

**CARIES INCIDENCE IN HEALTHY SIBLINGS OF CHILDREN
WITH AUTISM SPECTRUM DISORDER
A RETROSPECTIVE CHART REVIEW**

A Thesis

by

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Submitted to The Office of Graduate and Professional Studies of
Texas A&M University
in partial fulfillment of the requirements for the degree of

MASTER OF SCIENCE

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December 2013

Major Subject: Oral Biology

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ABSTRACT

Autism Spectrum Disorder (ASD) is a neurodevelopmental disorder distinguished by deficits in communication and social interaction and the presence of restrictive and repetitive behaviors. Children with ASD also have sensory integration issues that can cause them to be selective with textures of foods, snack frequently, and tend to have a predilection for sticky and sweet foods. Siblings of children with ASD also snack frequently. A retrospective chart review was conducted at a private pediatric dental practice in Coppell, Texas that treats autistic children and their siblings. Forty-five charts of healthy siblings of children with ASD and 43 charts of age-matched, healthy-healthy sibling pairs were reviewed. The number of decayed, missing, filled teeth (dmft) was recorded in each reviewed chart. No significant difference in dmft was found between the control group and the healthy siblings of children with ASD. Further research is needed to evaluate the effects a child with ASD child has on the oral health of the family and healthy siblings.

DEDICATION

I would like to dedicate this thesis to my father, Kaveh, who constantly has pushed me to strive for more (even when I pushed back). I also want to dedicate this to my cousin Romteen, who has autism, and has been my inspiration in so many facets of my life.

ACKNOWLEDGEMENTS

I truly appreciate the time, efforts and guidance given by Drs. Carolyn Kerins, Jason Koesters, Kavitha Viswanathan and Alton McWhorter. This research study was possible because of the organization and help from Dr. Melissa Rozas and her staff to whom I am very grateful.

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CHAPTER I

INTRODUCTION

BACKGROUND

Autism Spectrum Disorder (ASD) is a neurodevelopmental disorder distinguished by deficits in communication and social interaction and the presence of restrictive and repetitive behaviors. The *Diagnostic Statistical Manual for Mental Disorders Volume V (DSM-V)* (2013) revised the definition from a span of five different subtypes of autism to one encompassing diagnosis of Autism Spectrum Disorder. Distinct classifications of Asperger disorder and pervasive developmental disorder have been removed and they are now classified within the autism spectrum.¹

In 1943, Leo Kanner published a paper describing a condition affecting children who exhibited unusual behaviors and that same year Hans Asperger published a paper describing a very similar condition.² Both papers described traits of children who were “autistic,” which at that time was a term used to describe children with schizophrenia.³ Kanner delineated the differences between autism and schizophrenia, identifying them as separate conditions.² Those “unusual behaviors” are now described in much more detail and autism is distinguished from other conditions.

Hallmarks of autism include deficits in social communication and continuous repetitive behaviors, but the distinctive qualities of this population are much more complex.¹ In 1998, researchers attempted to describe the ‘unusual behaviors’ of autistic children by gathering several articles, reports from parents, teachers and autobiographical

accounts. The traits identified included: compulsivity, sensory processing issues (receiving, organizing, and interpreting stimuli), resistance to change, capacity for minute details and a sense of egocentrism (following their own wishes, interests, etc.).^{4,5} The inability to tolerate sensory stimuli makes it difficult for children with ASD to orient themselves through social situations and much of this is due to differences in sensory processing.⁶ Children with ASD have enhanced sensitivity to auditory stimuli and may over/under-respond to stimuli with inappropriate behaviors such as crying, visible agitation and irritability.^{4,7}

The Autism and Developmental Disabilities Monitoring Network has nearly 30 billing codes related with the medical diagnosis of ASD.⁸ Given this large population and broad inclusion criteria, children classified as autistic tend to vary in intellectual abilities and verbal skills. The *DSM-V* classifies autism spectrum in three degrees of severity of social impairment. Intellectual impairment is simply noted as present or not when the patient is diagnosed; however, there are no grading levels for intellectual ability.¹ It is estimated that approximately 60 to 75% of children with some form of ASD have cognitive skills in the intellectual disability range. In addition to the presence of restrictive and repetitive behaviors, an additional hallmark of ASD is a strict adherence to routine and rituals. A relationship appears to exist between nonverbal IQ and prevalence of certain repetitive behaviors. Patients with lower IQ scores exhibit a higher prevalence of repetitive behaviors; however, even high-functioning children with ASD demonstrate some repetitive behaviors.⁹

