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REVIEW

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A literature review of clinical efficiency, patient satisfaction, and future preference of Isolite and DryShield dental isolation systems among pediatric patients

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Abstract

This review aims to summarize and analyze previous studies that evaluated the clinical efficiency, patient satisfaction, and future preference of Isolite System Isolation (ISI) and DryShield System Isolation (DSI) and compare them to other forms of isolation during dental treatment in children. Both authors independently searched engines using the keywords "Isolite", "Vacuum", "DryShield" and their combinations in March 2022. The inclusion criteria included peer-reviewed articles written in English and clinical trials that assessed the clinical efficiency, patient satisfaction, and future preference of ISI or DSI during dental treatment on healthy unaffected children and compared it to other isolation systems such as rubber dam and cotton roll. A total of five articles were included, and data were extracted by both authors independently and compiled into one single table.Five clinical trials were identified. The use of both ISI and DSI systems is associated with more noise, requires less chair time, is more comfortable, and is preferred by more children than rubber dam or cotton ball isolation.The review reports promising results in clinical efficiency, patient satisfaction, and future preference for both Isolite and DryShield isolation systems. Both systems require less chair time and were preferred by pediatric patients for future dental treatment when compared to both rubber dam and cotton roll isolation systems. Less fluid leaking and gagging reflex were reported when compared to cotton roll isolation. When compared to rubber dam isolation, they were associated with less discomfort.

Keywords

Efficiency; Cotton roll; DryShield; Isolite; Retention; Patient satisfaction; Preference; Rubber dam

1. Introduction

The American Academy of Pediatric Dentistry emphasizes that the dentist should deliver safe pediatric dental care including patient airway protection by proper isolation [1]. Several techniques can be used during dental treatment, including cotton roll isolation (CRI), dry angle isolation, rubber dam isolation (RDI), and two recently developed systems called "Isolite System Isolation" (ISI) and DryShield System Isolation (DSI).

Rubber dam is considered the most commonly used isolation technique. It provides a clear working field and plays a significant role in minimizing the risk of ingestion of dental instruments and aspiration during treatment [2, 3], which can be of great advantage when treating children. Its use is associated with less stress for the working dentist, less pain perception by pediatric patients, and less working time when compared to CRI [4].Also, it provides an optimal dry environment for the placement of restorations, maximizing and enhancing the overall longevity of the restorative treatment provided [5–8]. However, other studies report that the use of RDI does not always enhance the quality of restorations or fissure sealants [7, 9].

Despite all the previously mentioned advantages, patient acceptance was reported to be one of the main reasons for not applying RDI during dental treatment, especially minor restorative and preventive treatments [10, 11]. Additionally, the time required for its placement [12, 13] is among the most commonly cited disadvantages. Another commonly used and acceptable isolation technique alternative to RDI is CRI; however, it can be challenging to achieve proper isolation with in young pediatric patients [14].

Isolite System Isolation is newly developed; it includes a disposable soft silicon attachment that combines a bite block, a retractor, and a high-speed suction with a built-in Light Emitting Diode (LED) light to enhance visualization. The retractor aids in the protraction of the tongue and the cheek during treatment. The high-speed suction provides a contamination-

free working field [15]. Another newly developed system is DSI. Both systems are similar, with a few small differences; DSI does not provide illumination and can be autoclaved [15].

The aim of this review was to summarize and analyze previous studies that evaluated the clinical efficiency, patient satisfaction, and future preference of Isolite System Isolation and DryShield System Isolation and compare them to other forms of isolation during dental treatment of pediatric patients. Hence, the review question was: "Is ISI or DSI efficient in isolation with desirable patient satisfaction and future preference compared to other isolation systems during dental treatment of pediatric patients?"

2. Materials and methods

2.1 Searching the literature

A PICO strategy was followed to identify the research problem and develop the research question: P: Population: healthy unaffected children, I: Intervention: ISI or DSI, C: Comparison: other isolation systems such as RDI and CRI, and O: Outcome: Clinical efficiency, patient satisfaction, and future preference. Therefore, the review question was: "Is ISI or DSI efficient in isolation with desirable patient satisfaction and future preference compared to other isolation systems during dental treatment in healthy pediatric patients?"

Both the ISI and DSI systems are similar, and the main difference between them is that DSI does not provide illumination and can be autoclaved [15]. Thus, it will not affect the patient's experience during dental treatment. Therefore, both systems were included in the review.

