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Behaviour guidance in dental treatment of patients with autism spectrum disorder

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Background. Autism spectrum disorder (ASD) is a neurodevelopmental disorder categorized into autism, pervasive developmental disorder – not otherwise specified (PDD-NOS) and Asperger syndrome.

Aims. To identify factors associated with the behaviour of patients with ASD in a dental setting, use of general anaesthesia (GA), and protective stabilization.

Design. The dental charts of 395 patients with ASD patients and 386 unaffected patients were reviewed. The following data were analysed: ASD diagnosis, age, gender, residence, seizure disorder, additional diagnosis (mental retardation, cerebral palsy, self-injurious behaviour or pica), medications, caries prevalence and severity, dental treatment history, behaviour, and behaviour guidance technique(s) used.

Results. Within both groups, younger patients were more uncooperative. ASD patients with autism were more uncooperative than patients with PDD-NOS; patients with an additional diagnosis were also more uncooperative. ASD patients with higher caries severity, who were uncooperative or female, were more likely to require GA. Use of protective stabilization was associated with lower caries severity, presence of seizure disorder, uncooperative behaviour, male gender, or residency in a group home/institution.

Conclusions. Autism spectrum disorder patients with autism, younger age and an additional diagnosis were more uncooperative. Factors associated with the use of GA and protective stabilization in patients with ASD were also identified.

Introduction

Autism spectrum disorder (ASD) is a life-long neurodevelopmental disorder characterized by qualitative abnormalities in reciprocal social interactions and patterns of communication, and by a restricted, stereotyped, repetitive repertoire of interests and activities[1–3]. The prevalence rate has been reported to be 5.7 per 1000 (National Health Interview Survey) and 5.5 per 1000 (National Survey of Children's Health), with a male : female ratio of 3.7 : 1[4]. ASD is a heterogeneous disorder with a wide range of expression, and is categorized into autism (autistic disorder), pervasive developmental disorder – not otherwise specified (PDD-NOS) and Asperger syndrome. Autism, PDD-NOS, and Asperger syndrome are included in the broader category of pervasive developmental disorders, along with Rett's disorder, and childhood disintegrative disorder[5]. Diagnosis of autism is based on four criteria: early onset (prior to age 3 years), severe abnormality of social reciprocity, severe abnormality of communication development (often including spoken language), restricted, repetitive and stereotypical patterns of behaviour, interest, and imagination[6,7].

The other two ASDs, PDD-NOS and Asperger syndrome, are less severe developmental disorders. PDD-NOS is a diagnosis of exclusion for those with problems similar to autism but insufficient to meet the criteria for autism in number, severity or age of onset[1]. Individuals with PDD-NOS have more social activity, higher empathy and greater interaction than

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those with autism[3]. The criteria for a diagnosis of Asperger syndrome are impaired social interaction, restricted, repetitive and stereotypical patterns of behaviour, interest and activities, clinically significant impairment in social, occupational or other functioning; and no clinically significant delay in language, cognitive development, adaptive behaviour or in curiosity about the environment[7]. Therefore, individuals with Asperger syndrome have many autistic-like symptoms but relatively normal language skills and intelligence[3].

Behavioural disturbances associated with ASD include self-injurious behaviour, aggression, temper tantrums, psychiatric symptoms, and pica[3,8]. Other conditions associated with ASD are mental retardation, seizure disorders, cerebral palsy, fragile X, tuberous sclerosis, untreated phenylketonuria, neurofibromatosis, and congenital rubella[2,3].

