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SCOPING REVIEW *DOI: 10.9789/2175-5361.rpcfo.v17.13846*

TOOTHBRUSHING STRATEGIES FOR CHILDREN WITH AUTISM: SCOPING REVIEW

Estratégias de escovação dentária para crianças com autismo: revisão de escopo

Estrategias de cepillado dental para niños con autismo: revisión de alcance

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RESUMO

Objetivo: este estudo tem por objetivo identificar e mapear evidências científicas de estratégias que visem a melhoria da aceitação de crianças com autismo à escovação dentária. **Método:** trata-se de revisão de escopo com protocolo de pesquisa desenvolvido de acordo com recomendações de PRISMA-ScR e método proposto por JBI® Manual 2020. A estratégia *Participants, Concept* e *Context* foi utilizada para elaboração da pergunta norteadora: "Que estratégias são desenvolvidas para melhorar a aceitação de crianças com Transtorno do Espectro Autista à escovação dentária?". **Resultados:** após submissão aos critérios de elegibilidade, selecionaram-se 16 artigos. Foram elaborados tópicos de acordo com as estratégias de escovação identificadas. **Conclusão:** esta revisão de escopo apontou que estudos sobre estratégias de escovação dentária em crianças com autismo utilizam-se, em sua grande maioria, de recursos visuais e mostram potencial em melhorar a aceitação da escovação dentária por essas crianças.

DESCRITORES: Transtorno do espectro autista; Escovação dentária; Saúde da criança; Saúde bucal; Odontologia.

ABSTRACT

Objective: this study aims to identify and map scientific evidence on strategies to improve the acceptance of toothbrushing in children with autism. **Method:** this is a scoping review with a research protocol developed according to PRISMA-ScR recommendations and the method proposed by the JBI® Manual 2020. The Participants, Concept, and Context (PCC) strategy was used to formulate the guiding question: "What strategies have been developed to improve the acceptance of toothbrushing

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in children with Autism Spectrum Disorder?" **Results:** after applying the eligibility criteria, 16 articles were selected. Topics were developed based on the identified toothbrushing strategies. **Conclusion:** this scoping review indicated that studies on toothbrushing strategies in children with autism predominantly use visual resources and show potential for improving the acceptance of toothbrushing in these children.

DESCRIPTORS: Autism spectrum disorder; Toothbrushing; Child health; Oral health; Dentistry.

RESUMEN

Objetivo: este estudio tiene como objetivo identificar y mapear evidencia científica sobre estrategias dirigidas a mejorar la aceptación del cepillado dental en niños con autismo. **Método:** se trata de una revisión de alcance con un protocolo de investigación desarrollado de acuerdo con las recomendaciones de PRISMA-ScR y el método propuesto por el JBI® Manual 2020. Se utilizó la estrategia Participantes, Concepto y Contexto (PCC) para formular la pregunta orientadora: "¿Qué estrategias se han desarrollado para mejorar la aceptación del cepillado dental en niños con Trastorno del Espectro Autista?" **Resultados:** después de aplicar los criterios de elegibilidad, se seleccionaron 16 artículos. Se elaboraron temas de acuerdo con las estrategias de cepillado identificadas. **Conclusión:** esta revisión de alcance indicó que los estudios sobre estrategias de cepillado dental en niños con autismo utilizan, en su mayoría, recursos visuales y muestran potencial para mejorar la aceptación del cepillado dental en estos niños.

DESCRIPTORES: Trastorno del espectro autista; Cepillado dental; Salud infantil; Salud bucal; Odontología.