According to a study in 2008 (revised in 2012) by the Centers for Disease Control, the prevalence of ASD is 11.3 per 1000 or roughly 1 in 88 among 8 year olds living in the

United States. This is a 78% increase over the years 2002 to 2008.⁸ There is a 3.4 to 4.5 times higher predilection in boys with an increased prevalence in more educated white, non-Hispanic families.⁸ Additionally, increased paternal and grandpaternal age has been found to be a risk factor.¹⁰ Alarming, it is estimated that overall frequency of ASD is approaching 1% of the population.⁸ It is unclear if this is due to a true increase in autism, increased awareness and diagnosis, or a combination of both.¹ As the incidence of autism rises, an increasing number of families are affected by the condition.

The true cause(s) of autism remain unclear and continuing research works to ascertain whether a genetic component exists. In 2005, the Translational Genomics Research Institute published a paper outlining their research project called the Autism Genome Project.¹¹ This study was designed to identify autism-susceptibility genes by looking at specific nucleotide peptides in thousands of families affected by autism across North America and Europe. The results of the second stage of this study were released in 2012 and concluded no single gene showed a significant association with autism.¹² Theories of environmental causes, specifically the measles, mumps and rubella (MMR) vaccine have been postulated. In 1998, falsified data suggesting a link between the MMR vaccine and autism was published by Dr. Andrew Wakefield.¹³ Although his work has since been disproven in multiple studies, it remains a controversial issue in the media and the community of families affected by ASD.¹⁴⁻¹⁷

Autism and feeding disorders

Children with autism experience more general feeding problems compared with healthy children and have a higher rate of gastrointestinal (GI) symptoms and irritability when compared with children with other developmental disabilities.^{18, 19} It has been found

that an immune system dysfunction results in hypersensitivity to certain foods, specifically gluten, and can result in GI symptoms.²⁰ Coincidentally, gluten-free diets tend to have higher carbohydrate intake, which can lead to negative effects on the child's dentition.²¹

Autistic children tend to prefer foods based on their textures and taste with a significant predilection for soft and sweet foods.²²⁻²⁴ Specifically, children with ASD prefer low-texture foods (pureed) and have a difficult time with introduction to new foods.²⁵ Due to poor muscle coordination in their tongues, autistic children tend to pouch their food instead of swallowing.²⁶ One study found healthy siblings of autistic children also had difficulty coping with ranges of textures and subsequently showed a preference for soft and sticky foods even though they themselves were not diagnosed with ASD.²³ As a consequence of their selective diet, autistic children can have increased susceptibility to systemic nutritional deficiencies (such as rickets).^{27, 28}

Autism and caries risk

Dental caries is a multifactorial process that involves the interaction of bacteria, salivary factors, and fermentable carbohydrates in the biofilm on the tooth surface.²⁹ Nutrition and diet can affect the development and integrity of the oral cavity and the progression of oral disease.³⁰ The presence of a chronic disease or learning disability can influence the progression and severity of the caries process due to alterations in oral hygiene and diet behavior.³¹ Dietary preferences of a child are typically related to the food choices made by the family. This situation is no different in a child with ASD; an autistic child in a family that consumes frequent quantities of sweets and other cariogenic foods is likely to have a predilection for the same foods.¹⁸ Sometimes children with chronic illnesses receive small and frequent sweet treats by well-meaning family members

or as a reward for behavior shaping.^{22, 31} These poor dietary choices can greatly increase the risk of developing caries for children with ASD.²²

Children with ASD and their siblings have been found to consume six or more snacks and meals per day placing these children in a high-risk category for developing dental caries.^{23, 32} Both the number of exposures to fermentable carbohydrates and the duration of those exposures increases caries susceptibility. Therefore, higher frequency of between meal snacking also increases caries risk and progression.³³ Each time a sugary treat is consumed intraoral pH drops into the acidic range promoting enamel demineralization.³³ Time and other factors such as water and salivary proteins are needed to buffer the acid and return the pH to a neutral or slightly basic level.²⁹ As autistic children and their siblings were found to have a predisposition for both sweet foods/beverages and frequent snacking, there is little chance for the teeth to remineralize between meals.²³ As food and diet can be a source of difficulty for families of children with ASD; it is possible that more sweets and soft foods are accessible to the entire family in order to accommodate the preferences of the child with ASD.²⁴

