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Davi Faria Lopes

INFLUÊNCIA DA PROTEÇÃO SUPERFICIAL NA LIBERAÇÃO DE FLÚOR E PROPRIEDADES MECÂNICAS DE CIMENTOS DE IONÔMERO DE VIDRO: REVISÃO SISTEMÁTICA E META-ANÁLISE

Santa Maria, RS

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Davi Faria Lopes

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Dissertação apresentada ao Programa de Pós-Graduação em Ciências Odontológicas, Área de Concentração em Odontologia, ênfase em Odontopediatria, da Universidade Federal de Santa Maria (UFSM, RS), como requisito parcial para a obtenção do título de **Mestre em Ciências Odontológicas.**

Orientador: Profa. Dra. Rachel de Oliveira Rocha

Santa Maria, RS
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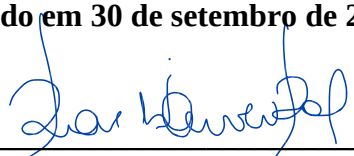

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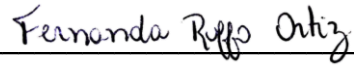

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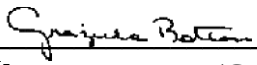

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DEDICATÓRIA

Dedico essa dissertação de mestrado para à minha mãe, principal responsável por minhas conquistas. Minha maior influência em educação, respeito e amor ao próximo. Exala boas energias, por isso as atrai no mesmo nível. Ela é uma pétala, só que de ferro. Delicada, mas forte, muito forte. Não duvide. Mulher batalhadora, uma grande professora, educadora e pedagoga, musa para todos que estão a sua volta.

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RESUMO

INFLUÊNCIA DA PROTEÇÃO SUPERFICIAL NA LIBERAÇÃO DE FLÚOR E PROPRIEDADES MECÂNICAS DE CIMENTOS DE IONÔMERO DE VIDRO: REVISÃO SISTEMÁTICA E META-ANÁLISE

AUTOR: Davi Faria Lopes
ORIENTADORA: Dra. Rachel de Oliveira Rocha

O cimento de ionômero de vidro (CIV) tem sido amplamente utilizado em Odontopediatria como material restaurador definitivo em razão das suas propriedades principais de adesão química ao esmalte e a dentina e liberação de flúor. Devido ao longo tempo de presa e sensibilidade à perda (sinérese) e ganho de água (embebição) durante esse período, tem-se sugerido o uso de materiais para proteção da superfície das restaurações, isolando-as do contato com a saliva até a presa final do CIV. No entanto, ainda não está claro na literatura se o efeito do uso destes agentes de proteção superficial nas propriedades dos CIVs. Deste modo, esta revisão sistemática de estudos laboratoriais teve como objetivo avaliar o efeito dos agentes de proteção superficial na libertação de flúor, microdureza e resistência dos cimentos de ionômero de vidro convencionais. Os estudos foram identificados a partir de uma busca sistemática nas bases de dados PubMed, Web of Science e Scopus. Dois revisores, de forma independente, seleccionaram os estudos, um revisor extraiu os dados, e avaliou o risco de viés. Os dados resultantes foram meta-analisados utilizando um modelo de efeitos aleatórios, com um nível de significância de $p < 0,05$. A heterogeneidade (I^2) foi avaliada através do teste Q de Cochran. Dos 1595 estudos potenciais, 26 estudos elegíveis foram identificados com dados de liberação de flúor, microdureza ou resistência. Os agentes de proteção superficial reduziram significativamente a liberação de flúor ($Z=9,62$; $p<0,00001$) e a microdureza ($Z = 2,77$; $p=0,006$), e não tiveram efeito sobre a resistência ($Z=0,91$; $p=0,36$). A maioria dos estudos apresentou alto risco de viés. Com base nos resultados encontrados, pode-se concluir que o emprego de agentes de proteção superficial não melhoram as propriedades mecânicas do cimento de ionômero de vidro e prejudicam a libertação de flúor.

Palavras-chave: Cimentos de ionômero de vidro. Testes mecânicos. Flúor. Testes de dureza.

ABSTRACT

INFLUENCE OF SURFACE PROTECTION ON FLUORIDE RELEASE AND MECHANICAL PROPERTIES OF GLASS IONOMER CEMENTS: SYSTEMATIC REVIEW AND META-ANALYSIS

AUTHOR: Davi Faria Lopes
ADVISOR: Dra. Rachel de Oliveira Rocha

Glass ionomer cement (GIC) has been widely used in pediatric dentistry as a definitive restorative material due to its main properties of chemical bonding to enamel and dentin and fluoride release. Due to the long setting time and sensitivity to water loss (syneresis) and gain (imbibition) during this period, surface coating agents have been suggested to isolate restorations from contact with saliva until the final setting of the GIC. However, it is still unclear in the literature whether the effect of using these surface coating agents on the properties of GICs. Thus, this systematic review of laboratory studies aimed to evaluate the effect of surface coating agents on fluoride release, microhardness, and strength of conventional glass ionomer cements. Studies were identified from a systematic search in PubMed, Web of Science, and Scopus databases. Two reviewers independently selected the studies; one reviewer extracted the data and assessed the risk of bias. The resulting data were meta-analyzed using a random-effects model, with a significance level of $p < 0.05$. Heterogeneity (I2) was assessed using Cochran's Q test. Of the 1595 potential studies, 26 eligible studies were identified with fluoride release, microhardness, or strength data. Surface coating agents significantly reduced the fluoride release ($Z=9.62$; $p<0.00001$) and microhardness ($Z = 2.77$; $p=0.006$), and had no effect on strength ($Z=0.91$; $p=0.36$). Most of the studies presented a high risk of bias. Based on the results found, it can be concluded that surface coating agents do not improve the mechanical properties of glass ionomer cement and impair fluoride release.

Keywords: Glass ionomer cements. Mechanical tests. Fluoride. Hardness tests.

SUMÁRIO

1 INTRODUÇÃO

O cimento de ionômero de vidro (CIV) é um dos materiais mais versáteis na Odontologia, devido às suas excelentes propriedades, como a biocompatibilidade, adesão química e coeficiente de expansão térmica semelhante à estrutura dentária. Além disso, o CIV funciona como um reservatório de liberação de flúor exercendo um efeito preventivo e terapêutico contra a cárie (DE AMORIM, LEAL, FRENCKEN, 2012). Em razão destas características, o CIV tem sido amplamente utilizado em Odontopediatria como material restaurador definitivo.

Porém, o CIV apresenta algumas peculiaridades que devem ser respeitadas para garantir suas melhores propriedades. Essencialmente, o cimento de ionômero vidro é composto por partículas de vidro de silicato de alumínio/cálcio e fluoreto de cálcio, que é misturado com uma solução aquosa de ácido policarboxílicos (ácidos poliacrílico – principal componente, itacônico e tartárico) resultando em uma matriz de policarboxilato de cálcio e alumínio. A reação de presa do cimento ocorre na presença de água, pois os ácidos policarboxílicos precisam desse meio para liberar prótons, iniciando a reação ácido-base e solidificando o material. Esta reação é, no entanto, lenta, podendo se estender por até 24 horas após a mistura do material e, durante este período, o cimento é sensível a perda (sinérese) ou ganho (embebição) de água, que pode interferir na formação da matriz, com consequente comprometimento das propriedades mecânicas do material. (SIDHU, NICHOLSON, 2016). Assim, o uso de CIV para restaurações dentárias de longa duração exige o emprego de materiais para proteção da superfície das restaurações, isolando-as do contato com a saliva, ou seja, que evitem os fenômenos de sinérese e embebição até a presa final do CIV.

Os materiais empregados mais comumente empregados para esse fim são os vernizes cavitários, sistemas adesivos, esmalte cosmético incolor, manteiga de cacau e vaselina sólida, além de produtos específicos comercializados para esse fim. A vaselina é considerada uma boa opção devido à sua segurança e biocompatibilidade, além de baixo custo; no entanto, pode ser facilmente removida e assim, um material protetor de superfície mais duradouro é desejado, sem que comprometa a liberação de flúor (ULUSOY, TUNC, BAYRAK, 2007).

HESSE et al., 2018 ao avaliarem o desgaste clínico de restaurações de CIV em molares decíduos ao longo de três anos, observaram um menor desgaste das restaurações protegidas por um sistema adesivo nanoparticulado quando comparadas as revestidas com vaselina sólida. Já no estudo de JAFARPOUR et al., 2019, as restaurações de CIV protegidas

com material resinoso (*resin-based coating*) apresentaram menor sorção e solubilidade comparadas as que não foram protegidas. Entretanto, a propriedade de liberação de flúor parece ser comprometida com o emprego de materiais resinosos para proteção superficial de restaurações de CIV (KAMATHAM, REDDY, 2013).

Assim, os resultados não consensuais de estudos que avaliaram diferentes materiais para proteção superficial de restaurações de CIV fazem com que a sistematização dos resultados dos estudos existentes, de forma a auxiliar a decisão de escolha do melhor material para essa finalidade seja necessária. Assim, o presente estudo tem como objetivo revisar sistematicamente a literatura de estudos laboratoriais a fim de identificar o melhor material para proteção superficial de restaurações de cimento de ionômero de vidro.

2 ARTIGO - INFLUENCE OF SURFACE COATING AGENTS ON FLUORIDE RELEASE AND MECHANICAL PROPERTIES OF CONVENTIONAL GLASS IONOMER CEMENTS: SYSTEMATIC REVIEW AND META-ANALYSIS.

O presente trabalho está apresentado na forma artigo, redigido conforme as normas do periódico International Journal of Paediatric Dentistry (ISSN 1365-263X); Qualis CAPES Quadriênio 2013-2016 - A1.

Article type: Systematic review

Influence of surface coating agents on fluoride release and mechanical properties of conventional glass ionomer cements: Systematic review and Meta-analysis.

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Author contributions:

ROR conceived the idea and study design. DFL and ROR performed the literature search. ROR performed the extraction of data and the meta-analysis. DFL wrote the manuscript. ROR and FZMS contributed substantially to discussion and proofread the manuscript before its submission.

Running title: Surface coating of glass ionomer cements

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Influence of surface coating agents on fluoride release and mechanical properties of conventional glass ionomer cements: Systematic review and Meta-analysis.