INTRODUCTION

Challenges in brushing teeth in children with autism are frequently reported in the scientific literature[1-5] and can be attributed to cognitive deficits and sensory hyperresponsiveness.[1] This characteristic is due to changes in sensory processing, common in individuals with autism, and can result in sensory avoidance and general anxiety due to a lack of recognition of needs in their environment.[6,7]

Consequently, due to this altered sensory response, children with autism often fail to respond well to oral hygiene care at home.[8] Therefore, these children may be more likely to dislike the feel of toothbrushes and toothpaste.[9]

Families with young children, particularly girls under six years of age, and non-verbal children on the autism spectrum, report even greater difficulties in maintaining their children's oral health[4]. Resistance to toothbrushing and aversion to sensations associated with oral hygiene may result in lower brushing frequency when comparing atypical children with their neurotypically developing peers, a fact identified in previous studies.[1,5] Therefore, it is understood that poor oral hygiene, resulting from, among other factors, lower toothbrushing frequency, can result in a high incidence of tooth decay in children with autism.[2]

Toothbrushing is essential for maintaining adequate oral health, and its implementation in children with autism presents challenges, particularly related to sensory hyperresponsiveness. Given the above, this study aims, through a scoping review, to identify and map scientific evidence of strategies aimed at improving the acceptance of toothbrushing among children with autism.

METHOD

The research protocol was developed according to the recommendations of the Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR)[10] and the method proposed by the JBI Manual for Evidence Synthesis.[11] This study was guided by the following steps: identification of the research question; identification of relevant studies; study selection; data analysis and grouping, synthesis, and presentation. The research protocol for this scoping review is registered on the Open Science Framework (OSF) platform, with DOI: 10.17605/OSF.IO/Y65W2.

The Participants, Concept, and Context (PCC) strategy was used to develop the guiding question. For P (participants), we defined children with ASD; C (concept), toothbrushing strategies; and C (context), acceptance of toothbrushing by children with autism. Therefore, this scoping review was conducted based on the following guiding question: "What strategies are being developed to improve the compliance of children with ASD with toothbrushing?"

Articles that addressed toothbrushing strategies aimed at improving compliance among children with autism were included. Studies on strategies to optimize adherence to toothpaste or floss use among individuals with autism were

also included, as these are directly related to oral hygiene. No age limit was established. Studies in Portuguese, English, or Spanish, available in full online with free access, or available through the Journal Portal of the Coordination for the Improvement of Higher Education Personnel (CAPES), through the Federated Academic Community (CAFe), with access provided by the University, published between 2014 and 2024, as well as studies with different methodological designs: qualitative, quantitative, and mixed.

Studies that described strategies for children's acceptance of toothbrushing without detailing their implementation or how the improvement in this acceptance was measured, as well as review studies, editorials, and opinion pieces, were excluded from this scoping review.

The search for articles was conducted in the health databases – Latin American and Caribbean Literature in Health Sciences (LILACS) and the U.S. National Institutes of Health's National Library of Medicine (PubMed).

The search strategy used six descriptors, in Portuguese and English, indexed in the National Library's Health Sciences Descriptors (DeCS) and Medical Subject Headings (MeSH): Autism Spectrum Disorder, Toothbrushing, Toothpastes, Oral Hygiene, Oral Health, and Dentistry. The descriptor "Child" was not added to the strategy because there is no age restriction. The Boolean operators AND and OR were used to combine the descriptors. The combination of search strategies in the databases is described in Chart 1.

Chart 1 - Distribution of search strategies by database.

Database	Search Strategy
PubMed	*("Autism Spectrum Disorder")* AND *(Toothbrushing* OR *Toothpastes* OR *"Oral Hygiene")* AND *("Oral Health"* OR *Dentistry)*.
LILACS	*("Autism Spectrum Disorder")* AND *(Toothbrushing* OR *Toothpastes* OR *"Oral Hygiene")* AND *("Oral Health"* OR *Dentistry)*.

Source: Prepared by the authors.

The Mendeley® bibliographic manager was used to exclude duplicates and assist in screening titles and abstracts, following the adopted eligibility criteria.

