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Research Article

Health Knowledge and Attitudes of Children with Autism Spectrum Disorders in Guangzhou, China

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1. Abstract

The aim of the present study was to gather and compare information about oral health behaviours and barriers to dental care of children with different severity of autism spectrum disorders (ASD) and their families and further evaluated dental knowledge and attitudes of their parents. The age at which children with ASD started brushing teeth (mean 3 years old) and the frequency of brushing per day (usually 2 times) were roughly the same in the four groups (Caries-free group, Low caries group, Middle caries group, High caries group), and all groups needed parental help to brush their teeth. Children with ASD had less frequently topical fluoridization, but more regularly used toothpaste with fluoride. In children with ASD, whether the teeth be brushed cleanly had a positive effect on the degree of caries ($P < 0.05$). Parents of ASD children had good dental knowledge and attitude and most of them chose pediatric dentistry department for oral treatment. For children who do not cooperate, most parents would also choose the treatment of oral disease under general anesthesia.

2. Keywords: Autism spectrum disorders; Oral hygiene; Dental caries; Oral health

3. Introduction

Autism spectrum disorder (ASD) is known as a psychological development disorder starting from infancy that impairs childhood social and communication abilities, behavioral, and intellectual functioning. Other disabilities such as mental retardation or epilepsy are found to coexist with autism [1]. A large-scale study estimated the prevalence of ASD in China was approximately 1% [2], though no official figures are currently available. As such, there is a high possibility that dentists will encounter children with autism during their daily practice [3].

A finding revealed that the main barriers to dental care were the child's behavior, cost of dental care, and lack of dental insurance. The child's behavior in the dental office includes sensorimotor deficits, impaired executive function, attention problems, aggression, irritability, comprehension difficulties, and language disabilities. These symptoms make it difficult for children with ASD to perform self-care in their daily life or cooperate during dental treatment, thus becoming a challenge for dentists [4]. The fact that children with ASD are typically hypersensitive should also not be ignored. Dental settings present several sensory triggers such as bright lights, noisy instruments, taste, smell, and touch that could lead to oral care difficulties and behavioral problems of children with ASD in the dental clinic [5, 6]. Moreover, 37% of mothers reported that most dentists did not know how to deal with these exceptional children with ASD [7]. It would be advantageous for the dentist to be aware of potential trigger factors that could lead to negative behavior in the patient with ASD. Notably, loud noise is a universal trigger for behavior

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change in the ASD group. The other most commonly cited triggers in the ASD group are strange taste, smell, head touching, bright lights, and enclosed spaces. Children with ASD may be at risk of receiving inappropriate dental care, since a lack of appropriately trained general dentists [8, 9]. However, it has been identified that dental practitioners are unwilling or unable to provide necessary care for exceptional children due to a lack of remuneration or training constraints [10, 11]. More training to the dentists regarding the dental characteristics of children with ASD is needed.

Recently, more and more researches have focused on the oral health issues of children with ASD. Children with ASD appear to have a slightly lower salivary pH and serum 25-OHD as compared to healthy children, making them vulnerable to developing oral health problems [12, 13]. As reported, compared with non-autistic healthy children, ASD exhibit a higher prevalence of caries, poorer oral hygiene, and more extensive needs for dental treatment. Therefore, oral health programs emphasizing caries prevention should be considered of particular importance for children and young people with autism [14]. A study by Du et al. [15] highlighted the potential importance of preschool children's proper oral health care for enhancing their quality of life. Essentially, the presence of ASD has precluded them from self-care, thus parents/caregivers may encounter greater difficulties and barriers in providing primary care for children with ASD relative to normal peers [6].

Up to now, most existing studies have compared oral health behaviors between children with or without autism, but little research has been carried out on the influencing factors of different degrees of caries in autism. The purpose of the present study was to investigate dental care utilization and oral habits of children with ASD of different oral caries severity to increase professional guidance and voluntary services for the family. Oral habits include the frequency of tooth brushing, parental assistance with tooth brushing, usage of toothpaste, and dental treatment.

4. Material and Methods

4.1. Study Sample

This study has been approved by the Research Ethics Committee of Guangzhou Municipal Center for Disease Control and Prevention (GZCDC2018035). A total of 127 children with ASD participated in the study with the consent of their parents. All ASD children aged 6 to 18 years were collected from QiZhi, PeiZhi, and Kang-Na public educational schools for mentally handicapped children. Guangzhou Cana School (Guangzhou Rehabilitation &Research Center for Children with ASD), affiliated to Guangzhou Disabled Persons'Federation, is the 1st public special education school and research center for children with ASD) and met the guidelines of ASD set out in the Diagnostic and Statistical Manual of Mental Disorders, Fifth Edition in Guangzhou, China.