ABSTRACT

Background: The effect of surface coating agents on glass ionomer cements' properties is unclear.

Aim: This systematic review of laboratory studies aimed to assess the effect of surface coating agents on fluoride release, microhardness, and strength of conventional glass ionomer cements.

Design: Studies were identified from a systematic search across the electronic databases PubMed, Web of Science, and Scopus. Two reviewers independently selected the studies; one reviewer extracted the data and evaluated the risk of bias. The outcome data were meta-analyzed using a random-effects model, with a significance level of $p < 0.05$. Heterogeneity (I^2) was assessed by the Cochran Q test.

Results: From 1595 screened studies, 26 eligible studies were identified with fluoride release, microhardness, or strength data. Surface coating agents significantly impaired the fluoride release ($Z=9.62$; $p<0.00001$) and microhardness ($Z=2.77$; $p=0.006$), and had no effect on strength ($Z=0.91$; $p=0.36$). Most of the studies presented a high risk of bias.

Conclusion: This systematic review and meta-analysis evidence that surface coating agents do not improve the mechanical properties of glass ionomer cement and impair the fluoride release.

Keywords: glass ionomer cement; systematic review; dentin; surface coating, fluoride release.

1. INTRODUCTION

Over the years, glass ionomer cements have had their properties improved to enable to be used in long-term restorations. The advantageous glass ionomer properties, including fluoride release, chemical adhesion, and biological compatibility,[1] contribute to its wide use in dentistry and, in particular, in pediatric dentistry. However, the prolonged setting reaction and moisture sensitivity[2] are concerns as early water contamination or prolonged dehydration can compromise the mechanical properties[3,4] and the restorations clinical performance.[5] To maintain the water balance during the setting reaction, the use of surface coating agents has been suggested,[6-8] including petroleum jelly, waterproof varnish, and light cure resins.[9,10]

According to previously published studies,[6,8] the ideal characteristics of a surface coating agent include protecting the glass ionomer cement during the maturation of material before the restoration be exposed to the oral environment (at least for 1 hour).[3,4] Longer protection times are also associated with improving mechanical[9,11,12] and physical properties of glass ionomer cements.[13]

Nevertheless, there seems to be no consensus about the best surface coating agent and, more importantly, whether it is even necessary. Fluoride releasing from coated glass ionomer cements seems to be severely impaired[14] by surface coating agents. Moreover, the influence of surface coating agents on mechanical properties seems to be material-dependent. Leiskar et al.,[15] pointed out that there is no need for coating agents over Fuji IX (GC Corporation) restorations to improve the strength. A similar trend was also found for other brands of glass ionomer cement and surface coating agents.[10,16,17] The effectiveness of surface coating in increase the microhardness of conventional glass ionomer cements is also unclear, as some studies pointed out some benefits[6,9] and other no effect of coating agents.[16,18,19]

Thus, considering the importance of laboratory studies as a means of evaluating

materials and, to some extent, predicting their clinical performance, and the role of systematic review in the decision-making process; the aim of this systematic review of laboratory studies was to assess the effect of surface coating agents on fluoride release, microhardness and strength of conventional glass ionomer cements. The tested null hypothesis was that surface coating agents do not influence the considered properties of glass ionomer cements.

2. MATERIALS AND METHODS

This systematic review was conducted and reported according to the Cochrane Handbook[20] and Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA).[21] The research PICO question was: "Are surface coating agents on glass ionomer cement really necessary to obtain better properties?"; in which the conventional glass ionomer cement was the 'population'; surface coating agents were the 'intervention'; uncoated was the 'control, and fluoride release, hardness, and shear punch or flexural strength were the 'outcomes'.

2.1 Search strategy

Three electronic databases PubMed/MEDLINE, SCOPUS, and ISI Web of Science, were searched to identify potential studies related to the research question. A search strategy was developed for PubMed/MEDLINE by combining controlled vocabulary (Mesh terms) and free terms as follow: ((((((glass ionomer cements[MeSH Terms]) OR (glass ionomer cements)) OR (glass ionomer)) OR (glass-ionomer)) OR (ionomer)) OR (ionomeric)) AND ((((((((((petrolatum[MeSH Terms]) OR (vaseline)) OR (surface coating)) OR (surface coat)) OR (coating)) OR (coat)) OR (surface protective agents)) OR (surface protective)) OR (surface protection)) OR (petroleum jelly)). An adapted strategy was developed for SCOPUS

and for ISI Web of Science considering the terms (ALL ("glass ionomer") AND ALL ("surface coating" OR "surface protection")) and (GLASS IONOMER) AND (SURFACE COATING), respectively. No language or publication date restrictions were considered in the search. Search results up June 2021 were collected in an electronic spreadsheet (Numbers 11.1, Apple Inc, Cupertino, CA, USA) and manually cross-checked to eliminate duplicates.

2.2 Study selection, inclusion, and exclusion criteria

The title and abstracts of each study were independently screened by two calibrated reviewers (D.F.L. and R.O.R) (Kappa= 0.82) according to the eligibility criteria: compared any surface coating agent with a control (uncoated) on conventional glass ionomer cements considering the properties: fluoride release, hardness, or strength. A third reviewer (F.Z.M.S.) was consulted to solve, by consensus, disagreements between examiners.

The selected studies were full-text retrieved and reviewed by the two reviewers and studies that not compared the same surface coating agent with a control using the same glass ionomer cement; and not presented the outcome presented as means and standard deviation were excluded.

The reference lists of the selected studies were manually screened to identify studies not registered in the search databases. Studies reporting the same bond strength data were considered only once.

2.3 Data extraction

A predefining collection form (Numbers 11.1, Apple Inc, Cupertino, CA, USA) was used to register the extracted data from the included studies, including first author name, year of publication, country of the first author, glass ionomer cement commercial brand name,

coating agent, methodology, sample size and evaluation time.

2.4 Assessment of risk of bias

The risk of bias criteria was adapted from a previous systematic review of in vitro studies,[22] considering the items: sample size calculation, random sequence for specimens allocation, complete description of specimens preparation, a single operator responsible for specimens preparation, glass ionomer cement used according to the manufacturer's instructions, outcome assessment clearly described and blinding of the operator responsible for the outcome analysis. For each clearly described item it was attributed a 'YES', and for undescribed or unclear item, a ‘NO' was attributed. Low risk of bias was considered for those studies with 6 or 7 ‘YES’, moderate risk of bias was considered for studies that received 4 or 5 ‘YES’, and studies that received 1 to 3 ‘YES' were considered as high risk of bias.

2.5 Data analysis

Meta-analysis was undertaken separately for fluoride release, hardness, strength. The inverse of variances (Z test) with a random-effects model was used for all analyses, considering a significance level of 5%. A predefined formula[20] was used to obtain a grouped mean and standard deviation for the studies that considered more than one glass ionomer cement or coating agent. Subgroup analyses were performed considering the evaluation time (after specimens storage). A grouped mean and standard deviation was also obtained for evaluation time when only a few studies considered a specific period.

Heterogeneity among studies was assessed using Cochran’s Q statistic and I^2 statistics. I^2 values higher than 50% were considered heterogeneous.20 All analyses were performed using Review Manager software (RevMan version 5.3; Cochrane Collaboration, London, UK).

3. RESULTS

3.1 Study selection

The study selection process as a PRISMA flowchart is shown in Figure 1. From the searched database, 1856 records were identified (1158 from PubMed, 487 from Scopus, 202 from Web of Science, and 9 from free search on Google Scholar). After subtraction of duplicates (261 records), the title and abstract of 1595 studies were reviewed, and 1551 studies were not included because they were not relevant. Thus, the full text of 44 studies was assessed, and eighteen studies were excluded. The remaining twenty-six studies were included in the systematic review and meta-analysis.

3.2 Study characteristics

Table 1 presents the data of descriptive analysis. The twenty-six studies were from fifteen countries, almost equally distributed. Croatia,[23-25] India,[14,26,27] Iran[16,19,28] and Turkey[20-31] contributed with 3 studies each, Brazil,[32,33] and United States[34, 35] with two studies each, and the other countries with one study each. All studies were published in English. Studies were published between 1994 and 2021.

Despite a significant variation in glass ionomer brand description, Fuji IX's most evaluated material (12 studies),[10,15,18,19,25,28-31,33,36,37] whereas G-Coat and Equia were the most evaluated coating agents, considered in 11 studies,[10,16,17,19,26-31,36] and 5 studies,[9,18,23,24,38] respectively. One single surface coating agent was compared with a control (uncoated) in twelve studies,[9,10,15,19,25,27-31,36,38] and the others fourteen studies compared two or more coating agents. Nine studies evaluated the effect of coating on glass ionomer microhardness,[6,9,16,18,19,28,32,33,39] 8 studies evaluated the fluoride release,[14,23,25-27,29,34,40] 11 studies evaluated the strength,[10,15,19,24,28,30,31,35-38] 5 studies evaluated flexural

strength,[10,24,28,30,38] 3 studies shear punch strength,[15,19,37] 2 studies evaluated diametral tensile strength,[35,36] and 1 study evaluated compressive strength.[31]

3.3 Risk of bias assessment

The risk of bias assessment for the included studies is displayed in Table 2. Five studies were judged as moderate risk of bias,[10,14,33,38,40] and the remaining eighteen as high risk. Unclear or absence of information about sample size calculation, a single operator responsible for specimens preparation, and blinding the operator responsible for the outcome analysis were observed in most studies.

3.4 Meta-analysis

Twenty-six included studies were considered in the meta-analysis. For the first analysis (fluoride release) (Figure 2), coated vs. control (uncoated), the overall effect was statistically significant ($Z = 9.62$; $p < 0.00001$), i.e., the use of coated material impairs the fluoride release from glass ionomer cement. A similar effect was found for subgroup analysis considering the evaluation time (after 7, 14, 21, 28 or 30, and more than 60 days). High heterogeneity was found (95%).

The overall meta-analysis considering microhardness (Figure 3) also show a statistically significant effect ($Z = 2.77$; $p = 0.006$) of coat reducing the mechanical property, with a heterogeneity parameter (I^2) of 92%. However, a subgroup analysis, considering immediate and 28 or 30 days evaluation did not show this negative effect ($Z = 1.11$; $p = 0.27$, and $Z = 1.38$; $p = 0.17$, respectively).