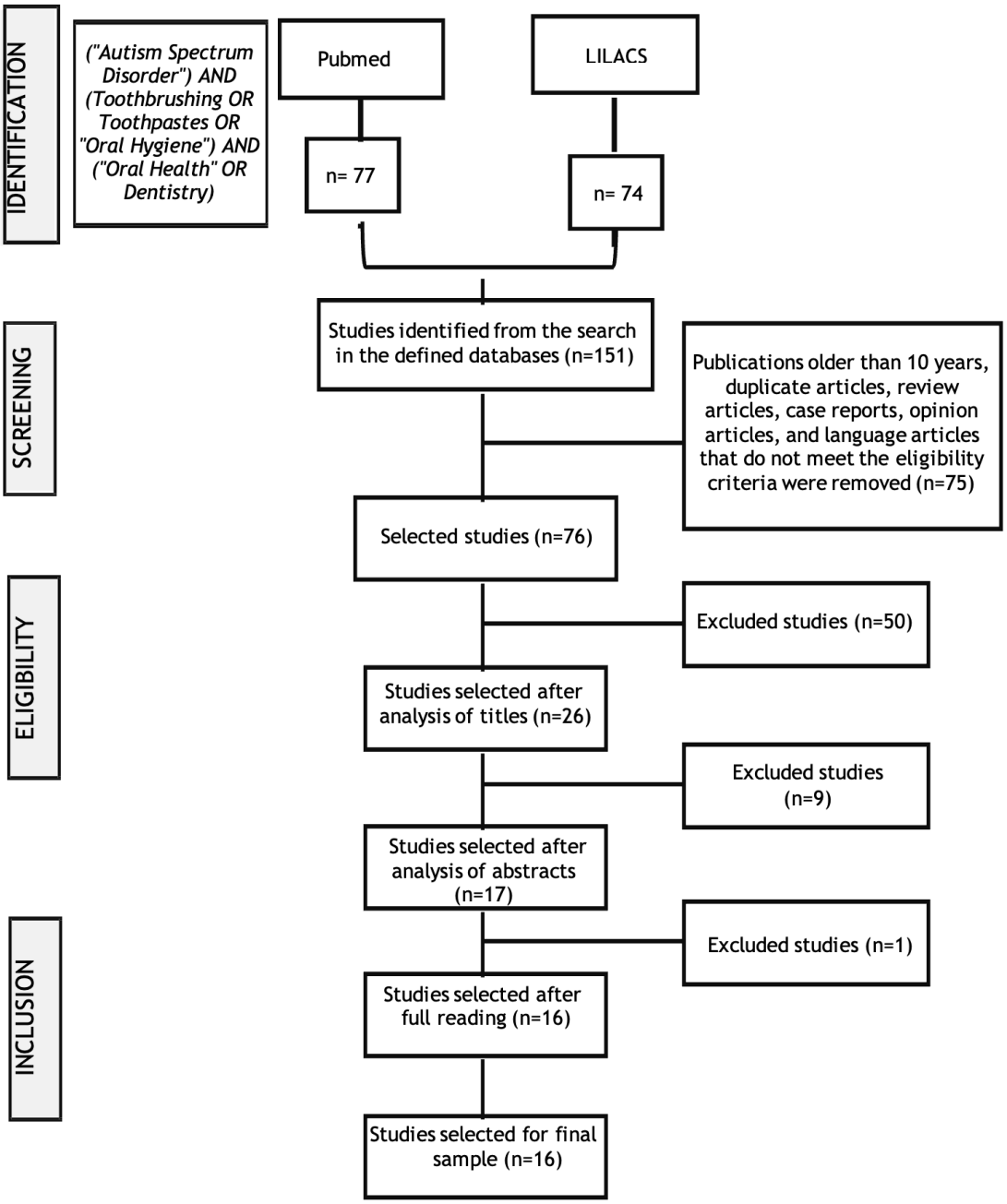
No formal assessment of the methodological quality of the included studies was performed, as scoping reviews are designed to provide insight into existing evidence, regardless of quality.

A Microsoft Office Excel® spreadsheet was used to extract data from the studies included in the final sample. The data were analyzed and presented in a flowchart and table, categorizing the selected studies (author, year and country, objective, toothbrushing strategy, study type, sample size, intervention duration, measurement method, and main results). The data were synthesized narratively, and the interpretation consisted of a summary of knowledge, discussion of the results, and proposals and suggestions for future research around the guiding question.

