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A Literature Review of Evaluation of Knowledge, Attitude and Practice among Developmental Pediatricians and Parents towards Vision Therapy for Children with Autism Spectrum Disorder.

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Abstract:

Background: According to the 2022 report of WHO, prevalence of autism spectrum disorder is stated to be 1%. 2011 census from India included people with mental illness and multiple disabilities however it failed to estimate the number of persons with autism. With prevalence increasing rapidly, it is imperative to do a knowledge, attitude and practice (KAP) analysis among developmental pediatricians and parents towards vision therapy which has proven results.

Methods: Literature from 2000 to 2024 was searched for studies and articles related to autism spectrum disorder (ASD), visual development and visual performance in ASD, vision therapy, vision therapy in ASD and referrals for vision therapy by various medical practitioners.

Literature comprising of characteristics and visual concerns in ASD is available. However, specific literature on referrals for vision therapy is not available. No significant surveys outline understanding and practice among developmental pediatricians towards vision therapy.

Research questions: Considering the current scenario, the questions that arise are:

a) Do we know how many referrals are obtained from developmental pediatricians for vision therapy?
b) Do we know about the knowledge, attitude and practice among developmental pediatricians towards vision therapy for children with ASD?
c) Can the knowledge be improved after creating awareness about vision therapy for children with ASD among developmental pediatricians and parents?

Keywords: Autism spectrum disorder, vision therapy, developmental pediatricians.

1. INTRODUCTION

As per 2022 World health organization report, prevalence of autism spectrum disorder (ASD) is 1% [1]. Indian reports have not been able to provide appropriate prevalence estimates of ASD. The prevalence of ASD has been on the rise and the reasons could be anything from improved diagnostic strategies to the actual increase in the number of children born with autistic features.

The point to be considered is with an increase in prevalence, it demands a professional and nation's responsibility to improve diagnostics, assess the features (general and visual) and provide therapeutic interventions to improve the quality of lives, reduce dependance and inculcate academics in children with ASD.

It is an overall opinion included in the reports that the therapies work the best if initiated early. Through optometric vision therapy, we can normalize some of the visual and visual motor deficits found in neurotypical children. If vision therapy could help autistic children, it could help them to lead a better and less dependent life, improve their academic pursuits with better sensory and motor inputs [2 - 7].

For the first time autism was described in 1943 by pediatric psychiatrist Leo Kanner. It has been recognized as a neuro-developmental disorder since the 1980s and is identified by symptoms which include poor social involvements, poor communication skills, stereotypical behavior with repetitions [8].

The spectrum of Autism (autism spectrum disorder) includes several disorders like pervasive developmental disorder – Not otherwise specified (PDD-NOS), autism and Asperger, Childhood Disintegrative Disorder, learning impediments, Rett Syndrome, and certain types of attention deficits and attention deficit hyperactivity disorder (ADHD) [9].

Studies suggest a genetic linkage of boys being affected more than girls in autism— probably due to genetic differences with X chromosome [10]. Studies indicate a 60 – 90 percent concordance in identical twins as compared to 0 – 10% fraternal ones [11]. In a study by Ozonoff S, about 20% of infants developed ASD when their biological sibling having autism [12].

With the use of Diagnostic and Statistical Manual-V (DSM-V), clinical areas evaluated are [13]:

1) Reduced social interaction includes general delay in development.

- Reduction in social-emotional reciprocation.
- Absent or reduced nonverbal communication behaviors utilized for social interaction like abnormal eye contact and body language.
- Inappropriate development of relationships and disinterest in social bonding.

2) Reduced and repetitive behaviors.

3) Stereotypical or repetitive speech, motor movements, or use of objects.

4) Symptoms must be present in childhood (may not be fully visible).

5) Symptoms limit and affect every day functioning.

A child can only be in autism spectrum disorders (ASD) if abnormal functioning is observed in these four areas before 3 years of age.

Typical ophthalmic disorders seen in children with autism spectrum disorder are, refractive errors, strabismus, oculomotor dysfunction, and anomalous gaze [9].

Refractive errors, strabismus and amblyopia were documented in this order by Ikeda in his study [14].