Impaired social interaction, communication, cognitive dysfunction and other associated psychiatric symptoms may impede dental care[1,3,5,6]. Patients with ASD may be incapable of cooperation in the dental setting as their developmental impairments may lead to great difficulties in interacting with other people and in understanding and following instructions. Changes in the environment, daily schedule or other routines often elicit behavioural resistance and tantrums[3]. A variety of basic behaviour guidance techniques can be utilized to enable dental treatment of patients with ASD, including the presence of parents or aides, the use of the tell-show-do technique, short, clear commands, and positive and negative verbal reinforcement[9,10]. The visit should be short, and sensory stimuli should be minimized[11]. A combination of desensitization, symbolic remodelling and reinforcement can also enable autistic patients to undergo dental exam[12]. In many situations, dental treatment of patients required the use of advanced behaviour guidance techniques, including sedation[13–15], and general anaesthesia (GA)[16].

It is not known whether other information present in the patient's medical history is associated with the behaviour of patients with ASD in a dental setting. In spite of the increasing prevalence of autism[1], many of the publications on the behaviour and behaviour guidance of dental patients with autism are expert opinions[3,6,10,11,17], while almost all published studies on this subject involved sample sizes of less than 50 patients[5,9,12–16,18–20], the only exception being a recent study on the predictors of cooperative behaviour involving 108 patients with autism[21].

The objectives of this study were to determine factors associated with the behaviour of patients with ASD in a dental setting, and the factors associated with the behaviour guidance technique(s) used during dental treatment of these patients. An unmatched comparison group of otherwise healthy, unaffected patients treated at the same hospital will be used to determine if there is a difference in the factors associated with dental care under GA between patients with ASD and unaffected patients at the same hospital.

Methods

The non-archived records at the dental department of the Franciscan Hospital for Children (FHFC) were physically searched to identify all individuals with a primary diagnosis of ASD who were active dental patients (patients seen between Jan 2005 and April 2007). The unaffected group consisted of active dental patients at the FHFC aged 3 years and older, who were otherwise healthy, did not have any medical conditions and were not on any medication. Inclusion criteria for the ASD group were: (1) Patients aged at least 3 years (the average age of diagnosis for ASD). (2) Patients with a diagnosis of ASD, as reported by their parent/legal guardian. (3) Completed, non-archived patient records, including medical history, dental chart, and treatment notes. Exclusion criteria for both groups were: (1) Patients younger than 3 years of age. (2) Patients with incomplete records.

A total of 395 patients with a primary diagnosis of ASD were identified[22]. The diagnosis of ASD (autism, PDD-NOS, or Asperger syndrome) was obtained from the patient's medical history, which was completed and

updated by the patient's parent or legal guardian during routine dental visits. A group of 386 patients without ASD (unaffected patients) was randomly selected from the same population of active dental patients at FHFC[22]. All patients were treated by supervised pediatric dentistry residents or attending faculty at FHFC. This study was approved by the Boston University Institutional Review Board.

Data on age, gender, caries prevalence and severity, dental treatment history (whether patient has received restorative/surgical treatment in addition to preventive treatment), behaviour, and the behaviour guidance technique used were collected from the charts of both the unaffected and ASD groups. Patients who had undergone restorative treatment or extractions were placed in the restorative/surgical treatment category, while patients who had preventive procedures only, such as dental examination, radiographs, prophylaxis, and fluoride treatment, were placed in the preventive treatment category. Caries prevalence was represented by the proportion of patients with a positive dental caries history – sum of decayed and filled teeth (dft) greater than 0 for the primary dentition, and sum of decayed, missing, and filled teeth (DMFT) greater than 0 for the permanent dentition. Caries severity was represented by the dft or DMFT, which are referred to as DMFT in this study. Patient behaviour, which was assessed at every visit by the treating dentist using the Frankl scale[23], was also recorded: definitively negative (−−), negative (−), positive (+), and definitively positive (++). In addition, data on residence (home or institution/group home), primary diagnosis (ASD category), seizure disorder, additional diagnosis (mental retardation, cerebral palsy, self-injurious behaviour, or pica), and medication used were obtained from the ASD group. These data were collected by parent/legal guardian report. ASD patients who were on antipsychotics, antidepressants, anxiolytic medications, mood stabilizers, or stimulants were categorized as using psychotropic medications. All data were obtained from each patient's most recent dental visit (for recall, emergency, or restorative appointment in the clinic or under GA) by two calibrated researchers. Patient behaviour was documented at the most recent dental visit in the clinic, as patient behaviour was not assessed during GA.