4.2. Questionnaire

A total of 127 the primary caregiver of ASD children were asked to answer 18 questionnaires designed by authors consisting of questions regarding socio-demographic information, ASD severity, frequency of tooth brushing, parental assistance with tooth brushing, usage of toothpaste in the home, usage of fluoride, routine visits to the dentist, parents' dental knowledge and attitude. We informed all participants of the purpose of filling in the questionnaire and obtained the consent of the parents before answering the questionnaire. The questionnaire was sent to school for filling by the primary caregiver when they accompanied the children and were also available for comment with teachers.

4.3. Oral Examination

The oral examination was conducted by two trained pediatric dentists. Before the inspection, the dentists were trained to be familiar with the inspection standards and methods, and the standard consistency test was carried out, and the Kappa value > 0.85 was obtained. All ASD children were examined by allowing them to seat in a comfortable chair under natural light using disposable dental examination kits in the presence of their caregivers. The presence of plaque on the anterior and molar teeth, caries and restorations, gingival status were assessed. According to the number of the decayed missing filled tooth (DMFT/dmft), children with autism were classified into four levels of dental caries [16] (Figure 1):

High-caries group: (DMFT +dmft) ≥8 or higher

Middle-caries group: 4 < (DMFT +dmft) < 8

Low-caries group: (DMFT +dmft) ≤ 4

Caries-free group: (DMFT +dmft) = 0

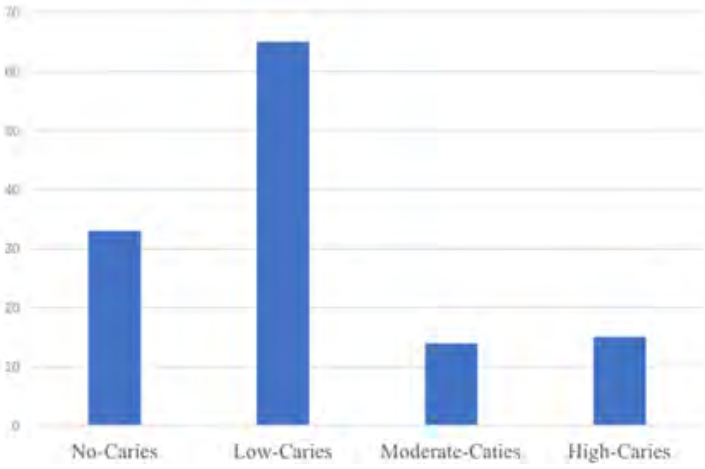

Figure 1: Different caries status in ASD

4.4. Community Involvement

We invited an autistic child expert to participated in our questionnaire design to evaluate the rationality of the questionnaire design. We also invited teachers of autistic children to lead autistic children to participated in oral examinations and organized autistic children and their parents to answer questionnaires at school.

4.5. Data Analysis

Cross-table was used to describe the data of categorization variables. The one-way variance was used to analyze the differences between oral health care and dental treatment. Statistical analysis was done using Statistical Package for Social Sciences (SPSS) version 26. The p value < 0.05 was taken as significant. Stepwise regression was used to explore the factors affecting caries mean. The data were described using frequencies and percentages for categorical variables.

4.6. Results

In total, 144 (of 248) parents responded to our study with a response rate of 58.06%. The survey from 17 patients was missing with more than 30% of the information. These patients were excluded from this study. Eventually, 127 children with autism were included in the study, consisting of 114 males and 13 females. According to DMFT+dmft, the severity of dental caries in autistic children was divided into 4 grades (Figure 1). Of these, 15 were in the High-caries group, 14 in the Middle-caries group, 65 in the Low-caries group, and 33 in the Caries-free group. Descriptive statistics and statistical differences in knowledge, attitude, and behavior related to oral health were conducted according to the four grades.

4.7. Demographic Profile of Children with ASD

The characteristics of children with ASD are shown in Table 1. The majority of the children with ASD were male (89.76%). The male to female ratio was 8:1. The majority of the primary caregivers were a mother (77.95%).

