativa de vida da população mundial faz que haja a redução da perda dos dentes, principalmente por alterações relacionadas a processos cariosos, tendo como consequência o aumento da frequência de alterações não relacionadas a bactérias como as lesões cervicais não cariosas e hipersensibilidade dentinária (HD) na prática clínica (Orchardson et al., 1994; Bartlett, 2006; Lopes et al., 2013).

A Hipersensibilidade dentinária (HD) é definida como uma dor aguda e de curta duração dor (Canadian Advisory Board on Dentin Hypersensitivity, 2003). Decorrente da exposição de dentina, a HD ocorre após estímulos térmicos, táteis, osmóticos ou químicos, não podendo ser atribuída a qualquer outra forma de defeito ou patologia dentária (Canadian Advisory Board on Dentin Hypersensitivity, 2003), sendo o estímulo térmico o mais comum estimulador dador (Amarasena & Spencer, 2011).

A HD é predominante em pacientes com o intervalo de idade de 20-50 anos, sendo mais

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prevalente entre 30-40 anos e em indivíduos do sexo feminino o que seria provavelmente relacionado com a sua higiene bucal e dieta (Chu & Lo 2010; Cummins 2010).
A HD possui diagnóstico específico e de difícil identificação na triagem do paciente, a não ser que este relate a característica da dor (Canadian Advisory Board on Dentin Hypersensitivity, 2003).
Dois processos são essenciais para o desenvolvimento de HD: localização da lesão (a dentina deve estar exposta),devido à perda de esmalte ou recessão gengival; e iniciação da lesão, os túbulos devem estar abertos, tanto na cavidade oral como na polpa (Canadian Advisory Board on Dentin Hypersensitivity, 2003).
A média do diâmetro dos túbulos é de 0.83m e 0.4 m.
O tratamento da hipersensibilidade dentinária deve consistir primeiramente da controle/eliminação dos agentes causais(Shiau et al., 2012)., tais como realização de ajuste oclusal, aconselhamento dietético e instruções de escovação para o paciente. Em seguida, os tratamentos devem se basear na redução dos movimentos dos fluidos dentro dos túbulos, através da obliteração dos mesmos e / ou bloqueio da resposta nervosa da polpa, tornando-os menos sensíveis a estimulação (Canadian Advisory Board on Dentin Hypersensitivity,2003).

Segundo os pesquisadores, como justificativa para a pesquisa, até à data, nenhum agente único ou uma forma de tratamento tem sido encontrado eficaz em todos os pacientes, ou para ter efeitos de longa duração. Atualmente na maioria dos casos para esse processo utiliza-se materiais restauradores diretos adesivos. Assim, o sucesso clínico de restaurações estéticas depende da efetividade e durabilidade dessa interface de união entre substrato e material, promovendo o selamento das margens do preparo cavitário (Carrilho et al., 2002; Martins et al., 2008).
Diante desse contexto, torna-se significante a avaliação da influência da aplicação de agentes dessensibilizantes na resistência de restaurações de resina composta realizadas com adesivos autocondicionantes. Dessa maneira será possível verificar se a combinação entre agentes dessensibilizantes e adesivos autocondicionante é uma boa opção para o tratamento de HD.
Conforme o protocolo, o tratamento da hipersensibilidade dentinária é um questionamento muito pouco esclarecido dentro da odontologia, devido a falta de estudos que comprovam a efetividade e longa duração dos protocolos, assim como o seu efeito nos procedimentos restauradores.

Metodologia:
Serão selecionados 60 dentes terceiros molares hígidos, que serão preparados e divididos em 6 grupos (n=10):
1) Adesivo Single Bond Universal;

2) Adesivo Clearfil SE Bond;
3) Adesivo Single Bond Universal + Painless;
4) Adesivo Single Bond Universal + Dessensibilize;
5) Adesivo Clearfil SE Bond + Painless;
6) Adesivo Clearfil SE Bond + Dessensibilize

Serão armazenadas em água destilada até o início da fase experimental.
Após a realização dos tratamentos de acordo com cada grupo será feita a restauração das amostras. E seguida, palitos de resina/dentina de ±1 mm2 serão obtidos de cada amostra e será realizado o ensaio mecânico de microtração.
Após a realização dos testes mecânicos as amostras serão levadas ao estereomicroscópio para avaliação do padrão de falha.
Os dados serão analisados, e caso os valores apresentem distribuição normal será empregada a Análise de variância em nível de 5% de probabilidade.
Será feita ANOVA fatorial para análise das diferenças entre os grupos experimentais, e caso ocorra diferença, será empregado o Teste de Tukey (P<0,05).
Será feita também One-way ANOVA para análise do grupo controle com cada um dos grupos experimentais e caso ocorra diferença, será empregado teste de Dunnett. Caso não apresente distribuição normal, os dados serão analisados com teste não paramétrico de Krushkall Wallis.

