

ORIGINAL ARTICLE

Effectiveness of “Oral Health Care for Children with Autism Spectrum Disorder Module” in Improving Tooth-Brushing Practice among Children with Autism Spectrum Disorder in Hospital Universiti Sains Malaysia

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ABSTRACT

Introduction: Autism spectrum disorder (ASD) is associated with behavioural problems which may affect children’s oral health statuses. Caregivers have crucial roles in caring for these children’s oral health. Thus, this study is aimed to evaluate the effectiveness of the Oral Health Care for Children with ASD (OHASD) Module in improving caregivers’ tooth-brushing difficulties in children ASD. **Methods:** Quasi-experimental study on caregivers of children with ASD aged 7 to 12 years who were registered at the Psychiatry Clinic Hospital Universiti Sains Malaysia (USM), Kelantan. The sociodemographic data obtained, and behavioural problems were assessed. Tooth-brushing difficulties were evaluated at pre- and six months post-intervention using OHASD Module. Data were analysed using IBM SPSS 26.0. **Results:** A total of 32 Malay children with ASD including their caregivers participated in this study. Caregivers were mostly mothers (78.1%) and children were mostly boys (84.4%), with mean age (SD) of 39.1 (4.19) and 8.8 (1.52) years respectively. Parent-reported questionnaire using the Modified Checklist for Autism in Toddlers (M-CHAT) showed 65.6% of children were highly sensitive to noises, 53.1% sometimes stared at nothing or wandered without purpose and 59.4% were unable to imitate caregivers’ faces. Significant differences between pre- and post-intervention for items; children who liked to close their mouths, turn their heads in different directions, did not understand the purpose of tooth-brushing ($P<0.05$). **Conclusion:** OHASD Module is useful in assisting caregivers in practising daily tooth-brushing of children with ASD.

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most of these children are visual learners and they tend to have better ability in retaining information through visual processing rather than through audio or verbal information processing (2, 4).

INTRODUCTION

Autism Spectrum Disorder (ASD) is a behavioural syndrome of an individual who displays impairments in social communication, has the characteristic of repetitive behaviours and shows restricted interests (1). Common signs and symptoms of ASD can be observed in a child as early as 36 months of age (2). Children with ASD commonly display impairment of social communication and restrained repetitive behaviours which begin in early childhood that persist throughout life and interfere with their daily living (3). Despite communication problem,

Teaching tools such as visual pedagogy can be in the form of a set of coloured photographs in books, social stories and video modelling (5). These materials are included under the Treatment and Education of Autistic and other Communication Handicapped Children (TEACCH) concept for teaching children with ASD at home and in school (6). Oral health education by using this method can familiarise the children with routines of daily oral hygiene practices and the ability to undergo dental procedures (4, 7).

The oral health status of children with ASD deteriorates

due to poor oral hygiene practice (8). Because of sensory hypersensitivity in the oral cavity, these children often show refusal or a disinclination to brush their teeth or perform oral hygiene practices (9, 10). Authors such as da Silva et al. (11) discovered high prevalence of gingivitis among children affected with ASD in the United States and India, namely 61.5% and 59.6% respectively. Several studies reported a higher dental caries experience among these children due to poor oral care (12, 13). With constant practice, these children will become more competent in practising daily tooth-brushing.

When this study was conducted, there was no known study on the effectiveness of oral health care module for caregivers and children with ASD. Therefore, this study aimed to evaluate the effectiveness of the oral health care module in improving caregiver’s tooth-brushing difficulties in children with ASD.

