

An Update on Dental Outlook for Autism

Anil Patil^{*}, Sridevi Tamgond, Sandhyarani B, Anand Shigli, Sharmila Patil and Sachin Gunda

Bharati Vidyapeeth Deemed University Dental College and Hospital, Sangli, Maharashtra, India

^{*}Corresponding author: Patil A, Bharati Vidyapeeth Deemed University Dental College and Hospital, Sangli, Maharashtra, India, Tel: +39 (0)81 5665880; E-mail: dranilp0888@gmail.com

Rec date: 01 April 2016; Acc date: 11 May 2016; Pub date: 18 May, 2016

Copyright: © 2016 Patil A, et al. This is an open-access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original author and source are credited.

Abstract

Autism or autistic disorder is lifetime neurodevelopment disorder described as major impairment in mutual social interactions, communication ability, and repetitive patterns of interests or behaviors.

Since, globally large number of children affected by this devastating disorder, dental professionals should provide oral health care with family-centered approach comprising thorough understanding of parental concern, exceptional medical conditions, and vivid behaviours of each personality patient to improve the treatment planning. This article analyses oral health status, dental needs, complications and treatment of autistic children.

Keywords: Autism; Autism spectrum disorder; Autistic disorder; Dental caries; Oral health

Introduction

Autism disorder (AD) was first explained by Leo Kanner in 1943, an American child psychologist [1]. Autism Disorder is also known as Kanner's autism, childhood autism, or early infantile autism [2]. Autism or autistic disorder is a severe lifelong neurodevelopment disability distinguished through major impairment in communication skills, mutual social interactions, and cyclic stereotypes of interests or behaviors. Autism spectrum disorder (ASD) is defined by the DSM-V as involving deficits in two major areas:

- 1) Social communication and social interaction and
- 2) Restricted / repetitive behaviors, interests or activities [3].

Few investigators explain the autism features not merely a brain disorder but multisystem metabolic disease [4].

Autism spectrum disorder (ASD) incorporates a group of neurodevelopment disabilities having a core set of defining criteria which encompass impaired communication, social interaction, and repetitive or restricted behavioral patterns [5]. ASD or pervasive developmental disorders (PDDs) characterize a group of disorders that encompasses five diagnostic subtypes such as autism, Rett's disorder, PDD not otherwise specified (PDD-NOS), Asperger's disorder, and child disintegrative disorder [6].

Discussion

There should be paradigm shift from etiology oriented approach for autism to management of autism; therefore this article analyzes oral health status, dental needs, complications and treatment of autistic children.

Etiology

In view of the complex characters of autism, a sole origin is unlikely. Genetic, environmental, and immunological factors may play a role in

its pathogenesis of AD [7]. Genetic factors such as gene deletions, gene mutations, copy number variants (CNVs), and other genetic aberrations are correlated to autism [8]. Autism involves almost three times as many males as females. Results of studies at AD families and twins concluded that autism has a genetic element [9]. AD is an organically based neurodevelopment disorder related with brain structure and function aberrations [8].

Prenatal factors such as intrauterine viral infections or metabolic disorders might be related to AD pathogenesis [10]. Thalidomide teratogenic drugs and valproate intrauterine exposures may be associated as etiology of autism in few children [11]. Genetic defects may be attributable to increased age of the parents, brain inflammation possibly caused by an immature bloodbrain barrier, defective placenta, and immune response of the mother to a viral or bacterial infection, neonatal encephalitis, or a toxic environment, and a premature birth. Furthermore, intracellular pathogens may possibly stimulate an immune response, consequential in brain injury, neuro-inflammation, autoimmune reactions, and autism [12]. There is evidence that Thimerosal (49% ethyl mercury) used as an antibacterial agent in vaccines has been implicated as a cause of autism [13].

Incidence and prevalence

Autism is a worldwide health catastrophe which recognizes no borders, nationality, social status or ethnicity. The prevalence predicted to be 1-2 per 1,000 for autism and 6 per 1,000 for Autism Spectrum Disorder, with about four times as many males as females [14]. Posserud et al., Wong, and Patricia et al. calculated nationwide approximate prevalence rates of autistic children as follows: Australia: 6.25 in 1000, Canada: 1 in 154, China: 1.1 in 1000, Denmark: Nearly 9 in 1000, Finland: 1 in 833, Iceland: 1 in 769, India: 1 in 250, Japan: Nearly 3 in 1000, Mexico: 2 to 6 per 1000, Philippines: 500,000 total children, Sweden: 1 in 188, US: 1 in 110 [15-17]. By looking at those numbers, dentists in every corner of world expected to treat AD children. Hence comprehensive knowledge of AD is must for successful dental treatment.