In addition to dietary concerns, it is estimated that 56% of autistic children are on at least one psychotropic medication.³⁴ Xerostomia is a well documented side effect of many of these medications and a reduction in salivary flow greatly increases a person's caries risk.³⁵

Caries risk is also influenced by social, cultural, and behavioral factors. One current topic in special needs dentistry is whether children with autism have higher caries rates.³⁶⁻³⁸ Conflicting outcomes have been reported with different studies showing higher, equal, and lower caries incidence. One study conducted in 2008 found that children with

ASD were 70% more likely to be caries free and have lower decayed, missing or filled teeth (dmft) than unaffected children in both primary and permanent dentition.³⁸ Another study in India showed significantly higher dental caries rates in autistic children and explained that their research outcome differed from studies done in the United States due to better access to care in the United States.³⁹ DeMattei et al. found that children with autism have higher levels of bruxism, gingivitis, and oral defensiveness but similar levels of caries activity when compared to controls.⁴⁰ More studies suggest caries activity does not appear to be significantly different in autistic patients when compared with their healthy counterparts.^{38, 41, 42}

For a variety of reasons, prevention of dental decay through diligent oral hygiene is more difficult for children with special health care needs. Autistic children can have deficits in motor skills in relation to their sensory integration issues which may negatively impact their manual dexterity needed for proper brushing.⁴³ These children may also have issues with reasoning, defiance and oral aversion that, when coupled with taste and texture issues with toothpaste, can provide barriers to recommended preventive maintenance.⁴⁴ Morinushi et al. showed that when oral health guidance was provided to caregivers, it resulted in significant decreases in caries incidence in children with ASD, but the effects on the siblings were not studied.³⁶ Due to inherent high-risk behaviors such as dietary preferences, medication-induced xerostomia and poor oral hygiene as a result of uncooperative behavior, one study suggested making autism a high caries risk indicator in the American Academy of Pediatric Dentistry (AAPD) Caries-risk Assessment Tool (CAT).²²

Autism and access to care

Access to care plays an important role in the dental caries process of the entire family of a child with ASD. Parents report that they feel it is difficult to obtain advice and necessary referrals for comprehensive treatment for their autistic child.⁴⁵ Delivering dental care can be difficult in-office and often more advanced behavior management techniques may be employed in this population to provide adequate care. Studies suggest 37% of autistic children receive dental care under general anesthesia.⁴⁶ One study found that up to 49% of children with ASD were orally defensive and combative (hitting, biting, pinching) toward the dental practitioners providing care.⁴⁰ Even early researchers noted that children with autism have difficulty coping with new and different environments, particularly ones with loud noises and bright lights such as the dental office.^{2, 47, 48} This type of behavior may discourage parents from taking their child to the dentist. In a survey of parents, only 4% of children with ASD reported attending the dentist twice yearly compared to 29% attendance of healthy children.⁴⁹

One study demonstrated that if the autistic children are desensitized with an introductory or “practice” appointment in the office setting they are more likely to cooperate and receive preventive care they need to avoid future more invasive treatment.⁵⁰ This concept of ‘desensitization’ has been the inspiration behind the innovation of Social Stories™ which is an interceptive approach to preparing children with ASD to cope with communicative and behavioral skills in social situations through picture and comic books.⁵¹

Parental perception and role is undeniably a large factor in oral health care and access to care for the family as the parents are typically the primary decision makers on

matters affecting their children's health.⁵² Dental disease and treatment needs are associated with the parent's perception of their child's oral health.⁵³ Oral health may be perceived as a low priority in patients with special needs.³¹ Parents of children with special health care needs report that their children have a significantly higher proportion of dental problems and often do not receive the preventive services needed.⁵⁴

The emotional burden of having a child with autism can be taxing and parents often consult support group websites that contain isolated, anecdotal reports of children who recover from autism after uses of alternative therapy. Some of these anecdotes report that materials and methods in the dental office can exacerbate the child's condition.⁵⁵ For example, the products with heavy metals (amalgam, stainless steel) have been reported by alternative medicine sources as contributors to patients' autism and can be a contraindication in children receiving the controversial chelation therapy.⁵⁶ Additionally, the use fluoride, nitrous oxide and products with bisphenol-A can be a source of concern for the parents of children with ASD. Some parents may develop strong opinions regarding these materials as they search for answers regarding their child's autism and the parents' subsequent actions can sometimes become barriers for the delivery of proper care.⁵⁵