MATERIALS AND METHODS

Samples

All information obtained during the study will be kept confidential under the auspices of the university’s ethics committee (USM/JEPeM/19060355) and Ministry of Health (NMRR-19-3862-49378). The selection of the sample was based on children with ASD who were registered at the Psychiatry Clinic Hospital Universiti Sains Malaysia (Hospital USM), Kelantan and their caregivers. Kelantan is situated in the north-eastern part of Peninsular Malaysia. The total number of registered patients with ASD was 68. Inclusion criteria included children with ASD who had a confirmed diagnosis of ASD by the psychiatrist. Children with physical disabilities involving the dexterity of their hands that prevented them from engaging in the tooth-brushing activity were excluded from this study. Therefore, the respondents were selected by simple random sampling, giving a total of 32 children with ASD being recruited in this study. A letter requesting permission was sent to the Director of Hospital USM to explain the purpose of the study and to obtain the details of children with ASD and their caregivers. Consent was obtained from the caregivers.

Identification of Behavioural Problems Linked to Autism Spectrum Disorder

The Modified Checklist for Autism in Toddlers (M-CHAT) which was developed by Robins et al. (14) was used to identify the behavioural problems of children with ASD in this study. Caregivers of children with ASD were requested to answer the Malay version of M-CHAT that has been incorporated in the New Child Health Record Book and fully implemented by the Ministry of Health Malaysia since 2013. It contained 23-item parent-report questionnaire as shown in Table I. The 23 items described in detail the child’s behaviour, frequency and severity, and specific examples of target

Table I. M-CHAT Checklist

Item	Checklist
1	Does your child enjoy being swung, bounced on your knee, etc.?
2	Does your child take an interest in other children?
3	Does your child like climbing on things, such as upstairs?
4	Does your child enjoy playing peek-a-boo/hide-and-seek?
5	Does your child ever pretend, for example, to talk on the phone or take care of a doll or pretend other things?
6	Does your child ever use his/her index finger to point, to ask for something?
7	Does your child ever use his/her index finger to point, to indicate interest in something?
8	Can your child play properly with small toys (e.g. cars or blocks) without just mouthing, fiddling, or dropping them?
9	Does your child ever bring objects over to you (parent) to show you something?
10	Does your child look you in the eye for more than a second or two?
11	Does your child ever seem oversensitive to noise? (e.g., plugging ears)
12	Does your child smile in response to your face or your smile?
13	Does your child imitate you? (e.g., you make a face-will your child imitate it?)
14	Does your child respond to his/her name when you call?
15	If you point at a toy across the room, does your child look at it?
16	Does your child walk?
17	Does your child look at things you are looking at?
18	Does your child make unusual finger movements near his/her face?
19	Does your child try to attract your attention to his/her own activity?
20	Have you ever wondered if your child is deaf?
21	Does your child understand what people say?
22	Does your child sometimes stare at nothing or wander with no purpose?
23	Does your child look at your face to check your reaction when faced with something unfamiliar?

behaviours for the purpose of a diagnostic evaluation. The smaller subset of items, which were the six critical items (items 2,7,9,13,14,15), could successfully identify children with ASD. Later, the Modified Checklist for Autism in Toddlers, Revised with Follow-up (M-CHAT-R/F) was introduced to make the original M-CHAT more comprehensible that is, by omitting the three poorly performing items namely peek-a-boo, playing with toys, and wandering without purpose resulting in 20 remaining items (15).

Questionnaire Development

Questions on sociodemographic profiles were adapted from Tugeman et al. (16) and Zaihan et al. (17). There were 16 binary “yes” or “no” answers items regarding the difficulties faced by the caregivers during the children’s tooth-brushing activity. The items were adapted from Zaihan et al. (17) and Du et al. (18). Items from Du et al. (18) were translated into Malay language by translators at the language centres. The intra-class correlation coefficient (ICC) score of the Malay language version was 0.8 and indicated as good.

The Oral Health Care Module for Children with ASD

The Oral Health Care Module for Children with ASD

(OHASD) contained a booklet on oral health care guidelines for children with ASD and a tooth-brushing poster in Malay language which is the participants mother tongue (Fig. 1). The objectives of the guidelines were to ensure the caregivers acquire the effective skills in tooth-brushing, flossing, and learning the proper positions of brushing their children's teeth. The development of the module was reviewed and approved by two Dental Public Health Specialists from the School of Dental Sciences USM and a psychiatrist from Hospital USM. The module was fully explained to the caregivers during intervention, and they were asked to read the module at home for the purpose of teaching their children during tooth-brushing.