Associated medical disorders

Fragile -X syndrome is observed in 2-5% of autistic persons which is the largest known subgroup of AD patients, with known aetiology [18]. 0.4-3% of patients with AD had tuberous sclerosis complex (TSC) and 17-58% of persons having TSC had AD [19]. Autism patients have immune system disorders, allergies, seizures and gastrointestinal disturbances [20]. Dentists should know these co-morbid problems to provide safe and quality dental care to AD patients.

Dysmorphic features, developmental delay, an uneven sex ratio, obstetric problems, and extremes of head size are nonspecific signs of autism [21]. Syndromes related to AD comprise of Joubert, Neurofibromatosis type 1, Prader-Willi, Timothy, Angelman, macrocephaly and overgrowth, Inv dup or idic, Turner, Williams, Klinefelter, XYY, 22q13.3 deletion, Tuberous sclerosis complex Smith-Magenis, Smith-Lemli-Opitz, Sanfilippo, and Cohen. Besides, mitochondrial cytopathies, Duchenne muscular dystrophy, and adenylosuccinate lyase deficiency are associated with AD [22].

Diagnosis of AD

As if no specific diagnostic tests, blood investigations and biopsies are available for autism. Consequently, a clinical diagnosis is derived from behavior and development, using 5th Edition of the Diagnostic Statistical Manual of Mental Disorders (DSM) [3]. The onset of autism is mostly observed in the first 3 years of life [23].

AD diagnosis requires a developmental screening followed by a comprehensive diagnostic evaluation. General developmental screenings assess learning skills, behaviours, speech, and movement, at correct interval period [24]. A comprehensive diagnostic assessment includes a complete review of the child's behaviour and development, parental interview, vision, hearing screening, genetic and neurological tests [25].

Early AD diagnosis has benefits for the child and family like early guidance concerning education and support; prior access to targeted behavioural, communication, social interventions; and recognition of co-morbid medical, psychiatric, developmental disorders [25]. Primary care providers should target children at risk like with language delay to guarantee that more children are diagnosed early [26]. Lai et al. suggested an oral examination during primary care attendance to start the introduction of the child to dentistry [27]. Dental care must be considered as integral part of comprehensive health care program coordinated by the medical home. Autistic children should be referred for regular dental care at the earliest to ascertain a dental routine to promote oral health.

Clinical features

Mental retardation is observed with almost 70% autism cases. The behavioral symptoms in children include hyperactivity, short attention span, temper tantrums, impulsivity, anger, agitation, moreover propensity for aggressive and self-injurious behaviors [28]. Every day routine alteration may initiate or increase it. Sleep disorders or parasomnias for instance sleepwalking and nightmares were less frequently reported sleep problems; than bruxism [29].

Disorders of language and social communication, poor response to external stimulation, tendency to isolate themselves, and poor eye-to-eye contact are well-recognized symptoms. Small procedures can be performed without local anaesthesia, since AD patients have higher pain threshold [30]. AD features auditory and tactile hypersensitivity

causing exaggerated response to light and odours [25]. Autistic patients dislike changes in their environment and want sameness and continuity [31]. They may respond with tantrums on small changes in routine.

Self-injurious behaviour (SIB), oral habits and malocclusion

SIB observed in 4-5% in patients with different psychiatric disorders, mostly with AD and brain damage. Alteration in daily routine may commence or amplify it. SIB may vary from self-pinching or scratching to self-biting or head banging. An injury mostly performed to draw family member or clinician's attention to avoid unwanted procedures. Furthermore, AD children may have damaging oral habits such as bruxism, lip biting, tongue thrusting, picking at the gingiva, and pica which may cause certain malocclusions. A mouth guard may help to discontinue this self-injurious oral behaviour [32]. Erosion and hyper responsive gag reflex are also common. Anterior open bite, ogival palate and dental crowding were diagnosed more commonly in ASD adults than unaffected individuals [33,34]. Similarly, reverse over jet, spacing, open bites and Class II molar relationship tendencies were more in AD patients [35].

Tooth eruption

Since, phenytoin is generally prescribed for AD children; tooth eruption may be delayed because of phenytoin-induced gingival hyperplasia [36].

Oral health status and dental needs

AD patients do not display peculiar oral and dental conditions. But, their dental treatment will be challenging because of complex and diverse clinical features. Oral health conditions comprise, drooling and difficulty swallowing; may be due to poor muscle tone not because of excessive saliva production [37]. The prevalence of dental caries in AD patients was equal to other children [30,38,39]. Few studies reported the prevalence of caries in AD children relatively lower [40-43]. Shapira et al. reported institutionalized autistic individuals exhibited lower caries rate than institutionalized schizophrenics [44]. The caries rate of autistic children in a day care facility was similar to that of their peers. Morinushi et al. examined Japanese autistic children participated in summer camp in 1980 and in 1995 which concluded that the caries experience in 1995 showed a clear decline from 1980 [45].