Critério de inclusão:
Serão incluídos no estudo dentes terceiros molares humanos hígidos de doadores com idade acima de 18 anos.

Critérios de exclusão:
Dentes terceiros molares humanos, que apresentarem cáries, trincas, defeitos estruturais, fraturas e restaurações pré-existentes; bem como dentes de pacientes doadores com idade abaixo de 18 anos.

Amostra de 60 indivíduos (dentes terceiros molares hígidos)
Cronograma pesquisa: 01/02/16 à 31/08/16
Orçamento: Gastos estimados de 932,50 com material necessário para a pesquisa (tipo custeio).

Objetivo da Pesquisa:

Objetivo Primário:

Avaliar o efeito de agentes dessensibilizantes mistos na resistência de união de adesivos autocondicionantes e da resina composta a dentina.

Objetivo Secundário:

1. Avaliar comparativamente o efeito dos produtos mistos para o tratamento da hipersensibilidade dentinária na resistência da restaurações adesivas
2. Avaliar comparativamente diferentes adesivos autocondcionantes na resistência de restaurações adesivas

Hipótese:

A hipótese nula do estudo é que os agentes dessensibilizantes mistos não irão alterar a resistência de união de adesivos autocondicionates e da resina composta a dentina.

Avaliação dos Riscos e Benefícios:

Segundo os pesquisadores:

Riscos: O único risco é a identificação do sujeito de pesquisa no momento da coleta do dente, o que contraria a Resolução 466/12. Porém a equipe executora se compromete a tratar os sujeitos participantes de forma sigilosa, não fazendo a identificação dos mesmos e do órgão doado. Os dentes utilizados serão dentes com indicação clínica de exodontia e os pacientes que concordarem farão a doação destes dentes por escrito ao assinarem o termo de consentimento livre e esclarecido.

Benefícios: O benefício desta pesquisa é indireto, ou seja, os resultados propiciarão o desenvolvimento de protocolos para tratamento mais efetivos para hipersensibilidade dentinária, objetivando a melhoria da qualidade de vida dos pacientes acometidos por essa alteração.

Comentários e Considerações sobre a Pesquisa:

O protocolo apresenta os procedimentos para a pesquisa de forma detalhada, conforme abaixo:

- CÁLCULO AMOSTRAL:

De acordo com o cálculo amostral (sample size) sugerido pelo programa estatístico Sigma Plot 12.0 baseado no teste Anova, com um poder de teste de 80%, alpha = 0,001, um valor de diferença mínima estimada de 25%, relativo a diferença na resistência de união e padrão de falha

de sistemas adesivos auto condicionantes associada a aplicação de agentes dessensibilizantes, um desvio padrão médio de 10 %, assumindo 6 diferentes grupos a serem avaliados. O tamanho mínimo da amostra será de 10 dentes por grupo na pesquisa.

- COLETA DOS DENTES

Os pacientes atendidos nas clínicas de cirurgia da FOUFU que apresentarem indicação de exodontia de terceiros molares humanos hígidos por motivo não relacionado a essa pesquisa, serão convidados a participar da pesquisa, doando os dentes extraídos após assinatura do Termo de Consentimento Livre e Esclarecido (TCLE).

- PREPARO DAS AMOSTRAS

Serão selecionados 60 dentes terceiros molares hígidos que serão limpos com curetas periodontais. As raízes dos dentes foram seccionadas e o terço oclusal das coroas serão cortados com disco diamantado dupla face em velocidade de 250 rpm com constante irrigação, montado em cortadeira de precisão (Isomet 1000, Buehler, Lake Bluff, IL, EUA), restando a dentina coronária com espessura de aproximadamente 2,5 mm. A superfície da dentina será lixada com lixa de carbeto de silício de granulação 600 por 60 segundos, a fim de padronizar camada smear layer (Lu et al., 2013) para realização de procedimento adesivo.

