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Review Article

Caries Preventive Effect and Retention of Moisture Tolerant Resin Based and Glass Ionomer Cement Sealants: A Systematic Review

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ABSTRACT

The traditional preventive method for treating decay often entails resin-based sealants, topical fluoride application and Glass Ionomer based sealants (GIC sealants). At present, topical fluoride application is less effective when compared with the pit and fissure sealant, as resin sealants were mentioned to be efficient in preventing occlusal cavities in both primary and permanent teeth by formation of resin tags. However, moisture contamination is a more common problem encountered with hydrophobic sealants, but not with GIC sealants, as they are not as moisture sensitive as hydrophobic resins. Hence, hydrophilic sealants were developed. Therefore, this current systematic review evaluated the current literature on the efficacy of caries prevention and retention between moisture-tolerant resin and GIC -based sealants among children and adolescents aged 6-18 years. Clinical trials assessing the effectiveness of Moisture Tolerant resin and GIC based sealant among 6-18 years of age groups, the follow-up duration exceedingly over 6 months were added. Two reviewers (J;JJ) extracted data data separately from the included publications, which they then integrated. Cochrane risk of assessment tool {RoB2} was used to evaluate the study's quality. Following six and twelve months, there was statistical significance in the caries prevention and retention of moisture tolerant resin-based sealants over GIC based sealants. The retention of moisture-tolerant sealants was statistically significant in all five of the selected experiments when compared to GIC sealants, showing the effectiveness of moisture-tolerant sealants in terms of retention.

Keywords Pit and fissure, Glass ionomer, Hydrophilic sealants.

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INTRODUCTION

Dental caries is a chronic disorder that depends on sugar. It lowers life quality and negatively affects the oral cavity, causing discomfort, tooth decay, cavity formation and structural damage to teeth.[1] First Permanent Molars (FPMs) have the most pits and fissures among the molars and they are usually helpless against dental caries, with approximately 60% of caries occurring in FPMs and 90% occurring in permanent teeth.[2] The most effective preventive measure for occlusal caries was reported to be pit and fissure sealants.[3-5]

A few variables can affect the longevity; the type of bonded enamel, the sort of surface treatment, amount of isolation that has been performed, depending upon the sort of sealant material used. The key indicator of the sealant's effectiveness is retention and marginal integration, which has been showed to lower the incidence of caries in pit and fissure regions. This issue can antagonistically influence the retention of these materials, especially with hydrophobic resin-based sealants. Since they cannot be used as effectively in outreach campaigns. To overcome this, the dental market launched these hydrophilic sealants.[6,7]

Recently, hydrophilic Moisture -tolerant sealants have been proposed as a promising solution for fissure caries. Moisture-tolerant resin-based sealants that can attach to enamel even in wet conditions were used to develop hydrophilic resin innovation.[8,9] The intrinsic capacity of the moisture-tolerant sealants seeps more profoundly into the pits and fissures even

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in presence of moisture, less technique-sensitive and easier to handle.[10,11] Therefore, these sealants are easier to use on children and especially in outreach programs where moisture control is poor.

There are various alternatives for caries preventive measures followed in outreach programs, one among them is Glass Ionomer Cement (GIC) based sealants,[12] as these sealants has been considered to be an alternative to resin-based sealants in situations where moisture control is a problem.[13]

One major drawback of resin-hydrophobic sealed fissures is that they are highly susceptible to moisture, making partial molar etching difficult. In place of this, glass ionomers have been showed to be an effective material for filling pits and fissures, exhibit lower moisture sensitivity than resins and play a significant role in their capacity to adhere to tooth structure and deliver fluoride.[14]

However, when used as a sealer for pits and fissures, the conventional glass-ionomer cements have demonstrated extremely low retention rates and leakage even in cases when they are entirely retained.[15-17]

Many research that showed contradictory results contrasted GIC sealants with pit and fissure sealants.[18-20] The efficacy and clinical performances of moisture-tolerant sealants should be explained using evidence-based material, as they were only introduced recently in comparison to the gold standard GIC sealants because of specific disadvantages of the latter. As far as we know, no systematic review has compared the preservation of GIC sealants with moisture-tolerant sealants.[21,22]

Our systematic review is expected to resolve inquiries: In the first place, when compared to GIC, clinical use of moisture-tolerant sealants in permanent and primary posterior teeth shows good retention. Second, in terms of the cariostatic impact, the use of moisture-tolerant sealants in primary and permanent teeth is comparable to GIC. In order to prevent dental cavities in children and adolescents aged 6 to 18, this systematic study set out to evaluate the retention efficacy of moisture-tolerant resin-based and GIC sealants.

MATERIALS AND METHODS

Protocol and Registration

The PRISMA declaration and the Preferred Reporting Items for Systematic Reviews guidelines were followed during the systematic review process. On November 11, 2023, the study was registered in the PROSPERO (International Prospective Register of Systematic Review) database (CRD42023477929).

Eligibility criteria

Participants

Healthy Children, adolescents between 6-18 years with sound or incipient carious primary or permanent molars are indicated for fissure sealant application.

Intervention

Application of Moisture Tolerant Resin Sealants.

Comparison

The comparison group included GIC based Sealants.

Outcome

The major outcome was the retention of the two kinds of sealants in a 12-month follow-up period and more. Retention was assessed through visual and tactile examination using different criteria including Modified version of the Color Covering Caries Sealant Evaluation System, Modified Simonsen's criteria, complete/partial retention and complete failure. The second outcome was the cariostatic effect.

Study design

For inclusion, clinical trials assessing the effectiveness of Moisture Tolerant Resin and GIC based sealants. 6-18 year's children, adolescents and the follow-up duration exceedingly more than 6 months were included. Theoretical reviews and non-fluoride releasing resin-based sealants were excluded. Studies that did not have an acceptable control group (Hydrophilic resin-based sealants.) Studies that did not assess retention and/or caries. Studies that did not have a comparable follow-up for a sample of both arms.

Information Sources and Search Strategy

A comprehensive literature search of the following databases was done which included studies of the PubMed, Google Scholar, Web of Science, Scopus, Cochrane database of systematic reviews, Science direct, Lilacs databases. And we used WHO Clinical Trials Registry Platform and Clinical Trial Registry of India.