Orellana et al. carried out a prospective case-control study on adults with ASD (n=30), with a mean age of 27.7 ± 5.69 years, and of a healthy control group (n=30) [33]. They were assisted in brushing 2-3 times a day. The CAOD and CAOS scores were significantly lower than in the controls. Adults with ASD and assisted dental hygiene presented fewer caries than control.

Mostly, autistic children favour soft, sweetened food. Because of poor tongue coordination they have a propensity to pouch food inside the mouth rather than swallowing it, thus increasing caries susceptibility [18]. Furthermore, the risk for dental caries likely to be higher in AD patients owing to lack in brushing and flossing skills, and the oral hygiene of these children is known to be deficient [46], also they lack to cooperate with preventive oral health practices. Autistic individuals have neither a higher salivary flow rate nor a enhanced salivary buffer capacity, moreover similar dental caries experiences were observed in primary and permanent dentitions in comparison with non-autistic healthy children [47]. Total antioxidant

concentration of saliva from AD children discovered significant low values compared to healthy children, which in fact did not affect the caries experience [48]. Regular dietary habits with moderately low frequency of in-between meals snacking and decreased carbohydrate ingestion may be attribute to low cariogenic activity with autism [45]. Contradictorily, good oral health standards observed might be credited to the dental hygiene routine of ASD children with supervised or executed by parents and caregivers. US autistic children with or without autism who had fair or poor teeth are faced with comparable dental issues [49].

But, few studies reported high caries prevalence has been previously reported for autistic individuals compared to other oral disorders, non-autistic controls [50-52]. On the contrary, lower caries indices allocated to ASD patients in relation to healthy siblings and developmentally disabled children [5,48,53]. Amusingly, there are only two controlled studies with unaffected controls that described statistically significant caries susceptibility for autistic individuals, either higher or lower [5,51]. Rajic et al. reported a combined treatment by a dental team and a pedopsychiatric team resulted in a decreased prevalence of caries in AD children with autism [54].

Oral hygiene, gingival and periodontal health

Most of autistic children had lower oral hygiene status, and nearly all had gingivitis [38]. Poor oral hygiene may be associated with irregular and inadequate brushing habits, lack of the manual dexterity of autistic children. Additionally, study reflected a lack of dental education, poor dental awareness, and lack of oral hygiene instructions from dental staff [38]. The presence of generalized gingivitis might be the adverse effects of medications used to treat the manifestations of autism, for instance psychoactive drugs or anticonvulsants, antipsychotics antidepressants, and stimulants [30].

Shapira et al. described Autistic children had severe periodontal problems in Israel [44]. Most of recent studies [33,35,48,50,51,52,55] revealed poor oral standards in young AD patients at statistical significance [33,35,48,50,55].

Vishnu Rekha et al. assessed oral health status for 483 children with autism from special education schools, autistic child centres and therapy centres [50]. Autistic children with primary dentition showed significantly higher incidence of dental caries (24%), compared to other oral conditions. Children with mixed dentition had more gingivitis (50%) and children with permanent dentition had more gingivitis (48.96%) and malocclusion (71.15%). All the oral conditions were observed more in boys than girls.

Jaber MA examined 61 patients with autism aged 6-16 years (45 males and 16 females) from Dubai and Sharjah Autism Centers [51]. The control group was selected from relatives or friends of autistic patients. Compared to controls, children with autism had significantly higher decayed, missing or filled teeth and significantly needed more restorative dental treatment. The majority of the autistic children either having poor or fair oral hygiene compared with control group. Also, 97.0% of the autistic children had gingivitis.

Al-Maweri et al. assessed 42 children with autism aged between 5 and 16 years in Yemen using case-control study [52]. Compared to controls, children with autism observed higher proportion of fistulae, ulcerative lesions, gingival hyperplasia, and cheilitis; but differences were not statistically significant. The mean dmft score was significantly higher in children with autism than in controls. Moreover, children

with autism revealed poorer oral hygiene than controls, and the majority had gingivitis.

Nonetheless, autistic children and young adults maintained best oral hygiene among special school attendants as compared to other developmental disabilities [56]. But, Fahlvik et al. stated no statistically significant differences in the prevalence of caries, gingivitis and degree of oral hygiene in comparison with non-autistic individuals [39]. Sarnat et al. reported that good oral hygiene maintenance is difficult for autistic children yet their gingival health was good [43]. Powered toothbrushes can cause a significant improvement in gingival health when constant reinforcement of oral hygiene instructions is performed [57].

Dental injury

Dental injuries are more common in autistic children. Frequent dental injury was enamel fracture and the most frequently permanent maxillary central incisors [58].

Barriers to dental care access

Parental survey reported child's attitude for dental procedures, expenditure and lack of insurance coverage have been recognized as the core hurdle to oral care delivery for ASD children [27]. Dislike to dental treatment, complications related with the medical condition, and trouble in locating a competent dentist was also stated by guardians of autistic children [59]. Autistic children are challenging to the dental team attributable to inadequate attention span and a low frustration threshold, reduced communication skills [60]. Dental management of autistic children is frequently a time-consuming process and necessitates numerous visits to start actual treatment [60].