The Wilcoxon rank test, Kruskal–Wallis nonparametric test, chi-square, and Fisher's exact test were used for statistical analyses at the $P < 0.05$ level of significance. As the unaffected and ASD groups were not matched for age, additional analyses stratified by age group were performed, using three age ranges (<11, 11–18, >18 years). Variables that were found to be associated with behaviour, use of GA, and protective stabilization were then analysed by logistic regression analyses at the $P < 0.05$ level of significance. The natural log transformations of DMFT were used in regression analyses as the DMFT distributions were highly positively skewed, which violates statistical assumptions of normality in regression analysis. All analyses were performed with the statistical analysis software (SAS) version 9.1 (SAS Institute Inc, Cary, NC, USA).

Results

Sample characteristics

Data collected from a group of 395 ASD patients and 386 healthy unaffected patients were analysed. ASD patients were diagnosed with autism (311 patients or 78.8%), PDD-NOS (77 patients or 19.5%) or Asperger syndrome (seven patients or 1.8%). Within the ASD group, the male : female ratio was 4 : 1, whereas gender distribution within the unaffected group was equal[22]. Patients in the ASD group were significantly older (median age: 12 years; interquartile range: 7 years; age range: 3–28 years) than patients in the unaffected group (median age: 8 years; interquartile range: 7 years; age range: 3–20 years) as FHFCs dental department retained some patients with ASD ($n = 14$) after they were 21 years of age[22]. There was no significant difference in age between males and females in the ASD group and the unaffected group[22]. Fifty-two per cent of ASD patients had a history of restorative/surgical treatment, compared to 38% of unaffected patients.

Behaviour

A significantly higher percentage of ASD patients were uncooperative (negative or definitively negative behaviour) compared to the unaffected group[22]. Subsequent analysis stratified by age showed similar results, as a significantly higher percentage of ASD patients below 11 years ($P < 0.001$), 11–18 years ($P < 0.001$), and above 18 years ($P = 0.005$) were uncooperative compared to unaffected patients in the same age range. Logistic regression analysis was performed to identify factors that were associated with behaviour. The analysis which controlled for age and gender, found that age, ASD diagnosis, and the presence of an additional diagnosis were associated with the uncooperative behaviour of ASD patients. A 1-year increase in age was associated with an 8% decrease in the likelihood of being uncooperative (adjusted OR = 0.92), whereas ASD patients with a diagnosis of PDD-NOS were 42% less likely (adjusted OR = 0.58) to be uncooperative during their dental appointment compared to patients with autism. Patients with Asperger syndrome also showed a decreased likelihood of being uncooperative compared to patients with autism, although this difference was not statistically significant. ASD patients with an additional diagnosis of mental retardation, cerebral palsy, self-injurious behaviour, or pica had a 100% increase (adjusted OR = 2.0) in the likelihood of uncooperative behaviour (Table 1). All other factors evaluated (gender, caries prevalence, DMFT, primary residence, presence of a seizure disorder, use of psychotropic medication, or history of restorative/surgical dental treatment) were not associated with behaviour.

Subsequent logistic regression analysis was carried out to identify factors associated with behaviour in the unaffected group. The analysis controlling for age and gender found that increased DMFT and a history of restorative/surgical dental treatment increased the likelihood of uncooperative behaviour in the unaffected group. On the other hand, an increase in age decreased the likelihood of uncooperative behaviour (Table 2). A history of restorative/surgical treatment increased the likelihood of uncooperative behaviour to above twofold (adjusted OR = 2.12). A 1-year increase in age was associated with a 26% decrease in uncooperative behaviour in unaffected patients (adjusted OR = 0.74). Gender and caries prevalence were not associated with behaviour.