Fig. 1 : Tooth-brushing poster

The modified tooth-brushing method emphasises on tooth-brushing in small circular movements on each tooth which begins at the maxillary right posterior teeth to the opposite site, followed by the mandibular teeth with mouth in an open position, and finally to bring the maxillary and mandibular teeth together and to brush at the anterior teeth.

The guidelines consisted of a main section describing oral hygiene practice instructions particularly on effective oral health care techniques including flossing. The tooth-brushing method was a modified method from the circular Fones method which was easy to carry out and took shorter time for the caregivers and the children to learn (19). The modified tooth-brushing method emphasised on tooth-brushing in small circular movements on each tooth. In comparison to the Fones method, the modified method begins at the maxillary right posterior teeth to the opposite site, followed by the mandibular teeth with mouth in an open position. The final step was to bring the maxillary and mandibular teeth together and to brush at the anterior teeth. The tooth-brushing covered the outer surfaces of each tooth, followed by the biting surfaces and the inside surfaces of all teeth, - alternately in each region. The guidelines also focused on the importance of no rinse after tooth-brushing in order to maintain the amount of fluoride in the mouth (20).

The reinforcement of the modified tooth-brushing method was taught with a poster. The objectives of creating the printed coloured posters were to reinforce

on the modified tooth-brushing technique besides using the oral health care guidelines and to develop the child's sensory and emotional stimulation. The poster was in the standard size of a laminated A4 paper measuring 210mm x 297mm. It consisted of real-coloured photos of tooth-brushing sequences on the occlusal, buccal and lingual surfaces on all teeth for both maxillary and mandibular teeth. The caregivers were instructed to place the poster at home in a location where the children would go to on a regular basis, such as in the bathroom or wherever tooth-brushing is usually performed. This was to encourage the children to look at the poster while brushing their teeth.

Data Collection

Upon arrival at the clinic, written consent and verbal consent were obtained from the caregivers and their children. A briefing on the study was given as well. The caregivers were then interviewed by the researcher based on the M-CHAT and questionnaire. The questionnaire was administered face-to-face with the caregivers during the initial phase at the Oral Health Specialist Clinic Hospital USM. After the baseline data were obtained, the intervention was done using the OHASD Module. The caregivers were briefed on the content of the oral health care guidelines and the tooth-brushing poster. Caregivers were advised on how to use the tooth-brushing poster for their children during daily brushing times. A follow-up of the questionnaire was supposed to be carried out at the same venue during post-intervention. However, due to the COVID-19 pandemic, the follow-up was conducted through telephone interview.

The caregivers' tooth-brushing difficulties in children with ASD were re-evaluated at sixth month after the initial dental visit. Due to the COVID-19 pandemic restrictions, the post-intervention data were obtained through telephone interview. The caregivers were contacted to arrange a suitable date and time for the interview. The researcher conducted phone interviews based on recommendations by Burke and Miller (21). Before initiating the interview, the researcher introduced herself and stated the study purpose. During the interview, the researcher read the questions and the answer choices in Malay language. Questions were repeated at the caregiver's request or if the caregiver did not understand. Subsequently, the caregivers' responses were repeated and recorded. All responses were then prepared for data analysis.

Data Analysis

All data were entered and analysed using the IBM SPSS version 26.0. Prior to the analysis, data were checked and cleaned. Calculation was made using the descriptive statistics such as frequency and percentage for the categorical variables. The M-CHAT results were displayed using descriptive statistics. Comparisons were made between pre-intervention and post-intervention. Descriptive data and McNemar's test were generated for

the comparison of caregivers' tooth-brushing difficulties in children with ASD before and after the intervention. The p-value was set as significant at p of less than 0.05.