Autistic children fail to develop joint attention; they also lack curiosity for the environment and inability to share information using spoken language, gestures and eye contact which may obscure professional oral procedures. Impaired interpretation of stimulus intake may cause unusual responses to visual, olfactory, tactile, auditory, and gustatory signals [61,62]. Moreover, autistic children may have hypersensitivity in intraoral and perioral regions, and hence experience annoyance by a gentle touch or fall back during dental examination. Moreover, the invasive nature of oral care may generate violent and self-injurious behavior like temper tantrums or head banging [63]. Oral defensiveness has also been reported in few autistic children [53].

Rigorous and constant special educational programs, behavioral therapy early in life can modify children's behavior and assist the attainment of self-care and social and communication skills [64]. Dietary modifications for instance the use of gluten-free, casein-free (GFCF) diet, and the elimination of food preservatives and additives (artificial flavors and colors) may cause in behavioral and physiological improvements in some children [65,66]. The treatment plan must be comprehensive with conservatively aggressive restoration of caries. Rampant caries, extensive proximal lesions, hypoplasia, pulp exposures must opt for crowns.

Appointment structure

Due to the inadequate attention span of autistic patients short, well-organized appointments must be planned and the waiting period should be less than 10-15 min, to prevent upsets [40]. Preventive dentistry with regular checkups might familiarize AD children with

the dental routine and identify potential dental conditions at an initial phase.

Dental environment

The dental clinics are characterized as an anxiety-provoking environment with bright fluorescent lights, devices generating loud, unexpected noises, and materials of unfamiliar smell, taste, and texture. Emotional distress caused by these distracting stimuli may be reduced by sensory adaptation of the clinical environment [67]. AD children may continue to cover their eyes or squint under light exposure [68]. The experimental introduction of rhythmic music, relaxing light conditions, and deep pressure reduced unpleasant patient reactions and better positive participation in dental prophylactic cleaning [67]. Cermak et al. observed a reduced physiological anxiety and reported lower pain and sensory discomfort in the sensory adapted dental environment compared to regular dental environment during oral prophylaxis for autistic children [69]. Parents may be requested to carry the child's favorite music video or music media. A sole dental operating room may be kept to for autistic child treatment. Conversations of any procedure should be avoided during the course. Light background music may be useful. During procedure movements should be minimal, as an AD child may be easily distracted [70].

Behavioral guidance

AD children having mild to moderate mental retardation with no severe behavioral disorders can be treated effectively in routine manner. Comprehensive understanding of basic behavioral patterns is important for successful delivery oral healthcare with AD children. Since, autistic children displays disparity in abilities, intelligence, and performance with heterogeneous symptoms, dentists will require unique therapeutic approach personalized for child. Nevertheless, flexibility is needed to fulfil quickly changing patient needs. One must listen to parents to know likes, dislikes, habits and behavior triggers which should be avoided during treatment. Few studies highlighted use of yoga to improve core autism symptoms and co-morbid psychiatric symptoms [71]. Use of firm pressure or deep touch pressure may have anxiolytic effects during dental procedure. Motivating child to use different dentifrices having different tastes and textures will help to cope up with use of dental materials. Also, powered toothbrushes should be advised to be used prior appointment; since noise and vibration of powered toothbrushes can simulate dental hand piece.

Desensitization

Kopel recommended splitting dental procedures into smaller steps [30]. Rehearsals at home before dental appointment may familiarize the child with fundamental dental instruments and procedures, and may include the dentist's instructions like "hands down" and "look at me". However, limitations of time, manpower, and money restrict use of desensitization programs.

Applied behaviour analysis

Applied behaviour analysis practices are derived from the Skinner's principles. These procedures are evidence based and have potential to improve outcome of conventional behaviour management procedures [72].

Communicative behaviour management

These methods are generally advocated and used for behaviour modifications in AD patients [30,38,40]. Routine behavior guidance techniques such as presence of parents, tell-show-do technique, simple, short, clear commands, and differential verbal reinforcement have been advised for dental treatment of autistic children [5]. Improper behaviour must be ignored [73]. Application of constant positive reinforces based on the modeling effects, are immediate verbal praise after each completed step of a procedure and a reward after completion of dental session [74]. Shaping and reinforcement may be beneficial to initiate communication with AD child [72]. Younger autistic children may respond better to positive reinforcement. Hence, the influence of child's age on social skills can be decisive in managing the autistic patient [27]. Dentist ought to consider dental stories usage to train children and families for dental visits. Patient's history can help in dental story selection [75]. The picture exchange communication system, such as book containing the pictures of objects, places, people and emotions that the child is familiar with to be used as mode of communication to others. Images of the dental materials and instruments introduction before dental appointment may help child to familiarize during the dental treatment as they usually follow obsessive routines [76].

