



## Dental Treatment of Autistic Patients

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### Abstract

Autism is a developmental disorder characterized by difficulties in social and communication interactions. Parentally induced autism, brain injury/anomalies, constitutional vulnerability, and developmental aphasia have been incriminated in the epidemiology of the disease. Other suspected etiologies are structural cerebellar changes, genetics, viral infections, and immunological abnormalities, with various teratogens and vaccines. Autism Spectrum Disorders (ASD) displayed prevalence rates of about 1%, and a fourfold higher predominance of men over women. The life expectancy of autistic patients is reduced, and the death rates seem to be higher than in the general population. Dental and oral pathologies are mainly carious lesions and periodontitis. Many autistic patients are uncooperative and required general anesthesia during dental treatments. Diagnosis of autistic dental diseases includes self-extraction of primary teeth, autistic syndrome and self-injurious behaviors. Most ASD are unmarried, poorly educated, and economically deprived. The number of adults with ASD grows. Some have a level of independence that allows full participation in their healthcare decisions; others have impairments that require dependence on caregivers to mediate the healthcare they receive.

**Keywords:** Autism, Men, Women, Communication disorders, Life expectancy, Caries, Periodontitis.

**Abbreviations:** ASD-Autism Spectrum Disorders, PDD-Pervasive Developmental Disorders, CDD-Childhood Disintegrative Disorder, AD-Autistic Disorder, PCBs-Polychlorinated Biphenyl, IQ-Intelligence Quotient, RBS-R-Repetitive Behavior Scale-Revised, GA-General Anesthesia, SIBs-Self-Injurious Behaviors, DMFT-Decayed Missing and Filled Teeth, IDD-Intellectual and Developmental Disabilities, ABA-Applied Behaviour Analysis.

### Autism Spectrum Disorders: Epidemiology, Etiology and Groups

Leo Kanner first described it in 1943. This pathology is referred to as Autism Spectrum Disorders (ASD) or as Pervasive Developmental Disorders (PDD), reciprocal social interactions, language and comportemental communication and behavior. A single etiology for autism or for any of the disorders on the autistic spectrum has yet to be determined. Suspected causes of these disorders have related autism to very different underlying neurology and cognitive processes: one is related to interpreting animate motion and mental states (i.e. the theory of mind) and the other appears to be associated to recognizing inanimate objects, events or patterns [1]. Abnormalities of the brain structure or function have been identified, but it is uncertain that they contribute actually to the etiology of autism.

#### Epidemiology

**ASD prevalence:** The prevalence rate per country give a current estimate of 1 in 110 children [2]. This was noticed during the three first years of the child's life. Autistic infants show less attention to social stimuli, smile and look at others, and they respond less to their own name. ASD prevalence rates of about 1%, but with prevalence higher in men. A male:female ratio of 4.6:1 has been reported on the gender-specific epidemiology of the autistic disorder. Older ASD children and adults perform worse on tests of face and emotion recognition. Children with autism are less likely to make requests or share experiences, and simply repeat others words (echolalia). Joint attention seems to be necessary for functional speech.

For example, they may look at a pointing hand instead of the pointed-at object, and they consistently fail to point at objects in order to comment on or share an experience. Children with autism have difficulty with imaginative play and with developing symbols into language. Language functions in general are disturbed in autism. The difficulty of explaining the whole syndrome on the basis of a single abnormality is postulated as an alternative hypothesis that a combination of language, perceptual, motor, and autonomic impairments is underlying autistic behavior [3].

Asperger Syndrome, pervasive developmental disorder not otherwise specified (or atypical autism), Rett Syndrome and Childhood Disintegrative Disorder (CDD), have also been identified in the group of autistic children [4]. However, ASD is up to now the most studied group.

#### Etiology

The etiology of Autistic Disorder (AD) has not been discovered. It has been suggested that it is an organic disorder characterized by abnormalities in the brain, especially the cerebellum and limbic system. Therefore the « theory of mind » has been implicated in autism [5]. A single computational deficit with multiple cognitive effects was originally suggested. Neurophysiologic, psychologic and epigenetic effects are still under evaluation, but without any solid conclusion.

#### ASD Changes with Time

##### Pollution

The frequency of autism has increased in the 1990s and early 2000s. This may be due to increased awareness and case reporting. It has long



been presumed that there is a common cause at the genetic, cognitive, and neural levels for autism's characteristic triad of symptoms. Exposure to air pollution during pregnancy, especially heavy metals (e.g. lead and mercury), may increase the risk of autism [6]. Environmental factors that have been claimed without evidence to contribute to or exacerbate autism include certain foods, infectious diseases, solvents, Polychlorinated Biphenyl (PCBs), phthalates and phenols used in plastic products, pesticides, brominated flame retardants, alcohol, smoking, illicit drugs, vaccines, and prenatal stress. During pregnancy, the future mother may have taken valproic acid (an antiepileptic drug) or drunk alcohol. A few cases of ASD have been attributed to toxic exposure, teratogens, perinatal insults, and prenatal infections such as rubella and cytomegalovirus. Discrepancies among reports make hypothetical any conclusion.