Autism and the family unit

The strain of having a child with special needs can add chronic stress to a family and as a result disturb the siblings of the affected child.⁵⁷ Notably, families with an autistic child report higher levels of overall stress.⁵⁸ When compared with families of children with other disabilities (such as Down syndrome), families with ASD children report significantly higher levels of parental stress and negative behavioral effects on the

healthy siblings.⁵⁹ Rivers et al. looked at the effects of an autistic child on the parents' relationship and found that when marital stress is increased, the healthy child feels an increased level of negativity towards their autistic brother or sister.⁶⁰ More pronounced and severe behavioral problems in the autistic child are indicative of a poorer relationship and a decrease in the healthy sibling's willingness to interact.⁶¹ In addition to the emotional burden, parents of children with special needs often experience greater financial stress. They tend to have more out-of-pocket expenses and require more time out of work to attend to their special needs child.⁶²

Healthy siblings have a tendency to have more internalizing behavior problems (such as depression and anxiety) and as a result have difficulties with other personal relationships in their adult lives.⁶³ These internalizing behaviors may be due in part to the attention that the autistic sibling gets for inappropriate behavior.⁶⁴ Younger healthy siblings tend to 'act out' and misbehave as an attention-seeking method, but tend to adapt better as they grow older.⁶⁵ The healthy siblings report feeling more lonely than other children and report that they have more responsibilities at home.⁵⁸ Interestingly, one study showed that in larger families, the depressive effects of having a sibling with ASD are not as prominent as in smaller families and as more support groups have developed these have helped families cope with the emotional aspect of having a child with ASD.⁶⁶

Although conflicting evidence exists about the caries incidence in children with autism, little has been studied on the oral health affects of having a sibling with autism. Considering the dietary implications, psychosocial differences, and familial strain of having a child with autism, it is anticipated the healthy siblings may have increased caries

incidence. The purpose of the following study was to determine if the dmft of healthy siblings of autistic patients differed from the dmft of healthy siblings of non-ASD patients.

CHAPTER II

CARIES INCIDENCE IN HEALTHY SIBLINGS OF CHILDREN WITH AUTISM SPECTRUM DISORDER: A RETROSPECTIVE CHART REVIEW

INTRODUCTION

Autism Spectrum Disorder (ASD) is a neurodevelopmental disorder distinguished by deficits in communication and social interaction and the presence of restrictive and repetitive behaviors. The *Diagnostic Statistical Manual for Mental Disorders Volume V (DSM-V)* (2013) revised the definition of this disorder from a span of five different subtypes of autism to one encompassing diagnosis of Autism Spectrum Disorder. Distinct classifications of Asperger disorder and pervasive developmental disorder have been removed and they are now classified within the autism spectrum.¹

The “unusual behaviors” and traits of autistic children include: compulsivity, sensory processing issues (receiving, organizing, and interpreting stimuli), resistance to change, capacity for minute details, and a sense of egocentrism (following their own wishes, interests, etc.).^{4, 5} When compared with other special needs conditions like Down syndrome, the inability to tolerate sensory stimuli makes it difficult for children with ASD to orient themselves through social situations, including dental visits.⁶

According to a recent study the prevalence of ASD is 11.3 per 1000 children or roughly 1 in 88 children aged 8 years living in the United States.⁸ This is a 78% increase over the years 2002 to 2008.⁸ There is a 3.4 to 4.5 times greater predilection in males with a higher prevalence in more educated white, non-Hispanic families.⁸ Additionally, increased paternal and grandpaternal age has been found to be a risk factor.¹⁰ Alarming,

it is estimated that overall frequency of ASD is approaching 1% of the population. It is unclear if this is due to a true increase in autism, increased awareness and diagnosis, or a combination of both.¹ As the incidence of autism rises, an increasing number of families are affected by the condition.