Search Terms

(School children) OR (Children)00 OR (Adolescents)) OR (Permanent molars) OR (Permanent dentition0) OR (Preventive dentistry) AND (Pit and fissure sealants) OR (Embrace wet bond) OR (Moisture tolerant resin sealants) OR (resin sealants) OR (hydrophilic sealants) OR (ART sealants) OR (UltraSeal XT Hydro) AND (Glass ionomer sealants) OR (Giomer sealants) OR (GC Fuji TRIAGE) OR (Glass carbomer) AND (Caries prevention) OR (Retention) OR (Sealant retention) OR (Caries development) Filters: Clinical Trial, Randomized Controlled Trial.

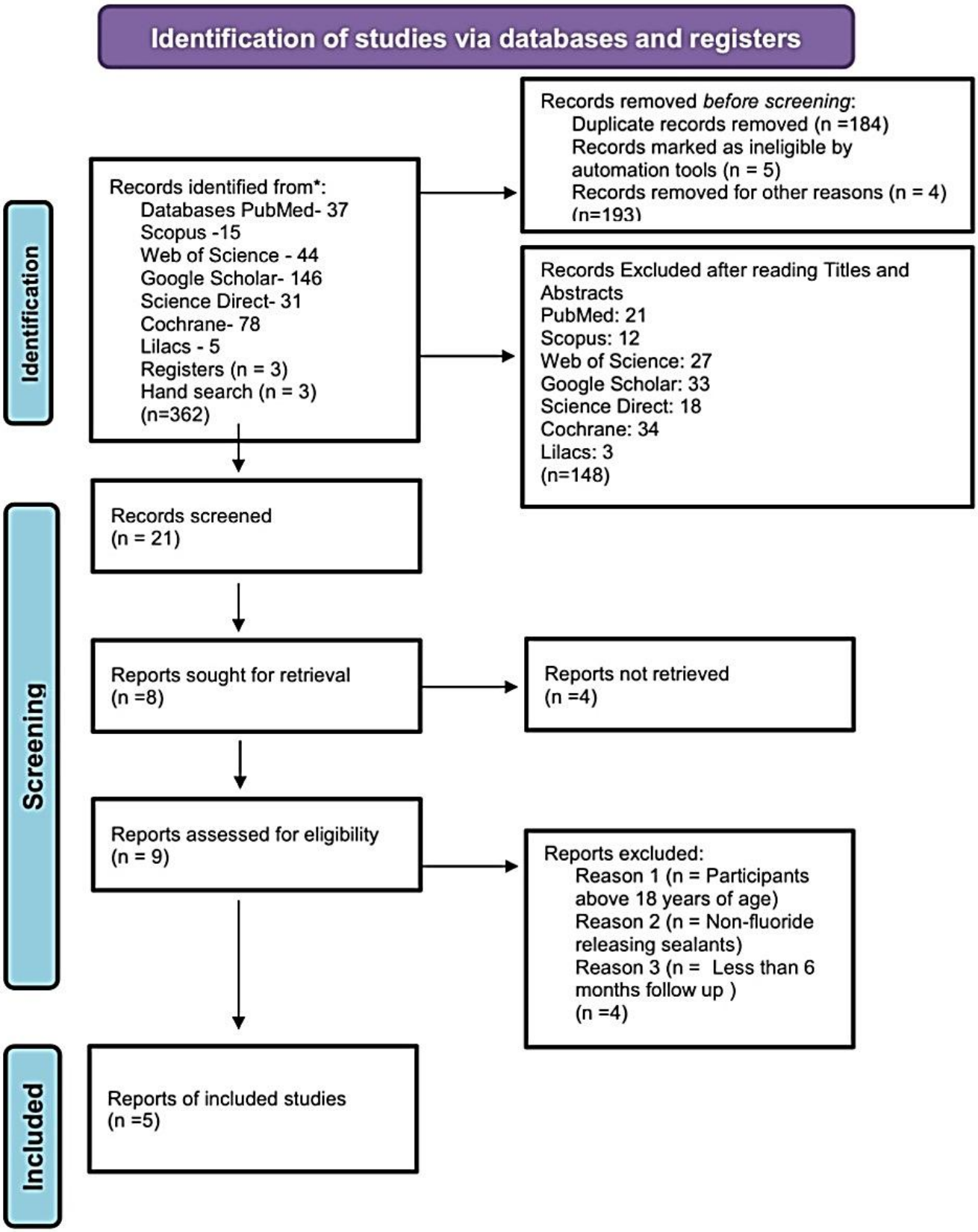

Figure 1: PRISMA Flowchart.

Study Selection and Data Extraction

Two reviewers (J) (J.J.) independently examined each chosen paper to ascertain if the title and abstract satisfied the requirements for inclusion. The identical reviewers conducted independent reviews of the full-text publications of a select few studies. Using a predetermined procedure, two reviewers (J) (J.J.) evaluated the chosen articles independently and an extraction datasheet contained documentation of the data extraction process. Publication year, Author and Journal, study setting (country), sample size, number of participants, No and type of dentition, randomization, intervention, allocation concealment, the follow-up time, assessment criteria and the retention and cariostatic effect result were among the extracted data included in the analysis.

Quality Assessment and Bias Risk Assessment

Using the Cochrane Risk of Bias Assessment method (RoB2), the quality of the assessment was evaluated,[23] The Oxford Centre for Evidence-Based Medicine, 2016, was utilized to evaluate the degree of evidence in every study that was included.[24]

Data Analysis

Due to heterogeneity of the outcome data, Meta-analysis cannot be performed.

RESULTS

Our search yielded 201 publications, which came from the following six databases: PubMed (*n*=37), Cochrane (*n*=78), Science Direct (*n*=31), Web of Science (*n*=44), Scopus (*n*=15), Lilacs (*n*=5) and ClinicalTrials.gov (*n*=3) Google Scholar (*n*=146). Additionally, we managed to get an extra 149 articles using these other sources.

There were just 148 articles left when the duplicate results were eliminated. After the titles and summaries of every article were evaluated for appropriateness, only 21 publications were deemed suitable for inclusion in this systematic review. Out of all the papers that were read in full, only five were deemed appropriate to be included in the qualitative synthesis (Figure 1).[25]

Study Characteristics

A summary of the studies that are part of the qualitative and quantitative synthesis is provided in (Table 1). Five of the studies[26-30] included RCTs using a split-mouth design and all five included blinding.