RESULTS

A total of 32 Malay children with ASD including their caregivers participated in this study from the first visit until the follow-up at Month Six (Table II). The caregivers were mostly mothers (78.1%) and the children were mostly boys (84.4%), with mean age (SD) of 39.1 (4.19) and 8.8 (1.52) years respectively. There were 12 children (37.5%) who were diagnosed by the psychiatrist with mild ASD and 20 children (62.5%) with moderate ASD. A greater proportion of caregivers had STPM or equivalent qualifications (34.4%) and were self-employed (34.3%). Furthermore, the median (interquartile range) of the caregivers' monthly income was MYR3700 (5750). Most of the caregivers (46.0%) were categorised as low-income.

Table III displays 23 items of the M-CHAT. Overall, most of the caregivers answered positive behaviours displayed by their children. Higher percentages were found in some of the important items in the M-CHAT. Regarding four items in reversed score which indicated risk for ASD, 65.6% of children displayed significantly high sensitivity to noise. Fifty-three point one percent of the children were claimed by their caregivers that they sometimes stared at nothing or wandered away without purpose. Meanwhile, relating to six critical items that suggested the need for referral to a specialist, over half of the children (59.4%) were unable to imitate their caregivers' faces.

Table IV shows 16 items on the caregivers' tooth-brushing difficulties in children with ASD during pre-

Table II: Sociodemographic characteristics of caregivers and children with ASD (n=32)

Variables	n (%)
Sex	
Caregivers	
Female	25 (78.1)
Male	7 (21.9)
Children	
Boy	27 (84.4)
Girl	5 (15.6)
Age (years)^a	
Caregiver	39.1 (4.19)
Child	8.8 (1.52)
ASD Severity	
Mild	12 (37.5)
Moderate	20 (62.5)
Caregiver's education level	
Master's degree/PhD	3 (9.4)
First degree	8 (25.0)
A-level or equivalent	11 (34.4)
O-level or equivalent	9 (28.1)
High school or equivalent	1 (3.1)
Caregiver's occupation	
Government	12 (37.5)
Private	3 (9.4)
Self-employed	11 (34.4)
Not employed	6 (18.8)
Caregiver's household income/month (MYR)^b	
High Income	10 (31.3)
Middle Income	7 (21.9)
Low Income	15 (46.9)

^aMean (SD); ^bMedian (IQR)

and post-intervention. Generally, the results show that caregivers encountered tooth-brushing difficulties in all items during pre-intervention, and the difficulties were completely improved especially on items 'tend to run away', 'scream and cry', 'tongue pushes away the toothbrushes', 'tooth-brushing is a difficult task', 'scared of tooth-brushing', 'unable to keep still during

Table III: Identification of behavioural problems using M-CHAT checklist (n=32)

M-CHAT Checklist	n=32	
	Yes n (%)	No n (%)
Does your child enjoy being swung, bounced on your knee, etc.?	28 (87.5)	4 (12.5)
Does your child take an interest in other children? ^b	17 (53.1)	15 (46.9)
Does your child like climbing on things, such as upstairs?	25 (78.1)	7 (21.9)
Does your child enjoy playing peek-a-boo/hide-and-seek?	20 (62.5)	12 (37.5)
Does your child ever pretend, for example, to talk on the phone or take care of a doll or pretend other things?	19 (59.4)	13 (40.6)
Does your child ever use his/her index finger to point, to ask for something?	29 (90.6)	3 (9.4)
Does your child ever use his/her index finger to point, to indicate interest in something? ^b	27 (84.4)	5 (15.6)
Can your child play properly with small toys (e.g. cars or blocks) without just mouthing, fiddling, or dropping them?	26 (81.3)	6 (18.8)
Does your child ever bring objects over to you (parent) to show you something? ^b	28 (87.5)	4 (12.5)
Does your child look you in the eye for more than a second or two?	20 (62.5)	12 (37.5)
Does your child ever seem oversensitive to noise? (e.g., plugging ears) ^a	21 (65.6)	11 (34.4)
Does your child smile in response to your face or your smile?	28 (87.5)	4 (12.5)
Does your child imitate you? (e.g., you make a face-will your child imitate it?) ^b	13 (40.6)	19 (59.4)
Does your child respond to his/her name when you call? ^b	29 (90.6)	3 (9.4)
If you point at a toy across the room, does your child look at it? ^b	23 (71.9)	9 (28.1)
Does your child walk?	32 (100.0)	0 (0)
Does your child look at things you are looking at?	18 (56.3)	14 (43.8)
Does your child make unusual finger movements near his/her face? ^a	7 (21.9)	25 (78.1)
Does your child try to attract your attention to his/her own activity?	21 (65.6)	11 (34.4)
Have you ever wondered if your child is deaf? ^a	7 (21.9)	25 (78.1)
Does your child understand what people say?	24 (75.0)	8 (25.0)
Does your child sometimes stare at nothing or wander with no purpose? ^a	17 (53.1)	15 (46.9)
Does your child look at your face to check your reaction when faced with something unfamiliar?	27 (84.4)	5 (15.6)