### Genes Research

Autism genetic research has narrowed the suspected genetic cause to chromosome 15. However, chromosomes 2, 7, 9, and 16 have also been implicated in the genetics of autism. Autism affects information processing in the brain and how nerve cells and their synapses are connected and organized. The Diagnostic and Statistical Manual of Mental Disorders, combines autism and less severe forms of the condition, including Asperger syndrome and Pervasive Developmental Disorder Not Otherwise Specified (PDD-NOS) into the diagnosis of autism spectrum disorder. There is an association between head circumference and deficits in both verbal abilities and nonverbal Intelligence Quotient (IQ).

As the name indicates, Autism Spectrum Disorder (ASD) varies widely in its clinical manifestations; however, dentists are likely to encounter difficulties with communication and socialization. Autistic individuals can display many forms of repetitive or restricted behavior, which the Repetitive Behavior Scale-Revised (RBS-R) categorizes as follows

- **Stereotyped behaviors:** Repetitive movements, such as hand flapping, head rolling, or body rocking.
- **Compulsive behaviors:** Time-consuming behaviors intended to reduce anxiety that an individual feels compelled to perform repeatedly or according to rigid rules, such as placing objects in a specific order, checking things, or hand washing.
- **Sameness:** Resistance to change; for example, insisting that the furniture not be moved or refusing to be interrupted.
- **Ritualistic behavior:** Unvarying pattern of daily activities, such as an unchanging menu or a dressing ritual. This is closely associated with sameness and an independent validation has suggested combining the two factors.
- **Restricted interests:** Interests or fixations that is abnormal in theme or intensity, such as preoccupation with a single television program, toy, or game.
- **Self-injury:** Behaviors such as eye-poking, skin-picking, hand-biting and head-banging.

Autistic individuals may have symptoms that are independent of the diagnosis, but it may affect the individual or the family. An estimated 0.5% to 10% of individuals with ASD show unusual abilities, ranging from splinter skills such as the memorization of trivia to the extraordinarily rare talents of prodigious autistic savants.

Autism is often called autistic disorder, childhood autism, or infantile autism. Autism refers to the classic autistic disorder; in clinical practice, autism, ASD, and PDD are often used interchangeably. ASD, in turn, is a subset of the broader autism phenotype, which describes individuals who may not have ASD but do have autistic-like traits, such as avoiding eye contact. Autism can also be divided into syndromal and non-syndromal autism. The syndromal autism is associated with severe or profound intellectual disability or a congenital syndrome with physical symptoms.

### Screening Autism (Symptoms of Autism)

- No response to name (or eye-to-eye gaze) by 6 months.
- No babbling by 12 months (18-40 months).
- No gesturing (pointing, waving, etc.) by 12 months.
- No single words by 16 months.
- No two-word (spontaneous, not just echolalic) phrases by 24 months.
- Loss of any language or social skills, at any age.
- Patients taken in charge by pre-school and school children or educational institutionalized structures (age range 3-21 years).
- Adults (young or old)>18 years, 5(22-49 years, and more). 60% or older.

Three different forms of autism allow accurate identification of the pathology:

- Communication disorders.
- Social interaction disorders.
- Repetitive and stereotypical restricted nature of behaviors.

**Other forms:** Autism is also known as a group of Pervasive Development Disorders (ASD or PDD) including:

- **Asperger syndrome:** Normal or above-normal intelligence, but they have social interactions disorders.
- **Rett's syndrome:** Develops normally up to 6 months and then regression begins, with appearance of autistic symptoms. Four successive stages have been recognized in Rett syndrome. **Stage 1** begins between 6 and 18 months; **Stage 2** begins between 1 and 4 years; **Stage 3** begins between 2 and 10 years, and **Stage 4** starts after 10 years and expands in adults. This syndrome is affecting predominantly females, the gene mutation being located at Xq28.
- **Disintegrative disorders of childhood:** Has normal development until 2 years, then the autistic symptoms appear. **Symptoms 1:** Language is absent or reduced to a few words. Poor understanding, patient lonely and indifferent and the absence of smile is noted. **Symptoms 2:** Gestures (shaking hands in front of the eyes); matrices; hyper or hypo sensitive to noises, pain or tactile stimuli. Mental retardation is present in 75% cases. In addition, trouble falling asleep, low need to sleep, and frequent awakenings during the night are added to the symptomatology. Sleep disturbances are commonly reported both in autistic children and adults.