With respect to the kind of hydrophilic sealant, only one study[26-30] used UltraSeal XT® hydro (Ultradent Products, USA), whereas four studies used Embrace WetBond sealant (Pulpdent Corporation, Watertown, USA). Furthermore, there was greater variation in the use of hydrophobic sealants. For example, two studies[26,27] used Glass carbomer (GCP Dental, The Netherlands); two studies[28,30] used Fuji TRIAGE (GC, Tokyo, Japan); one study[30] used Clinpro (3M ESPE, St. Paul, USA); one study[29] used ART sealants (Voco, Cuxhaven, Germany); two studies[30] used. Clinpro in the study by Sarah Emad Ali *et al.* (2021)[30] Fuji TRIAGE and Glass carbomer in the studies by Sarah Emad Ali *et al.* (2021) and Subramaniam *et al.* (2015).[30]

The lowest age was accompanied by significant variances in mean age found in three studies by Subramaniam *et al.* (2015), Laith Alsabek *et al.* (2019), Sarah Emad Ali *et al.* (2021) [26,29,30] which was 6-9 years and the highest age were 7-11 years by Praveen Bhoopathi Haricharan *et al.* (2019)[28] The largest sample size was discovered in the study by Subramaniam *et al.* (2015)[28] (432-1st permanent molars in 108 patients) and the smallest sample size was found in the study by Sarah Emad Ali *et al.* (2021) (75-1st permanent molars in 30 patients). The studies' choice of the arch (maxilla or mandible) indicated that both types of arches were used in every study.

The method of isolation used was the same in all studies using cotton rolls except for two studies[27,30] that utilized a rubber dam. One study simply utilized a mouth mirror and blunt probe as an analysis tool[26] while two others employed both a visual examination and DIAGNOdent device[26] two studies type 1 examination with all the instruments used.[28,30]

The evaluation criteria of sealants were done by using the modified Simonsen's criteria in two studies[28,30] Color, Coverage and Caries (CCC) evaluation system was used in one study[26] complete retention, partial retention and compete failure was used in two studies.[29,30]

The follow-up period also showed a significant difference between the studies with Eda Haznedaroglu *et al.* (2016)[27] having the longest (48 months) and Subramanian *et al.* (2015)[26] having the shortest (1 month) (Table 2).

Quality Assessment of Selected Articles and Level of Evidence

Three writers evaluated the five RCTs that were included in the Cochrane Risk of Bias assessment method (RoB2). A kappa value of 0.83 indicated that there was complete agreement amongst the examiners.

The five studies have a low risk of bias based on the first domain's randomization procedure, as determined by the Risk of Assessment tool [RoB2]. The intended intervention of the second domain poses a moderate risk of bias in one study, but the remaining four exhibits a low risk of bias. The third domain of missing outcome data includes five low-risk studies; the fourth domain's measurement of the outcome includes two studies with a moderate risk of bias and three low-risk studies. Based on the published results of the fifth domain, there is low risk of bias in the five investigations for each of the five selected studies.[26-30]

Table 1: Characteristics of selected studies.

Author and Year	Study Setting	Groups	Study Design	Sample size	Age group	No And type of dentition	Method of Examination and Instruments used	Statistical Analysis
Subramania *et al.* (2015).[26]	Bangalore	I-teeth 16 and 46 (glass carbomer) and teeth 26 and 36 (embrace wet bond) II- teeth 16 and 36 (glass carbomer) and teeth 26 and 46 (embrace wet bond) III-teeth 26 and 46 (glass carbomer) and teeth 16 and 36 (embrace wet bond) IV groups-teeth 26 and 36 (glass carbomer) and teeth 16 and 46 (embrace wet bond).	Randomized control trial.	108 M- 56 F-52.	6-9 years	432 permanent molars.	Type 3 examination-Mouth mirror and blunt dental probes.	Z-test
Eda Haznedaroglu *et al.* (2016).[27]	Marmara University, Turkey	Group A-Glass ionomer-based sealants Group B-Resin based sealants.	Randomized controlled, parallel-group clinical trial.	40 M- 20 F- 20	7-10 years	160 permanent molars.	Type 4 examination- Visual examination.	Two-way ANOVA.
Praveen Bhoopathi Haricharan *et al.* (2019)[28]	karnataka	Group A-Glass ionomer-based sealants Group B-Resin based sealants.	split-mouth, randomized con- trolled clinical trial.	90 M- 44 F- 46	7-11 years	180 permanent molars.	Type 1 examination.	Chi-square test.
Laith Alsabek *et al.* (2019)[29]	Damascus University	Group A-Embrace wet bond sealant Group B-Fuji TRIAGE.	Single blind, split-mouth, randomized con- trolled clinical trial.	40 M-23 F- 17	6-9 years	80 permanent molars.	Type 4 examination-Visual and tactile examination and scored according to ICDAS criteria and DIAGNOdent device.	Mann-Whitney U test.
Sarah Emad Ali *et al.* (2021)[30]	Ain Shams University	Group 1-Conventional hydrophobic resin-based sealants - Clinpro Group 2-Fuji TRIAGE Group 3- Embrace wet bond.	Randomized controlled, parallel-group clinical trial.	30 M-12 F- 18	6-9 years	75 permanent molars.	Type 1 examination-Examination with all the aids.	Mann-Whitney U test

(Figure 2a and 2b), the Oxford level of evidence was provided as 1b.[24]