As amostras serão então divididas aleatoriamente nos grupos (n=10):

1)Adesivo Single Bond Universal;

2) Adesivo Clearfil SE Bond;

3) Adesivo SingleBond Universal + Painless;

4) Adesivo Single Bond Universal + Dessensibilize;

5) Adesivo Clearfil SE Bond + Painless;

6) Adesivo Clearfil SE Bond +Dessensibilize e armazenadas em água destilada até o início da fase experimental.

– TRATAMENTO E RESTAURAÇÃO DAS AMOSTRAS

As amostras serão então tratadas com os agentes adesivos e/ou agentes dessensibilizantes de acordo com cada grupo. As aplicações serão realizadas de acordo com as recomendações específicas dos fabricantes de cada produto, sendo que os agentes dessensibilizante serão aplicados previamente aos sistemas adesivos.

Após os tratamentos das amostras, todas elas passarão para a etapa do procedimento restaurador. Nesse momento serão confeccionadas restaurações com 5 mm de espessura com a utilização de compósito resinoso, com dois incrementos de 2 mm e um incremento de 1 mm, sendo cada incremento fotoativados por 40 segundos cada usando aparelho de luz halógena (Optilux 501; Kerr Corporation).

– ENSAIO MECÂNICO DE MICROTRAÇÃO

Após a restauração das amostras, será aguardado um período de armazenamento de 24 horas antes do início do ensaio mecânico de microtração.

Após esse período, as amostras serão seccionadas utilizando disco diamantado dupla-face montado em cortadeira de precisão (Isomet1000, Buehler, Lake Bluff, IL, EUA).

As amostras serão fixadas em uma base de acrílico com cera pegajosa em bastão (Asfer Indústria Química Ltda., São Paulo,SP, Brasil), e seccionados nos planos X e Y em ângulo de 90 graus entre os cortes para obter amostras em forma de palito, com aproximadamente 1 mm2 de área de união. As dimensões dos palitos serão mensurados com paquímetro digital para assegurar uma área de secção transversal de 1 mm2 ± 0,05 mm2. Para o ensaio mecânico de microtração, serão utilizados apenas os palitos da região central de cada dente.

Após o corte, os palitos serão fixados com cola de cianoacrilato em dispositivo de Geraldeli e submetidos à ensaio de microtração utilizando o equipamento Microtensile OM100 (Odeme DentalResearch, Luzerna, SC, Brasil), com célula de carga de 20 kgf e velocidade de0,7 mm/min.

Por fim , a resistência adesiva, em MPa, será calculada dividindo aforça (N) no momento da falha pela sua área de secção transversal (em mm2).

– ANÁLISE DO PADRÃO DE FALHA

A classificação do padrão de falha será realizada em estereomicroscópio (Mitutoyo, Suzano, SP, Brasil), acoplado a câmera (AxioCam ERc5s, ZeissOberkochen, Alemanha) com aumento de 40X. As falhas serão classificadas como "coesivas" (falha no substrato dentina ou resina);

"adesiva"(na interface de união dentina-resina) ou "mista" (na interface dentina-resina incluindo falha em um dos substratos). A porcentagem de padrão de falha será calculada de acordo com a frequência observada em cada grupo experimental (Wagner et al., 2014).

– ANÁLISE DOS DADOS

Os dados serão submetidos ao teste de Kolmogorov-Smirnov para verificar a sua normalidade. Em

caso de normalidade serão submetidos ao teste análise de variância (ANOVA) para análise das diferenças entre os grupos experimentais. Caso ocorra diferença entre os grupos, será empregado teste de comparação de médias, Teste de Tukey (P<0,05) para definir entre quais grupos ocorreram diferenças significantes a este nível de probabilidade.
Será feita também One-way ANOVA para análise do grupo controle com cada um dos grupos experimentais. Caso ocorra diferença entre o grupo controle com os grupos experimentais, será empregado teste de Dunnett. Caso não apresente distribuição normal, os dados serão analisados com teste não paramétrico de Krushkall Wallis.
Os valores, em porcentagem, do padrão de falha serão submetidos ao Teste Exato de Fisher (p<0,05).

Considerações sobre os Termos de apresentação obrigatória:
Todos os documentos foram apresentados e estão de acordo com as exigências.

Recomendações:
Não há.