The third meta-analysis considering the strength data is depicted in Figure 4. The overall and subgroup analysis for the different evaluation times (immediate, 28/35 days, 8 weeks, 6, and 12 months) did not show a significant coated effect on glass ionomer cement

strength. The overall meta-analysis resulted in high heterogeneity (I^2=86%).

4. DISCUSSION

This meta-analysis set out to examine the effects of surface coating agents on glass ionomer cement properties. Pooled effect sizes across all considered glass ionomer properties outcomes showed that coating agents do not improve mechanical properties (strength) and impair the fluoride release and surface microhardness.

Glass ionomer cement has been considered an option to restore primary and permanent teeth because of its advantageous properties as adhesion to enamel and dentin, biocompatibility, and fluoride release. However, the long setting time,[36] and water sensitivity during the setting reaction can compromise the adequate maturation, impairing mechanical properties, and as a consequence, reducing the longevity of the restorations. Several surface coating agents have been suggested to protect the glass ionomer during the hardening and maturation process,[31] increasing the mechanical properties and clinical performance.[41,42] At the moment, there is no consensus regarding the best surface coating agent or even if it is really necessary, as there is no consensus about it.

The ability to release fluoride is considered a primary property of glass ionomer,[42] on account of caries inhibitory effect adjacent to restorations. A recent panel on the threshold properties for the clinical use of glass ionomer considered that higher fluoride release values with no significant erosion are desirable.[42] Eight studies identified in this review assessed the fluoride release of glass ionomer coated or uncoated.[14,23,25-27,29,34,40] The pooled effect size found significantly higher fluoride release values for uncoated groups, regardless of the evaluation time (immediate to more than 60 days). Higher fluoride release values of uncoated glass ionomer were expected as the setting reaction may extend for 24 hours.[23,25,26] During

this period, the immature glass ionomer is more soluble, and high levels of fluoride release are observed due to the wash-off effect.[26] The use of surface coating agents could inhibit the superficial wash-off effect,[14,26] reducing fluoride release. However, there was substantial heterogeneity among studies regarding specimens preparation, glass ionomer brands, storage media, and fluoride release evaluation method.

A similar trend was observed regarding the effect of coating agents on glass ionomer microhardness. Although no effect had been observed on immediate and 28/30 days, an adverse effect of coating agents on microhardness values was observed on overall and subgroup meta-analysis, considering the evaluation time +56 days. High heterogeneity was also observed, probably related to microhardness test parameters (Vickers and Knoop indenter and applied load), different surface coating agents evaluated, including petroleum jelly, nail varnish, and resinous coating agents. The poor hardness properties of coating agents because of the absence or low amount of fillers can explain the observed result. However, even after a longer storage time, coated agents could not able to improve glass ionomer microhardness. Microhardness is directly related to the compressive strength of a restorative material,[43] and both are considered as primary mechanical properties for glass ionomer restorations.[42] In the present systematic review, only one study evaluated compressive strength.[31] Another 10 studies evaluated flexural,[10,24,28,30,38] shear punch,[15,19,37] and diametral tensile strength.[35,36] Even so, no significant effect was observed for coating agents on glass ionomer strength, regardless of the evaluation time.

The included studies compared several surface coating agents, including petroleum jelly, nail varnish, adhesive systems, and light-cured resinous coat. G-Coat Plus (GC Corporation) and petroleum jelly were the most evaluated coated. Despite the differences in composition, no subgroup meta-analysis was performed considering the coating agents, whereas the considered control group was uncoated glass ionomer. Furthermore, subgroups

meta-analysis considering the longer evaluation time resulted in the same trend of immediate evaluation, confirming the absence of effect on strength or negative effect on fluoride release and microhardness, of surface coating agents compared to control.

Fuji IX (GC Corporation) was the most evaluated glass ionomer cement among the various cements used in the included studies. The diversity of glass ionomer cements, surface coating agents, and mainly, the non-standardized testing protocols are probably responsible for heterogeneity found for all overall meta-analyses. High heterogeneity is usual in a meta-analysis of laboratory studies,[22] and for this reason, the meta-analyses were performed using the random effect model. Furthermore, only five studies[10,14,33,38,40] presented a moderate risk of bias; the others presented a high risk of bias. The sample size calculation, random sequence of specimens allocation, a single operator responsible for specimens preparation, and blinded operator responsible for the outcome analysis were the most undescribed or unclear parameters considered in the risk of bias. The heterogeneity and the high risk of bias of the included studies also represent a limitation of this systematic review; thus, the results should be interpreted with caution. Nevertheless, the number of included studies, from several research groups, publication years, evaluating several glass ionomer cements, and coating agents available in the market, can provide a good overview of the research question. Even so, high-quality laboratory and clinical studies are needed to confirm the obtained results. Whereas laboratory studies can predict the clinical performance of glass ionomer restorations,[42] the results of this systematic review showed that surface coating agents may not be needed to obtain the best properties of glass ionomer cements, and may even impair the fluoride release.

5. CONCLUSION

The available evidence from laboratory studies indicates that surface coating agents do

not improve the mechanical properties of glass ionomer cement and impair the fluoride release. Our data suggest that surface coating on glass ionomer cements is not necessary.

Why this paper is important to pediatric dentists

Surface coating can not be used in clinical practice with no detrimental effect on glass ionomer cements.

The use of surface coating agents can jeopardize the fluoride release from glass ionomer cements.

Figure legends

Figure 1. Flow diagram for studies' search and inclusion according to PRISMA 2020.

Figure 2. Overall meta-analysis comparing the fluoride release from coated *vs* uncoated glass ionomer cements.

Figure 3. Forest plot for microhardness values comparing coated *vs* uncoated glass ionomer cements.

Figure 4. Forest plot for strength values comparing coated *vs* uncoated glass ionomer cements.

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Table 1. Descriptive data of included studies

Author	Country	Glass ionomer cement*	Coat*	Metodology	Sample size	Evaluation time
Bagheri et al., 2013[19]	Iran	Fuji IX (GC Corporation)	G-Coat Plus (GC Corporation)	Shear punch strength Vickers microhardness	N = 6 N = 3	24 hours 4 and 8 weeks
Bagheri et al., 2017[28]	Iran	Fuji IX Fast (GC Corporation) Riva Self Cure (SDI)	G-Coat Plus (GC Corporation)	Flexural strength Vickers microhardness	N = 5 N = 3	24 hours 1, 3 and 6 months
Bonifácio et al., 2011[10]	Netherlands	GC Fuji IX GP Extra (GC Europe) Ketac Molar (Aplicap) (3M ESPE)	G-Coat Plus (GC Europe)	Flexural strength	N = 10	24 hours
Brito et al., 2009[32]	Brazil	Ketac Molar Easy Mix (3M ESPE)	Cavitine (SS White) Magic Bond (Vigodent) Adper Single Bond (3M ESPE) Nail varnish (Colorama) Solid petroleum jelly**	Knoop microhardness	N = 10	24 hours
Brzovic-Rajic[23]	Croatia	Equia Fort (GC)	Equia Forte Coat (GC) Fuji varnish (GC)	Fluoride release	N = 6	24 hours 4, 30 and 60 days
Castro et al., 1994[34]	United States	Ketac Fil Aplicap (ESPE Premier)	Ketac varnish Visiobond (ESPE Premier) Scotchbond II LC (3M Dental Products)	Fluoride release	N = 5	7, 14, 21 and 28 days
Cho et al., 1995[35]	United States	Ketac-Bond Aplicap (ESPE)	Petroleum jelly (Vaseline, Chesebrough Ponds) Delton (Johnson a& Johnson)	Diametral tensile strength	N = 10	24 hours
Faraji et al., 2017[16]	Iran	Equia GI (GC America)	G-Coat (GC America) Margin Bond (Coltene/Whaledent)	Vickers microhardness	N = 20	24 hours 3 and 6 months
Fatima et al., 2013[39]	Paquistan	Vitrofil (DFL)	Petroleum jelly Varnish** Nail varnish**	Vickers microhardness	N = 18	24 hours