Retention of Moisture Tolerant and GIC Based Sealants

RCTs with 6 months follow-ups

After six months, a considerable proportion of these GC-sealed teeth had less than 50% of the fissure system coated with the material ($p<0.05$). On mandibular molars, sealant retention was better; in 6 months, EWB demonstrated complete sealing of the fissure system in a significantly higher number of teeth.[26] By the conclusion of the sixth month, almost 35% of the resin sealant and Glass Ionomer Cements (GIC) sealants in each group remained totally intact by Praveen Bhoopathi Haricharan *et al.* (2019).[28] Six months later, Group A had 34/40 (85%) and Group B had 25/40 (62.5%) of complete retention. Additionally, group B had a partial loss of 7/40 (17.5%) compared to group A's 2/40 (5%) loss. Additionally, the overall loss for groups A and B was 4/40 (10%) and 8/40 (20%), respectively. Following a six-month follow-up, the difference in sealant retention between the two groups was shown to be statistically significant ($p<0.05$) by Laith Alsabek *et al.* (2019).[29] After 6 months, from the 25 teeth sealed with the conventional resin-based clinpro sealant 17 (68%) showed successful total retention, 6(24%) showed partial loss and 2(8%) showed total loss. However, from the 25 teeth sealed with the glass ionomer Fuji Triage sealant 8(32%) showed successful total retention, 12(48%) showed partial loss and 5(20%) showed total loss. The moisture tolerant resin-based Embrace Wet bond sealant showed total retention in 21(84%) of the teeth sealed with it, 4(16%) partial loss and none showed total loss of the 25 teeth sealed by this sealant by Sarah Emad Ali *et al.* (2021).[30]

RCTs with 12 months follow-ups

Significantly, ten teeth had lost all of their GC sealant at the end of the first year. According to Subramaniam *et al.* (2015),[26] a greater percentage of mandibular molars sealed with EBW had more than 50% of the fissures closed with sealant after 12 months (p 0.05). All of the individuals' carious primary teeth were restored and Eda Haznedaroglu *et al.* (2016)[27] followed up with 100% of them over the 12-month research period. On the other hand, there was no sign of dental cavities and about 18 and 11% of the GIC and resin group sealants were entirely gone. There isn't much of a distinction between these sealant classes by Praveen Bhoopathi Haricharan *et al.* (2019).[28] After 12 months, from the 23-tooth sealed with the conventional resin-based clinpro sealant 13 (56.5%) showed successful total retention, 5(21.7%) showed partial loss and 4(17.4%) showed total loss. The percentage of

Table 2: Risk of Bias assessment table.

Author and Year	Randomization	Blinding	Allocation Concealment	Retention criteria	Caries Evaluation	Follow up
Subramania *et al.* (2015).[26]	Yes-Randomization into I-IV groups [27 children in each group].	Yes-double blinding Participants and examiners were blinded.	No	CCC sealant criteria.	Mouth mirror and blunt dental probes.	1, 3, 6 and 12, 18 and 24 months.
Eda Haznedaroglu *et al.* (2016).[27]	Yes-Block randomization.	Yes-single blinding Participants and parents were blinded.	Yes	dental explorer following Simonsen's criteria score.	dental explorer and DIAGNOdent device.	6, 12, 24, 36 and 48 months.
Praveen Bhoopathi Haricharan *et al.* (2019).[28]	Yes-randomization	Yes - double blinding Participants and examiners were blinded.	Yes	Modified Simonsen's criteria score.	Diagnostic criteria of WHO survey.	3, 6 and 12 months.
Laith Alsabek *et al.* (2019).[29]	Yes-Randomization into were right or left/ treatment A or treatment B	Yes-single blinding Participants were blinded	Yes-Two opaque envelops.	dental explorer following Simonsen's criteria score	N/A	3 and 6 months.
Sarah Emad Ali *et al.* (2021).[30]	Yes-Randomization into I-III groups [25 children in each group].	Yes-single blinding Participants were blinded.	Yes-study director.	Changed Simonsen's criteria score.	Visual examination for caries.	6 and 12 months.

completely retained sealants was lower for Embrace Wet bond sealant as compared to Clinpro sealant following a 12-month period of observation. However, it was determined that there was no statistically significant difference in sealant retention between the two groups. So, embrace wet bond sealant showed better performance than Fuji Triage sealant but not compared with clinpro sealant after 12 months in terms of retention by Sarah Emad Ali *et al.* (2021).[30]

RCTs with 24 months follow-ups

The complete loss of GC sealant from these teeth was much greater. After additional assessment at 18 and 24 months, Subramania *et al.* (2015)[26] found that the sealant retention patterns of both GC and EBW were comparable. All of the individuals' carious primary teeth were restored and Eda Haznedaroglu *et al.* (2016)[27] followed up with all of them 100% of the time over the study's 24-month duration.

RCTs with Above 24 months follow ups

After 48 months, 96 sealants from 24 individuals were ready for the final examination. Eda Haznedaroglu *et al.* (2016)[27] discovered that the retention rates of the HRS group were statistically higher than those of the GIS group for each time period.

Cariostatic Effect of Moisture Tolerant and GIC Based Sealants

RCTs with 6 months follow-ups

According to Subramaniam *et al.* (2015),[26] there was no difference in the incidence of caries between the two materials. All of the individuals' primary teeth that were carious were restored and they were followed up on 100% of the time for six months. There was no difference between the two materials' caries incidence by Eda Haznedaroglu *et al.* (2016)[27] No evidence of caries at 6 months by Praveen Bhoopathi Haricharan *et al.* (2019).[28] None of the teeth sealed with the three types of sealants showed any evidence of decay by Sarah Emad Ali *et al.* (2021).[30]

RCTs with 12 months follow-ups

According to Subramaniam *et al.* (2015),[26] after 12 months, a greater frequency of mandibular molars in both groups had white spot lesions. According to Eda Haznedaroglu *et al.* (2016),[27] there was no difference in the incidence of caries between the two materials. By the end of a year, the percentage of dentinal caries was 7.8 for the GIC group and 6.7% for the resin group, according to Praveen Bhoopathi Haricharan *et al.* (2019).[28]

RCTs with 24 months follow-ups

Three teeth with white spot lesions, six teeth with brown spot lesions and two teeth with enamel caries were seen in the maxillary molars sealed with EBW after a year. According to