^aFour items in reversed score items which indicate risk for ASD; ^bSix critical items that suggest the need of referral to a specialist

Table IV: Comparison in caregivers' tooth-brushing difficulties in children with ASD during pre- and post-intervention (n=32)

Variable	Pre	Post	P value
	n (%)	n (%)	
Likes to close mouth	14 (43.8)	1 (3.1)	<0.001
Turning head in different directions	13 (40.6)	2 (6.3)	0.001
Tends to run away	6 (18.8)	0 (0)	-
Screams and/or cries	8 (25.0)	0 (0)	-
Tongue pushes away the toothbrush	5 (15.6)	0 (0)	-
Bites the toothbrush	11 (34.4)	4 (12.5)	0.016
Chews the toothbrush	4 (12.5)	1 (3.1)	0.250
Mouth will be hard to open	10 (31.3)	1 (3.1)	0.012
Tends to gag once the toothbrush is in the mouth	8 (25.0)	6 (18.8)	0.687
Tooth-brushing is a difficult task	6 (18.8)	0 (0)	-
Scared of tooth-brushing	1 (3.1)	0 (0)	-
Cannot keep still for tooth-brushing	8 (25.0)	0 (0)	-
Does not understand tooth-brushing	11 (34.4)	1 (3.1)	0.006
Does not like anything in mouth	6 (18.8)	1 (3.1)	0.063
Medical condition	3 (9.4)	0 (0)	-
It takes too much time and effort	3 (9.4)	0 (0)	-

McNemar test. Significance level was set at $P < 0.05$.

tooth-brushing', 'medical condition' and 'too much time and effort'. In addition, significant differences were seen especially among children who liked to close their mouths; $P < 0.001$, turn their heads in different directions; $P = 0.001$, and did not understand the purpose of tooth-brushing; $P = 0.006$.

DISCUSSION

The findings of this study revealed that more than half of the caregivers had received secondary education qualifications. Similar to the findings of a study conducted in Egypt (22) among 60 children with ASD aged 6 to 12 years, it was discovered that more than half of the mothers had secondary education qualifications and that improvements were seen in the mothers' oral health care knowledge and practices, and the children's quality of life after being given health education intervention. However, these mothers were lacking in oral health awareness and had difficulties in accessing oral hygiene tools and oral health care facilities for their children (22). In a study involving 60 Latinx caregivers of children with or without ASD aged 4 to 14 years in Los Angeles (23), it was found that caregivers of children with ASD who received lower education displayed lower oral knowledge scores, less frequent dental visits, increased feelings of being discriminated against, increased children's fear of the dentists, and difficulty in finding a dentist. Furthermore, a study conducted in Iran (24) among 55 children with ASD and 165 children without ASD aged 6 to 12 years found that more than half of the caregivers of children with ASD received secondary education compared to caregivers of children without ASD. The results of the study concluded that children with ASD displayed higher caries experience scores, higher prevalence of gingivitis, and displayed negative behaviours during dental examinations compared to children without ASD (24).