RESULTS

After a literature search, 151 references were identified (Figure 1). Cataloging the references in the Mendeley® bibliographic manager allowed for the elimination of duplicate studies. After meeting the eligibility criteria, 16 articles were selected. Figure 1 presents the flowchart with the search strategy.

Figure 1 - Flowchart showing the search process and selection of included studies.



Source: Prepared by the authors.

Chart 2 contains key information on the selected studies.

Chart 2 - Characterization of the selected studies, by objective and main results.

Nº	Objective	Main results
1	To evaluate the effectiveness of video modeling to improve toothbrushing in children with autism.	Oral hygiene improved without statistically significant differences compared to the control group.[12]
2	To evaluate the effectiveness of a Picture Exchange Communication System (PECS) toothbrushing program and parents' perceptions of its use.	Plaque and gingival indices decreased significantly after the intervention (p<0.001).[13]
3	To evaluate a toothbrushing training program using a digital app.	Children were able to perform more steps independently. Initially, some children skipped 17 steps. After eight months, only one step (spitting) was skipped.[14]
4	To evaluate yoga as a complement to regular toothbrushing skill training methods in children with ASD.	Mean plaque and gingival indices began to show significant differences after the second month, with the intervention group demonstrating better oral hygiene.[15]
5	To evaluate the effectiveness of toothbrushing in children with ASD after the use of visual pedagogy.	Brushing ability and cooperation of children with ASD improved significantly (p<0.05). Dental plaque indices decreased significantly (p<0.05).[16]
6	To evaluate the effectiveness of toothbrushing training assisted by social stories in improving toothbrushing performance.	After the intervention, children performed more brushing steps (p<0.001). Brushing time increased significantly (p<0.01). There was a greater reduction in debris and gingival inflammation rates among children with autism (p =0.01 and p<0.001, respectively). A positive parental attitude toward the intervention was associated with better gingival health in their children (OR=3.53, p=0.03).[17]
7	To evaluate the effectiveness of visual pedagogy in improving oral hygiene and gingival health in children with autism.	Significantly lower levels of plaque and gingival inflammation were found at three and six months compared to baseline. Children with poorer initial oral hygiene were more likely to improve with the intervention.[18]
8	To examine the effectiveness of parental training in improving oral hygiene and oral health in children with ASD.	Parent training was associated with increased toothbrushing and a reduction in plaque and behavioral problems in children.[19]
9	To evaluate the effectiveness of sensory-based interventions in oral health education for adolescents with ASD. Evaluate the effectiveness of culturally adapted visual materials in improving oral hygiene in children with ASD.	A significant difference was observed in plaque (p=<0.001) and gingival (p=<0.001) indices after 6 and 12 weeks, with no statistically significant difference between the groups.[20]
10	Develop a visual toothbrushing pedagogy and assess its feasibility and effectiveness for children with ASD.	Oral hygiene status improved significantly in both groups. The experimental group showed a significant improvement in oral hygiene status (p=0.030).[21]
11	Evaluate the potential of the "Picture Assisted Illustration Reinforcement" communication system and conventional verbal techniques in oral health education for children with autism.	The number of brushing steps in the intervention group was greater than in the control group at three (p<0.01) and six months (p<0.01).[22]
12	Evaluate and compare toothbrushing educational interventions on the oral hygiene status of students with ASD.	There was a significant reduction in gingivitis scores (p=0.043) and oral hygiene scores (p < 0.05) compared to the conventional group.[23]
13	Evaluate the effectiveness of the Oral Health Module for Children with ASD in improving toothbrushing.	Significantly lower IHOS in the intervention group (video), with better oral health (p=0.006). Parents' knowledge and attitude improved, with no significant difference between the groups.[24]
14	Compare video modeling with social storytelling in improving oral hygiene in children with ASD.	Significant differences between interventions for: "children who liked to close their mouths","turn their heads in different directions,"and "did not understand the purpose of tooth brushing".[25]
15	Examine experiences with a smart electric toothbrush used by children with ASD.	The OHIS score was significantly lower in the intervention group (video), with better oral health status (p=0.006). Parental knowledge and attitude improved, with no significant difference between groups.[26]
16	To evaluate the effectiveness of video modeling to improve toothbrushing in children with autism.	58.8% of children allowed brushing more frequently. Average brushing time of 1 min and 58 sec.[27]

Source: Prepared by the authors.