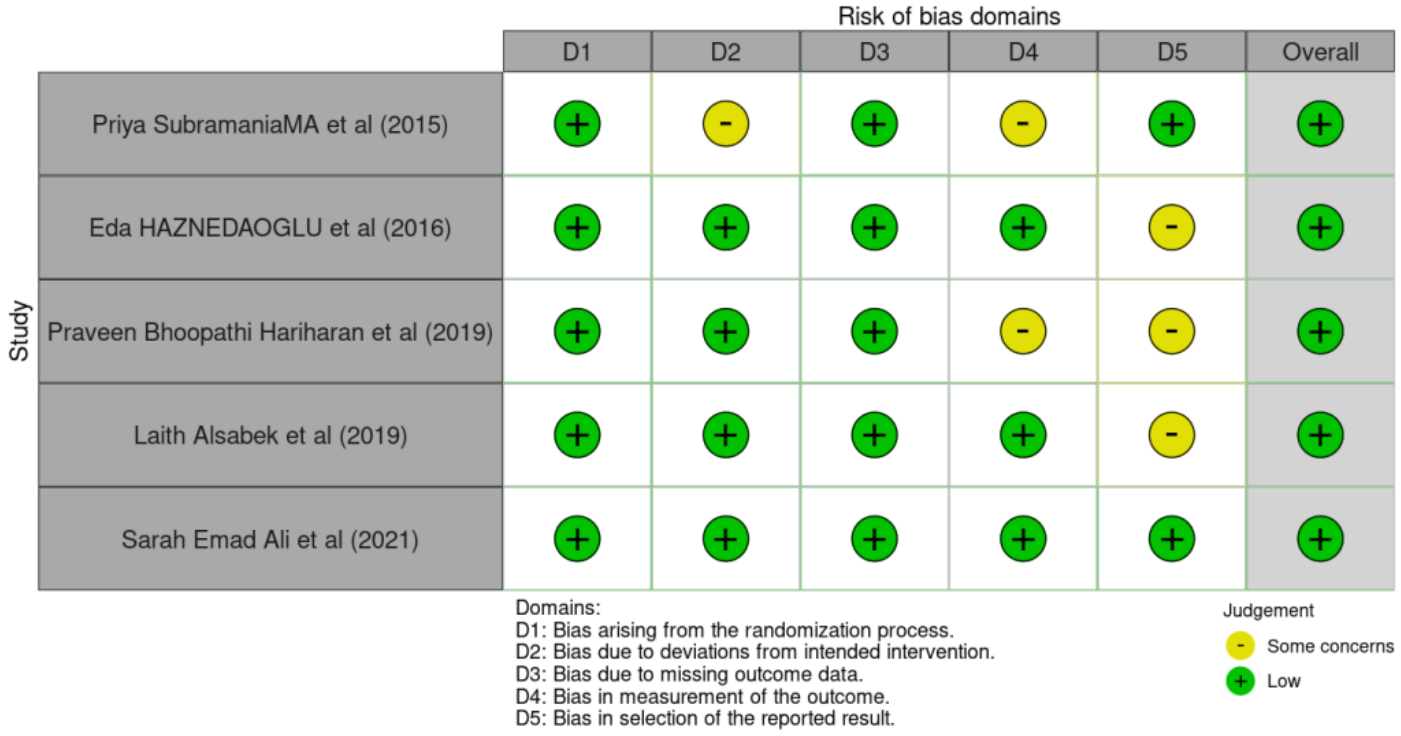

Figure 2a: Cochrane risk of bias assessment for randomized [RoB2].

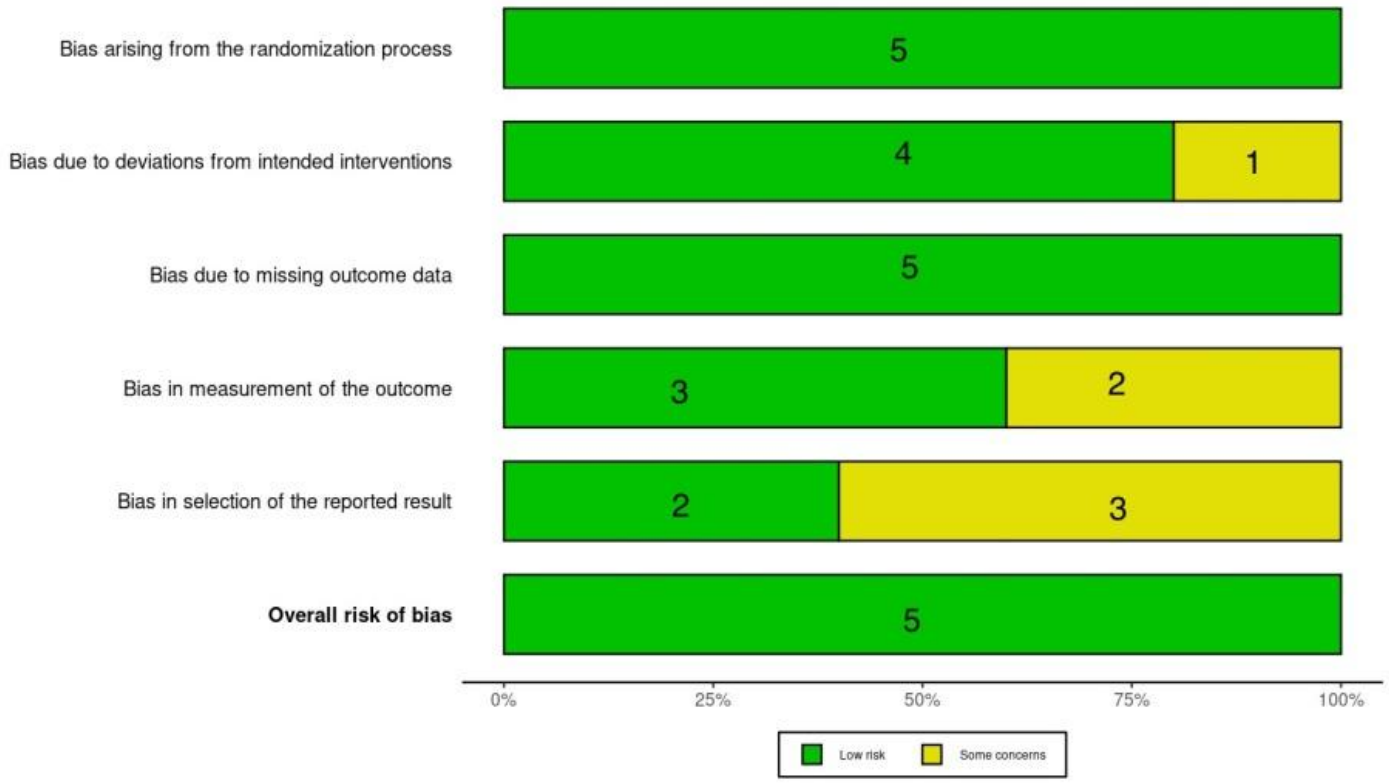

Figure 2b: Cochrane Risk of Bias Assessment for Randomized [RoB2].