Keywords "Isolite", "Vacuum", "DryShield" and their combinations were examined in the following search engines: Wiley-Online Library, PubMed, Scopus, ScienceDirect, Cochrane Central Register of Controlled Trials, and Google Scholar by both authors independently in March 2022. The inclusion criteria included peer-reviewed articles, articles written in English, and clinical trials that assessed the clinical efficiency, patient satisfaction, and future preference of ISI or DSI during dental treatment. Studies should be done on healthy unaffected children and compared to other isolation systems such as RDI and CRI.

The search identified 2569 potentially eligible articles. All articles were evaluated by both authors independently and duplicates were removed. Disagreements between the two authors were discussed until consensus was reached. A Prisma flowchart is presented in Fig. 1.

2.2 Data extraction

Data extraction was conducted by both authors independently using a customized table. The table included the publication details (author/s, publication year, and country), study settings, research methodology (study design, number and age of participants, number and type of teeth, and type of isolation during dental treatment), follow-up period/s, clinical efficiency, patient satisfaction, and future preference. Finally, the extracted data was compiled into a single table.

2.3 Quality appraisal and risk of bias

The quality of the methodologies and results of included studies was assessed by using the Consolidated Standards of Reporting Trials (CONSORT) 2010 checklist for clinical trials quality assessment [16]. It consisted of 15 categories with 26 items. One point was assigned for each item. Thus, the scale ranged from zero to 26. The reviewers then categorized studies independently to high-quality (score 18 to 26), moderate quality (score 9 to 17), and low-quality (score 0 to 8). In addition, risk of bias was assessed using the Cochrane Risk of Bias Tool for randomized clinical trials that consists of five domains: selection, performance, attrition, reporting, and other. Studies were grouped according to these five domains to low-, unclear-, or high-risk of bias [17]. The quality and risk of bias of each study were graded by both authors independently. In case of disagreement, a third reviewer was consulted. Finally, the extracted data were compiled into one single table. No studies were excluded for low-quality or high-risk of bias. A summary of the Cochrane risk of bias tool for included randomized clinical trials is presented in Fig. 3.

2.4 Level of evidence

For this systematic review, clinical recommendations were developed based on the strength of the evidence statement using the guidelines of Shekelle *et al*., (1999) [18]. These recommendations reflect the quality of the scientific evidence and state the principal summary measures. Category of evidence is classified to "category I" if is evidence from at least one randomized controlled trial; "category II" of evidence is from at least one controlled study without randomization; and "category III" is evidence from non-experimental descriptive studies, such as comparative studies, correlation studies, and case-control studies. As for strength of recommendation, it is classified to "class A" if it is directly based on category I evidence, "class B" if it is directly based on category II evidence, and Class C if it is directly based on category III evidence.

3. Results

After removing duplicates and reviewing the abstracts, five studies met the inclusion criteria [15, 19–22]. A summary of all the included studies is presented in **Supplementary Table 1**.

3.1 Study Characteristics

All included studies used split-mouth design and were conducted after 2009 [15, 20, 21].Three of them were conducted in the USA [15, 20, 21] and two in Saudi Arabia [13, 19] on healthy and cooperative pediatric patients. Alhareky *et al*., (2014) [15] aimed to assess the degree of patient satisfaction with ISI compared to RDI, while Collette *et al*., (2010) [20] assessed patient acceptance of ISI compared to CRI. Recently, Mattar *et al*., (2021) [22] assessed patient preference under three isolation techniques ISI, CRI, and RDI, while Bagher *et al*., (2021) [19] assessed patient satisfaction and preference for DSI compared to RDI. The chair time required, isolation