The distribution of publications by year was similar from 2019 onward. The United States of America had the highest number of publications (n=4).[12,19,26,27] All 16 articles were published in English.

After identifying the strategies implemented in the selected studies, a word cloud was constructed using the WordClouds.com platform. By analyzing the word cloud (Figure 2), it is possible to identify that "Video Modeling" stands out as the most frequent strategy among the selected studies.

Figure 2 - Word cloud according to tooth brushing strategies implemented by the studies selected in the final sample.

Source: Prepared by the authors.

DISCUSSION

Next, toothbrushing strategies aimed at children with ASD will be discussed and analyzed according to the listed publications.

Video modeling

Among strategies for improving toothbrushing adherence, video modeling stands out. In this method, the child watches a video of themselves or an adult/peer performing steps of a specific task before actually performing it.[26] This strategy minimizes distractions by providing educational information to children with ASD in a comfortable and engaging way, while also being accessible to families.[12]

A study evaluated the effectiveness of an intervention using an educational video and daily email reminders for three weeks to improve toothbrushing in children with autism. The intervention video modeled proper brushing technique. The authors found the intervention promising for promoting oral health in children with autism and also reported that email reminders may have encouraged oral hygiene.[12]

Two studies investigated the effectiveness of video modeling compared to social stories in promoting toothbrushing in individuals with ASD. One of these studies[24] identified a reduction in the Simplified Oral Hygiene Index (SOHI) in the video modeling group, indicating improvements in oral health, while parental knowledge and attitude improved in both groups, with no significant difference between them. The results of this study[24] suggest that video modeling can improve the oral hygiene status of individuals with ASD and, consequently, contribute to reducing the financial, social, and emotional burden of healthcare for parents.

This difference between video modeling and social storytelling was not identified in another selected study.[26] These authors[26] identified significant improvements in plaque and gingival indices after 30 days of intervention, however, without significant differences between groups. In the caregivers' perception, there was greater acceptance of oral hygiene with video modeling.

Therefore, video modeling emerges as a promising strategy for improving toothbrushing and, consequently, oral hygiene in children with ASD. It is worth noting that in comparison to social history, to identify the existence of statistically significant differences between interventions, regarding the effectiveness of adherence to tooth brushing, further studies are needed, considering that the studies[24,26] differed in their findings, which makes it difficult to generalize the results.

Social Story

In the 1990s, Carol Gray[28] developed Social Story™ to explain events and interactions objectively and simply to her students with ASD. Using short, illustrated stories, the social story describes specific scenarios, situations, and how the child can react appropriately.[28]

Social stories focused on toothbrushing are an approach with potential for promoting oral health in children with different developmental profiles. This was investigated in a study[17] that found that regular use of social stories resulted in a significant increase in the number of brushing steps performed and the time taken to complete them. Parental attitudes toward the intervention positively influenced the results, highlighting the importance of family involvement.[17]

Communication Systems

The Picture Exchange Communication System (PECS) was developed to enable children with ASD to learn to initiate requests and communicate needs through pictures.[29] Regarding toothbrushing, a study[13] identified improvements in plaque and gingivitis scores in children and adolescents with ASD using PECS. Many participating parents found PECS difficult to use, but all agreed that it was a useful tool and would continue to use it.

A system inspired by PECS was called Picture Assisted Illustration Reinforcement (PAIR). This communication system presents illustrations that demonstrate the sequence of actions for performing oral hygiene[23]. In the study that implemented PAIR[23], there was a significant reduction in gingivitis and oral hygiene scores.

Various Visual Resources

Other studies listed in this review investigated visual resources, in addition to those already mentioned, as strategies to improve toothbrushing acceptance among children with autism, including flip charts, desk calendars, and digital tools. Visual pedagogy was developed using 13 toothbrushing steps, using flip charts with photographs of children performing toothbrushing steps and a DVD with verbal explanations, bilingual captions, and background music. Statistically significant improvements in toothbrushing skills, regarding the number of brushing steps and the quality of performance, were observed over three and six months of follow-up.