The current practice of ASD screening in the general psychiatric clinic in Hospital USM is using M-CHAT.

The 18-month-olds are screened and referred to the specialists. Using the same approach by Seif Eldin et al. (25) and Shabani et al. (26), the present study attempted to identify the behavioural characteristics of older children with ASD in this study. Seif Eldin et al. (25) concluded that the screening tool was simple and effective for screening children with ASD aged 2 to 10 years due to the limited number of trained mental health professionals in the Arab countries. Meanwhile, Shabani et al. (26) discovered that affected Albanian children between 3 and 13 years old were in medium and high-risk levels of ASD. In contrast to the findings in the present study, Shabani et al. (26) reported that most of the children did not like to play hide-and-seek, answer the phone or take care of a doll, point, ask for something, play with small toys, and bring objects to their parents. However, a similar finding in the present study was that children mostly did not imitate their parents' expressions.

Children with ASD in this study displayed some critical ASD behaviours listed in the M-CHAT such as high sensitivity to noise, staring at nothing or wandering away without purpose, and not imitating their caregivers' facial expressions. According to Robertson and Simmons (27), children on the spectrum can display exaggerated reactions or unresponsiveness to noise. Loud noise can cause pain while low intensity noises can cause discomfort to the children (27). Prior studies by Nagib and Williams (28) and Schwartz et al. (29) provide supporting evidence to the present study. Nagib and Williams (28) distributed an online questionnaire to 168 Canadian families and discovered that 87% of children with ASD aged 3 to 16 years experienced hypersensitivity to noise. Meanwhile, Schwartz et al (29) studied 83 children and adults with ASD aged 5 to 21 in the US and found that minimally verbal individuals with ASD displayed more atypical auditory behaviours such as ear covering and humming compared to verbally fluent individuals with ASD. These atypical auditory behaviours are reflexes to reduce or avoid sensory stimulation on loud noises due to the deficits in receptive vocabulary and neural responses to changes in sound intensity (29). In relation to dentistry, a review by Kuhaneck and Chisholm (30) reported that children with ASD who visit dentists can be distracted by people's voices, beeping noises and dental equipment. In addition, parental reports on barriers to dental care among children with ASD in Saudi Arabia showed that 65% of the children displayed hypersensitivities mostly to sounds in the dental clinic settings (31).

Most of the caregivers in the present study faced tooth-brushing difficulties in their children during the pre-intervention phase. The findings are consistent with a previous study by Smutkeeree et al. (7) involving 30 children with ASD aged 5 to 17 years in Thailand. It was reported that 73.3% of the caregivers were unable to help their children complete tooth-brushing

correctly prior to intervention. In addition, evidence from a number of studies have established that children with ASD had difficulties in practising daily tooth-brushing (32). A review by Mah et al. (33) describes how permanent ASD characteristics affect children's motor functions, sensory, communication, medical conditions, and general behaviours which can lead to oral health problems. The researchers also emphasised on the need for caregivers' involvement in children's oral health care.

Children who closed their mouths and turned their heads in different directions while brushing might display self-protective reactions to specific aspects (that is, smell, taste or texture of toothpastes or toothbrushes due to their sensory abnormalities (4, 9, 30). Within the latest version of the DSM-5, atypical sensory behaviours are subcategorised under 'restricted, repetitive patterns of behaviour, interests, or activities' which describes the hyper- and hypo-reactivity to sensory stimuli (34). Repetitive behaviours in these children resulted in the inability to open their mouths and to stand still (12). Short attention span, hyperactivity and temper tantrums also affect children's cooperativeness which imposed great challenges to caregivers to conduct effective tooth-brushing (35).