Subramania *et al.* (2015),[26] at 24 months, enamel caries was found in 3 teeth sealed with EBW compared to just 1 tooth sealed with GC. During the first 24 months following treatment, no teeth developed caries (Eda Haznedaroglu *et al.*, 2016).[27]

RCTs with Above 24 months follow ups

At 48 months, the DIAGNOdent pen values for all carious teeth in the GIS group ranged from 21 to 29, whereas for five teeth in the RS group, they were between 21 and 29 and for seven teeth, they were more than 30. Dentine caries was found in 7 (58.3%) of the 12 cases of complete loss that were detected in the RS group by Eda Haznedaroglu *et al.* (2016).[27]

Of the five studies, two had a moderate risk of bias and three had a low risk. Two studies have a moderate risk of bias because the allocation and blinding details are not apparent, which makes it difficult to overcome selection, performance and detection biases, respectively.

DISCUSSION

This comprehensive review set out to assess and contrast the cariostatic impact and retention of moisture tolerant and hydrophobic RBSs in primary and/or permanent teeth. It was determined that five articles would work well in the qualitative synthesis. The study's primary conclusions of retention indicated that there at in 6 months, EWB was found to be statistically significant than GIC sealants because it showed a lower than 50% was sealed by Subramaniam *et al.* (2015).[26] There was no sealants statistically significant between two sealants by Eda Haznedaroglu *et al.* (2016).[27] One-fourth of the resin based and Glass Ionomer Sealants (GIC) in each group remained completely after six months and it is not statistically significant by Praveen Bhoopathi Haricharan *et al.* (2019). [28] For groups A and B, the overall loss was 4/40 (10%) and 8/40 (20%) respectively. Following a six-month follow-up, the difference in sealant retention between the two groups was shown to be statistically significant ($p<0.05$) by Laith Alsabek *et al.* (2019).[29] After 6 months, from the 25 teeth sealed with the conventional resin-based clinpro sealant 17 (68%) showed successful total retention, from the 25 teeth sealed with the glass ionomer Fuji Triage sealant 8(32%) showed successful total retention, 12(48%) The moisture tolerant resin-based Embrace Wet bond sealant showed total retention in 21(84%) of the teeth sealed with it. So, EWB is highly statistically significant than other two sealants by Sarah Emad Ali *et al.* (2021).[30] Significantly, ten teeth had lost all of their GC sealant at the 12-month mark. At 12 months, more than 50% of the fissures in a substantially larger percentage of mandibular molars sealed with EBW by Subramaniam *et al.* (2015).[26] There was no significance between two sealants by Eda Haznedaroglu *et al.* (2016).[27] Since around 18 and 11% of the GIC and resin group sealants were entirely lost, there hasn't been a discernible difference between these sealant groups, according to Praveen Bhoopathi Haricharan *et al.* (2019).[28] The two groups' sealant retention differences after a year were not determined to be statistically significant from the

23 teeth sealed with the conventional resin-based clinpro sealant 13 (56.5%) showed successful total retention, 5(21.7%) showed partial loss and 4(17.4%) showed total loss. The percentage of completely retained sealants was lower for Embrace Wetbond sealant as compared to Clinpro sealant after 12 months follow up. So, Embrace wet bond sealant showed better performance than Fuji Triage sealant but not compared with clinpro sealant after 12 months in terms of retention by Sarah Emad Ali *et al.* (2021).[30] Complete losses of GC sealant from these teeth was substantially greater by Subramaniam *et al.* (2015)[26] in 24 months. Following a 48-month period, Eda Haznedaroglu *et al.* (2016)[27] determined that the retention rates of the HRS group were statistically significantly higher than those of the GIS group.

Regarding Cariostatic effect in 6 months, there was no difference between the two materials by Subramaniam *et al.* (2015), Eda Haznedaroglu *et al.*, Praveen Bhoopathi Haricharan *et al.* (2019), Sarah Emad Ali *et al.* (2021).[26-28,30] More mandibular molars in both groups had white spot lesions in 12 months, moisture-tolerant sealants were significantly less significant than GIC sealants by Subramaniam *et al.* (2015).[26] At the conclusion of a 12-month period, the GIC and resin groups had dentinal caries proportions of 7.8 and 6.7%, respectively. So, Hydrophilic sealants statistically significant than GIC sealants by Praveen Bhoopathi Haricharan *et al.* (2019).[28] At 24 months follow-up, there was less significance when compared with GIC sealants because enamel caries was discovered in three teeth sealed with EBW by Subramaniam *et al.* (2015).[26] After 24 months follow up, the significance is low when compared with GIC sealants by Eda Haznedaroglu *et al.* (2016).[27]

In this systematic review, we examined research that contrasted the cariostatic effect and retention of both types of sealants. Five articles were identified that satisfied the inclusion requirements. There is a low risk of selection bias in this research, as evidenced by the fact that five of the studies were RCTs. Shorter follow-up times would likely be sufficient to assess the variations between these types of sealants, therefore the minimum follow-up periods were found to be at least 6 months to ascertain the efficacy of both sealants. The analysis pooled the results of both similar and different follow-up periods (6, 12, 24 and 48 months) but analyses of RCTs were done separately to avoid bias in the study results. The most frequent follow-up period in the selected studies was 6 and 12 months [26-28,30] which was considered a suitable duration for proper evaluation of the clinical performance of sealants.

Because complete sealant retention over a longer period of time would result in a longer duration of caries prevention, the effectiveness of both sealants was determined in the inclusion criteria to be measured by retention and cariostatic impact.[10] Since the enamel bond strength of both dentitions has been demonstrated to be the same, data from primary and permanent teeth were also decided to be taken into account. However, no research has been done on primary teeth comparing the two sealants. Therefore, we strongly advise carrying out more RCTs to examine the clinical effectiveness, retention and cariostatic impact of moisture tolerant resin-based sealants and GIC sealants among primary teeth.