Dental treatment under GA

In the ASD group, GA was the most commonly used advanced behaviour guidance technique ($n = 146$; 37%). More individuals in the ASD group required dental treatment under GA than in the unaffected group[22]. Subsequent analysis stratified by age found that a significantly higher percentage of ASD patients aged 11–18 years ($P < 0.001$) and above 18 years ($P = 0.04$) required GA compared to unaffected patients in the same age range. There was no difference in patients <11 years ($P = 0.7$), as a large number of the

Table 1. Factors associated with uncooperative behaviour in the ASD group.

Variables	Adjusted odds ratio* (95% CI)	*P*-value
Age (years)	0.92 (0.89–0.96)	<0.001
ASD diagnosis		
Autism	1.0	
PDD-NOS	0.58 (0.37–0.93)	0.02
Asperger syndrome	0.34 (0.08–1.37)	0.1
Additional diagnosis	2.00 (1.21–3.32)	0.007
Gender		
Male	1.00	
Female	1.34 (0.85–2.11)	0.2

CI, confidence interval.
*Adjusted for all other factors in the model.

Table 2. Factors associated with uncooperative behaviour in the unaffected group.

Variables	Adjusted odds ratio* (95% CI)	*P*-value
Age (years)	0.74 (0.69–0.78)	<0.001
Caries severity (log DMFT)	1.09 (1.04–1.15)	<0.001
Restorative/surgical dental treatment	2.12 (1.38–3.27)	<0.001
Gender		
Male	1.00	
Female	1.01 (0.68–1.51)	1.0

CI, confidence interval.
*Adjusted for all other factors in the model.

unaffected patients who required treatment under GA were at a pre-cooperative age.

Logistic regression analysis was performed to identify factors associated with the use of GA. The analysis found that controlling for age and gender, ASD patients with increased DMFT, were uncooperative or female were more likely to require GA for dental treatment (Table 3). A one-log increase in DMFT was associated with a 63% increase (adjusted OR = 1.63) in the likelihood of requiring GA (Table 3). ASD patients with uncooperative behaviour (adjusted OR = 2.02), or who were female (adjusted OR = 2.18) had greater than 100% increase in the likelihood of requiring dental treatment under GA (Table 3). Age, primary residence, ASD diagnosis, additional diagnosis, seizure disorder, and use of psychotropic medication were not associated with the use of GA.

Logistic regression analysis was performed to identify factors associated with the use of GA in the unaffected group. The analysis found that controlling for age and gender, age, DMFT, and behaviour were associated with the use of GA in the unaffected group. A one-log increase in DMFT corresponded to greater than 100-fold increase in the likelihood of requiring GA for dental treatment (adjusted OR = 102.87). A one-level change in behaviour on the Frankl scale (towards more negative behaviour) corresponded to a 264% increase in the likelihood of requiring GA for dental treatment (adjusted OR = 3.64) (Table 4). Younger patients were more likely to required GA for dental treatment, but gender was not associated with the use of GA.

Table 3. Factors associated with dental treatment under GA in the ASD group.

Variables	Adjusted odds ratio* (95% CI)	*P*-value
Caries severity (log DMFT)	1.63 (1.34–1.98)	<0.001
Behaviour†	2.02 (1.51–2.70)	<0.001
Gender		
Male	1.00	
Female	2.18 (1.10–4.31)	0.03
Age (years)	0.97 (0.92–1.02)	0.2

CI, confidence interval.
*Adjusted for all other factors in the model.
†Behaviour (Frankl scale): 1 = definitively positive; 2 = positive; 3 = negative; 4 = definitively negative.

Table 4. Factors associated with dental treatment under GA in the unaffected group.