### Risk Factors, Death and Suicide Rate

Risk factors of mortality include moderate to severe intellectual disability, epilepsy, and female sex. Death occurs during sudden unexpected death in epilepsy, and accidents. There is also an increased risk of mortality from a wide variety of causes that are found also at similar rates in the general population.

Age group of moderate to profound intellectual disability is 17% for the 18-29 years old group of subjects, 28.6% for 30-44 years old group, 44.7 for 45-64 years old group and 9.2 for patients older than 65 years [7]. The life expectancy is significantly reduced (8-12 years for the pre-school and school-age group; adolescent's pre-puberty and adults 13-29 years up to 46 years). Epidemiologic studies found an almost twofold higher mortality rate in ASD compared to the sex-and age-matched population. The general mortality risk is higher for men than women. There are no systematic data on life expectancy in autism, but there is some indication suggesting that death rates are higher in ASD compared a general population [8].

In people with intellectual disabilities, deaths are often related to inadequate institutional care, poor medical supervision, or infection. Approximately 12% of autistic patients achieve a high level of independence in adulthood [9]. Although some improvement may be expected over the years, the majority of ASD still suffer from "significant degrees of symptomatology and dependency" in adult life. The autism suicide rate "is among the taboos of the public debate". Their mortality is not the subject of any study and no public interest,



probably because studies focus mostly on childhood, and other factors that some medical institutions desire to hide.

### **Antipsychotic and Antidepressants Medications**

The most common medications reported were antipsychotics, antidepressants, (mainly selective serotonin reuptake inhibitors), and anticonvulsants [10]. Most adult autists are doing well, living independently, and had jobs (often of a high level). However, some were still living with their parents and a few were experiencing difficulties with social relationships. Rates of mental health problems, mainly anxiety and depression, were higher than in the general population.

### **The Costs of Supporting Children with ASD**

The costs of supporting children with ASDs were estimated to be £2.7 billion each year in the UK. For adults, these costs amount to £25 billion each year. The lifetime cost, after discounting is estimated at approximately £1.23 million, and the cost for someone with ASD without intellectual disability is approximately £0.80 million. For adults, these costs amount to £25 billion each year [11].

## **Dental Treatment of Patients with ASD**

### **The Needs for Dental Treatments**

ASD displays higher caries severity than the general population, however these data are controversial. Kamen and Skier [12] reported a low incidence of caries in autistic children. Conflicting results have emerged from the limited number of studies which were carried out on normative oral health assessment of children with ASD. With respect to dental treatments, these children were uncooperative [13,14]. However, it is also possible that the problem of autistic children to cooperate to dental treatment in some cases resulted from an inferior precision of the diagnostic procedures. Some decayed surfaces might have escaped to detection.

A significantly higher percentage of patients with ASD required dental treatment to take place under General Anesthesia (GA). Caries prevalence and severity in patients with ASD was not associated with institutionalization or to additional diagnosis. Young (2-5 years old) and children (9-12 years old) patients with ASD need treatment under general anesthesia in the operating room. GA was necessary in 37% of all patients when comprehensive care was required or difficult procedures were carried out. ASD adults need preventive and restorative procedures to reduce the impact of dental caries and gingivitis.

### **Caries and Treatment Needs by Dental Patients with Autism**

By definition, an individual with autism will have difficulty with three domains:

- Language and communication,
- Socialization, and
- Repetitive behaviors.

Excessive anxiety may be a secondary characteristic of ASD. This anxiety may be responsible for the Self-Injurious Behaviors (SIBs) that as many as 50% of ASD children experience. For the most part, these behaviors are mild [15].

The majority of autistic children had poor oral hygiene, and almost all of them had gingivitis. It could be due to lack of necessary manual dexterity of autistic children, which result in inadequate tooth brushing, or the side effects of medications used to control the manifestations of autism. Children with autism exhibited higher caries prevalence, poor oral hygiene and extensive unmet needs for dental treatment compared with the non-autistic control group.

Dental caries or Decayed, Missing, and Filled Teeth (DMFT) were found to be lower than the values found for institutionalized schizophrenics. In primary dentition the patients with AD demonstrated a significantly higher caries rate than the group « control » during initial examination. However, at recall, Decay-Missing-Filled (DMF) values were comparable [16]. In some cases, the prevalence of caries in children with AD could even be comparatively lower. Almost autistic children had gingivitis due either to psychoactive drugs or anticonvulsants [2].