Autism and caries risk

Dental caries is a multifactorial process that involves the interaction of bacteria, salivary factors from the host, and fermentable carbohydrates in the biofilm on the tooth surface.²⁹ Nutrition and diet can affect the development and integrity of the oral cavity and the progression of oral disease.³⁰

Children with autism experience more general feeding problems compared with healthy children and have a higher rate of gastrointestinal (GI) symptoms when compared with children with other developmental disabilities.^{19, 25} It has been found that an immune system dysfunction results in hypersensitivity to certain foods, specifically gluten, and can result in GI symptoms.²⁰ Coincidentally, gluten-free diets tend to have higher carbohydrate intake in their diet, which can have potential negative dental effects on the child.²¹

Autistic children tend to prefer foods based on their textures and taste with a significant predilection for soft and sweetened foods.²²⁻²⁴ Due to poor muscle coordination in their tongues, autistic children tend to pouch their food instead of swallowing increasing the exposure time to fermentable carbohydrates.²⁶ One study found healthy siblings of autistic children also had difficulty coping with ranges of textures and subsequently showed a preference for soft and sticky foods even though they themselves were not diagnosed with ASD, thereby increasing their caries risk.

Dietary preferences of a child are typically related to the food choices made by the family. This situation is no different in a child with ASD; an autistic child in a family that consumes frequent quantities of sweets and other cariogenic foods is likely to have a predilection for the same foods.¹⁸ Sometimes children with chronic illnesses receive small and frequent sweet treats by well-meaning family members or as a reward for behavior shaping.^{22,31} These poor dietary choices can greatly increase the risk of developing caries for children with ASD.²²

Children with ASD and their siblings have been found to consume six or more snacks and meals per day placing these children in a high-risk category for developing dental caries.^{23,32} The role of fermentable carbohydrates in caries initiation and progression is directly related to the frequency and duration of exposures. As autistic children and their siblings were found to have a predisposition for both sweet foods/beverages and frequent snacking, there is little chance for the teeth to remineralize between meals.²³ As food and diet can be a source of difficulty for families of children with ASD, it is possible that more sweets and soft foods are accessible to the entire family in order to accommodate the preferences of the child with ASD.²⁴

Caries risk is also influenced by social, cultural, and behavioral factors. One current topic in special needs dentistry is whether children with autism have higher caries rates.³⁶⁻³⁸ Conflicting outcomes have been reported with different studies showing higher, equal, and lower caries incidence. More studies appear to find that caries activity is not significantly different in autistic patients when compared with their healthy counterparts.^{38,41,42} One study suggested making autism a high-risk caries indicator in the American Academy of Pediatric Dentistry (AAPD) Caries-risk Assessment Tool (CAT)

due to inherent high-risk behaviors and factors such as dietary preferences, xerostomia induced by common ASD medications, and poor oral hygiene.^{22, 34}

Autism and the family unit

The strain of having a child with special needs can add chronic stress to a family and as a result disturb the siblings of the affected child.⁵⁷ Notably, families with an autistic child report higher levels of overall stress. When compared with families of children with other disabilities (such as Down syndrome), families with ASD children have significantly higher levels of parental stress and negative behavioral effects on the siblings.⁵⁹ More pronounced and severe behavioral problems in the autistic child are indicative of a poorer sibling relationship and a decrease in the sibling's willingness to interact.⁶¹

Healthy siblings have a tendency to have more internalizing behavior problems (such as depression and anxiety) and as a result have difficulties with other personal relationships in their adult lives.⁶³ These internalizing behaviors may be due in part to the attention that the autistic sibling gets for inappropriate behavior.⁶⁴ Younger healthy siblings tend to 'act out' and misbehave as an attention-seeking method, but tend to adapt better as they grow older.⁶⁵ This interaction can make dental appointments difficult for the healthy siblings as well, or cause parents to avoid seeking routine dental care.

Although conflicting evidence exists about the caries incidence in children with autism, little has been studied on the oral health effects of having a sibling with autism. Considering the dietary implications, psychosocial differences, and familial strain of having a child with autism, it is anticipated the healthy siblings may have increased caries risk. The purpose of the following study was to determine if the decayed, missing, filled

teeth (dmft) of healthy siblings of autistic patients differed from the dmft of healthy siblings of healthy patients.

MATERIALS AND METHODS

A retrospective chart review was conducted in a private pediatric dental practice located in Coppel, Texas. Exams were completed by two board-certified, pediatric dentists. Forty-five charts for the siblings of autistic children (study group) and 43 charts of healthy sibling pairs (control group) were reviewed.