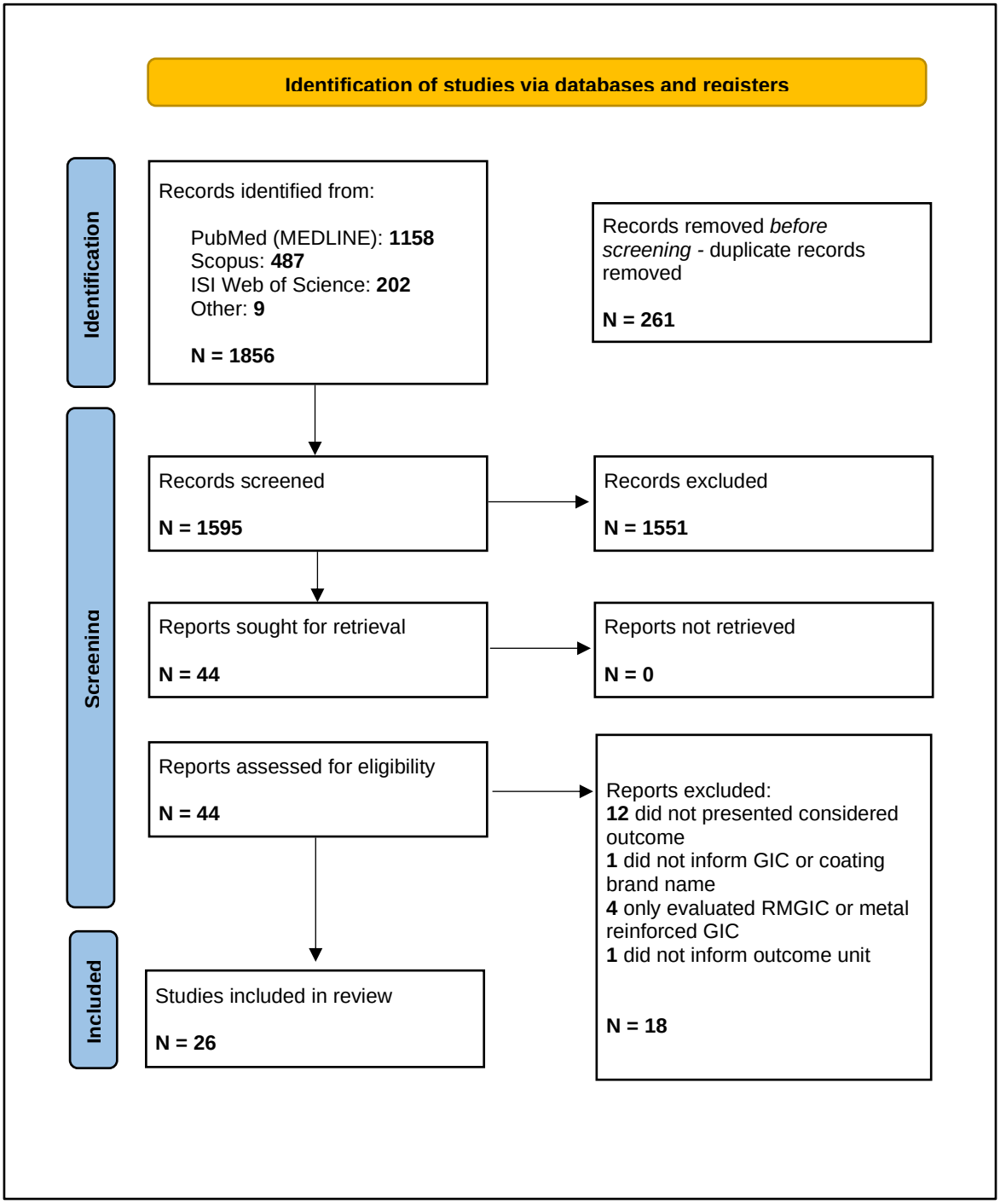
Gorseta et al., 2016[24]	Croatia	Fuji Equia Fil Ketac Molar Aplicap	Petroleum jelly (VaselineVR, Uniliver) EquiaCoat VR (GC)	Flexural strength	N = 6	24 hours
Habib et al., 2020[40]	Egypt	Equia Forte Fill (GC Corporation)	Equia Forte Coat (GC) Single Bond Universal (3M ESPE) Petroleum jelly (Hindustan Lever Ltd, Unilever)	Fluoride release	N = 6	24 hours 7, 14, 21, 28, 35, 42, 49, 56 and 63 days
Handoko et al. 2020[9]	Indonesia	Equia Forte Fill (GC)	Equia Forte Coat (GC)	Vickers microhardness	N = 10	24 hours
Hotta, Hirukawa, 1994[6]	Japan	Fuji Ionomer (GC Corp) Chelon-Fill (ESPE) Chemfil II (De Trey)	Occlusin (ICI) Bellfeel Brightener (Kanebo)	Knoop microhardness	N = 10	24 hours 7 days
Kamatham, Reddy, 2013[14]	India	Fuji II (GC Corporation)	Namuvar cavity varnish (Ratnagiri) Petroleum jelly (Vaseline, Hindustan lever ltd.)	Fluoride release	N = 10	24 hours 7 and 14 days
Kélic et al., 2020[25]	Croatia	Fuji IX Extra (GC Europe)	GC Fuji Coat LC (GC Europe)	Fluoride release	N = 6	24 hours 7, 28, 84 and 168 days
Kishore et al., 2016[26]	India	Fuji II (GC Corporation)	G-Coat Plus (GC corporation) Petroleum jelly (Vaseline, Hindustan Lever Ltd.)	Fluoride release	N = 10	24 hours 7 and 14 days
Leiskar et al., 2013[15]	Norway	Fuji IX GP Capsule (GC Corporation)	Fuji Coat LC (GC Corporation)	Shear punch strength	N = 16	24 hours 7, 15, 35 and 54 days
Novrizal et al., 2018[36]	Indonesia	Fuji IX GP Extra (GC Corporation)	GC Coat Plus (GC Corporation)	Diametral tensile strength	N - 6	24 hours 1 week
Pilo et al., 2017[37]	Israel	Ketac Molar (3M ESPE) Riva Self Cure (SDI) Ionofil Molar AC (VOCO) Fuji IX GP Fast (GC Corp)	Ketac Glaze (3M ESPE) Riva Coat LC (SDI) Final Varnish LC (VOCO) G-Coat Plus (GC Corp)	Shear punch strength	N = 15	24 hours 1 and 8 weeks

Ryu et al., 2019[18]	Korea	Fuji IX Extra (GC Europe)	Equia Coat (GC America) Adper Scotchbond Multi-Purpose adhesive (3M ESPE)	Vickers microhardness	N = 10	24 hours
Shintone et al., 2009[33]	Brazil	Vidrion R (SS White) Fuji IX (GC Corp.) Magic Glass ART (Vigodent) Maxxion R (FGM) Chem-Flex (Dentsply)	Nail varnish** Varnish recommended by the manufacturer	Vickers microhardness	N = 12	24 hours 7 and 30 days
Thongbai-on, Banomyoungm 2020[38]	Thailand	Equia Forte Fill (GC)	Equia Forte Coat (GC)	Flexural strength	N = 6	24 hours
Tiwari, Nandlal, 2013[27]	India	GC Gold Level (GC Corporation)	G-Coat Plus (GC Corporation)	Fluoride release	N = 10	24 hours 7, 14 and 21 days
Ugurlu, 2021[29]	Turkey	Fuji IX GP Capsule (GC)	G-Coat Plus (GC)	Fluoride release	N = 15	24 hours 7, 15, 21 and 28 days
Ugurlu, 2020 (a)[30]	Turkey	Fuji IX GP Capsule (GC)	G-Coat Plus (GC)	Flexural strength	N = 10	24 hours 1 year
Ugurlu, 2020 (b)[31]	Turkey	Fuji IX GP Capsule (GC)	G-Coat Plus (GC)	Flexural strength$ Compressive strength	N = 10	24 hours 1 year

* As described in the study.
** Brand not informed.
$ Data published previously. Not considered in the meta-analysis.

Table 2. Risk of bias

Author	Sample size calculation	Random sequence	Specimen preparation	Single operator	Manufactors' instructions	Outcome clearly described	Blinded operator	Risk of bias
Bagheri et al., 2013[19]	N	Y	Y	N	N	Y	N	**High**
Bagheri et al., 2017[28]	N	Y	Y	N	N	Y	N	**High**
Bonifácio et al., 2011[10]	N	Y	Y	N	Y	Y	N	**Moderate**
Brito et al., 2009[32]	N	N	Y	N	N	Y	N	**High**
Brzovic-Rajic et al., 2018[23]	N	N	Y	N	Y	Y	N	**High**
Castro et al., 1994[34]	N	N	Y	N	N	Y	N	**High**
Cho et al., 1995[35]	N	N	Y	N	N	Y	N	**High**
Faraji et al., 2017[16]	Y	N	Y	N	N	N	N	**High**
Fatima et al., 2013[39]	N	N	Y	N	Y	Y	N	**High**
Gorseta et al., 2016[24]	N	N	Y	N	N	Y	N	**High**
Habib et al., 2020[40]	Y	Y	Y	N	Y	Y	N	**Moderate**
Handoko et al. 2020[9]	N	N	Y	N	N	Y	N	**High**
Hotta, Hirukawa, 1994[6]	N	N	Y	N	Y	N	N	**High**
Kamatham, Reddy, 2013[14]	N	Y	Y	N	Y	Y	N	**Moderate**
Kélic et al., 2020[25]	N	N	Y	N	N	Y	N	**High**
Kishore et al., 2016[26]	N	N	Y	N	Y	Y	N	**High**
Leiskar et al., 2013[15]	N	N	Y	N	N	Y	N	**High**
Novrizal et al., 2018[36]	N	N	Y	N	Y	Y	N	**High**
Pilo et al., 2017[37]	N	Y	Y	N	N	Y	N	**High**
Ryu et al., 2019[18]	N	N	Y	N	Y	Y	N	**High**
Shintone et al., 2009[33]	N	Y	Y	N	Y	Y	N	**Moderate**
Thongbai-on, Banomyoung 2020[38]	N	Y	Y	Y	Y	Y	N	**Moderate**
Tiwari, Nandlal, 2013[27]	N	N	N	N	N	N	N	**High**
Ugurlu, 2021[29]	N	Y	Y	N	N	Y	N	**High**
Ugurlu, 2020 (a)[30]	N	Y	Y	N	N	Y	N	**High**
Ugurlu, 2020 (b)[31]	N	Y	Y	N	N	Y	N	**High**