The oral status of 4,732 adults with Intellectual and Developmental Disabilities (IDD) was studied by Morgan et al. [17]. 32.2 % had untreated dental caries, 80.3% had periodontitis. Detailed medical history, physical examination, clinical intraoral and radiographic examination, incisional biopsy, neuropaediatric, psychological and speech evaluation were necessary. Diagnosis included hypochromic macrocytic anemia, caries, coronal fracture, periodontitis, self-extraction of primary teeth and permanent teeth buds, non-specific oral ulcer with inflammatory reaction, mild mental retardation, speech impairment, autistic syndrome and self-injurious behaviour consisting of putting fingers and foreign objects in the gingiva, fingernail biting and hair pulling. Altogether, these ASD symptoms implicate dental preventive and restorative treatments [18].

### **Procedures Commonly used to Reduce Phobic Behavior to Dental Fear in Children with Autism**

Clinicians can work with patients on the autism spectrum and their supporters in order to find effective strategies and accommodations to reduce barriers due to the pathology. In people with nontraditional communication or atypical cognition, illness is often presents as a change from baseline behavior or function. Clinicians should consider a full differential diagnosis, including common medical and psychosocial causes [19,20]. Studies showed that when low IQ (Intelligence quotient) autistic children were compared with mentally retarded non-autistic children, very few group differences were found, but when high IQ autistic children were compared with typically developing children the differences were quite marked.

### **Dental Treatments of ASD are Possible, Closely Associated with Four Methods that seems to be Efficient or at Least Useful**

**Visual pedagogy:** The process known as functional behavioral assessment may take place during the pre-visit consultation of parents. At that time, the dentist can organize the home-centered preparation that includes familiarization with dental instruments, teaching of skills required for the dental examination using phrases such as 'open your mouth', and developing custom-made photo books to assist the child to get acquainted with the dental operatory room. Most of the parents found maintaining good oral hygiene easier than they had found it before the study and concluded that visual pedagogy was a useful tool for helping people with autism in improving their oral hygiene. A gentle introduction to tooth brushing using alternatives, such as a washcloth, toothbrushes of different texture and design or an electric toothbrush may enhance the acceptance of toothbrush by the child with ASD.

**Sensory adapted environment:** Children with ASD may present hypersensitivity in intraoral and perioral regions, and therefore experience frustration by a light touch or even fall back during dental examination. The experimental introduction of relaxing light conditions, rhythmic music, and deep pressure in the dental setting diminished adverse patient reactions and enhanced positive participation in dental prophylactic cleaning. Duration of the dental visit, and sensory sensitization should be kept to a minimum.

**Applied Behaviour Analysis (ABA):** ABA principles have been also adopted in young autistic patients with needle phobia and diabetes to permit medical monitoring of the blood glucose levels. The 'positive'





or 'negative' reinforcement classification depicts whether the increase of the behaviour is linked with initiation or termination of the stimulus respectively. For example, giving a sticker, a 'good job' or 'well done' praise might serve as a positive reinforcer, in case there is proof it leads to enhanced compliance in the dental chair. On the other hand, the child may be negatively reinforced or motivated to stand still during drilling for a predetermined time period, for instance counting from 0 up to 10, if immediately after the intervention is interrupted for a while. The sequence of events is repeated as long as necessary for the procedure to be completed. Using shaping and reinforcement as per case requirements may be beneficial in founding communication with a child with ASD.

**Advanced behaviour guidance methods:** Antipsychotic medications are most commonly prescribed for ASD patients to alleviate symptoms of irritability, distress, self-injurious behaviour, aggression and delusions. The dental specialists should be aware of the oral adverse reactions of the aforementioned drugs, which can be summarized as xerostomia, sialorrhea, sialadenitis, stomatitis, gingival enlargement, edema and discoloration of the tongue.

### Clinical Recommendations and Future Research Goals

Dental care should be viewed as integral part of comprehensive health care program coordinated by the medical home. Based on the higher frequency of the regular medical screening of autistic children compared to scheduled dental visits, it can be presumed that an interdisciplinary approach with the child's physician might help to overcome the anxiety of the dental appointment [21].

**Pharmacological behavior:** Frequently used drugs were nitrous oxide, diazepam, hydroxyzine, chloral hydrate, and promethazine, in contrast to chlorpromazine, diphenhydramine, and meperidine. The drugs were administered in different dosages and regimens, such as a sole agent or in various combinations. Physicochemical properties of saliva, dietary and oral hygiene habits: Individuals with autism have neither higher salivary flow rate nor superior buffer capacity related to non-autistic controls. Determination of the total antioxidant concentration of salivary samples collected from autistic children revealed significant reduced values compared to normally developed subjects of the same age, which apparently did not affect the caries experience.