Expedited approval was received from the Institutional Review Board at the Texas A&M University Health Science Center Baylor College of Dentistry to complete the chart review.

The office's electronic record system, Dentrix® (Dentrix D5, Henry Schein Inc., New York) was utilized to identify patients diagnosed with autism or Asperger disorder. An additional search was completed to identify siblings with an identical guarantor of the autistic or Asperger patients. Inclusion criteria for the study group required the patient have an American Society of Anesthesiologists (ASA) rating of I, had only one older or younger sibling diagnosed with ASD, shared the same guarantor and home address as the autistic sibling, and was seen at the dental office at age 6 years or under. The age 6 years was selected to minimize variability of data by establishing population that principally was limited to the primary dentition. Each chart was reviewed and subjects that met the inclusion criteria received a more profound review of their dental record including documentation of their caries experience. The caries experience was recorded as a

numerical value of dmft and documented for the dates that the child was 6 years of age and younger. Age of the autistic sibling was also recorded.

To populate a control group, a similar search of the office's electronic health record (EHR) database generated a list of healthy-healthy sibling pairs with identical guarantors. Subjects were excluded if any child in the family had a documented medical condition of any type; however, drug and food allergies were not considered a medical condition for purposes of this study. The same inclusion criteria was utilized as the study group, less the requirement of sibling with ASD. Forty-three charts of healthy, age-matched patients were randomly selected.

Independent *t*-tests were completed to compare dmft scores. Data analyses were performed utilizing SPSS (SPSS 20.0, IBM Corp., Armonk, New York).

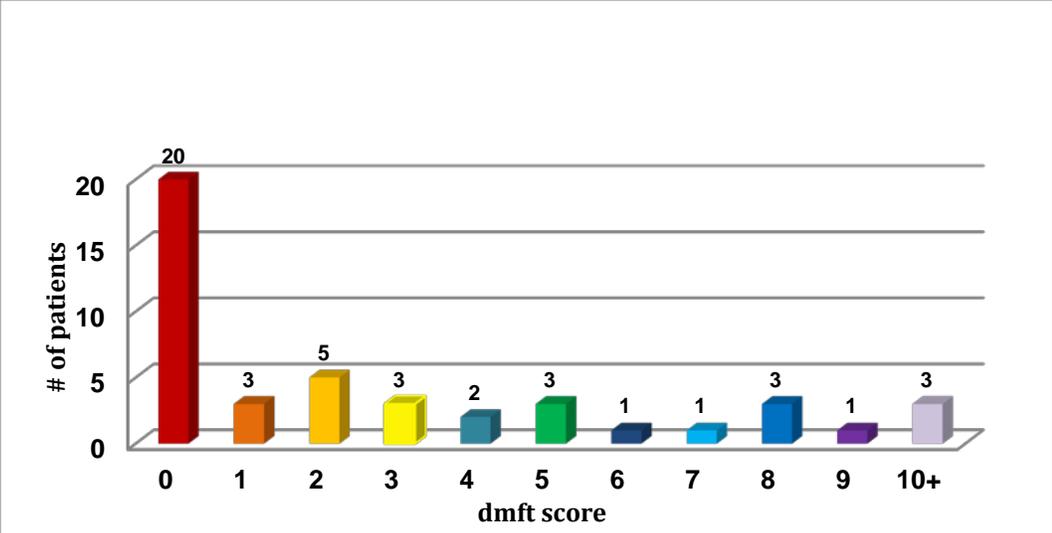
RESULTS

This study included 45 healthy siblings of patients that were diagnosed with either autism or Asperger disorders. A total of 88 children's charts were reviewed. In selecting for the control subjects, only families with two or more healthy children were considered. Only one child was selected from these families and that was the child whose age most closely matched the study population.

The average age of the study group was 5.67 years old with a standard deviation of 0.798; the average age of the control group was 5.74 years old with a standard deviation of 0.759. In the study group was composed of 73% females and the average age was 5.67 years. The control group was 53% female and the average age was 5.74 years. Descriptive statistics of both populations are in Table 1 Descriptive statistics of study vs. control group.