Identification of studies via databases and registers
Identification
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Screening
Records screened
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Records excluded
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Reports sought for retrieval
N = 44
Reports not retrieved
N = 0
Reports assessed for eligibility
N = 44
Reports excluded:
12 did not presented considered outcome
1 did not inform GIC or coating brand name
4 only evaluated RMGIC or metal reinforced GIC
1 did not inform outcome unit
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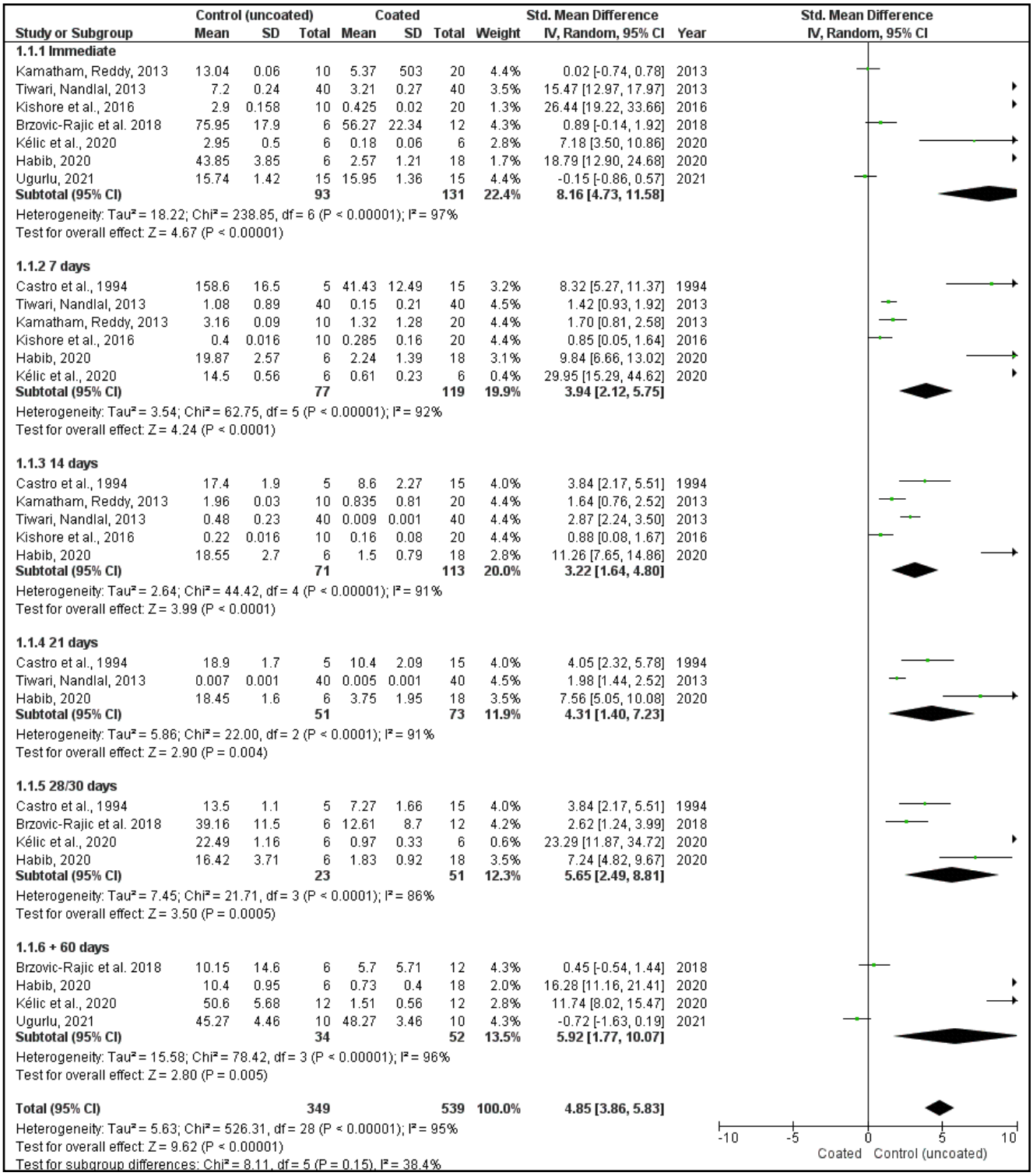
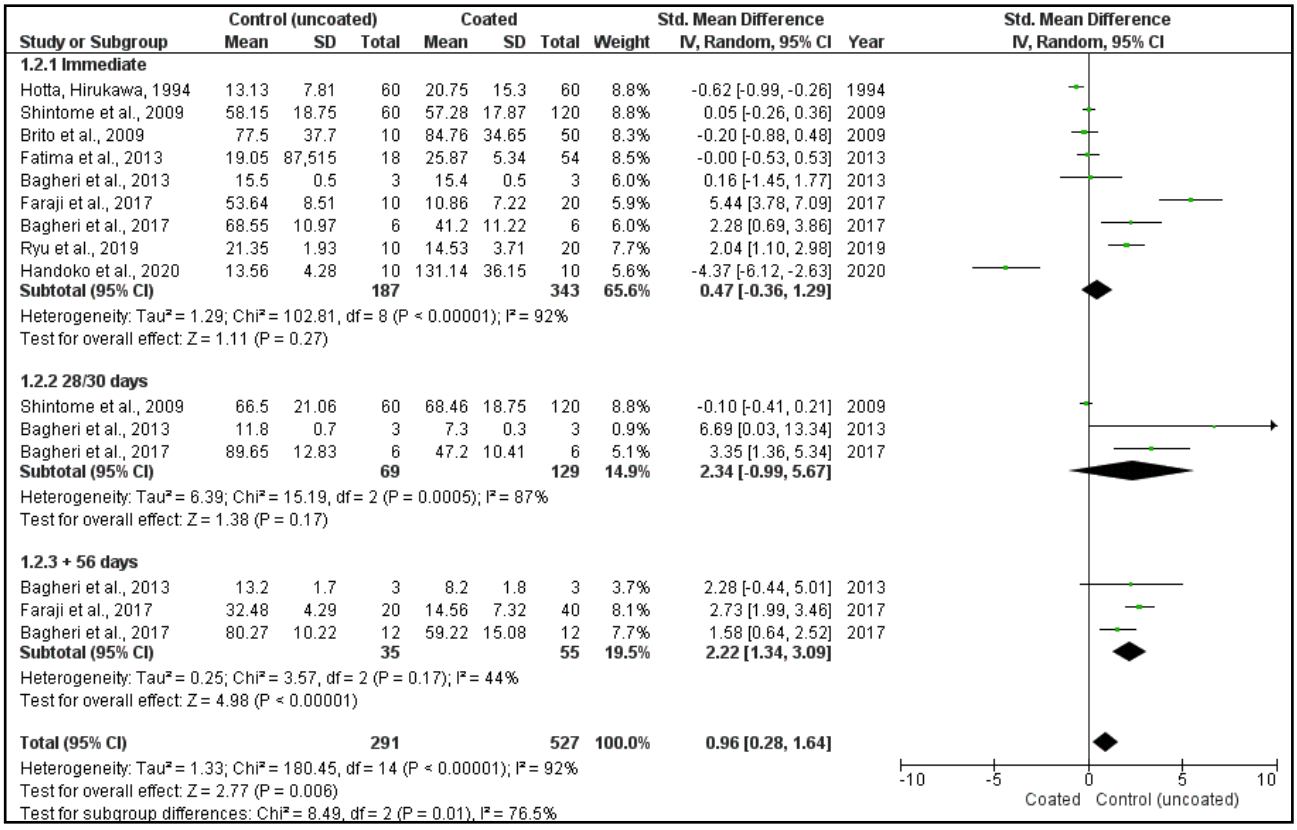
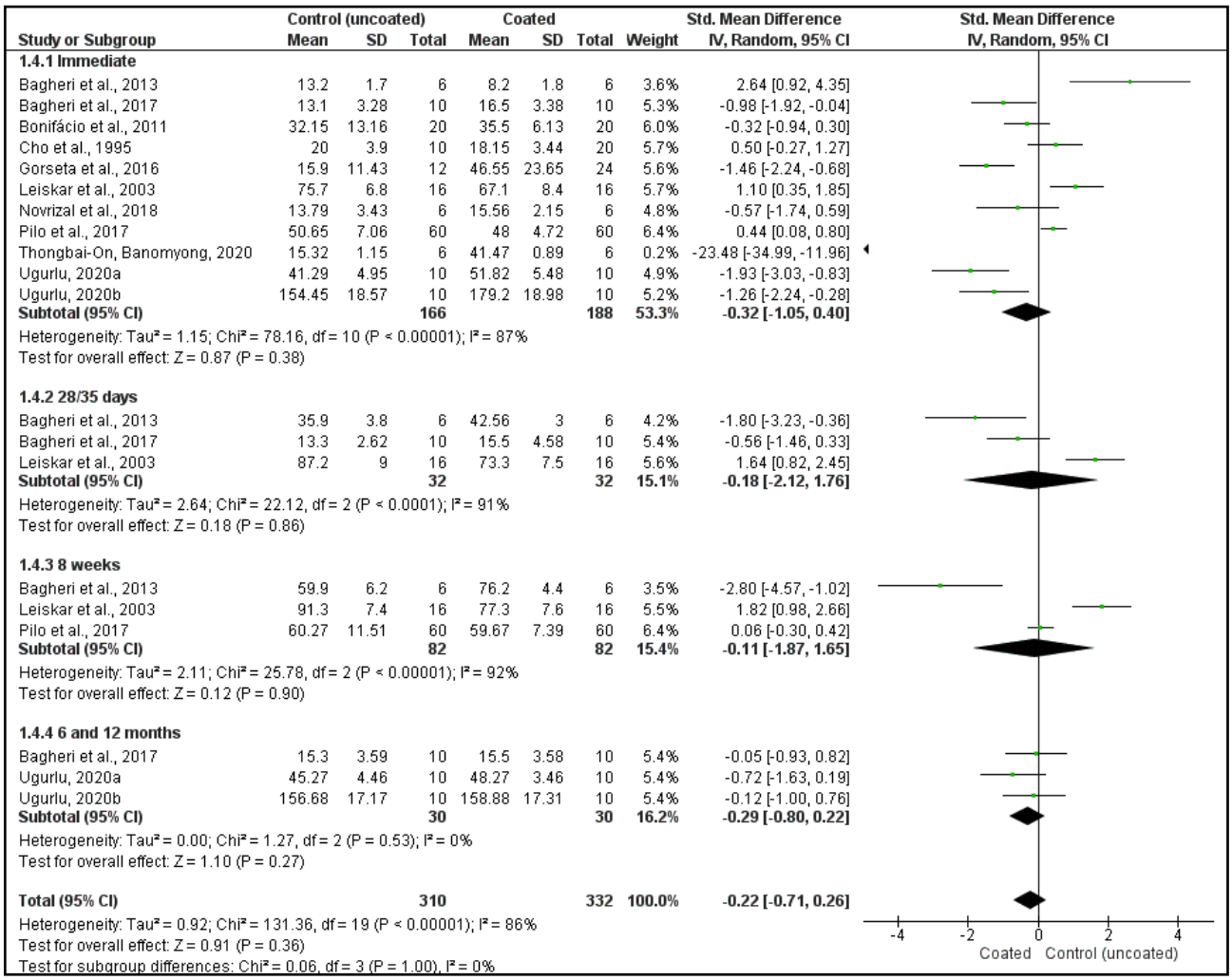
Included
Studies included in review
N = 26