Variables	Adjusted odds ratio* (95% CI)	*P*-value
Age (years)	0.65 (0.54–0.78)	<0.001
Caries severity (log DMFT)	102.87 (27–393.62)	<0.001
Behaviour†	3.64 (2.26–5.85)	<0.001
Gender		
Male	1.00	
Female	0.91 (0.40–2.08)	0.8

CI, confidence interval.
*Adjusted for all other factors in the model.
†Behaviour (Frankl scale): 1 = definitively positive; 2 = positive; 3 = negative; 4 = definitively negative.

Behaviour guidance in the ASD group

Other advanced behaviour guidance techniques used during dental treatment of ASD patients were protective stabilization (n = 78; 20%) and conscious sedation (n = 14; 4%). In addition, the basic behaviour guidance technique of nitrous oxide/oxygen inhalation was used in a small number of patients with ASD (n = 9; 2%). A comparable number of unaffected patients received dental treated under nitrous oxide (n = 6; 2%) and conscious sedation (n = 15; 4%). Protective stabilization was not used on unaffected patients in this study.

Protective stabilization. The use of protective stabilization, involving the dental team/parent/caregiver, a restrictive device, or a combination thereof, was the second most common advanced behaviour guidance technique used in ASD patients. Logistic regression analysis was performed to identify factors associated with the use of protective stabilization. The analysis found that controlling for age and gender, ASD patients who had increased DMFT or female were less likely to require protective stabilization. ASD patients who were uncooperative, residing in a group home or institution, or had a seizure disorder were more likely to require protective stabilization for dental treatment (Table 5). A one-log increase in DMFT corresponded to a 9% decrease in the

Table 5. Factors associated with dental treatment with protective stabilization in the ASD group.

Variables	Adjusted odds ratio* (95% CI)	*P*-value
Caries severity (log DMFT)	0.91 (0.87–0.95)	<0.001
Behaviour†	2.69 (1.90–3.80)	<0.001
Residence	2.56 (1.38–4.73)	0.003
Gender		
Male	1.00	
Female	0.38 (0.17–0.86)	0.02
Seizure disorder	2.19 (1.12–4.28)	0.02
Age (years)	1.03 (0.96–1.10)	0.5

CI, confidence interval.
*Adjusted for all other factors in the model.
†Behaviour (Frankl scale): 1 = definitively positive; 2 = positive; 3 = negative; 4 = definitively negative.

likelihood of requiring protective stabilization for dental treatment (adjusted OR = 0.91). A one-level change in behaviour on the Frankl scale (towards more negative behaviour) corresponded to a 169% increase in the likelihood of requiring protective stabilization for dental treatment (adjusted OR = 2.69). Residency in an institution/group home (adjusted OR = 2.56) and the presence of a seizure disorder (adjusted OR = 2.19) corresponded to 156% and 119% increase in the likelihood of requiring protective stabilization respectively. Use of protective stabilization was not associated with age, ASD diagnosis, use of psychotropic medication, or an additional diagnosis.

Conscious sedation. Conscious sedation with oral midazolam (with or without nitrous oxide/oxygen inhalation) was used in 4% of the ASD patients. Conscious sedation was successful 100% of the time, as the appointment was considered successful if some of the planned dental treatment could be accomplished. Within the ASD group, a lower percentage of patients that had preventive treatment only (1.6%) needed sedation compared to those with a history of restorative/surgical dental treatment (5.4%) ($P = 0.04$). Gender ($P = 0.5$), behaviour ($P = 0.3$), primary residence ($P = 0.2$), ASD diagnosis ($P = 1$), presence of an additional diagnosis ($P = 1$), seizure disorder ($P = 1$), use of psychotropic medication ($P = 0.05$), and caries prevalence ($P = 0.07$) were not associated with the use of conscious sedation during dental treatment. Logistic regression was not carried out for dental treatment under sedation ($n = 14$) or nitrous oxide ($n = 9$) due to small sample sizes.