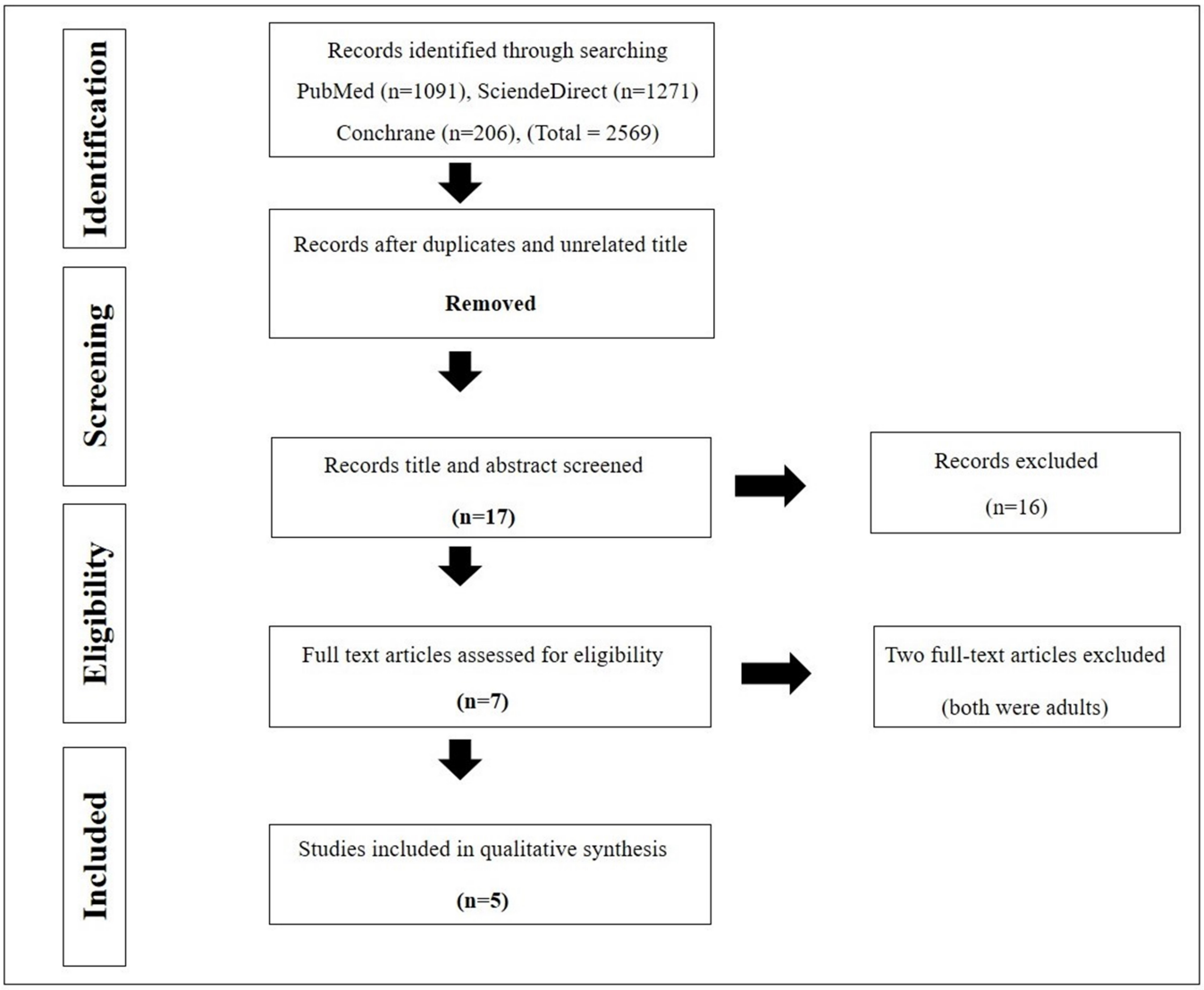

FIGURE 1. PRISMA flow chart.