Ezegwui found that hypermetropia (11.1%) and astigmatism (22.2%) were the important refractive errors. This was also seen by Denis [15, 16].

Atypical visual scan paths while looking at faces and while having social interactions in individuals with ASD show anomalous control of eye movements when viewing different objects and human faces [17–19]. Klin documented atypical visual behaviour of children with ASD in filmed social interactions. He reported that autistic subjects looked more at objects, and when looking at faces, they fixated around mouth instead of eyes [2].

During saccades, children with ASD show reduced accuracy [20 - 22]. These deficits are seen more in children compared to adolescents, suggesting that the ability to precisely control eye movements may mature later.

Several systemic conditions are linked with autism - intellectual impairment, seizure disorder, disruptive behavior, and learning difficulties. Both children and adults with autism show abnormalities in communication, social interactions, and play activities. Children with ASD find it difficult to modulate or process visual, tactile, and auditory stimuli [23, 24].

Children with autism may be difficult to evaluate clinically due to limited communication skills and unpredictable behavior. Most of them exhibit atypical gaze and have stereotypical behavior such as eye pressing, hand picking, and light gazing [25].

There is insufficient information on the visual inputs in ASD. Traditional visual assessment techniques and treatment have not always been effective due to limited communication skills and behavior.

Autism spectrum disorder and visual processing

Sensory anomalies as well as visual processing issues are common among children with ASD. In a child with ASD, there is anomalous development of the motor and sensory systems. Hence the overall functionality is compromised.

Autism and visual patterns:

As the visual system in a child with ASD is not well coordinated with the other systems, it interferes with academic pursuits as well as behaviour of the child. Some of the visual issues that are seen are:

1. Poor eye contact with no expressions
2. Poor concentration and attention skills
3. Poor pursuits and saccades
4. Peripheral and central visual processes do not integrate with each other
5. Inability to recognize objects from different angles
6. Lack of integration between cognition, motor and sensory systems
7. Spatial awareness is poorly understood and followed
8. Several adaptations are ingrained
9. Looking from weird angles at an object

10. Fascination with certain objects

The only way to know about visual development is to get a thorough visual analysis performed. Any development delay in vision can be trained. Our goal is to improve the overall quality of life of our patients. We can do this by helping individuals reach their full potential.

2. Need for the study and methods followed

The prevalence of autism spectrum disorder is going up at a very fast pace. Societal unrest is increasing as there is no tangible treatment/cure/solution/explanation forthcoming from the medical profession. In such a scenario, it becomes imperative to delve into some of the aspects of autism spectrum. One of the major concerns of the parents is poor eye contact, wayward eye movements and poor fixation. Children with ASD are often referred to occupational therapists, who adopt bottom-up strategies to tackle eye movement related issues. It is important to find out the knowledge of developmental pediatricians towards vision therapy as they are the primary sources of referral for different therapies. It is also important to understand their referral practice

patterns for different therapies. Apart from the pediatricians it is important to know about parental knowledge about vision therapy and how it can help children with autism.

This study is a systematic review of studies from 2000 to 2024 conducted using PubMed, Google Scholar, and the Cochrane Library, focusing on visual development, autism spectrum disorder, its features, diagnosis, and referrals by developmental pediatricians for vision therapy. Out of many identified studies, the ones that met inclusion criteria, emphasizing features of ASD, diagnostic methods, and developmental pediatricians' practices for referrals for vision therapy.

3. REVIEW OF LITERATURE

3.1 VISUAL DEVELOPMENT

Vision, though sensory, is highly motor in function. Gesell mentioned how vision is integrated with the motor system, posture, motor skills, proprioception, and intelligence [19]. He discussed the prenatal anatomical development and found how the visual system coordinates with the motor and vestibular controls. In 1986, Cron discussed the visual development in a child [20]. They described different behavioral and non-behavioral methods to measure various parameters including eye movements. They mentioned that it is important to use both behavioral, and non - behavioral methods of measurements. In 2002, Palmer, a physical therapist, threw light on the importance of motor development and vestibular control in visual development and academics[5]. She mentioned the role of primitive reflexes and discussed them. She also discussed the importance of these reflexes in "learning to read and reading to learn in future". Head movement and its control in a normal child were discussed and she wrote,

"The need for a thorough analysis of all aspects of head movement control is all the more important because head movements are a core element of orienting behavior involving a number of interactive sensory and motor systems."