Discussion

Franciscan Hospital for Children dental department serves a large number of patients with a variety of special needs, including ASD. Behaviour guidance techniques used at the department follow the guidelines of the American Academy of Pediatric Dentistry[24]. This retrospective study aimed to evaluate the factors associated with behaviour of patients with ASD in a dental setting and identify potential factors that predispose the patients to require special management for dental care. To our knowledge, there are three publications on the behaviour and management of patients with PDD-NOS or Asperger syndrome during dental treatment. One is a case report on the management of a patient with Asperger syndrome[25], and two are studies on the dental care of 20[20] and 39[26] patients with ASD.

A significantly higher percentage of ASD patients were uncooperative during dental treatment when compared to unaffected patients. This high prevalence of behavioural difficulties in patients with ASD necessitates special attention from the dentist in behaviour guidance techniques to enable delivery of dental care. Stratified analysis showed that this was consistent in all three age ranges examined. Results from this study indicated that ASD patients with an additional diagnosis of mental retardation, cerebral palsy, self-injurious behaviour, or pica had a 100% increase in the likelihood of being uncooperative compared to patients without an additional diagnosis. A 2007 study also found that having concurrent medical diagnosis was a predictor for uncooperative behaviour in autistic children[21]. This study also found that patients diagnosed with autism were significantly more uncooperative when compared to patients with PDD-NOS, which correlates with the diagnostic criteria for these disorders. Patients with Asperger syndrome may also

have a decreased likelihood of being uncooperative compared to patients with autism, and further investigation with a larger group of patients with Asperger is needed to verify this observation. Younger patients were also found to be more uncooperative. These factors associated with behaviour of ASD patients in a dental setting can give the dentist insight into patients' ability to cooperate during their dental visit.

This study found that the advanced behaviour guidance techniques used during dental treatment of ASD patients, from most to least common were GA, protective stabilization, and conscious sedation. The basic behaviour guidance technique of nitrous oxide/oxygen inhalation was used in a small number of patients. This concurs with a previous study on 28 patients with autism, which found GA to be the most common advanced behaviour guidance technique used[9]. In contrast, another study reported that protective stabilization was the most common advanced guidance technique used, followed by GA[16]. Other studies on behaviour guidance of patients with ASD did not report prevalence of use of the different guidance techniques.

Thirty-seven per cent of ASD patients in this study required dental treatment under GA, which was the same as the result reported previously for autistic patients[16]. The main predictors for the use of GA that were identified for both groups of patients were high caries activity (DMFT) and uncooperative behaviour. Because of the association between an increase in age and a decrease in uncooperative behaviour, the association seen between uncooperative behaviour (documented at the most recent dental visit), and previous use of GA for dental treatment may have been underestimated. In the ASD group, female patients were significantly more likely to require GA for dental treatment. On the other hand, gender was not associated with use of GA in the unaffected group, whereas younger patients were significantly more likely to require GA. A 1-year increase in age was associated with 26% decrease in uncooperative behaviour in unaffected patients, compared with only 8% decrease in patients with ASD. As an increase in age is associated with a substantial improvement in behaviour in unaffected patients, the likelihood of requiring GA is reduced in these patients.

In this study, conscious sedation with midazolam (with or without nitrous oxide/oxygen inhalation) was used in 4% of the ASD patients, which enabled successful dental treatment. The same percentage of unaffected patients was treated under conscious sedation. Others have also reported the successful use of sedation in the management of autistic patients[14,15,17]. Results in this study showed that midazolam, with or without nitrous oxide/oxygen, was equally effective in providing sedation to both unaffected and ASD patients for dental treatment, although atypical response to sedation had been reported previously[13]. Because of the small sample size observed in this study, additional research is needed on the use of sedation in ASD patients.