4.8. Oral Hygiene and Health Care Habits

The results of oral hygiene and health care habits are provided in Table 2. All children from four groups started brushing their teeth at around age 3. Among them, 55.9% (71/127) of children with ASD brushed their teeth twice per day, while 41.73% (53/127) children brushed once per day. The use of fluoride toothpaste was lowest in the High-caries group (7/123, 5.69%) in comparison with the Middle-caries group (8/123, 6.50%), Caries-free group (16/123, 13.01%), and Low-caries group (41/123, 33.33%). More than half of children with ASD (57.48%) always required their parents/caregivers to help them brush their teeth. The statistical analysis results showed significant differences were obtained in the cleanliness after tooth brushing among different groups (P < 0.05). Regardless of the severity of ASD, brushing teeth cleanly in oral hygiene is more critical than the first time to start brushing and the number of brushing per day. Most of the children did not use topical fluoride regularly.

Table 1: Demographic profile of children with ASD.

Characteristics		ASD (N=127)	Percentage (%)
Gender			
	male	114	89.76
	female	13	10.24
Age (years)			2
	6-9.9	36	28.35
	10-13.9	63	49.6
	14-17.9	28	22.05
The primary daily caregiver of the child			
	father	16	12.6
	mother	99	77.95
	grandfather	7	5.51
	Grandmother	3	2.36
	baby sitter	2	1.57

Table 2: Oral health behaviours of children with ASD

Characteristic	No-caries	Low-caries	Moderate-caries	High-caries	F(P)
Childs' perceived severity ASD ?					
Mild	1	4	1	2	
Moderate	11	34	3	6	1.953(0.128)
Severe	19	24	9	8	
Unknown	2	2	1	1	
When dose your child begin brushing his/her teeth(years) ?					
0-0.5	4	3	0	1	
1	4	7	1	2	
2	5	13	2	3	

3	8	24	4	3	0.506(0.679)
4	3	6	4	2	
5	7	4	1	2	
Unknown	2	8	2	2	
How many times does your child brush his/her teeth a day ?					
Once	15	27	6	5	
Twice	18	36	8	9	0.441(0.724)
Thrice	0	2	0	1	
Assisted brushing with parent ?					
Never	13	24	8	7	
Always	19	40	6	8	
No brushing teeth	1	1	0	0	0.798(0.497)
Does your child brush his/her teeth cleanly ?					
Very clean	8	4	2	0	
cleaner	16	30	7	5	
general	6	25	5	6	3.369(0.021)
Don't clean	1	3	0	3	
Unknown	2	3	0	1	
Does your child brush his/her teeth with fluoride toothpaste ?					
Yes	16	41	8	7	
No	11	10	2	3	
Unknown	5	11	3	3	0.025(0.995)
Don’t use toothpaste	0	3	0	0	
Whether topical fluoride is used within three months ?					
Yes	3	9	1	2	
No	8	32	5	5	1.13(0.343)
Unknown	0	1	0	3	

4.9. Dental Services

The results about dental services of children with ASD are shown in Table 3. In the four study groups, 46.825% (59/126) children had received dental treatment, 59.38% (38/64) of children had visited the pediatric dentistry department for treatment. Of the 59 children who received dental treatment, the low-caries group (22/59, 37.28%) accounted for the most, but their treatment items were simple, such as pit and fissure sealing, coating fluoride, deciduous tooth retention, and filling superficial caries. For children who did not cooperate with treatment, 76.344% (71/93) parents would choose to receive oral disease treatment under general anesthesia, among which the Lower-caries group (41/71, 57.746%) accounted for a larger proportion.

Table 3: Dental services of children with ASD

	No-caries %(n)	**Low-caries %(n)**	**Moderate-caries %(n)**	**High- caries %(n)**
Visit pediatric dentistry department for treatment				
Yes	9.38 (6)	35.94 (23)	4.69 (3)	9.38 (6)
No	3.13 (2)	15.63 (10)	1.56 (1)	3.13 (2)
Not clear	3.13 (2)	9.38 (6)	1.56 (1)	3.13 (2)
The main reason for dental visits				
check	5.97 (4)	29.85 (20)	28.57 (2)	5.97 (4)
prevention	2.86 (2)	5.97 (4)	0 (0)	2.86 (2)
Some treatment	4.48 (3)	16.42 (11)	2.86 (2)	2.86 (2)
Forget	2.86 (2)	8.95 (6)	1.49 (1)	2.86 (2)
Ever attended oral treatment				