A desk calendar with drawings of toothbrushing steps was also investigated. The results indicated improvements in brushing ability, cooperation, and a reduction in plaque. Culturally adapted visual resources demonstrated significant improvements in oral hygiene, with a statistically significant difference favoring the adapted resources. This study[21] revealed the importance of adapting oral health interventions to the cultural and linguistic specificities of the target population, promoting a more effective and inclusive approach to caring for children with ASD.

Three studies developed digital tools.[14,20,27] In one of these studies[14], a training program based on a behavioral approach and visual pedagogy mediated by a digital tool was evaluated for toothbrushing autonomy in children and adolescents with ASD. The authors suggested that the use of adapted strategies and digital tools can be effective in improving oral health and promoting autonomy in children with ASD.[14]

In a prospective study[20], they compared toothbrushing strategies for adolescents with ASD: visual cards and the Brush Up app. The results showed a statistically significant reduction in plaque and gingival indices in both groups, with no significant difference between the strategies.

Caregiver experience was also evaluated[27], with the use of an electric toothbrush in children with ASD combined with augmented reality. In addition to greater autonomy, it was observed that most children approved of the type of toothbrush and demonstrated less frustration. Despite their different approaches[14,16,20,22,27], visual pedagogies have proven to be effective alternatives to the acceptance of tooth brushing in children with ASD.

Parent training

Parental support or supervision is essential for effective toothbrushing, and self-regulatory factors, such as planning, can ensure better supervision. Visual toothbrushing instructions for parents indicated a significant reduction in plaque levels and gingival inflammation in children with ASD after three and six months of intervention.

The benefits of parent training can lead to increased toothbrushing frequency for children with ASD. In previous research, such training was conducted. Families who completed all training sessions were more likely to maintain adequate toothbrushing frequency.

In another study, a module for caregivers was developed that included a booklet and poster with color photos of toothbrushing sequences for training. Most caregivers faced difficulties brushing their children's teeth before the intervention, such as "brushing is a difficult task" or "fear of brushing their teeth," and improvements were observed after the intervention. These strategies aimed at parents/caregivers reinforce what was reported in a previous study[4] in which the authors emphasize the need to focus on the family, since parents are aware of factors that trigger well-being or aversion in their children.

Yoga

Among the studies included in the final sample, one study evaluated interventions with yoga practices to improve oral hygiene in children with autism. The yoga program included warm-up and relaxation practices. The intervention, with daily sessions for three months under the guidance of a yoga therapist and supervision of a pediatrician, demonstrated improvements in motor skills, concentration, and coordination, resulting in faster and more effective brushing skills.

The brushing strategies addressed in the selected studies focused on teaching brushing techniques to children with ASD. Three selected studies reported the use of the Fones technique due to its simplicity, with circular movements, making it easier to accept. Another study, involving adolescents with ASD, used a modified Bass technique, which may require greater manual dexterity. The studies were implemented for a period of no less than three weeks. This highlights the importance of repetition and consistency in its implementation in the routine of families of children with ASD. The results were measured, for example, by toothbrushing frequency[19,26,27] and plaque reduction.[12,13,15,16,18-21,26]

The selected publications addressed predominantly visual strategies. This corroborates the understanding that children with autism are visual learners, preferring to process this type of information.[33] However, since scoping reviews aim to identify gaps in scientific evidence, in addition to mapping scientific evidence, this review highlights that no studies were found on strategies directly aimed at managing sensory hypersensitivity to toothbrush texture or toothpaste aversion in children with autism.

FINAL CONSIDERATIONS

This scoping review indicated that studies on toothbrushing strategies for children with ASD largely utilize visual aids and show potential for improving these children's acceptance of toothbrushing.

It is hoped that this scoping review will provide input to parents/caregivers and dental professionals regarding the oral health care of children with autism.

Regarding future developments, it is hoped that this study will prompt research on toothbrushing strategies/approaches targeted at sensory desensitization, common in children with autism.

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