Visual pedagogy

Bäckman and Pilebro in a prospective study on autistic children included a series of pictures that showed a structured method and technique of tooth brushing [77]. After 12 months, the amount of visible plaque was reduced and concluded that visual pedagogy was a valuable means for serving people with autism for betterment of their oral hygiene. Intensive behaviour-based programming has proven as a useful approach for training AD patients [78]. A latest successful study on training autistic patients using a behavioral procedure, including visual pedagogy, audiovisual modeling was performed [79].

Pharmacological behaviour management techniques

Protective stabilization, conscious sedation and nitrous oxide inhalation have been less admired practices in autistic patients [37]. Frequently used drugs were nitrous oxide, diazepam, hydroxyzine, chloral hydrate, and promethazine. The pharmacological agents were administered in diverse dosages, as an individual agent or in assorted combinations [74,80]. A lengthier administration and higher concentrations of nitrous oxide than customary was necessary to accomplish the desired level of sedation in AD patients. A comprehensive and leisurely management of all dental conditions by can be done in a single appointment using general anaesthesia [32].

Role of the family, educators and online information

Beyond the monetary cost, emotional burden on family with the emotional damage attributable to immense difficulties associated with autistic person cause enduring conflict and occasionally physical threats [81]. Rearing AD kid creates stressful circumstances related with adaptation to child's routine, coordination of multidisciplinary caretakers, education and health care systems hindrance, and resource limitations [82]. Therefore, a scheduled dental visit becomes a major ordeal for children with autism, parents and care providers. Education of the caregivers on the importance of good oral health of autistic children is strongly recommended, as it would likely help to prevent dental caries and its progression [83]. Numerous studies have observed

a lack of dental knowledge among primary health care persons, and educators [84-86].

The dental team must guide parents to recognize professional and social care support networks [87]. Nevertheless, because of uncontrolled and varied quality of internet information, mostly common persons will encounter doubtful credibility and accuracy of web information [88]. Di Pietro et al. evaluated autism advocacy sites data and concluded that the predominance of citations about treatment safety and efficacy were unsupported [89]. Dentists ought to post user-friendly and reliable data concerning dental treatment of patients with special care needs with evidence-based education supplies on their practice website.

Legal Considerations

75% of autistic persons turn out to be either institutionalized or are incapable to live independently [90]. Autism is a disability under the Disability Discrimination Act. Hence, institutions should do considerable modifications to incorporate autistic individuals. Varied nature of disability in autism causes diverse needs of individuals and their families. Every public body should promote the equality of autistic individuals under the Disability Equality Duty since autism affects social communications, social inclusions [24].

Conclusion

Happy and playful children with full of energy and enthusiasm are vital part of society. Since autistic children often exhibit, multiple serious medical and behavioral issues which may overshadow oral health conditions. Therefore, comprehensive dental care of AD child needs flexible approach with thorough understanding of the autistic behavioural profile, behavioural guidance techniques, and personalised therapeutic approach with compassionate rapport with patient.

A multidisciplinary team of clinical psychologists, psychotherapists, special educators, audiologists, opticians, pediatric dentist, dieticians, speech and language therapists and social workers, is desirable to diagnose and provide comprehensive medical care for AD children. AD patient's management must be customized as per severity of the disease and clinical behavioral features; at times "outside the box" thinking is needed. Furthermore, appropriate behavior management technique should be used while treating AD children. Oral hygiene maintenance and preventive dental treatments should be emphasized; so, proper oral health education programs must be targeted to these special children.