Yes	11.90 (15)	17.46 (22)	5.56 (7)	3.97 (5)
No	14.29 (18)	34.13 (43)	5.56 (7)	7.14 (9)
Whether to receive GA for dental treatment				
YES	17.20 (16)	44.09 (41)	7.53 (7)	7.53 (7)
NO	4.30 (4)	6.45 (6)	2.15 (2)	3.23 (3)
Not aware of general anaesthesia	**0 (0)**	**5.38 (5)**	**0 (0)**	**2.15 (2)**

4.10. Oral Knowledge

The descriptive statistics of knowledge and attitude related to oral health are shown in Table 4. The score of oral knowledge in the Low-caries group was higher than that in the other three groups. But parents' awareness of fluoride or pit and fissure sealing as effective prevention of dental caries was generally low.

4.11. Multiple Linear Regression Model

A multiple linear regression model was used to evaluate the effect of different oral health behaviors and sociodemographic factors on the children's severity of dental caries (Table 5). The results showed that brushing teeth cleanly is the only factor that has a significant and positive impact on the severity of dental caries. The children's gender, daily caregiver, the severity of autism, the first time to start brushing, frequency of brushing, the use of fluoride toothpaste, and fluoride application did not exhibit significant associations.

Table 4: Oral health knowledge among parents of children with ASD.

	Correct number (n=126)	The percentage of response on questions of oral health knowledge and atitude **(n(%))**			
		No-caries	**Low-cariesn**	**Moderate-caries**	**High- caries**
Candy can cause tooth decay	119	30(23.81)	62(49.20)	14(11.11)	13(10.32)
Decayed deciduous teeth do not need reatment	118	30(23.81)	61(48.41)	14(11.11)	13(10.32)
pit and fissure sealing can prevent dental caries	92	24(19.05)	47(37.30)	12(9.52)	9(7.14)
Brushing teeth can not prevent dental problems	97	25(19.84)	50(36.68)	11(8.73)	11(8.73)
Regular visits to the dentist is necessary	124	33(26.19)	63(50.00)	14(11.11)	4(11.11)
Fluoride can prevent dental caries	54	8(6.30)	33(25.98)	6(21.00)	7(5.51)

Table 5: A multiple linear regression model was used to evaluate the effect of different oral health behaviours and sociodemographic factors on the children's severity of dental caries.

	Unstandardized Coefficients			
Model	B	Std.error	t	P
How clean after brushing teeth	-0.06	1.835	-0.033	0.974
	1.278	0.638	2.004	0.049

5. Discussion

The global prevalence of ASD has been reported to be increasing. With the transition to DSM-5 and the relabeling of all-pervasive developmental disorders under the umbrella term of Autism Spectrum Disorder, the number of affected children has dramatically increased [17, 18]. Keeping this surge in mind, dentists must know about ASD to give adequate treatment to their patients. Most general dentists did not convince that their undergraduate education prepared them sufficiently to treat patients with special needs the frequency at which pediatric dentists stated they use appropriate behavior management strategies when treating ASD patients correlated with their educational backgrounds, the better they reported to have been educated, the more likely they were to treat patients with special needs efficiently [19, 20] the results of this study indicate that dental care of ASD children is not optimal although all the children enrolled in this study have visited a dentist. Due to the vulnerability of this patient group and their specific needs, it is of utmost importance to further investigate dentists and the primary caregivers' knowledge and skills, treatment options, and effective behavioral management techniques in the prevention and treatment of dental diseases.

5.1. Oral Health Knowledge

Differences in oral health status exist among preschool children with and without autism spectrum disorder. Most studies reported that children with ASD have more caries, poorer oral hygiene, and inadequate oral health care [14, 21, 22]. Subgroup analyses revealed that children with ASD had a significantly higher DMFT index than non-ASD children in Asia, concluding that children with ASD have worse dental health status than normal children in Asia [23]. But there is no further study to gather and compare information

about oral health behaviors and barriers to dental care of children with different severity of caries in ASD. SO we studied further and showed that the score of oral knowledge was relatively high in the four groups as parents may be more sensitive to the influences of ASD in daily life, such as oral health. The results of this study indicate that parents of children with ASD had better dental knowledge and attitudes. In terms of snacking habits, parents reported that children with ASD do not have an interest in snacking, which may be associated with their food selectivity or sensory singularity. The above may explain why preschool children with ASD exhibited fewer caries experiences and better gingival health than children without autism spectrum disorder [24, 25].