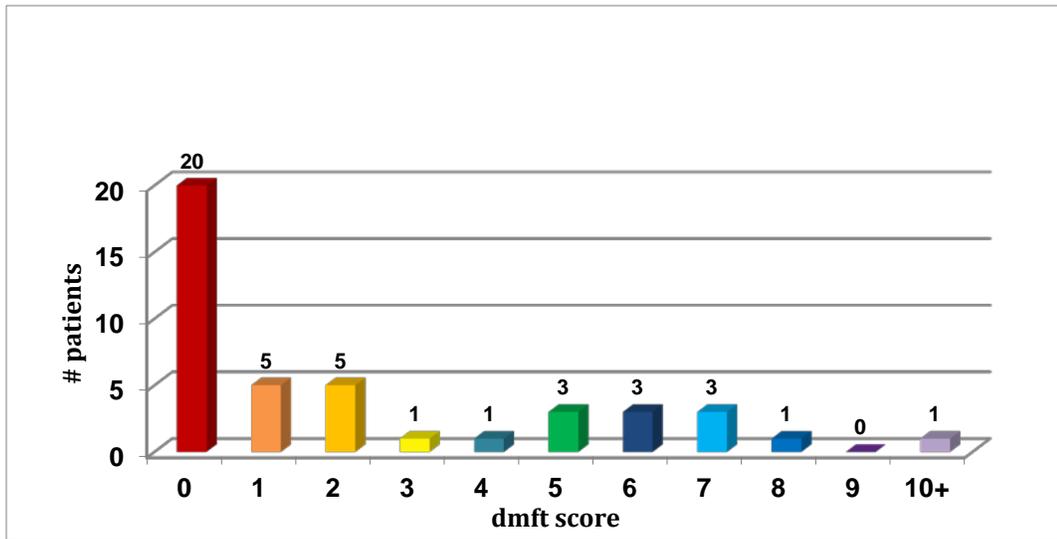
The difference in mean dmft scores was not significant ($P=0.298$) between siblings of children with ASD (2.73) and healthy sibling pairs (2.23). Among subjects in the study group, males had a slightly higher mean dmft score (2.69) than the females that was not significant ($P=0.267$). Figure 3 Mean caries experience in study group versus the control demonstrates the difference between Figure 1 Caries experience for healthy children with ASD siblings and Figure 2 Caries experience for healthy children with healthy siblings both demonstrate the distribution of dmft scores for both populations.

Figure 1. Caries experience for healthy children with ASD siblings



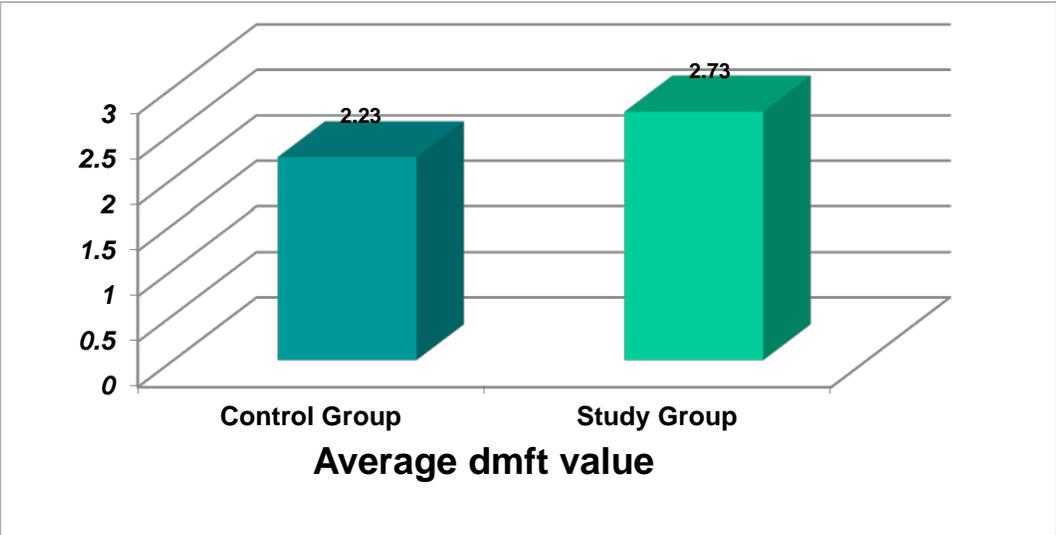
dmft= decayed-missing-filled teeth

Figure 2. Caries experience for healthy children with healthy siblings



dmft= decayed, missing, filled, teeth

Figure 3. Mean caries experience in study group versus the control group



dmft= decayed, missing, filled teeth

Table 1. Descriptive statistics of study vs. control group

	With autistic sibling	With healthy sibling
Number of patients	45	43
Age of patient, years ($\bar{x} \pm SD$)	5.67 \pm 0.798	5.74 \pm 0.759
Gender, %Female	73	53
Age of autistic sibling, years ($\bar{x} \pm SD$)	7.5 \pm 3.92	N/A
dmft (\bar{x})	2.73	2.23