In the embryological stage, eyes are recognizable as small dots at as less as 18 days. Various factors including motor system, physiological development, cortical development and vestibular system development contribute to visual development.

Visual processing involves vestibular and cortical controls. Interference in any of the processes affects visual processing adversely. Academic visual requirements are highly motor centric. If the ocular movements are not smooth and accurate, it may result in poor reading and comprehension. If the balance mechanism is inadequate, it may lead to oculomotor dysfunctions.

In a study carried out by Miller et al to assess dyspraxia in high functioning school aged children with autism spectrum disorder and to find association of motor functions including eye movements with dyspraxia. They looked at the role of visual motor integration in dyspraxia too [19]. They found that children with ASD performed significantly poorly on ideational and Bucco facial praxis, motor skills, automacity, saccadic accuracy and visual motor integration skills. They suggested that dyspraxia in autism involved cerebellar movement controls and their integration with cortical networ

3.2 DIAGNOSIS AND CLASSIFICATION OF AUTISM SPECTRUM DISORDER

Autism is a part of pervasive developmental disorder (PDD). Prevalence of autism is on the rise with no known treatment. Autism is thought to have multiple causes [26, 27]. The possible causes range from genetic mutations, deletions of genes, viral infections, inflammation of the brain post vaccination etc. The inflammation could be due to inflamed/defective placenta, poor blood-brain barrier, poor immunity of the mother, preterm birth or improper environment. Autism has strong hereditary linkage and is thought to be highly related genetically. Considering the genetic links, genetic screening and gene therapies might hold a lot of promise in finding a solution for autism [26 - 28]. The issues like social incompatibility and communication difficulties may have their origins in the amygdala and left medial cortex of the brain. Autism has been found to affect males more than the females [15]. Though this fact is well documented, there is hardly any reason provided for this. Better understanding of the gender difference might provide better understanding of the pathognomy of the disorder [16]. Considering the socioeconomic status of the parents of children with autism, it was seen that parents of children with autism had a better socioeconomic status [24]. This could possibly be related to better access and affordability to pediatric and developmental services.

There are various scales to diagnose and assess ASD. One of the scales on which diagnosis of ASD is based is Childhood Autism Rating Scale (CARS)[25] This test was used to rate 537 children over a 10-year period. Cronbach alpha (internal consistency) of the scale was found to be 0.94. Inter practitioner reliability was found to be 0.71 with 2 practitioners scoring 280 children. CARS scores showed a correlation of 0.84 with clinical rating of psychosis and had acceptable validity [25]. Reliability and validity of 3 scales which are commonly used – the autism behavior checklist, the real-life rating scale and the childhood autism rating scale, were compared [26]. CARS was found to be reliable and valid.

A study was conducted to evaluate CARS as a diagnostic test for 2- and 4-year-old referred for autism[27]. Results confirmed the validity of CARS in distinguishing autism from PDD – NOS and other typically developing children and those with other developmental disorders. To provide better outcome and to understand the disorder better, it has always been endeavored to find a tool to diagnose

autism at a very young age [28]. The autism observation scale for infants (AOSI) was one such scale to detect early signs in high-risk infants (with siblings in the autism spectrum). Reliability of the test was found to be good for 6-, 12- and 18-months old infants. Inter rater reliability was good for 12 month (and above) old infants. A study was conducted to check agreement and correlation between autism diagnostic interview – revised (ADI-R) and CARS. 66.7% agreement was observed between the two [36]. Diagnostic tests with CARS showed a higher diagnosis of autism than ADI-R. Children who were classified as autistics using both the scales had much lower intelligence and developmental quotients and severe symptoms as compared to the children who were diagnosed by CARS only. Another study to compare diagnosis of 83 children with suspected autism using ADI-R and CARS was conducted. The agreement between the two systems was found to be 85.7%. Interesting results were observed when 18 males and equal number of females were evaluated using both the scales to ascertain possible gender differences. No significant differences were seen [29]. This suggested that autism symptoms with both the scales do not show any gender preferences when the chronological and mental ages were same.