Conclusões ou Pendências e Lista de Inadequações:

De acordo com as atribuições definidas na Resolução CNS 466/12, o CEP manifesta-se pela aprovação do protocolo de pesquisa proposto.
O protocolo não apresenta problemas de ética nas condutas de pesquisa com seres humanos, nos limites da redação e da metodologia apresentadas.

Considerações Finais a critério do CEP:
Data para entrega de Relatório Final ao CEP/UFU: Outubro de 2016.

OBS.: O CEP/UFU LEMBRA QUE QUALQUER MUDANÇA NO PROTOCOLO DEVE SER INFORMADA IMEDIATAMENTE AO CEP PARA FINS DE ANÁLISE E APROVAÇÃO DA MESMA.

O CEP/UFU lembra que:
a- segundo a Resolução 466/12, o pesquisador deverá arquivar por 5 anos o relatório da pesquisa e os Termos de Consentimento Livre e Esclarecido, assinados pelo sujeito de pesquisa.
b- poderá, por escolha aleatória, visitar o pesquisador para conferência do relatório e documentação pertinente ao projeto.

c- a aprovação do protocolo de pesquisa pelo CEP/UFU dá-se em decorrência do atendimento a Resolução CNS 466/12, não implicando na qualidade científica do mesmo.

Orientações ao pesquisador :

• O sujeito da pesquisa tem a liberdade de recusar-se a participar ou de retirar seu consentimento em qualquer fase da pesquisa, sem penalização alguma e sem prejuízo ao seu cuidado (Res. CNS 466/12) e deve receber uma via original do Termo de Consentimento Livre e Esclarecido, na íntegra, por ele assinado.

• O pesquisador deve desenvolver a pesquisa conforme delineada no protocolo aprovado e descontinuar o estudo somente após análise das razões da descontinuidade pelo CEP que o aprovou (Res. CNS 466/12), aguardando seu parecer, exceto quando perceber risco ou dano não previsto ao sujeito participante ou quando constatar a superioridade de regime oferecido a um dos grupos da pesquisa que requeiram ação imediata.

• O CEP deve ser informado de todos os efeitos adversos ou fatos relevantes que alterem o curso normal do estudo (Res. CNS 466/12). É papel de o pesquisador assegurar medidas imediatas adequadas frente a evento adverso grave ocorrido (mesmo que tenha sido em outro centro) e enviar notificação ao CEP e à Agência Nacional de Vigilância Sanitária – ANVISA – junto com seu posicionamento.

• Eventuais modificações ou emendas ao protocolo devem ser apresentadas ao CEP de forma clara e sucinta, identificando a parte do protocolo a ser modificada e suas justificativas. Em caso de projetos do Grupo I ou II apresentados anteriormente à ANVISA, o pesquisador ou patrocinador deve enviá-las também à mesma, junto com o parecer aprobatório do CEP, para serem juntadas ao protocolo inicial (Res.251/97, item III.2.e).

Este parecer foi elaborado baseado nos documentos abaixo relacionados:

Tipo Documento	Arquivo	Postagem	Autor	Situação
Informações Básicas do Projeto	PB_INFORMAÇÕES_BÁSICAS_DO_PROJETO_590358.pdf	16/09/2015 10:15:50		Aceito
TCLE / Termos de Assentimento / Justificativa de Ausência	TCLE_2.pdf	15/09/2015 23:19:36	Paulo Vinícius Soares	Aceito
Outros	Instituicao2.pdf	15/09/2015 23:17:02	Paulo Vinícius Soares	Aceito

Projeto Detalhado / Brochura Investigador	Projeto_CEP_2.pdf	15/09/2015 23:13:53	Paulo Vinícius Soares	Aceito
Folha de Rosto	Folha_de_Rosto_2.pdf	15/09/2015 23:12:27	Paulo Vinícius Soares	Aceito
Outros	Instrumento_para_Coleta_de_Dados.pdf	12/09/2015 10:51:46	Paulo Vinícius Soares	Aceito
Outros	Lattes_dos_Pesquisadores.pdf	12/09/2015 10:49:53	Paulo Vinícius Soares	Aceito
Outros	Pesquisador.pdf	12/09/2015 10:49:19	Paulo Vinícius Soares	Aceito
Outros	Tamanho_da_Amostra.pdf	12/09/2015 10:47:21	Paulo Vinícius Soares	Aceito
Declaração de Pesquisadores	Termo_de_Compromisso_da_Equipe.pdf	12/09/2015 10:44:02	Paulo Vinícius Soares	Aceito