Control (uncoated)
Coated
Std. Mean Difference
Std. Mean Difference
Study or Subgroup Mean SD Total Mean SD Total Weight IV, Random, 95% CI Year
IV, Random, 95% CI
1.1.1 Immediate
Kamatham, Reddy, 2013 13.04 0.06 10 5.37 503 20 4.4% 0.02 [-0.74, 0.78] 2013
Tiwari, Nandlal, 2013 7.2 0.24 40 3.21 0.27 40 3.5% 15.47 [12.97, 17.97] 2013
Kishore et al., 2016 2.9 0.158 10 0.425 0.02 20 1.3% 26.44 [19.22, 33.66] 2016
Brzovic-Rajic et al. 2018 75.95 17.9 6 56.27 22.34 12 4.3% 0.89 [-0.14, 1.92] 2018
Kélic et al., 2020 2.95 0.5 6 0.18 0.06 6 2.8% 7.18 [3.50, 10.86] 2020
Habib, 2020 43.85 3.85 6 2.57 1.21 18 1.7% 18.79 [12.90, 24.68] 2020
Ugurlu, 2021 15.74 1.42 15 15.95 1.36 15 4.4% -0.15 [-0.86, 0.57] 2021
Subtotal (95% CI) 93 131 22.4% 8.16 [4.73, 11.58]
Heterogeneity: Tau² = 18.22; Chi² = 238.85, df = 6 (P < 0.00001); I² = 97%
Test for overall effect: Z = 4.67 (P < 0.00001)
1.1.2 7 days
Castro et al., 1994 158.6 16.5 5 41.43 12.49 15 3.2% 8.32 [5.27, 11.37] 1994
Tiwari, Nandlal, 2013 1.08 0.89 40 0.15 0.21 40 4.5% 1.42 [0.93, 1.92] 2013
Kamatham, Reddy, 2013 3.16 0.09 10 1.32 1.28 20 4.4% 1.70 [0.81, 2.58] 2013
Kishore et al., 2016 0.4 0.016 10 0.285 0.16 20 4.4% 0.85 [0.05, 1.64] 2016
Habib, 2020 19.87 2.57 6 2.24 1.39 18 3.1% 9.84 [6.66, 13.02] 2020
Kélic et al., 2020 14.5 0.56 6 0.61 0.23 6 0.4% 29.95 [15.29, 44.62] 2020
Subtotal (95% CI) 77 119 19.9% 3.94 [2.12, 5.75]
Heterogeneity: Tau² = 3.54; Chi² = 62.75, df = 5 (P < 0.00001); I² = 92%
Test for overall effect: Z = 4.24 (P < 0.0001)
1.1.3 14 days
Castro et al., 1994 17.4 1.9 5 8.6 2.27 15 4.0% 3.84 [2.17, 5.51] 1994
Kamatham, Reddy, 2013 1.96 0.03 10 0.835 0.81 20 4.4% 1.64 [0.76, 2.52] 2013
Tiwari, Nandlal, 2013 0.48 0.23 40 0.009 0.001 40 4.4% 2.87 [2.24, 3.50] 2013
Kishore et al., 2016 0.22 0.016 10 0.16 0.08 20 4.4% 0.88 [0.08, 1.67] 2016
Habib, 2020 18.55 2.7 6 1.5 0.79 18 2.8% 11.26 [7.65, 14.86] 2020
Subtotal (95% CI) 71 113 20.0% 3.22 [1.64, 4.80]
Heterogeneity: Tau² = 2.64; Chi² = 44.42, df = 4 (P < 0.00001); I² = 91%
Test for overall effect: Z = 3.99 (P < 0.0001)
1.1.4 21 days
Castro et al., 1994 18.9 1.7 5 10.4 2.09 15 4.0% 4.05 [2.32, 5.78] 1994
Tiwari, Nandlal, 2013 0.007 0.001 40 0.005 0.001 40 4.5% 1.98 [1.44, 2.52] 2013
Habib, 2020 18.45 1.6 6 3.75 1.95 18 3.5% 7.56 [5.05, 10.08] 2020
Subtotal (95% CI) 51 73 11.9% 4.31 [1.40, 7.23]
Heterogeneity: Tau² = 5.86; Chi² = 22.00, df = 2 (P < 0.0001); I² = 91%
Test for overall effect: Z = 2.90 (P = 0.004)
1.1.5 28/30 days
Castro et al., 1994 13.5 1.1 5 7.27 1.66 15 4.0% 3.84 [2.17, 5.51] 1994
Brzovic-Rajic et al. 2018 39.16 11.5 6 12.61 8.7 12 4.2% 2.62 [1.24, 3.99] 2018
Kélic et al., 2020 22.49 1.16 6 0.97 0.33 6 0.6% 23.29 [11.87, 34.72] 2020
Habib, 2020 16.42 3.71 6 1.83 0.92 18 3.5% 7.24 [4.82, 9.67] 2020
Subtotal (95% CI) 23 51 12.3% 5.65 [2.49, 8.81]
Heterogeneity: Tau² = 7.45; Chi² = 21.71, df = 3 (P < 0.0001); I² = 86%
Test for overall effect: Z = 3.50 (P = 0.0005)
1.1.6 + 60 days
Brzovic-Rajic et al. 2018 10.15 14.6 6 5.7 5.71 12 4.3% 0.45 [-0.54, 1.44] 2018
Habib, 2020 10.4 0.95 6 0.73 0.4 18 2.0% 16.28 [11.16, 21.41] 2020
Kélic et al., 2020 50.6 5.68 12 1.51 0.56 12 2.8% 11.74 [8.02, 15.47] 2020
Ugurlu, 2021 45.27 4.46 10 48.27 3.46 10 4.3% -0.72 [-1.63, 0.19] 2021
Subtotal (95% CI) 34 52 13.5% 5.92 [1.77, 10.07]
Heterogeneity: Tau² = 15.58; Chi² = 78.42, df = 3 (P < 0.00001); I² = 96%
Test for overall effect: Z = 2.80 (P = 0.005)
Total (95% CI) 349 539 100.0% 4.85 [3.86, 5.83]
Heterogeneity: Tau² = 5.63; Chi² = 526.31, df = 28 (P < 0.00001); I² = 95%
Test for overall effect: Z = 9.62 (P < 0.00001)
Test for subgroup differences: Chi² = 8.11, df = 5 (P = 0.15), I² = 38.4%
-10
-5
0
5
10
Coated
Control (uncoated)


Control (uncoated)
Coated
Std. Mean Difference
Std. Mean Difference
Study or Subgroup Mean SD Total Mean SD Total Weight IV, Random, 95% CI Year
IV, Random, 95% CI
1.2.1 Immediate
Hotta, Hirukawa, 1994 13.13 7.81 60 20.75 15.3 60 8.8% -0.62 [-0.99, -0.26] 1994
Shintome et al., 2009 58.15 18.75 60 57.28 17.87 120 8.8% 0.05 [-0.26, 0.36] 2009
Brito et al., 2009 77.5 37.7 10 84.76 34.65 50 8.3% -0.20 [-0.88, 0.48] 2009
Fatima et al., 2013 19.05 87,515 18 25.87 5.34 54 8.5% -0.00 [-0.53, 0.53] 2013
Bagheri et al., 2013 15.5 0.5 3 15.4 0.5 3 6.0% 0.16 [-1.45, 1.77] 2013
Faraji et al., 2017 53.64 8.51 10 10.86 7.22 20 5.9% 5.44 [3.78, 7.09] 2017
Bagheri et al., 2017 68.55 10.97 6 41.2 11.22 6 6.0% 2.28 [0.69, 3.86] 2017
Ryu et al., 2019 21.35 1.93 10 14.53 3.71 20 7.7% 2.04 [1.10, 2.98] 2019
Handoko et al., 2020 13.56 4.28 10 131.14 36.15 10 5.6% -4.37 [-6.12, -2.63] 2020
Subtotal (95% CI) 187 343 65.6% 0.47 [-0.36, 1.29]
Heterogeneity: Tau² = 1.29; Chi² = 102.81, df = 8 (P < 0.00001); I² = 92%
Test for overall effect: Z = 1.11 (P = 0.27)
1.2.2 28/30 days
Shintome et al., 2009 66.5 21.06 60 68.46 18.75 120 8.8% -0.10 [-0.41, 0.21] 2009
Bagheri et al., 2013 11.8 0.7 3 7.3 0.3 3 0.9% 6.69 [0.03, 13.34] 2013
Bagheri et al., 2017 89.65 12.83 6 47.2 10.41 6 5.1% 3.35 [1.36, 5.34] 2017
Subtotal (95% CI) 69 129 14.9% 2.34 [-0.99, 5.67]
Heterogeneity: Tau² = 6.39; Chi² = 15.19, df = 2 (P = 0.0005); I² = 87%
Test for overall effect: Z = 1.38 (P = 0.17)
1.2.3 + 56 days
Bagheri et al., 2013 13.2 1.7 3 8.2 1.8 3 3.7% 2.28 [-0.44, 5.01] 2013
Faraji et al., 2017 32.48 4.29 20 14.56 7.32 40 8.1% 2.73 [1.99, 3.46] 2017
Bagheri et al., 2017 80.27 10.22 12 59.22 15.08 12 7.7% 1.58 [0.64, 2.52] 2017
Subtotal (95% CI) 35 55 19.5% 2.22 [1.34, 3.09]
Heterogeneity: Tau² = 0.25; Chi² = 3.57, df = 2 (P = 0.17); I² = 44%
Test for overall effect: Z = 4.98 (P < 0.00001)
Total (95% CI) 291 527 100.0% 0.96 [0.28, 1.64]
Heterogeneity: Tau² = 1.33; Chi² = 180.45, df = 14 (P < 0.00001); I² = 92%
Test for overall effect: Z = 2.77 (P = 0.006)
Test for subgroup differences: Chi² = 8.49, df = 2 (P = 0.01), I² = 76.5%
-10
-5
0
5
10
Coated
Control (uncoated)