After a year, there was more significance between the two groups according to the retention of sealants in this systematic review. However, moisture tolerant resin-based sealants were preferred in the sealants, which can be explained by the sealant's capacity to pierce deeper into pits and fissures even when moisture is present.[29] Furthermore, moisture tolerant resin-based sealants were preferred in the sealants after a year.

The use of a low-viscosity hydrophilic adhesive system beneath the GIC Sealants may be the cause of lower retention rates of GIC sealants. On the other hand, one of the study limitations is the limited number of included trials. Also, a substantial decline in available longevity data has to be considered and can be seen between the 6 months and 1 year follow-up period. This limitation highlights the necessity of well-conducted RCTs with follow-up time longer than 2 years.[31]

Few RCTs exploring whether moisture tolerant resin-based sealants were equivalent to Resin based Sealants like Clinpro in sealing molars of children aged 7 to 11 years were found in this systematic review. The lack of retentive and carious effective sealants verses GIC sealants underscores the necessity for high-quality, well-designed RCT.

To reduce the effect of confounding factors, future research should consider using a typical protocol and design, such as random sequence generation and split-mouth design. To reduce any reporting bias, coming scientific trials should consider documenting other procedural data that may affect the outcomes, such as operator training, evaluation criteria and clinical process specifics.

CONCLUSION

All five selected studies reported that a statistically significant difference was seen in the moisture retention tolerant sealants when compared with GIC sealant which clearly shows that moisture tolerant sealants were effective in terms of retention. With respect to caries preventive effect, two studies have reported the incidence of caries in both the sealants and statistical insignificance of the difference was discovered. Therefore, we can propose that moisture tolerant RBSs can be a perfect substitute for traditional GIC sealants, particularly in situations where adequate isolation cannot be achieved.

CLINICAL SIGNIFICANCE

Pit and fissure caries should be intervened at an early stage, else it can lead to progression of caries and serious consequences, which ultimately affect the oral health quality of life.[32-34] Clinical application of moisture-tolerant resin-based sealants shows good retention in posterior primary and permanent teeth as

well adhere effectively to damp enamel tooth surface.[35] Second, the application of moisture-tolerant sealants to primary and permanent teeth has a cariostatic effect similar to that of GIC sealants. The clinicians can use as a tool for cost-effective caries preventive measure moisture-tolerant resin-based sealants.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

ABBREVIATIONS

GIC: Glass Ionomer Cement; **EBW:** Embrace Wet Bond; **RCT:** Randomized controlled trial; **CCC:** Colour, coverage caries; **RoB:** Risk of Bias.