References

1. Kanner L (1943) Autistic disturbances of affective contact. *New Child* 2: 217-250.
2. American Psychiatric Association (1994) Diagnostic and statistical manual of mental disorders DSM-IV. 4th ed. Washington, DC.
3. APA (2013) Diagnostic and statistical manual of mental disorders:DSM-5 Washington, DC.
4. Changing the Course of Autism. Boulder, CO: Sentient Publications, pp. 42-46.
5. Jepson B (2007a) Changing the Course of Autism. Boulder, CO: Sentient Publications
6. Loo CY, Graham RM, Hughes CV (2009) Behaviour guidance in dental treatment of patients with autism spectrum disorder. *Int J Paediatr Dent* 19: 390-398.
7. Posey DJ, Stigler KA, Erickson CA, McDougle CJ (2008) Antipsychotics in the treatment of autism. *J Clin Invest* 118: 6-14.
8. Kidd PM (2002) Autism, an extreme challenge to integrative medicine. Part: I: The knowledge base. *Altern Med Rev* 7: 292-316.
9. Minshew NJ (1996) Brief report: brain mechanisms in autism: functional and structural abnormalities. *J Autism Dev Disord* 26: 205-209.
10. Review of Autism Research: Epidemiology and Causes, Medical Research Council, 2001.
11. Hashimoto T, Tayama M, Murakawa K, Yoshimoto T, Miyazaki M, et al. (1995) Development of the brainstem and cerebellum in autistic patients. *J Autism Dev Disord* 25: 1-18.
12. Williams G, King J, Cunningham M, Stephan M, Kerr B, et al. (2001) Fetal valproate syndrome and autism: additional evidence of an association. *Dev Med Child Neurol* 43: 202-206.
13. Ratajczak HV (2011) Theoretical aspects of autism: causes--a review. *J Immunotoxicol* 8: 68-79.
14. Geier DA, Audhya T, Kern JK, Geier MR (2010) Blood mercury levels in autism spectrum disorder: Is there a threshold level? *Acta Neurobiol Exp (Wars)* 70: 177-186.
15. Newschaffer CJ, Croen LA, Daniels J, Giarelli E, Grether JK, et al. (2007) The epidemiology of autism spectrum disorders. *Annu Rev Public Health* 28: 235-258.
16. Posserud M, Lundervold AJ, Lie SA, Gillberg C (2010) The prevalence of autism spectrum disorders: impact of diagnostic instrument and non-response bias. *Soc Psychiatry Psychiatr Epidemiol* 45: 319-327.
17. Wong VC, Hui SL (2008) Epidemiological study of autism spectrum disorder in China. *J Child Neurol* 23: 67-72.
18. Patricia B, Kopetz E, Desmond L (2012) Endowed Autism Worldwide: Prevalence, Perceptions, Acceptance, Action. *J Social Sci* 8:196-201.
19. Bailey AJ, Rutter ML (1991) Autism. *Sci Prog* 75: 389-402.
20. Smalley SL, Tanguay PE, Smith M, Gutierrez G (1992) Autism and tuberous sclerosis. *J Autism Dev Disord* 22: 339-355.
21. Rada RE (2010) Controversial issues in treating the dental patient with autism. *J Am Dent Assoc* 141: 947-953.
22. MacLean JE, Szatmari P, Jones MB, Bryson SE, Mahoney WJ, et al. (1999) Familial factors influence level of functioning in pervasive developmental disorders. *J Am Acad Child Adolesc Psychiatry* 38: 746-53.
23. Caglayan AO (2010) Genetic causes of syndromic and non-syndromic autism. *Dev Med Child Neurol* 52: 130-138.
24. Kolvin I (1971) Studies in the childhood psychoses. I. Diagnostic criteria and classification. *Br J Psychiatry* 118: 381-384.
25. Udhy J, Varadharaja MM, Parthiban J, Srinivasan I (2014) Autism Disorder (AD): An Updated Review for Paediatric Dentists. *J Clin Diagn Res* 8: 275-279.
26. American Psychiatric Association (1994) Diagnostic and statistical manual of mental disorders (4th edn) Washington, DC: American Psychiatric Association, pp: 65-78.
27. Vostanis P, Smith B, Chung MC, Corbett J (1994) Early detection of childhood autism: a review of screening instruments and rating scales. *Child Care Health Dev* 20: 165-77.
28. Lai, Milano M, Roberts MW, Hooper SR (2012) Unmet dental needs and barriers to dental care among children with autism spectrum disorders. *J Autism Dev Disord* 42: 1294-1303.
29. Friedlander AH, Yagiela JA, Paterno VI, Mahler ME (2003) The pathophysiology, medical management, and dental implications of autism. *J Calif Dent Assoc* 31: 681-682.
30. Gail Williams P, Sears LL, Allard A (2004) Sleep problems in children with autism. *J Sleep Res* 13: 265-268.
31. Kopel HM (1977) The autistic child in dental practice. *ASDC J Dent Child* 44: 302-309.
32. McDonald RE, Avery DR (1994) Dentistry for the child and adolescent. 6th ed. St. Louis: Mosby-Year Book 11: 601-605.
33. Muthu MS, Prathibha KM (2008) Management of a child with autism and severe bruxism: a case report. *J Indian Soc Pedod Prev Dent* 26: 82-84.