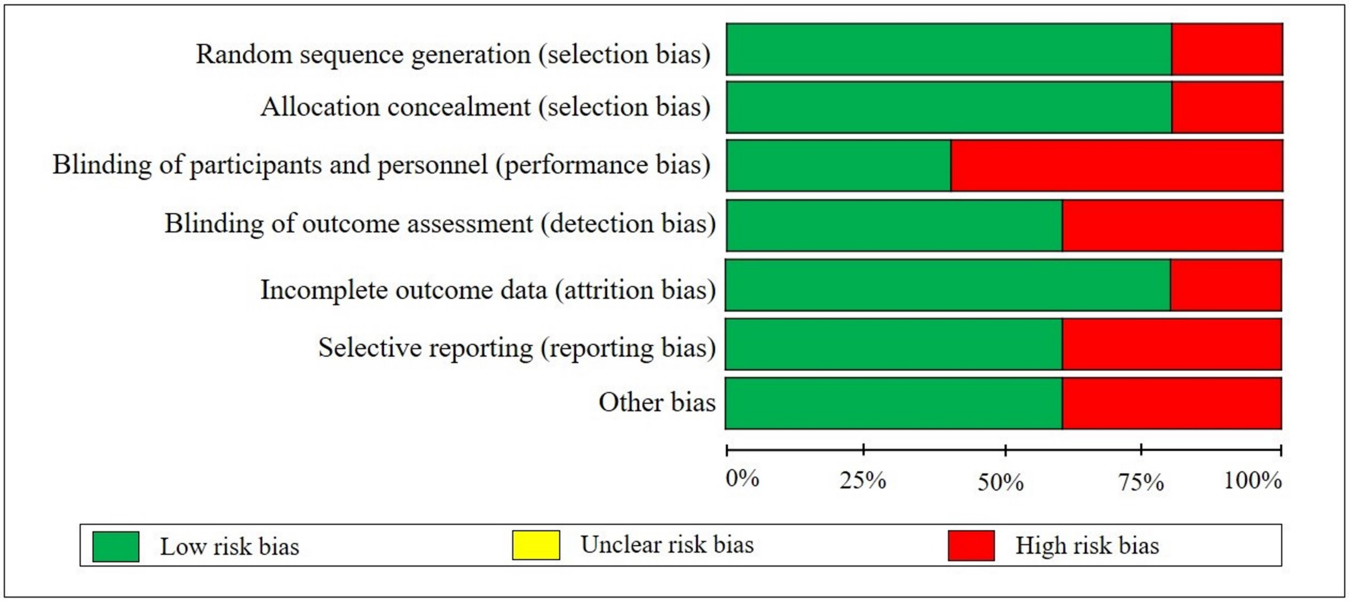

FIGURE 2. Risk of bias graph: review authors' judgments about each risk of bias item presented as percentages across all included studies.

preference for future dental [15, 19–22], clinical efficiency [15], retention rate of the applied fissure sealants [21], and the subjective patient discomfort and pain [19] were among the outcomes assessed by the included studies.

3.2 Questionnaire

A verbally administrated questionnaire was utilized by Alhareky *et al*., (2014) [15], Collette *et al*., (2010) [20], Bagher *et al*., (2021) [19], and Mattar *et al*., (2021) [22] immediately at the end of the visit, after removing the isolation system. The questionnaire was originally developed by Collette *et al*. [20], in 2010 to assess patient acceptance of ISI compared to CRI and consisted of seven closed-ended questions. Later in 2014, Alhareky *et al*. [15], utilized the same questionnaire with minor modifications, to compare ISI and RDI instead of ISI and CRI. In Bagher, *et al*. (2021) [19] the questionnaire was developed and validated in Arabic after reviewing the previously developed English questionnaires by Collette *et al*. [20], (2010) and Alhareky *et al*. [15], (2014), while Mattar *et al*. [22], (2021) designed and validated a 10-item interview-based questionnaire in Arabic.

3.3 Outcomes

3.3.1 Chair time

Both the ISI [15, 20]and DSI [19] required significantly less chair time. The ISI required an average of 9.36 minutes less when compared to the RDI [15] and one minute less when compared to CRI [20]. Similarly, the DSI required 0.91 minutes less than the time for the RDI [19]. The mean chair time for ISI was reported to be 10 minutes by Alhareky *et al*., (2014) [15], 5.67 minutes by Collette *et al*., (2010) [20], and 4.14 minutes by Mattar *et al*., (2021) [22], while the mean chair time for DSI was 3.59 minutes.

Mattar *et al*. [22], (2021) compared the chair time needed for fissure sealant application under three isolation techniques and reported that CRI required the least time (4.05 minutes) while RDI required the longest time (4.27 minutes), but the difference between the three techniques was not significant.

3.3.2 Noise

It was reported that both ISI [15, 20, 22] and DSI [19] are significantly noisier than RDI [15, 19, 22] and CRI [20, 22].

3.3.3 Lip and cheek stretching, pressure on the tongue, and gagging reflex

Both isolation systems caused slightly more stretching on the lips and cheeks, more pressure on the tongue, and stimulated gagging reflex when compared to RDI [15, 19] and CRI [20], especially among older children. However, when the three isolation systems (ISI, CRI, and RDI) were compared in a single study, the RDI was reported to cause more stretching by significantly more children, and CRI was reported by fewer [22].

3.3.4 Fluid leaking into mouth and unpleasant taste

Significantly fewer children reported an unpleasant taste of the material used with ISI when compared to CRI [20]. Although unpleasant taste [15] and water leaking into the mouth were reported to be higher with RDI when compared to both other systems [15, 19], the difference was not significant.

3.3.5 Discomfort and pain

Although more children reported that ISI caused more discomfort than CRI, the difference was not significant [20]. Yet, when the ISI was compared to RDI, ISI was reported to be significantly more comfortable [15]. In addition, a slightly higher pain score was reported with RDI compared to DSI [19]. Thus, when the three isolation systems (ISI, CRI and RDI) were compared together in a single study, the CRI was reported by significantly more children to be the most comfortable isolation technique, and RDI was reported to be the least comfortable isolation technique [22].