This study found that 20% of patients with ASD required protective stabilization during dental treatment, while this technique was not used for the unaffected group. A recent study reported the use of a stabilization device in 29% of autistic children[27]. In contrast, a study published in 1999 found that 44% of patients with autism required protective stabilization[16]. This is probably due to differences in patient behaviour, as the previous study reported 72% of the patients were uncooperative[16], whereas 55% of the ASD patients in this study were uncooperative[22]. In addition, the use of protective stabilization in healthy patients has decreased in acceptability over the past two decades[28]. In contrast, a recent study reported that stabilization device was highly acceptable among parents of autistic children treated using this technique, although acceptability was lower among parents whose children were not treated using the technique[27]. Results from this study also indicated that ASD patients with uncooperative behaviour, residency in a group home or institution, and presence of a seizure disorder were associated with the need for protective stabilization during dental treatment. The association between place of residence and presence of seizure disorder are new findings, suggesting that these two

factors may be used as possible indicators to predict the need of protective stabilization during dental visits of patients with ASD. These two possible predictors may be related to uncooperative behaviour. ASD patients with increased caries severity were less likely to require protective stabilization because minor or short operative procedures were performed using protective stabilization, whereas patients with increased caries severity and extensive treatment needs were treated under GA. There was a decreased likelihood of protective stabilization use in female patients. This observation, and the increased likelihood of use of GA for dental treatment of female patients, may be due to parental attitudes and preferences regarding behaviour guidance technique, as there was no difference in behaviour or caries experience between male and female ASD patients.

In this study, ASD patients without severe behavioural problems were able to cooperate during dental treatment with the use of basic behaviour guidance techniques, and when necessary, nitrous oxide–oxygen sedation. Results also indicate that the use of sedative agents may be required for patients, who are unable to cooperate fully with care, while long and involved treatment procedures are best performed under GA. The protocol for use of behaviour guidance techniques at the FHFC follows the guidelines provided by the American Academy of Pediatric Dentistry, which stated that 'With the parent/caregiver's assistance, most patients with physical and mental disabilities can be managed in the dental office. Protective stabilization can be helpful in patients for whom traditional behaviour guidance techniques are not adequate. When protective stabilization is not feasible or effective, sedation, or GA is the behavioural guidance armamentarium of choice'[24].

The limitations of this study are its retrospective character, possible inaccuracy of parental report of ASD diagnosis and provision of dental care by multiple clinicians. Patient behaviour was documented at the most recent dental visit in the clinic, and not selected based on the type of dental procedure performed during the visit. As patients may behave differently during a dental exam, hygiene appointment, restorative procedure, or extraction, this is a potential confounder, which was not taken into account in this study. An additional limitation of the study is the caries prevalence and severity may be underestimated in some patients, as the availability of radiographs was not documented. One shortcoming of this study is that the unaffected group was not age and gender matched, therefore, all logistic regression models were performed after adjusting for these two factors.

What this paper adds

- Provides verification that uncooperative behaviour was associated with younger age in both patients with ASD and unaffected patients.
- Within the ASD group, uncooperative behaviour was also associated with a diagnosis of autism compared to a diagnosis of PDD-NOS, and with the presence of an additional diagnosis of mental retardation, cerebral palsy, self-injurious behaviour, or pica.
- Advanced behaviour guidance techniques used during dental treatment of ASD patients, from most to least common were GA, protective stabilization (involving the dental team/parent/caregiver, a restrictive device or a combination thereof), and conscious sedation using oral midazolam (with or without nitrous oxide/oxygen).

Why this paper is important to paediatric dentists

- The high prevalence of behavioural difficulties in patients with ASD demands special attention from the dentist in behaviour guidance techniques to enable delivery of dental care.
- Awareness of factors associated with behaviour of ASD patients in a dental setting can give the dentist insight into patients' ability to cooperate during their dental visit.
- Identification of factors associated with the use of particular behaviour guidance techniques in a large sample of ASD patients can support the dentist's choice of techniques utilized to provide dental treatment to these patients.

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