Control (uncoated)
Coated
Std. Mean Difference
Std. Mean Difference
Study or Subgroup Mean SD Total Mean SD Total Weight IV, Random, 95% CI
IV, Random, 95% CI
1.4.1 Immediate
Bagheri et al., 2013 13.2 1.7 6 8.2 1.8 6 3.6% 2.64 [0.92, 4.35]
Bagheri et al., 2017 13.1 3.28 10 16.5 3.38 10 5.3% -0.98 [-1.92, -0.04]
Bonifácio et al., 2011 32.15 13.16 20 35.5 6.13 20 6.0% -0.32 [-0.94, 0.30]
Cho et al., 1995 20 3.9 10 18.15 3.44 20 5.7% 0.50 [-0.27, 1.27]
Gorseta et al., 2016 15.9 11.43 12 46.55 23.65 24 5.6% -1.46 [-2.24, -0.68]
Leiskar et al., 2003 75.7 6.8 16 67.1 8.4 16 5.7% 1.10 [0.35, 1.85]
Novrizal et al., 2018 13.79 3.43 6 15.56 2.15 6 4.8% -0.57 [-1.74, 0.59]
Pilo et al., 2017 50.65 7.06 60 48 4.72 60 6.4% 0.44 [0.08, 0.80]
Thongbai-On, Banomyong, 2020 15.32 1.15 6 41.47 0.89 6 0.2% -23.48 [-34.99, -11.96]
Ugurlu, 2020a 41.29 4.95 10 51.82 5.48 10 4.9% -1.93 [-3.03, -0.83]
Ugurlu, 2020b 154.45 18.57 10 179.2 18.98 10 5.2% -1.26 [-2.24, -0.28]
Subtotal (95% CI) 166 188 53.3% -0.32 [-1.05, 0.40]
Heterogeneity: Tau² = 1.15; Chi² = 78.16, df = 10 (P < 0.00001); I² = 87%
Test for overall effect: Z = 0.87 (P = 0.38)
1.4.2 28/35 days
Bagheri et al., 2013 35.9 3.8 6 42.56 3 6 4.2% -1.80 [-3.23, -0.36]
Bagheri et al., 2017 13.3 2.62 10 15.5 4.58 10 5.4% -0.56 [-1.46, 0.33]
Leiskar et al., 2003 87.2 9 16 73.3 7.5 16 5.6% 1.64 [0.82, 2.45]
Subtotal (95% CI) 32 32 15.1% -0.18 [-2.12, 1.76]
Heterogeneity: Tau² = 2.64; Chi² = 22.12, df = 2 (P < 0.0001); I² = 91%
Test for overall effect: Z = 0.18 (P = 0.86)
1.4.3 8 weeks
Bagheri et al., 2013 59.9 6.2 6 76.2 4.4 6 3.5% -2.80 [-4.57, -1.02]
Leiskar et al., 2003 91.3 7.4 16 77.3 7.6 16 5.5% 1.82 [0.98, 2.66]
Pilo et al., 2017 60.27 11.51 60 59.67 7.39 60 6.4% 0.06 [-0.30, 0.42]
Subtotal (95% CI) 82 82 15.4% -0.11 [-1.87, 1.65]
Heterogeneity: Tau² = 2.11; Chi² = 25.78, df = 2 (P < 0.00001); I² = 92%
Test for overall effect: Z = 0.12 (P = 0.90)
1.4.4 6 and 12 months
Bagheri et al., 2017 15.3 3.59 10 15.5 3.58 10 5.4% -0.05 [-0.93, 0.82]
Ugurlu, 2020a 45.27 4.46 10 48.27 3.46 10 5.4% -0.72 [-1.63, 0.19]
Ugurlu, 2020b 156.68 17.17 10 158.88 17.31 10 5.4% -0.12 [-1.00, 0.76]
Subtotal (95% CI) 30 30 16.2% -0.29 [-0.80, 0.22]
Heterogeneity: Tau² = 0.00; Chi² = 1.27, df = 2 (P = 0.53); I² = 0%
Test for overall effect: Z = 1.10 (P = 0.27)
Total (95% CI) 310 332 100.0% -0.22 [-0.71, 0.26]
Heterogeneity: Tau² = 0.92; Chi² = 131.36, df = 19 (P < 0.00001); I² = 86%
Test for overall effect: Z = 0.91 (P = 0.36)
Test for subgroup differences: Chi² = 0.06, df = 3 (P = 1.00), I² = 0%
-4
-2
0
2
4
Coated
Control (uncoated)

3. CONCLUSÃO

Por meio da revisão sistemática e meta-análise realizada pode-se concluir que o uso de agentes de proteção superficial reduz as propriedades de liberação de flúor e dureza dos cimentos de ionômero de vidro sem proporcionar benefícios na resistência do material. Diante disso, pode-se sugerir que o emprego dos agentes de proteção superficial não é necessário na prática clínica.

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SIDHU S.; NICHOLSON J.; A review of glass-ionomer cements for clinical dentistry. **Journal of Functional Biomaterials,** v. 7, n. 3, p. E16, 2016.

ULUSOY AT.; TUNC ES.; BAYRAK Ş. Clinical performance of a glass ionomer sealant protected with two different resin-based agents over a 2-year follow-up period. **European Journal of Paediatric Dentistry**, v. 18, n. 1, p. 10 - 14, 2017.

ANEXO 1

Author Guidelines

Sections

1. SUBMISSION

Authors should kindly note that submission implies that the content has not been published or submitted for publication elsewhere except as a brief abstract in the proceedings of a scientific meeting or symposium.

Once the submission materials have been prepared in accordance with the Author Guidelines, manuscripts should be submitted online at https://mc.manuscriptcentral.com/ijpd

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2. AIMS AND SCOPE

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3. MANUSCRIPT CATEGORIES AND REQUIREMENTS

i. Original Articles

Divided into: Summary, Introduction, Material and methods, Results, Discussion, Bullet points, Acknowledgements, References, Figure legends, Tables and Figures arranged in this order.

- **Summary** should be structured using the following subheadings: Background, Hypothesis or Aim, Design, Results, and Conclusions and should be less than 200 words.
- **Introduction** should be brief and end with a statement of the aim of the study or hypotheses tested. Describe and cite only the most relevant earlier studies. Avoid presentation of an extensive review of the field.
- **Material and methods** should be clearly described and provide enough detail so that the observations can be critically evaluated and, if necessary repeated. Use section subheadings in a logical order to title each category or method. Use this order also in the results section. Authors should have considered the ethical aspects of their research and should ensure that the project was approved by an appropriate ethical committee, which should be stated. Type of statistical analysis must be described clearly and carefully.
- **Results** should clearly and concisely report the findings, and division using subheadings is encouraged. Double documentation of data in text, tables or figures is not acceptable. Tables and figures should not include data that can be given in the text in one or two sentences.
- **Discussion** section presents the interpretation of the findings. This is the only proper section for subjective comments and reference to previous literature. Avoid repetition of results, do not use subheadings or reference to tables in the results section.
- **Bullet Points:** Authors will need to provide no more than 3 ‘key points ’that summarise the key messages of their paper to be published with their article. The key points should be written with a practitioner audience in mind under the heading:
- *Why this paper is important to paediatric dentists.

References: Maximum 30.

ii. Review Articles

May be invited by the Editor.

iii. Systematic reviews

We consider publishing systematic reviews if the manuscript has comprehensive and unbiased sampling of literature and covering topics related to Paediatric Dentistry.
References: Maximum 30.
Articles for the *International Journal of Paediatric Dentistry* should include: a) description of search strategy of relevant literature (search terms and databases), b) inclusion criteria (language, type of studies i.e. randomized controlled trial or other, duration of studies and chosen endpoints, c) evaluation of papers and level of evidence. For examples see:
Twetman S, Axelsson S, Dahlgren H et al. Caries-preventive effect of fluoride toothpaste: a systematic review. Acta Odontologica Scandivica 2003; 61: 347-355.
Paulsson L, Bondemark L, Söderfeldt B. A systematic review of the consequences of premature birth on palatal morphology, dental occlusion, tooth-crown dimensions, and tooth maturity and eruption. Angle Orthodontist 2004; 74: 269-279.

iv. Short Communications

Brief scientific articles or short case reports may be submitted, which should be no longer than three pages of double-spaced text and include a maximum of three illustrations. They should contain important, new, definitive information of sufficient significance to warrant publication. They should not be divided into different parts and summaries are not required.
References: Maximum 30.

v. Brief Clinical Reports/Case Reports

Short papers not exceeding 800 words, including a maximum of three illustrations and five references may be accepted for publication if they serve to promote communication between clinicians and researchers. If the paper describes a genetic disorder, the OMIM unique six-digit number should be provided for online cross reference (Online Mendelian Inheritance in Man).
A paper submitted as a Brief Clinical/Case Report should include the following:

- a short **Introduction** (avoid lengthy reviews of literature);
- the **Case report** itself (a brief description of the patient/s, presenting condition, any special

investigations and outcomes);
- a **Discussion** which should highlight specific aspects of the case(s), explain/interpret the main findings and provide a scientific appraisal of any previously reported work in the field.
- **Bullet Points:** Authors will need to provide no more than 3 ‘key points ’that summarise the key messages of their paper to be published with their article. The key points should be written with a practitioner audience in mind under the heading:
- *Why this paper is important to paediatric dentists.

vi. Letters to the Editor
Letters should be no more than 1,500 words, with no more than 10 references. There should be no abstract, tables or figures.

4. PREPARING THE SUBMISSION

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The manuscript should be submitted in separate files: title page; main text file; figures.

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The title page should contain:
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ii. A short running title of less than 50 characters;
iii. The full names of the authors and a statement of author contributions, e.g.
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iv. The author's institutional affiliations where the work was conducted, with a footnote for the author’s present address if different from where the work was conducted;
v. Acknowledgments;
vi. Word count (excluding tables)

Authorship
Please refer to the journal’s authorship policy the Editorial Policies and Ethical Considerations section for details on eligibility for author listing.

Acknowledgments
Contributions from anyone who does not meet the criteria for authorship should be listed, with permission from the contributor, in an Acknowledgments section. Financial and material support should also be mentioned. Thanks to anonymous reviewers are not appropriate.

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As papers are double-blind peer reviewed the main text file should not include any information that might identify the authors.
The main text file should be presented in the following order:
i. Title, abstract and key words;
ii. Main text;
iii. References;
iv. Tables (each table complete with title and footnotes);
v. Figure legends;
vi. Appendices (if relevant).
Figures and supporting information should be supplied as separate files.

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Please provide 3-6 keywords. Keywords should be taken from the list provided at submission in ScholarOne.

Main Text
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- The journal uses British spelling; however, authors may submit using either option, as spelling of accepted papers is converted during the production process.

References
All references should be numbered consecutively in order of appearance and should be as complete as possible. In text citations should cite references in consecutive order using Arabic superscript numerals. For more information about AMA reference style please consult the **AMA Manual of Style**
Sample references follow:

Journal article
1. King VM, Armstrong DM, Apps R, Trott JR. Numerical aspects of pontine, lateral reticular, and inferior olivary projections to two paravermal cortical zones of the cat cerebellum. J Comp Neurol 1998;390:537-551.