The score obtained after running CARS classifies the child as having no autism to severe autism.

3.3 AUTISM AND VISUAL BEHAVIOR

It was seen that in children with ASD there are changes in the neurological chemistry affecting neurophysiology, cognition, oculo motor system, perception, and visual information processing [30]. This in turn leads to deficient processing of the information. They also viewed that a behavioral and developmental optometrist should be a part of diagnostic and treatment team to take care of children suffering from autism spectrum disorder.

Autism is a disorder of neurobiological processing [31]. Children with autism display several behavioral signs including poor communication skills, poor social interactions and difficulty with information processing as well as responding to sensory stimuli. They also display numerous signs related to vision issues [33]. Ocular and visual issues seen in ASD can vary in severity and modality. All the signs and symptoms may not present in all the children and may have varying intensities [33]. Most of these symptoms are due to processing of sensory and visual information. Ocular/visual symptoms may be due to refractive errors, binocular vision anomalies, ocular movement disorders and contrast sensitivity functions. They may also face difficulties due to inappropriate spatial perception, color vision processing, sensitivity to light, processing visual motor issues like eye hand coordination, inadequate proprioception, and processing of center vs periphery (parvocellular vs magnocellular processing). In a study conducted by Falck – Ytter T et al, it was seen how the children with ASD vs the typically developing children perform with and without the eye contact [32]. TD children performed well when looked at and poorly when they were not looked at. However, the children with ASD performed better than TD group with an averted gaze. Performance cognitively did not show any differences in performance with direct gaze.

Some of the visual and general signs and symptoms displayed by children with ASD are listed below:

3.4 VISUAL SIGNS

- Gaze aversion: Children with autism avoid eye contact and at most times do not look into the eyes of the person who they are talking to.
- Lateral vision: Children with autism like to see from the corner of the eyes.
- Excessive head movements: Children with autism exhibit excessive and erratic head movements.
- Prolonged fixation on certain objects: Several children with autism are attracted by certain objects/shapes and continue to look at them.
- Hyper/hypo fixations on certain objects: They look at certain objects or even their hands continuously and avoid looking at other objects in vicinity.
- Attraction towards shining and spinning objects: Quite often, children with ASD are highly attracted by shiny and particularly spinning or rotating objects like fans, wheels etc.
- Light and / or sound sensitivity: They sometimes show excessive sensitivity to bright lights, colors and sound and avoid them.

3.5 GENERAL SIGNS

- Lack of interest in surroundings: Autistic children show a generalized disinterest in their surroundings, making them aloof.
- Poor social interactions: They are not very responsive socially when they meet new people.
- Poor or no communication: Most children with ASD are non-verbal and are poor communicators. Although they are poor communicators, they find ways to communicate their needs to their parents.
- Fidgeting with objects: They develop a liking for certain objects and always keep them in their possession.
- Flicking fingers and flapping hands near their face: Most children falling under ASD domain keep flicking their fingers and flap hands close to their face.
- Tip toeing: Several children with ASD tend to walk on their toes.

Hyperactivity: Often, the parents complain that the children in autistic spectrum are hyperactive and do not sit in a place. They tend to move around aimlessly and without a purpose.

3.6 EYE MOVEMENTS

Foetal eye movements are observed during exceedingly early stages of gestation [5]. Four types of eye movements are recognized:

Type 1 –Single straight movement from midline position to the lower orbital margins, and a slow return to its original position. These movements are noticed until around 25 weeks of gestation.

Type 2 – Single movements to the medial or lateral positions. They may be prolonged and are seen until almost 40 weeks.

Type 3 – Complex movements including rotatory components. The periodicity of these movements is variable and are interspersed with linear movements. They are seen till 41 weeks or so.

Type 4 – Nystagmoid eye movements are seen which continue till the term.

Eye movements are very slow initially which increase in speed up to 35 weeks. From the 36th week, the movements reduce and initiate inactivity of the eyes. This signifies the inhibitory patterns and the wakefulness of the foetus.