3.3.6 Preference for future dental treatment

Many more children preferred ISI when compared to RDI [15] but there was no significant difference in the children's preference between ISI and CRI [20] and between DSI and RDI [19] as few felt there was any difference. However, when the three isolation systems (ISI, CRI, and RDI) were compared in a single study, the CRI was preferred by significantly more children, and RDI was the least preferred isolation technique [22].

3.3.7 Retention rate

There was no significant difference in the retention rate of sealants placed using ISI or CRI; six and 12 months after the application [21].

3.4 Assessing risk of bias

The studies' quality assessment according to CONSORT is presented in Table 1. In addition, the review of authors' judgment on each risk-of-bias item and the risk-of-bias summary according to the Cochrane risk-of-bias tool for randomized clinical trial is presented in Figs. 2,3. Two of the included studies [15, 20] were classified as moderate-risk, and three studies [19, 21, 22] were classified as high-quality.

3.5 Level of evidence

The level of evidence and strength of recommendations for the effectiveness of ISI in chair time reduction, patient's future preference, and fissure sealant retention was found to be category Ib which is evidence from at least one randomized controlled trial as presented in Table 2 indicating a moderate level of evidence.

4. Discussion

Both ISI and DSI systems are newly developed and have become popular in Dentistry [15]. Therefore, this review aimed to summarize and analyze previous studies that evaluated the clinical efficiency, patient satisfaction, and future preference

TABLE 1. Studies' quality assessment according to CONSORT.

Consort Items	References				
	Collette *et al.* [20], (2010)	Alhareky *et al.* [15], (2014)	Bagher *et al.* [19], (2021)	Mattar *et al.* [22], (2021)	Lyman *et al.* [21], (2012)
Trial design (2)	1	1	2	2	2
Participants (2)	1	1.5	2	2	2
Interventions (1)	1	1	1	1	1
Outcomes in methodology (1)	0	1	1	1	1
Sample size (2)	0	0	2	2	2
Randomization (4)	2	2	4	4	4
Blinding (2)	0	0	0	0	2
Statistical methods (2)	2	1	2	2	2
Participant (2)	0.5	1	2	2	1
Recruitment (2)	2	2	2	2	2
Baseline data (1)	0.5	0	1	1	0
Numbers analyzed (1)	0	1	1	1	1
Outcomes in results (2)	1	1	2	1	1
Ancillary analysis (1)	1	0	1	1	1
Harm (1)	1	1	1	1	1
Total/26	13	13.5	24	23	23
Quality	Moderate	Moderate	High	High	High

TABLE 2. Studies' quality assessment according to CONSORT.

Topic	Recommendation	Evidence Category	Recommendation Strength
Chair time	ISI & DSI chair time are less than both CRI and RDI.	Ib*	A^
Noise	ISI & DSI are associated with more noise than CRI and RDI.	Ib*	A^
Stretching/Gagging	ISI & DSI are associated with more stretching than RDI and caused more gagging than CRI.	Ib*	A^
Unpleasant taste	ISI less unpleasant taste than CRI.	Ib*	A^
Discomfort	ISI is associated with more discomfort compared to CRI but less discomfort when compared to RDI. DSI is associated with higher pain score compared to RDI.	Ib*	A^
Future preference	ISI is preferred for future dental treatment by more patient when compared to RDI.	Ib*	A^
Fissure sealant retention	Fissure sealant retention after isolating with ISI is similar to CRI.	Ib*	A^

Notes: This table is according to the recommendation system of Shekelle et al. [19], (1999).
** Category Ib is evidence from at least one randomized controlled trial.*
^ Class A is directly based on category I evidence. ISI: Isolite System Isolation, CRI: Cotton Role Isolation, RDI: Rubber Dam Isolation, DSI: DryShield System Isolation.

FIGURE 3. Risk of bias summary according to Cochrane risk of bias tool for included randomized clinical trials.

of ISI and DSI and compare them to other forms of isolation during dental treatment in children.

The average chair time required for the ISI in the study conducted by Collette *et al*., (2010) [20] was (5.7 minutes), just a little more than half the time (10 minutes) reported by Alhareky *et al*., (2014) [15], less than two minutes more than the time (3.6 minutes) reported by Bagher *et al*., (2021) [19] and Mattar *et al*., (2021) [22] (4.1 minutes). This can be explained by the difference in the time setting between the studies. In the studies conducted by Collette *et al*., (2010) [20] and Bagher *et al*., (2021) [19], the start time was at the insertion of the isolation system into the oral cavity and the end was when all the instruments were removed from the oral cavity after sealant application. On the other hand, Alhareky *et al*., (2014) [15] included the time required for topical anesthesia application prior to RDI usage and the time required to assemble and adjust the ISI, which explains the differences in time.