5.2. Dental Treatment

Parents experience significant challenges in providing oral health care for their children at home and bringing them to the dental clinic for treatment due to oral sensitivities, impaired communication, and anxiety. The children suffering from ASD had significantly higher oral pain and lesions rates, and their immediate relatives were disturbed due to their oral problems [3]. There were significantly more uncooperative patients with ASD than in healthy children. Our study showed that 38.89% had received dental treatment. Of the 49 children that received dental treatment children, only 5 high-caries group children had received dental treatment. This low number could be due to the perceived severity of ASD, which has much more oral sensitivities, impaired communication, and anxiety in these children. Although the low caries group had received more dental treatment than the other three groups, the treatment items were basic and were restricted to such as pit and fissure sealing, fluoride, deciduous tooth retention, and filling for superficial caries and serious oral problems remain unresolved. ASD patients do not readily cooperate, and their parents are willing to do dental treatment under general anesthesia [25], which is consistent with our study. Our study showed 76.34% of parents will consent for their children to receive oral disease treatment under general anesthesia. Dental treatment under general anesthesia is more indicated in ASD children and should be considered in case of failure of other treatment alternatives. Parents of ASD children seem to advocate for dental treatment under general anesthesia due to their children's impaired behavior and uncooperative traits, despite costs and risks [26].

5.3. Fluoride Application

It is essential to understand the challenges in oral self-care and barriers to dental services among children with ASD. In this study, most parents will opt for the pediatric dentistry department for treatment. The doctor may give some more professional oral advice, which could help boost the quality of care and set up a series of individualized behavioral management for these individuals [27].

Fluoride-containing kinds of toothpaste are by far the most essential way of delivering the benefits of fluoride worldwide. The preventive effects of conjoint exposure (e.g., use of fluoride toothpaste in a fluoridated area) are cumulative. The World Health Organization has informed the member states about the benefits of the appropriate use of fluoride and numerous countries have policies to maximize the benefits of fluoride; however, some states still lag [28]. But an increasing number of epidemiological reports highlighted the potential link between ASD and chronic fluoride exposure. A high ASD prevalence has been reported from countries with water fluoridation as well as from endemic fluorosis areas. We suggest focusing the ASD prevention on the reduction of the F and Al3+ burdens from daily life [29]. Parents need to receive education regarding the significance of fluoride and optimal fluoride exposure required for their children [30]. This study has concluded that about 23% of ASD children use topical fluoride within three months, more than 50% of them use fluoride toothpaste at home. But in addition to using fluoride toothpaste correctly, it's also important to brush your teeth correctly. The results showed that brushing teeth cleanly is the only factor that has a significant and positive impact on the severity of dental caries ($P < 0.05$). The children's gender, daily caregiver, severity of autism, the first time to start brushing, frequency of brushing, the use of fluoride toothpaste and fluoride application did not exhibit significant associations. Dentists should provide professional oral health services to teachers and primary caregivers, and encourage children with ASD to integrate into the basic oral care habits of their families.

Both parents and general dentists are the primary oral health caregivers of children with ASD. It is crucial to understand the challenges in oral self-care in children and barriers to dental services. The limitation encountered in this study is the small sample size, and it only compares autism between individuals and does not compare autism with healthy children. Therefore, it cannot be extrapolated to the whole population. It is recommended that a similar study be conducted on a national scale. Parents should also be provided with professional oral health services in special schools to develop good oral health habits. Moreover, workshops regarding autistic children should be held for dentists to improve their skills in dealing with these cases.

All the children with autism in our survey were enrolled in special schools, and their primary caregiver is their mother. Our study suggests that the main reason for the high severity of oral caries in children with ASD is the lack of tooth brushing. Parents should be taught their children to how to brush their teeth cleaner or help them clean their teeth. Dentists should provide professional oral health services to teachers and primary caregivers, and encourage children with ASD to integrate into the basic oral care habits of their families. Due to the children's specific needs, it's necessary to increase more training by the dentists regarding the needs and characteristics of children with ASD for offering more professional guidance.

6. Ethical Approval and Informed Consent

This study has been approved by the Research Ethics Committee of Guangzhou Municipal Center for Disease Control and Prevention

(GZCDC2018035). All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. A total of 127 children with ASD participated in the study with the consent of their parents.

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