Situação do Parecer:
Aprovado

Necessita Apreciação da CONEP:
Não

UBERLANDIA, 02 de Dezembro de 2015

Assinado por:
Sandra Terezinha de Farias Furtado
(Coordenador)

Anexo V- Questionário – Capítulo 3

QUESTIONÁRIO DE PERCEPÇÃO DO CIRURGIÃO DENTISTA HIPERSENSIBILIDADE DENTINÁRIA

1. **Quantos anos de prática clínica você possui?**
    - Até 5 anos
    - Entre 6 e 10 anos
    - Entre 11 e 20 anos
    - Entre 21 e 30 anos
    - Acima de 30 anos

2. **Você atende em qual tipo de clínica?**
    - Clínica de alto fluxo
    - Clínica particular

3. **Você possui pós-graduação?**
    - Não
    - Sim, somente especialização
    - Sim, somente mestrado
    - Sim, somente doutorado
    - Sim, especialização e mestrado
    - Sim, especialização e doutorado

4. **Quais fatores abaixo estão relacionados a hipersensibilidade dentinária?**
    - Hábitos ocupacionais
    - Uso de pastas abrasivas
    - Distúrbios alimentares
    - Métodos de escovação
    - Doenças gastresofágicas
    - Prematuridades oclusais
    - Hábitos parafuncionais
    - Dieta ácida

5. **Qual a frequência de pacientes com hipersensibilidade dentinária no seu consultório?**
    - De 0 a 30%
    - De 30 a 60%
    - De 60 a 100%
    - Não tenho pacientes com hipersensibilidade dentinária

6. **Como pode ser explicado o mecanismo da hipersensibilidade dentinária?**
    - Através do estímulo dos túbulos dentinários, resultante de agentes agressores externos, gerando um quadro de dor de longa duração.
    - Pelo estímulo dos túbulos dentinários expostos, promovendo a movimentação do fluido promove uma deformação dos odontoblastos e causando dor aguda de curta duração.
    - Por meio de processo inflamatório dentinário resultante de agentes agressores externos, gerando um quadro de dor de curta duração.

7. **Como você realiza o diagnóstico clínico da hipersensibilidade dentinária?**
    - Percussão vertical e horizontal com cabo de espelho
    - Sondagem clínica periodontal minunciosa
    - Estímulo com jato de ar e/ou sonda exploradora
    - Estímulo térmico (quente ou frio)

8. **Como você realiza o manejo da hipersensibilidade dentinária?**
    - Não realizo este tipo de tratamento
    - Utilizo agente dessensibilizante dentinário
    - Utilizo laserterapia
    - Utilizo agente dessensibilizante dentinário e laserterapia
    - Utilizo pastas dessensilizantes
    - Realizo o tratamento endodôntico dos dentes acometidos

9. **Quais tipos de agentes dessensibilizantes você conhece?**
    - Agente dessensibilizante de ação neural

- Agente dessensibilizante de ação obliteradora
- Agentes dessensibilizantes de ação neural e obliteradora
- Não conheço diferentes tipos de agentes dessensibilizantes
- Não conheço nenhum tipo de agentes dessensibilizantes

10. **Quais as orientações passadas ao seu paciente com hipersensibilidade dentinária?**
    - Bochecho com flúor
    - Tratamento caseiro
    - Controle de hábitos parafuncionais
    - Uso contínuo de pasta dessensibilizante
    - Controle da dieta
    - Orientações sobre técnicas de escovação dental

11. **Você recomenda o uso de pastas dessensibilizantes?**
    - Sim, durante o tratamento
    - Sim, após o término do tratamento para proservação a longo prazo
    - Sim, durante e após o tratamento
    - Não realizo esse tipo de tratamento

12. **Qual o índice de recidivas observadas após o tratamento da hipersensibilidade dentinária?**
    - Menor do que 30%
    - Entre 30-50%
    - Maior do que 50%
    - Não sei, pois não realizar este tipo de tratamento

13. **Você ainda considera o tratamento e controle da hipersensibilidade dentinária um desafio?**
    - Sim, pois ainda não há um protocolo específico para o tratamento
    - Sim, pois a dor é subjetiva e de difícil mensuração
    - Não, os melhores tratamentos já estão consolidados