Book
2. Voet D, Voet JG. Biochemistry. New York: John Wiley & Sons; 1990. 1223 p.

Internet document
3. American Cancer Society. Cancer Facts & Figures 2003.
http://www.cancer.org/downloads/STT/CAFF2003PWSecured.pdf Accessed March 3, 2003

Tables
Tables should be self-contained and complement, not duplicate, information contained in the text. They should be supplied as editable files, not pasted as images. Legends should be concise but comprehensive – the table, legend, and footnotes must be understandable without reference to the text. All abbreviations must be defined in footnotes. Footnote symbols: †, ‡, §, ¶, should be used (in that order) and *, **, *** should be reserved for P-values. Statistical measures such as SD or SEM should be identified in the headings.

Figure Legends
Legends should be concise but comprehensive – the figure and its legend must be understandable without reference to the text. Include definitions of any symbols used and define/explain all abbreviations and units of measurement.

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Although authors are encouraged to send the highest-quality figures possible, for peer-review purposes, a wide variety of formats, sizes, and resolutions are accepted.
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In the text, please reference figures as for instance 'Figure 1', 'Figure 2' to match the tag name you choose for the individual figure files uploaded.

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Model Organisms: "Experiments were conducted in c. elegans strain SP304 (RRID:CGC_SP304)"
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Tools, Software, and Databases: "Image analysis was conducted with CellProfiler Image Analysis

Software, V2.0 (http://www.cellprofiler.org, RRID:nif-0000-00280)"

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statement.org. A **CONSORT checklist** should also be included in the submission material under "Supplementary Files for Review".
If your study is a randomized clinical trial, you will need to fill in all sections of the CONSORT Checklist. If your study is not a randomized trial, not all sections of the checklist might apply to your manuscript, in which case you simply fill in N/A.
All prospective clinical trials which have a commencement date after the 31st January 2017 must be registered with a public trials registry: **www.clinicaltrials.gov**, **http://clinicaltrials.ifpma.org/clinicaltrials/**, **http://isrctn.org/**. The clinical trial registration number and name of the trial register will then be published with the paper.

Research Reporting Guidelines
Accurate and complete reporting enables readers to fully appraise research, replicate it, and use it. The guidelines listed below should be followed where appropriate and where applicable, checklists, and flow diagrams uploaded with your submission; these may be published alongside the final version of your paper.
• **Observational studies** : **STROBE** checklists for cohort, case-control, and cross-sectional studies, either individual or combined
• **Systematic reviews** : **PRISMA**
• Meta-analyses of observational studies: **MOOSE**
• **Case reports** : **CARE**
• In vitro studies: **CRIS**
• **Qualitative research** : **COREQ**
• **Diagnostic / prognostic studies** : **STARD**
• **Quality improvement studies** : **SQUIRE**
• **Economic evaluations** : **CHEERS**
• **Animal pre-clinical studies** : **ARRIVE**
• **Study protocols** : **SPIRIT**
• **Clinical practice guidelines** : **AGREE**

The **Equator Network** (Enhancing the Quality and Transparency Of Health Research) provides a comprehensive list of reporting guidelines.

We also encourage authors to refer to and follow guidelines from:
• **Future of Research Communications and e-Scholarship (FORCE11)**
• **National Research Council's Institute for Laboratory Animal Research guidelines**
• **The Gold Standard Publication Checklist from Hooijmans and colleagues**
• **Minimum Information Guidelines from Diverse Bioscience Communities (MIBBI) website**
• **FAIRsharing website**

Sequence Data

Nucleotide sequence data can be submitted in electronic form to any of the three major collaborative databases: DDBJ, EMBL, or GenBank. It is only necessary to submit to one database as data are exchanged between DDBJ, EMBL, and GenBank on a daily basis. The suggested wording for referring to accession-number information is: 'These sequence data have been submitted to the DDBJ/EMBL/GenBank databases under accession number U12345'. Addresses are as follows:
- DNA Data Bank of Japan (DDBJ): www.ddbj.nig.ac.jp
- EMBL Nucleotide Archive: ebi.ac.uk/ena
- GenBank: www.ncbi.nlm.nih.gov/genbank

Proteins sequence data should be submitted to either of the following repositories:
- Protein Information Resource (PIR): pir.georgetown.edu
- SWISS-PROT: expasy.ch/sprot/sprot-top

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For papers describing structural data, atomic coordinates and the associated experimental data should be deposited in the appropriate databank (see below). **Please note that the data in databanks must be released, at the latest, upon publication of the article.** We trust in the cooperation of our authors to ensure that atomic coordinates and experimental data are released on time.

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Author Guidelines Updated 08 February 2021

ANEXO 2

PRISMA CHECK LIST

Section and Topic	Item #	Checklist item	Location where item is reported
TITLE			
Title	1	Identify the report as a systematic review.	Page 11
ABSTRACT			
Abstract	2	See the PRISMA 2020 for Abstracts checklist.	Page 13
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of existing knowledge.	Pages 14, 15
Objectives	4	Provide an explicit statement of the objective(s) or question(s) the review addresses.	Page 15
METHODS			
Eligibility criteria	5	Specify the inclusion and exclusion criteria for the review and how studies were grouped for the syntheses.	Page 16
Information sources	6	Specify all databases, registers, websites, organisations, reference lists and other sources searched or consulted to identify studies. Specify the date when each source was last searched or consulted.	Page 15
Search strategy	7	Present the full search strategies for all databases, registers and websites, including any filters and limits used.	Page 15
Selection process	8	Specify the methods used to decide whether a study met the inclusion criteria of the review, including how many reviewers screened each record and each report retrieved, whether they worked independently, and if applicable, details of automation tools used in the process.	Page 16
Data collection process	9	Specify the methods used to collect data from reports, including how many reviewers collected data from each report, whether they worked independently, any processes for obtaining or confirming data from study investigators, and if applicable, details of automation tools used in the process.	Pages 16, 17
Data items	10a	List and define all outcomes for which data were sought. Specify whether all results that were compatible with each outcome domain in each study were sought (e.g. for all measures, time points, analyses), and if not, the methods used to decide which results to collect.	Pages 15, 16
	10b	List and define all other variables for which data were sought (e.g. participant and intervention characteristics, funding sources). Describe any assumptions made about any missing or unclear information.	-
Study risk of bias assessment	11	Specify the methods used to assess risk of bias in the included studies, including details of the tool(s) used, how many reviewers assessed each study and whether they worked independently, and if applicable, details of automation tools used in the process.	Page 17
Effect measures	12	Specify for each outcome the effect measure(s) (e.g. risk ratio, mean difference) used in the synthesis or presentation of results.	Page 17
Synthesis methods	13a	Describe the processes used to decide which studies were eligible for each synthesis (e.g. tabulating the study intervention characteristics and comparing against the planned groups for each synthesis (item #5)).	Page 17
	13b	Describe any methods required to prepare the data for presentation or synthesis, such as handling of missing summary statistics, or data conversions.	Page 17
	13c	Describe any methods used to tabulate or visually display results of individual studies and syntheses.	Page 17
	13d	Describe any methods used to synthesize results and provide a rationale for the choice(s). If meta-analysis was performed, describe the model(s), method(s) to identify the presence and extent of statistical heterogeneity, and software package(s) used.	Page 17
	13e	Describe any methods used to explore possible causes of heterogeneity among study results (e.g. subgroup analysis, meta-regression).	Page 17
	13f	Describe any sensitivity analyses conducted to assess robustness of the synthesized results.	Page 17
Reporting bias assessment	14	Describe any methods used to assess risk of bias due to missing results in a synthesis (arising from reporting biases).	Page 17

Section and Topic	Item #	Checklist item	Location where item is reported
Certainty assessment	15	Describe any methods used to assess certainty (or confidence) in the body of evidence for an outcome.	-
RESULTS			
Study selection	16a	Describe the results of the search and selection process, from the number of records identified in the search to the number of studies included in the review, ideally using a flow diagram.	Page 18
	16b	Cite studies that might appear to meet the inclusion criteria, but which were excluded, and explain why they were excluded.	Page 18
Study characteristics	17	Cite each included study and present its characteristics.	Page 18
Risk of bias in studies	18	Present assessments of risk of bias for each included study.	Page 19
Results of individual studies	19	For all outcomes, present, for each study: (a) summary statistics for each group (where appropriate) and (b) an effect estimate and its precision (e.g. confidence/credible interval), ideally using structured tables or plots.	Figures 2 a 4, Page 19
Results of syntheses	20a	For each synthesis, briefly summarise the characteristics and risk of bias among contributing studies.	Figures 2 a 4, Page 19
	20b	Present results of all statistical syntheses conducted. If meta-analysis was done, present for each the summary estimate and its precision (e.g. confidence/credible interval) and measures of statistical heterogeneity. If comparing groups, describe the direction of the effect.	Figures 2 a 4, Page 19
	20c	Present results of all investigations of possible causes of heterogeneity among study results.	Figures 2 a 4, Page 19
	20d	Present results of all sensitivity analyses conducted to assess the robustness of the synthesized results.	Figures 2 a 4, Page 19
Reporting biases	21	Present assessments of risk of bias due to missing results (arising from reporting biases) for each synthesis assessed.	Table 2
Certainty of evidence	22	Present assessments of certainty (or confidence) in the body of evidence for each outcome assessed.	-
DISCUSSION			
Discussion	23a	Provide a general interpretation of the results in the context of other evidence.	Pages 20, 21
	23b	Discuss any limitations of the evidence included in the review.	Pages 20, 21
	23c	Discuss any limitations of the review processes used.	Page 22
	23d	Discuss implications of the results for practice, policy, and future research.	Page 22
OTHER INFORMATION			
Registration and protocol	24a	Provide registration information for the review, including register name and registration number, or state that the review was not registered.	-
	24b	Indicate where the review protocol can be accessed, or state that a protocol was not prepared.	-
	24c	Describe and explain any amendments to information provided at registration or in the protocol.	-
Support	25	Describe sources of financial or non-financial support for the review, and the role of the funders or sponsors in the review.	-
Competing interests	26	Declare any competing interests of review authors.	-
Availability of data, code and other materials	27	Report which of the following are publicly available and where they can be found: template data collection forms; data extracted from included studies; data used for all analyses; analytic code; any other materials used in the review.	-