Dmft= decayed, missing, filled teeth

DISCUSSION

The presence of a sibling with autism did not significantly affect the dmft score of the healthy siblings in this study; therefore, the hypothesis that having a sibling with autism has a significant effect on dmft was not supported by the findings in this study.

The data for this study was collected from a private practice setting with only two practitioners. Both the primary dentist and the associate dentist are board-certified pediatric dentists and the practice has remained in the same location for 15 years. Additionally, the quality of the data is strong in that the sample is from a population who likely live in the vicinity of the practice and share a similar socioeconomic status. The limited number of providers and similitude of the subjects helped to reduce confounding variables and provide strength to the study.

Unfortunately, this study is limited by a small sample size. A power analysis was completed after data collection and found that a sample size of greater than 1700 would be necessary to demonstrate a statistically significant difference. Although the incidence of autism is on the rise, a singular practice is still unlikely to have that many patients diagnosed with ASD. Additionally, children with intellectual disability are often granted a special type of Medicaid insurance for which other siblings may not qualify; therefore, the siblings may be treated at a different office that accepts their insurance. Since children with ASD often require specialized care in the dental office, it is also feasible that the healthy siblings are treated by a general dentist and the autistic child at a pediatric dentist.

41, 49, 50

Parental perception and role is undeniably a large factor in oral health care of the family, as the parents are usually the primary decision makers on matters affecting their

children's health.⁵² Dental disease and treatment needs are associated with the parent's perception of their child's oral health and oral health may be perceived as a low priority in patients with special needs.^{31, 53} Access to care plays a role in the oral health care of the entire family of a child with ASD. Parents report that they feel it is difficult to obtain advice and necessary referrals for comprehensive treatment for their autistic child and dentistry is one of the most cited unmet needs of children with special health care needs.^{45, 67} The healthy siblings may be affected by the difficulty the parents face in meeting health care needs for their child with ASD in addition to their other children.

The stigma that may be attached with having a child with autism may discourage parents from reporting when the diagnosis at the dental office. A confounding variable is that the charts were selected based on parent-reported ASD. With the ever-changing characteristics of what qualifies a patient as within the spectrum (most recent *DSM-V* update in 2013), some of the patients were diagnosed over 10 years ago and the specifications for diagnosis for ASD have evolved over those 10 years.^{1, 68}

Delivering dental care can be difficult in office for several reasons and often more advanced behavior management techniques are employed in this population to provide adequate care. One study found that up to 49% of children with ASD were orally defensive and combative (hitting, biting, pinching) towards the dental practitioners providing care.⁴⁰ This type of behavior maybe embarrassing to the parent and discourage them from taking their child to the dentist. Only 4% of parents of children with ASD report they attend the dentist twice yearly compared to 29% attendance of healthy children.⁴⁹ Because parents may be less likely to bring their ASD child to the dentist, it is unknown if they are failing to bring the healthy siblings as well.

Although the patient population is theoretically similar, one limitation of the study was the inability to control for factors such as socioeconomic status, vertical transmission of caries and home hygiene practices. The inclusion criteria included age, however, some of the patients had their permanent molars erupted and others did not. It is possible that all of these variables can affect the data.

Though this study did not find a significant difference between healthy siblings of children with autism and their healthy-healthy counterparts, it is understood that having a child with ASD does affect a family on many different levels.^{62, 64, 69} As the incidence of autism increases, dentists should consider this strain on the family unit and tailor their oral health education for the entire family to account for the effects of an ASD child on the family relationship. Further research with a larger population sample may yield different results.

CONCLUSIONS

1. A sibling with autism does not appear to increase caries incidence in healthy siblings 6 years old and under.
2. More research is needed to improve the data and knowledge about the oral health of the sibling of children with ASD.

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