34. Orellana LM, Silvestre FJ, Martínez-Sanchis S, Martínez-Mihi V, Bautista D (2012) Oral manifestations in a group of adults with autism spectrum disorder. *Med Oral Patol Oral Cir Bucal* 17: e415-419.
35. Ozgen H, Hellemann GS, Stellato RK, Lahuis B, van Daalen E, et al. (2011) Morphological features in children with autism spectrum disorders: a matched case-control study. *J Autism Dev Disord* 41: 23-31.
36. Luppapanornlarp S, Leelataweewud P, Putongkam P, Ketanont S (2010) Periodontal status and orthodontic treatment need of autistic children. *World J Orthod* 11: 256-261.
37. Alaluusua S, Malmivirta R (1994) Early plaque accumulation – a sign for caries risk in young children. *Community Dentistry and Oral Epidemiology*. 22: 273-276.
38. Loo CY, Graham RM, Hughes CV (2008) The caries experience and behavior of dental patients with autism spectrum disorder. *J Am Dent Assoc*. 139: 1518-1524.
39. Lowe O, Lindemann R (1985) Assessment of the autistic patient's dental needs and ability to undergo dental examination. *ASDC J Dent Child* 52: 29-35.
40. Fahlvik-Planefeldt C, Herrstrom P (2001) Dental care of autistic children within the nonspecialized Public Dental Service. *Swed Dent J* 25:113-118.
41. Kamen S, Skier J (1985) Dental management of the autistic child. *Spec Care Dentist* 5: 20-23.
42. Murshid EZ (2005) Oral health status, dental needs habits and behavioral attitude towards dental treatment of a group of autistic children in Riyadh, Saudi Arabia. *Saudi Dent J* 17: 132-139.
43. Namal N, Vehit HE, Koksall S (2007) Do autistic children have higher levels of caries? A cross-sectional study in Turkish children. *J Indian Soc Pedod Prev Dent* 25: 97-102.
44. Sarnat H, Samuel E, Ashkenazi-Alfasi N, Peretz B (2016) Oral Health Characteristics of Preschool Children with Autistic Syndrome Disorder. *J Clin Pediatr Dent* 40: 21-25.
45. Shapira J, Mann J, Tamari I, Mester R, Knobler H, et al. (1989) Oral health status and dental needs of an autistic population of children and young adults. *Spec Care Dentist* 9: 38-41.
46. Morinushi T, Ueda Y, Tanaka C (2001) Autistic children: experience and severity of dental caries between 1980 and 1995 in Kagoshima City, Japan. *J Clin Pediatr Dent* 25: 323-328.
47. Klein U, Nowak AJ (1998) Autistic disorder: a review for the pediatric dentist. *Pediatr Dent* 20: 312-317.
48. Bassoukou IH, Nicolau J, dos Santos MT (2009) Saliva flow rate, buffer capacity, and pH of autistic individuals. *Clin Oral Investig* 13: 23-27.
49. Rai K, Hegde AM, Jose N (2012) Salivary antioxidants and oral health in children with autism. *Arch Oral Biol* 57: 1116-1120.
50. Dorota T (2008) Kopycka-Kedzierawski, Peggy Auinger Dental Needs and Status of Autistic Children: Results from the National Survey of Children's Health. *Pediatr Dent* 30: 54-58
51. Vishnu Rekha C, Arangannal P, Shahed H (2012) Oral health status of children with autistic disorder in Chennai. *Eur Arch Paediatr Dent* 13: 126-131.
52. Jaber MA (2011) Dental caries experience, oral health status and treatment needs of dental patients with autism. *J Appl Oral Sci* 19: 212-217.
53. Al-Maweri SA, Halboub ES, Al-Soneidar WA, Al-Sufyani GA (2014) Oral lesions and dental status of autistic children in Yemen: A case-control study. *J Int Soc Prev Community Dent* 4: S199-203.
54. DeMattei R, Cuvo A, Maurizio S (2007) Oral assessment of children with an autism spectrum disorder. *J Dent Hyg* 81: 65.
55. RajiĀ A, DzingalaseviĀ G (1989) Autistic children and dental care. *Acta Stomatol Croat* 23: 175-183.
56. Subramaniam P, Gupta M (2011) Oral health status of autistic children in India. *J Clin Pediatr Dent* 36: 43-47.
57. Altun C, Guven G, Akgun OM, Akkurt MD, Basak F, et al. (2010) Oral health status of disabled individuals attending special schools. *Eur J Dent* 4: 361-366.
58. Vajawat M, Deepika PC, Kumar V, Rajeshwari P (2015) A clinicomicrobiological study to evaluate the efficacy of manual and powered toothbrushes among autistic patients. *Contemp Clin* 6: 500-504.
59. Altun C, Guven G, Yorbik O, Acikel C (2010) Dental injuries in autistic patients. *Pediatr Dent* 32: 343-346.
60. Nelson LP, Getzin A, Graham D, Zhou J, Wagle EM, et al. (2011) Unmet dental needs and barriers to care for children with significant special health care needs. *Pediatr Dent* 33: 29-36.
61. Klein U, Nowak AJ (1999) Characteristics of patients with autistic disorder (AD) presenting for dental treatment: a survey and chart review. *Spec Care Dentist* 19: 200-207.
62. Barbaresi WJ, Katusic SK, Voigt RG (2006) Autism: a review of the state of the science for pediatric primary health care clinicians. *Arch Pediatr Adolesc Med* 160: 1167-1175.
63. Stein LI, Polido JC, Mailloux Z, Coleman GG, Cermak SA (2011) Oral care and sensory sensitivities in children with autism spectrum disorders. *Spec Care Dentist* 31: 102-110.
64. Shreck KA, Metz B, Mulick JA, Smith A (2000) Making it fit: A Provocative Look at Models of Early Intensive Behavioral Intervention for Children with Autism. *The Behavior Analyst Today* 1: 27-32.
65. Patel K, Curtis L (2007) A comprehensive approach to treating autism and attention-deficit hyperactivity disorder: A pre-pilot study. *Journal of Alternative and Complementary Medicine*. 13: 1091-1097.
66. Millward C, Ferriter M, Calver S, Connell-Jones G (2008) Gluten and casein-free diets for autistic spectrum disorder. *Cochrane Database of Systematic Reviews*.
67. Shapiro M, Sgan-Cohen HD, Parush S, Melmed RN (2009) Influence of adapted environment on the anxiety of medically treated children with developmental disability. *J Pediatr* 154: 546-550.
68. Tomchek SD, Dunn W (2007) Sensory processing in children with and without autism: a comparative study using the short sensory profile. *Am J Occup Ther* 61: 190-200.
69. Cermak SA, Stein Duker LI, Williams ME, Dawson ME, Lane CJ, et al. (2015) Sensory Adapted Dental Environments to Enhance Oral Care for Children with Autism Spectrum Disorders: A Randomized Controlled Pilot Study. *J Autism Dev Disord*. 45: 2876-2888.
70. Swallow JN (1969) The dental management of autistic children. *Br Dent J* 126: 128-131.
71. Gwynette MF, Warren NJ, Warthen J, Truleove JS, Ross CP, et al. (2015) Yoga as an Intervention for Patients with Autism Spectrum Disorder: A Review of the Evidence and Future Directions. *Autism Open Access* 5: 1000155
72. Hernandez P, Ikkanda Z (2011) Applied behavior analysis: behavior management of children with autism spectrum disorders in dental environments. *J Am Dent Assoc* 142: 281-287.
73. Robinson MD, Milius AC (1976) *Childhood autism in: Dentistry for the handicapped child*. St. Louis: The CV Mosby Company.
74. Braff MH, Nealon L (1979) Sedation of the autistic patient for dental procedures. *ASDC J Dent Child* 46: 404-407.
75. Marion IW, Nelson TM, Sheller B, McKinney CM, Scott JM (2016) Dental stories for children with autism. *Spec Care Dentist*.
76. Ann-Marie C, Roposa A. "Building bridges: Understanding and Guiding the Dental Patients with Autism.
77. Bäckman B, Pilebro C (1999) Visual pedagogy in dentistry for children with autism. *ASDC J Dent Child* 66: 294, 325-331.
78. Eikeseth S, Smith T, Jahr E, Eldevik S (2002) Intensive behavioral treatment at school for 4- to 7-year-old children with autism. A 1-year comparison controlled study. *Behav Modif* 26: 49-68.
79. Orellana LM, Martínez-Sanchis S, Silvestre FJ (2014) Training adults and children with an autism spectrum disorder to be compliant with a clinical dental assessment using a TEACCH-based approach. *J Autism Dev Disord* 44: 776-785.
80. Lowe O, Iedrychowski JR (1987) A sedation technique for autistic patients who require dental treatment. *Spec Care Dentist* 7: 267-270.