The present study observed that children with ASD had poor understanding of purpose in tooth-brushing. Generally, these children display poor eye contact or difficulty in understanding people's body language and facial expression (33). According to Chadwick et al. (36), individuals with intellectual disabilities have difficulty to focus when tooth-brushing (that is easily distracted), to estimate the length of time required, to understand the purpose of tooth-brushing, and have a tendency to refuse assistance. Due to the difficulties, they often display behaviours like grinding their teeth, closing their mouths, biting on toothbrushes, ingesting toothpaste, moving their heads, and talking during brushing (36). Children with ASD have language abilities but still require parental support (37, 38). Visual pedagogy - for instance the Picture Exchange Communication System (PECS) - was found effective in reducing plaque and gingivitis in children with ASD using cards series showing a structured tooth-brushing method (37). Therefore, the PECS or other visual pedagogy tools should be helpful in delivering oral health information about oral hygiene practices and improving children's oral health status.

After using the OHASD Module, the results of the present study showed that the caregivers' difficulties in children's tooth-brushing were improved during post-intervention compared to pre-intervention. These findings reflected the results of previous studies which suggested that visual pedagogy in the form of a table calendar and a checklist board (7) and a flip chart together with a training DVD (39) could provide reminders and promote children's engagement in tooth-brushing. Due

to children's physical impairments which affect their manual dexterity and physical functions, caregivers' assistance is needed in children's coordinating skills such as holding toothbrushes, unscrewing toothpaste caps and placing toothpaste on brushes which suggest that traditional oral hygiene instructions may not be effective for children with ASD (36). Therefore, the oral health care guidelines emphasized on tooth-brushing techniques in quadrants and various tooth-brushing positions supported by caregivers in consideration of ASD severity and children's behaviours. At the end of this study, some caregivers were satisfied with the outcome from the utilisation of the tooth-brushing poster. The caregivers informed that the poster helped their children to readily get involved in the practice of tooth-brushing at home. This effect is explained by the findings from a recent systematic review and meta-analysis (40) which supports visual pedagogy improves both oral hygiene skills and cooperation of children with ASD during oral health care.

The present study has some limitations and suggestions for future research. A limited number of participants recruited from one health care centre might not constitute a representative sample of the population. Due to the COVID-19 pandemic during the data collection period, the face-to-face data collection for the post intervention was discontinued and changed to telephone interview. A possible drawback to telephone interview was its limitation to caregivers who had telephones and this study might have engaged in substantial selection bias (41). Future research should involve a larger number of participants of different cultures and backgrounds and include oral health examinations. In addition, comparison of effectiveness of the oral health care module should be made with caregivers and children without ASD to study the complexities of caregivers' involvement and the children's adaptations in oral health care involving their physical, cognitive, and emotional development.

Implication for practice

The OHASD Module provides user-friendly guidelines for dental professionals, caregivers, teachers, and trainers. Although tooth-brushing is easily performed by typically developed children, the task requires good comprehension and great effort by children with ASD. As emphasised by Mah et al. (33), oral health knowledge is essential for the caregivers as they play important roles in their children's health care and development. The modified tooth-brushing method gives recommendations and ample time to the caregivers on how tooth-brushing should be done effectively. As soon as these children can accept brushing and are able to start brushing on their own, it is not hard for the children to practise it as part of their daily routine (40). Without some guidance on tooth-brushing for these children, the caregivers may neglect the children's oral hygiene which eventually leads to caries and periodontal diseases (10). The findings

from this study can contribute to building caregivers' confidence and a positive oral health attitude towards oral health care among children with ASD. Overall, the OHASD Module can be preferred over other forms of TEACCH concepts because the consequences of tooth-brushing were developed with consideration for the needs of children with ASD whereby the module included narrations comprising short phrases and simple language and was tested on the caregivers and children with ASD.

CONCLUSION

The findings of this study showed that tooth-brushing difficulties existed among caregivers of children with ASD. After using the OHASD Module for six months, the results showed that the caregivers' experience in aiding their children's tooth-brushing has improved. The utilisation of the customised module is crucial in assisting the caregivers in the daily tooth-brushing practice of children with ASD.

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