Due to the continuous high-speed evacuation in the ISI and DSI, most of the children reported more noise during their use when compared to both RDI [15, 19, 22] and CRI [20, 22]. In addition, children felt that both isolation systems caused slightly more stretching of the lips and cheeks, more pressure on the tongue, and stimulated a gagging reflex when compared to RDI [15, 19] and CRI [20], especially among older children. Therefore, proper selection of the isolation system mouthpiece size before starting any dental treatment is a crucial part of decreasing discomfort and pain and improving patients' satisfaction.

In the study conducted by Mattar *et al*. [22], (2021) it was reported that RDI caused more stretching than ISI because the ISI has a bite block component to help the patients keep their jaw open rather than constantly asking the patient to open his/her mouth The bite block was not used during the RDI.

Also, despite the noise and the stretching reported by most of the children during the use of ISI, the system was found to be more comfortable, and significantly more children preferred the ISI over the RDI [15]for future dental treatment. Also, there was no significant difference in the children's preference between ISI and CRI [20]. This can be attributed to the reduction in the chair time required by ISI and DSI and the elimination of the pressure and discomfort usually associated with RDI clamp application [15]. However, when the three isolation techniques were investigated in a single study, significantly more children preferred CRI when compared to ISI and RDI [22]. The author justified that this could be attributed to the differences in the operators' skills and the utilization of all techniques on each child rather than just two techniques.

A verbally administered questionnaire was utilized by Alhareky *et al*. [15], (2014), Collette *et al*. [20], (2010), Bagher *et al*. [19], (2021), and Mattar *et al*. [22], (2021). In the studies conducted by Alhareky *et al*. [15], (2014)and Collette *et al*. [20], (2010), the questionnaire was developed in English. Yet, nothing was mentioned in either article regarding the internal consistency, validity, and reliability of the utilized questionnaire. Mattar *et al*. [22], (2021) and Bagher. *et al*.

[19] (2021) developed a validated Arabic questionnaire.

Consequently, a study to evaluate the reliability and validity of the use of an English questionnaire is required in order to ensure that the questions can be understood and correctly interpreted by the intended respondents. In addition, in the paper of Alhareky *et al*. [15], (2014), it was mentioned that one of the two operators applied the pit and fissure sealant and administered the questionnaire verbally without providing any details regarding calibration or training on administering of the questionnaire.

In addition, all of the included studies measured subjective variables and tools that might provide inaccurate or biased results, especially among pediatric patients [23]. Therefore, future studies that measure both subjective and objective measures including heart rate and oxygen saturation are recommended to obtain more reliable conclusions.

There were a limited number of studies found in the literature with mostly no sample size calculation, non-validated questionnaires, limited types of population, and mostly measuring subjective measures, which restricted the outcome and generalization of the evidence. More randomized clinical trials with large sample sizes that measure objective variables and with longer follow-up periods are required to compare the clinical efficiency, patient satisfaction, and future preference of both newly developed isolation systems.

5. Conclusion

The review reports promising results in clinical efficiency, patient satisfaction, and future preference for both Isolite and DryShield isolation systems. Both systems require less chair time and were preferred by pediatric patients for future dental treatment when compared to both rubber dam and cotton roll isolation systems. Less fluid leaking and gagging reflexes were reported when compared to cotton roll isolation. When compared to rubber dam isolation, they were associated with less discomfort.

AVAILABILITY OF DATA AND MATERIALS

The data are contained within this article (and supplementary material). The data presented in this study are available on reasonable request from the corresponding author.

AUTHOR CONTRIBUTIONS

SMB and HJS—equally designed the research study. SMB and HJS—equally performed the research. SMB and HJS—equally analyzed the data. SMB and HJS—equally wrote the manuscript. Both authors read and approve the final manuscript.

ETHICS APPROVAL AND CONSENT TO PARTICIPATE

Not applicable.

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CONFLICT OF INTEREST

The authors declare no conflict of interest.

SUPPLEMENTARY MATERIAL

Supplementary material associated with this article can be found, in the online version, at https://oss.jocpd.com/files/article/1675735779439984640/attachment/Supplementary%20Table%201-final.docx.

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