81. Volkmar FR, Klin A (2005) Issues in the classification of autism and related conditions. In: *Handbook of Autism and Pervasive Developmental Disorders*.
82. Tway R, Connolly PM, Novak JM (2007) Coping strategies used by parents of children with autism. *J Am Acad Nurse Pract* 19: 251-260.
83. Guideline on management of persons with special health care needs. Reference Manual 2006-07. *Pediatr Dent* 28: 85.
84. Ditto MR, Jones JE, Sanders B, Weddell JA, Jackson R, et al. (2010) Pediatrician's role in children's oral health: an Indiana survey. *Clin Pediatr* 49: 12-19.
85. Rabiei S, Mohebbi SZ, Yazdani R, Virtanen JI (2014) Primary care nurses' awareness of and willingness to perform children's oral health care. *BMC Oral Health* 14: 26.
86. Ehizele A, Chiwuzie J, Ofili A (2011) Oral health knowledge, attitude and practices among Nigerian primary school teachers. *Int J Dent Hyg* 9: 254-260.
87. Delli K, Reichart PA, Bornstein MM, Livas C (2013) Management of children with autism spectrum disorder in the dental setting: Concerns, behavioural approaches and recommendations. *Med Oral Patol Oral Cir Bucal* 1: e862-868.
88. Livas C, Delli K, Ren Y (2012) Quality evaluation of the available Internet information regarding pain during orthodontic treatment. *Angle Orthod*.
89. Di Pietro NC, Whiteley L, Mizgalewicz A, Illes J (2013) Treatments for neurodevelopmental disorders: evidence, advocacy, and the Internet. *J Autism Dev Disord* 43: 122-133.
90. Paul R (1987) *Natural History*. In: *Handbook of Autism and Pervasive Developmental Disorders*, New York: John Wiley & Sons Inc.