3.6.1 SMOOTH PURSUITS

It has been seen that the smooth pursuit movements are seen from 6 weeks after birth [20]. Aslin presented evidence on the fact that smooth pursuits are visible around six to eight weeks post birth. Although, the child performs pursuit movements, they may not be smooth in nature, and may comprise of multiple mini saccadic eye movements [32, 33]. Absence or inhibition of smooth pursuits could possibly be due to factors like attention issues, temporal resolution (possibly because the fovea is not fully developed and the visual information cannot be processed soon), velocity analysis, acuity, contrast sensitivity function, motion analysis and peripheral interference.

3.6.2 SACCADES

Aslin and Salapatek studied the saccadic movements in infants. They reported latencies in the range of 500 – 800 msec [21]. They observed that the infants make hypometric saccades (saccades lesser in amplitude than required) of almost 50% of required excursions. With the target located 30 degrees from the midline, localization was achieved by multiple hypometric saccades.

3.7 THEORY OF MOTOR LEARNING – SCIENTIFIC THEORY BEHIND VISION THERAPY

Motor learning (i.e., acquiring perceptual-motor skills) requires description and explanation of changes occurring in motor performance and its control that take place with specific practice methods and within certain parameters. Acquiring new (or making changes in the old) motor skills take place in three well understood and specified phases [17].

1. Verbal-cognitive phase
2. Associative phase
3. Autonomous phase

Thus, the motor patterns become automatic and “open loop” (i.e., they do not require any monitoring or feedback on a constant basis). The earlier phases require constant monitoring and conscious thinking while they are being performed (i.e., closed loop). This is done to improve and master the motor skills and their performance [17].

The above description of motor skill acquisition must be learned for every new motor skill. If the basic mechanism of motor learning is utilized in optometric vision therapy for binocular vision disorders and visual information processing disorders, it is justified to train a series of oculomotor and perceptual

learning skills using a wide range of targets and test methodologies to ensure appropriate development of a complete range of motor skills that can then be used in one's everyday activities [17].

3.8 DIAGNOSIS AND REFERRALS

Committee of children with disabilities in 2001 [34] made a policy statement stating that, "Primary care physicians have the opportunity, especially within the context of the medical home, to be the first point of contact when parents have concerns about their child's development or behavior. The goal of this policy statement is to help the pediatrician recognize the early symptoms of autism and participate in its diagnosis and management. This statement and the accompanying technical report will serve to familiarize the pediatrician with currently accepted criteria defining the spectrum of autism, strategies used in making a diagnosis, and conventional and alternative interventions. "

In 2006 a study was conducted to analyze screening and management practices towards ASD among general pediatricians [35]. Of all the pediatricians, most (82%) routinely screened for general developmental delays, but only 8% screened for ASD. The main reasons reported for not screening for ASD were lack of familiarity with tools (62%), referred to a specialist (47%), or not sufficient time (32%). Most specialist referrals (77%) were to a developmental pediatrician. Most pediatricians (71%) believed that ASD prevalence has increased, and nearly all attributed this to changes in diagnostic criteria and treatment. The survey concluded that the service system limitations must be overcome to increase awareness and familiarity with screening tools, provide sufficient time and resources, improve screening, and enhance provider education.

In a study conducted in 2019 to understand the diagnosis and subsequently referral criteria by the pediatricians [36]. 290 primary care providers with 54 pediatric practices were evaluated. At 18 months rate of screening was 93%, which dropped to 82% at 24 months. Among screen failed subjects 18% were diagnosed to have ASD. Only 31% of children were referred to a specialist for further evaluation. The study concluded that high ASD screenings do not end up in increase in referrals for further evaluation or diagnosis. Additional training of primary care providers with respect to referral process after a failed ASD screening is mandated.

9. CONCLUSION

The current review did not find any articles or studies with reference to referral criteria by the pediatricians for vision therapy. Even though evidence is available about role of vision and vision therapy in ASD, we are not sure of knowledge or awareness of pediatricians towards this important intervention. To analyze the issues the following questions have been documented.

a) Do we know how many referrals are obtained from developmental pediatricians for vision therapy?

b) Do we know about the knowledge, attitude and practice among developmental peditricians about vision therapy for children with ASD?

c) Can the knowledge be improved after creating awareness about vision therapy for children with ASD among developmental pediatricians and parents?

A detailed multicentric study to answer these questions will go a long way in providing long-awaited solutions to the children suffering from ASD.

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