**Tell-Show-Do:** Frequent positive and negative reinforcement paired with firmness are necessary. However a higher rate of flexibility is required to comply with quickly changing patient needs. Other recommendations, gain based on the modeling effects of constant positive reinforcers are immediate verbal praise after each accomplished step of a procedure and a prize at the end of a dental session. The oral commands should be clear, short, and simple sentences. Visual pedagogy involves the series of colored photographs describing step-by-step dental visit and tooth brushing to introduce oral hygiene to autistic children. Many autistic children are visual learners. Visual schedule may help to reduce the apprehension in children by understanding the sequence of procedures.

Beneficial relaxing effects of deep touch pressure for children with AD have been described. Calming effects were also noted by some dentists. Tell-show-do, voice control with short, clear commands and positive reinforcement are successful first-line management Clinique's for the autistic patient. Impaired social interaction, communication, cognitive dysfunctions and other associated psychiatric symptoms may impede dental care. A variety of basic behaviour guidance techniques may be utilized to enable dental treatment of patients with ASD, including the presence of parents or aides, and the use of the tell-show-do technique [13,14,22].

### Prevalence, Social and Treatments Needed by ASD

Autistic patients demonstrate varying degrees of function. Many "high functioning" adults can live in society. However, at present, the

research emphasizes early diagnosis and treating infants and children rather than adults. Adolescents are 10-21 years old, and adults 22-53 years old may be included in this cohort. Some affected patients are non-verbal but others are echoic (repeating statements heard from others) [23].

### ASD Prevalence Rates: A Public Health Problem

Most often due to lack of public support, many adults with autism depend on their families for the support they need, including housing, financial support. As families get older, have less opportunity to provide the support they need, or when parents die, the unsustainability of a system that relies too much on family support is unimportant. Governments must urgently meet the support needs of aging people with autism and ensure that they can continue to live in dignity and enjoy their rights at a later age.

The increase of autism becomes an "urgent" public health problem. 1.7% of American children are autists. The average is 1 child in 68 children in 2014 (vs. the situation nowadays: one in 34 children and vs. Arkansas 1 in 76 children). In old age, social isolation and loneliness have negative effects on the quality of life. There is greater risk of mortality, depression, and poorer health. Individuals with ASD have fewer friendships, and they may be even more affected than 'neurotypicals' by the loss of loved ones and shrinking family networks due to illness and immobility. The mean age for the patients surveyed was 43.4 (range 26.2-60.5) years and mean follow-up time was 35.5 (range 21.3-47.0) years.

The ASD prevalence is about 1%, higher in men than women [23]. There are no systematic data on life expectancy in autism, but there is some indication that death rates are higher than in the general population. The mean age at death for individuals with autism was 36.2 years (SD=20.9 years), compared with 72.0 years (SD=9.2 years) for the general population. Research on healthcare experiences of individuals with autism has been almost uniformly limited to studies of children and their families, who consistently report more difficulty obtaining health care for their children and less satisfaction with that care, once received. Adults with autism are just as likely as other adults to have a primary care provider, but are more likely to have unmet physical and mental health needs, and they are less likely to receive preventive care.

The number of adults with autism spectrum disorders will continue to grow. Some will have a level of independence that allows for full participation in their healthcare decisions; others will have impairments that require dependence on caregivers to mediate the healthcare they receive.

### Old Autist Patients

Many siblings expressed considerable anxiety about what would happen when their parents died, leaving them as the main person responsible for their sibling with autism. Although only a minority of the adults with autism was still living at home, their parents, many of whom were now in their 70s or 80s, also expressed fears about the future and who would look after the welfare of their son or daughter when they will be no longer alive. There were particular fears that, with forthcoming financial cuts to social services, people currently living in adequate residential placements may be relocated to cheaper, less appropriate settings if they had no one to advocate for them.

The average proportion of adults still living at home was 48%; the average proportion in employment (regular, supported, or sheltered) or full-time education was 46% and, for those in employment, jobs were often at a low level and poorly paid.

What happens to people with autism as they approach old age? Almost all current adult outcome studies have focused on people in their 20s to 40s. Knowledge about the aging process in ASD is almost nonexistent, and systematic information about the physical and mental health needs



of elderly people with ASD is lacking, and limited to children with autism, aged 31- 44 years [4]. The public health problem is increasing for early childhood and adolescents which are more numerous per each decade. This problem will probably increase in the next future, despite the shorter and declining number of patients belonging to this specific group.

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