REFERENCES

1. Beauchamp J, Caufield PW, Crall JJ, Donly K, Feigal R, Gooch B, *et al*. Evidence-based clinical recommendations for the use of pit-and-fissure sealants: a report of the American Dental Association Council on Scientific Affairs. J Am Dent Assoc. 2008;139(3):257-68. doi: 10.14219/jada.archive.2008.0155, PMID 18310730.
2. Hoffman I. A moisture tolerant, resin-based pit and fissure sealant. Dent Tribune. 2009;4:17-8.
3. Tellez M, Gray SL, Gray S, Lim S, Ismail AI. Sealants and dental caries: dentists' perspectives on evidence-based recommendations. J Am Dent Assoc. 2011;142(9):1033-40. doi: 10.14219/jada.archive.2011.0324, PMID 21881070.
4. Chen X, Du M, Fan M, Mulder J, Huysmans MC, Frencken JE. Effectiveness of two new types of sealants: retention after 2 years. Clin Oral Investig. 2012;16(5):1443-50. doi: 10.1007/s00784-011-0633-9, PMID 22124610.
5. Antonson SA, Antonson DE, Brener S, Crutchfield J, Larumbe J, Michaud C, *et al*. Twenty-four-month clinical evaluation of fissure sealants on partially erupted permanent first molars: glass ionomer versus resin-based sealant. J Am Dent Assoc. 2012;143(2):115-22. doi: 10.14219/jada.archive.2012.0121, PMID 22298552.
6. Wright JT, Tampi MP, Graham L, Estrich C, Crall JJ, Fontana M, *et al.* Sealants for preventing and arresting pit-and-fissure occlusal caries in primary and permanent molars. Pediatr Dent. 2016;38(4):282-308. doi: 10.1016/j.adaj.2016.06.003, PMID 27557916.
7. Van Duinen RN, Davidson CL, De Gee AJ, Feilzer AJ. In situ transformation of glass-ionomer into an enamel-like material. Am J Dent. 2004;17(4):223-7. PMID 15478479.
8. Badami V, Ahuja B. Biosmart materials: breaking new ground in dentistry. ScientificWorldJournal. 2014;2014(1):986912. doi: 10.1155/2014/986912, PMID 24672407.
9. Cannon ML, Comisi JC. Bioactive and therapeutic preventive approach to dental pit and fissure sealants. Compend Contin Educ Dent. 2013;34(8):642-5. PMID 24564618.
10. Unal M, Oztas N. Remineralization capacity of three fissure sealants with and without gaseous ozone on non-cavitated incipient pit and fissure caries. J Clin Pediatr Dent. 2015;39(4):364-70. doi: 10.17796/1053-4628-39.4.364, PMID 26161609.
11. Achilleos EE, Rahiotis C, Kakaboura A, Vougiouklakis G. Evaluation of a new fluorescence-based device in the detection of incipient occlusal caries lesions. Lasers Med Sci. 2013;28(1):193-201. doi: 10.1007/s10103-012-1111-6, PMID 22576667.
12. Messer LB, Calache H, Morgan MV. the retention of pit and fissure sealants placed in primary school children by Dentl Health Services, Victoria. Aust Dent J. 1997;42(4):233-9. doi: 10.1111/j.1834-7819.1997.tb00127.x.
13. Prabakar J, John J, Arumugham IM, Kumar RP, Srisakthi D. Comparative evaluation of retention, cariostatic effect and discoloration of conventional and hydrophilic sealants-A single blinded randomized split mouth clinical trial. Contemp Clin Dent. 2018;9(6):233-9. doi: 10.4103/ccd.ccd_132_18.
14. Richard Mathewson J, Primosch ER. Fundamentals of pediatric dentistry. Chicago: Quintessence Publishing; 2008. p. 119-20.
15. Simonsen RJ. Retention and effectiveness of dental sealant after 15 years. J Am Dent Assoc. 1991;122(10):34-42. doi: 10.14219/jada.archive.1991.0289, PMID 1835987.
16. Aranda W, Courson F, Degrange M. In vitro evaluation of embrace TM wetbond TM pit and fissure sealant. Eur Cells Mater. 2005;9(1):73-4.
17. Pardi V, Pereira AC, Mialhe FL, de Castro Meneghim M, Ambrosano GM. A 5-year evaluation of two glass-ionomer cements used as fissure sealants. Community Dent Oral Epidemiol. 2003;5:386-91.
18. Bhat PK, Konde S, Raj SN, Kumar NC. Moisture-tolerant resin-based sealant: a boon. Contemp Clin Dent. 2013;4(3):343-8. doi: 10.4103/0976-237X.118394, PMID 24124301.
19. Subramaniam P, Konde S, Mandanna DK. Retention of a resin-based sealant and a glass ionomer used as a fissure sealant: a comparative clinical study. J Indian Soc Pedod Prev Dent. 2008;26(3):114-20. doi: 10.4103/0970-4388.43192, PMID 18923223.
20. Mohapatra S, Prabakar J, Indiran MA, Kumar RP, Sakthi DS. Comparison and Evaluation of the Retention, cariostatic Effect and Discoloration of Conventional Clinpro 3M ESPE and hydrophilic Ultraseal XT Hydro among 12-15-year-old Schoolchildren for a Period of 6 months: A Single-blind Randomized Clinical Trial. Int J Clin Pediatr Dent. 2020;13(6):688-93. doi: 10.5005/jp-journals-10005-1859, PMID 33976497.
21. Bhushan U, Goswami M. Evaluation of retention of pit and fissure sealants placed with and without air abrasion pretreatment in 6-8-year-old children-An in vivo study. J Clin Exp Dent. 2017;9(2):e211-7. doi: 10.4317/jced.53259, PMID 28210438.
22. Mathew SR, Narayanan RK, Vadekkepurayil K, Puthiyapurayil J. One-year clinical evaluation of retention ability and anticaries effect of a glass ionomer-based and a resin-based fissure sealant on permanent first molars: an in vivo study. Int J Clin Pediatr Dent. 2019;12(6):553-9. doi: 10.5005/jp-journals-10005-1702, PMID 32440074.
23. Higgins JP, Altman DG, Gøtzsche PC, Jüni P, Moher D, Oxman AD, *et al*. The Cochrane Collaboration's tool for assessing risk of bias in randomised trials. BMJ. 2011;343:d5928. doi: 10.1136/bmj.d5928, PMID 22008217.
24. Howick J, Chalmers I, Glasziou P, Greenhalgh T, Heneghan C, Liberati A, *et al.* The 2011 Oxford CEBM level of evidence. Available from: http://www.cebm.net/index.aspx?o=5653;2016.
25. Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, *et al*. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. BMJ. 2021;372:n71. doi: 10.1136/bmj.n71, PMID 33782057.
26. Subramaniam P, Jayasurya S, Babu KL. Evaluation of glass carbomer sealant and a moisture tolerant resin sealant-A comparative study. Int J Dent Sci Res. 2015;2(2-3):41-8. doi: 10.1016/j.ijdsr.2015.05.001.
27. Haznedaroğlu E, Güner Ş, Duman C, Menteş A. A 48-month randomized controlled trial of caries prevention effect of a one-time application of glass ionomer sealant versus resin sealant. Dent Mater J. 2016;35(3):532-8. doi: 10.4012/dmj.2016-084, PMID 27086573.
28. Haricharan PB, Barad N, Patil CR, Voruganti S, Mudrakola DP, Turagam N. Dawn of a new age fissure sealant? A study evaluating the clinical performance of embrace WetBond and ART sealants: results from a randomized controlled clinical trial. Eur J Dent. 2019;13(4):503-9. doi: 10.1055/s-0039-1696894, PMID 31891967.
29. Alsabek L, Al-Nerabieah Z, Bshara N, Comisi JC. Retention and remineralization effect of moisture tolerant resin-based sealant and glass ionomer sealant on non-cavitated pit and fissure caries: randomized controlled clinical trial. J Dent. 2019;86:69-74. doi: 10.1016/j.jdent.2019.05.027, PMID 31136817.
30. El-Din SEA, Allam GG, Abdel-Aziz AM. Comparing the clinical performance of three different pit and fissure sealants in terms of retention and caries prevention effect: A Randomized clinical trial. Int J Clin Dent. 2021;14(4):515-30.
31. Silvertown JD, BOP, Wong SH, Abrams KS, Sivagurunathan SM, Mathews BT. Amaechi, Comparison of the canary System and DIAGNO dent for the in vitro detection of caries under opaque dental sealants. J. Invest Clin Dent. 2017;8(4):12239.
32. Jayachandar D, Gurunathan D, Jeevanandan G. Prevalence of early loss of primary molars among children aged 5-10 years in Chennai: a cross-sectional study. J Indian Soc Pedod Prev Dent. 2019;37(2):115-9. doi: 10.4103/1319-2442.261340, PMID 31249172.
33. Jayakumar A, Gurunathan D, Mathew MG. Correlation of protein level with the severity of early childhood caries-an observational study. J Res Med Dent Sci. 2020;8(7):534-6.
34. Gandhi JM, Gurunathan D, Doraikannan S, Balasubramaniam A. Oral Health status for primary dentition - a pilot study. J Indian Soc Pedod Prev Dent. 2021;39(4):369-72. doi: 10.4103/jisppd.jisppd_155_21, PMID 35102959.
35. Prabakar J, Indiran MA, Kumar P, Dooraikannan S, Jeevanandan G. Microleakage assessment of two different pit and fissure sealants: a comparative confocal laser scanning microscopy study. Int J Clin Pediatr Dent. 2020; 13; Suppl 1:(l1):29-33. doi: 10.5005/jp-journals-10005-1862, PMID 34434011.

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