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Manuscript

Lowerlimb Joint Laxity in Children with Autism Spectrum Disorders.

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Abstract:

Introduction:

It's unlikely that children with autism spectrum disorders (ASD) depict with stereotyped behavior, social and communication problems along with other behavioral issues. These children also present with physical abnormalities such as delay in gross motor and fine motor milestones, hypotonia along with increased joint laxity. The fact that most of the studies done in the past have focused on social and behavioral problems ASD children which has diluted the focus and attention of rehabilitation community on physical findings especially the joint mobility.

Objective:

The main objective of this study was to compare the lower limb joint laxity of children with Autism Spectrum Disorders with typically developing children.

Methods:

A total forty five children with (34 boys and 11 girls) with an average age of 8.47 years (range 4-14 years) along with forty five typically developing children (32 boys and 13 girls) with an average age 8.87

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years (range 4-14 years) were selected for the comparison. The maximum passive joint range of motion was examined using universal goniometer for hip, knee and ankle joints. The examination procedure was based on standardized clinical guidelines of performing goniometry.

Result:

The data was analyzed using independent 't' test in SPSS software .It was found that children with ASD depicted significant difference in passive range of motion for ankle dorsiflexion , plantar flexion, knee flexion, extension along with hip flexion, abduction, adduction as compared to typically developing peers. On the contrary, there was no significant difference seen in hip extension along with internal and external rotation when compared with the asymptomatic group.

Conclusion:

This study has highlighted that attention is required for physical impairments also rather than behavioral and communication problems in ASD children. Motor deficits increases the morbidity of condition many folds affecting the quality of life of these children and their caregivers. According to this study, ASD children have increased joint laxity for all lower limb ranges except hip extension and rotations.

Keywords: ASD, Joint laxity, Goniometry, Physiotherapy, Range of Motion

INTRODUCTION

Autism Spectrum Disorders (ASD) is an umbrella term used for a group of neurodevelopmental disorders of early childhood. The children with ASD presents with impairments in communication, social interaction, restricted repetitive and stereotyped behaviors[1]. The approximate pervasiveness is 1% in the United Kingdom and 1.5% in the United States. The prevalence of Autism Spectrum Disorders (ASD) tends to increase due to enhanced awareness and diagnostic methods. The worldwide prevalence data depicts 61.9/10,000 in 2012 [2]. The prevalence of ASD in India varies from 0.15% to 1.01% . Similarly, it was 1 in 125 in toddlers and 1 in 85 in early school aged children. [3].

The principle features in ASD as reported by CDC are persistent deficits in communication and social interaction along with restrictive behavior and interests[4]. This has diverted the attention of the rehabilitation fraternity towards improving behavior and communication. But at the same time few studies have also reported that the children with ASD presents with motor impairments, hypotonia, increased joint laxity and tip toe walking clearly focusing the demand to explore the physical impairments seen in these patients. Therefore, there is paucity of literature in context to physical problems faced by these children such as abnormal joint laxity, motor and gait impairments[3].

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Interestingly, there is abundance of data on gross motor and fine motor control but there is lack of evidence for joint mobility and other physical findings in our country. This study was aimed to explore the scenario of ASD in the state of Punjab. Although researches have shown a difference in passive range of motion for ASD population as compared to normally developing age mates, but no study has been done so far for the state of Punjab.

The joint laxity can make this group of population more prone to injuries and abnormal joint loading while performing activities of daily living. The physical impairments like joint hypermobility is linked to abnormal biomechanics leading to chronic pain and proprioceptive defecits. These physical abnormalities also leads to altered motor coordination and balance in children with ASD[5]. All these parameters can enhance the handicap of this population affecting the quality of life of their parents and care givers. The plight of the situation is such that there is negligible data available regarding screening of Autistic Children with motor and gait impairments for the state of Punjab. Now days many NGO's and special schools are working towards ASD children and their parents but, then too the motor and gait abnormalities are not screened, if screened then are not taken into consideration for management. This study in itself was a pioneer step towards screening of joint laxity

in children with ASD. This study investigates the lowerlimb joint laxity in ASD children in the state of Punjab. This work purposes to divert the attention of rehabilitation fraternity towards physical impairments of ASD children so that appropriate physiotherapy strategies may be framed for them.

MATERIALS AND METHODS

The study is designed as descriptive study. It was conducted during November 2018 to October 2019. For the purpose of the study pre diagnosed children with ASD were selected from the special schools and institutions spanned across various districts of Punjab. A total forty five children with (34 boys and 11 girls) with an average age of 8.47 years (range 4-14 years) along with forty five typically developing children (32 boys and 13 girls) with an average age 8.87 years (range 4-14 years) were selected for the comparison. All subjects were assessed for generalized motor and sensory examination. The ASD subjects were included according to the following criteria; (1) prediagnosed with ASD (2) children without any orthosis or splints (3) able to follow commands (4) born more than 36 weeks of gestation (5) birth weight more than 2500 g (6) absence of any genetic disorder linked with ASD (7) no

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history of seizures (8) absence of any congenital physical deformity [3]. After approval from the institution ethical committee a written consent was taken from the care givers and parents for participation of children in the study. The joint mobility assessment was done by the method of goniometry for hip, knee and ankle bilaterally for both the groups. The joint mobility was examined thoroughly using a universal goniometer for Hip flexion, extension, abduction, adduction and rotations. Similarly the passive joint range was checked for knee flexion, extension along with ankle doriflexion and plantar flexion. For these joints maximum passive range of motion was analyzed following the guidelines mentioned in the book measurement of joint range of motion[6]. Three trials were undertaken for recording the range of motion of all joints and average was calculated for each reading which was considered for analysis. The statistical analysis was done by using SPSS software. An independent 't' test was performed to compare the joint hyperlaxity of two groups.

RESULTS

Table 1 Comparison of Means of lower limb passive range of motion in Group A and Group B

Sr. no.	Passive ROM	Group A * ASD (Mean ±SD)	Group B TDC * (Mean ± SD)	t-value	Significance
1	Ankle DF (R)	35.11± 5.27	31.33 ± 3.03	4.62 (S)	0.000
	Ankle DF (L)	35.11±5.27	31.33 ± 3.03	4.62 (S)	0.000
2	Ankle PF (R)	53.88±7.06	51.66 ± 3.52	2.114 (S)	0.00
	Ankle PF (L)	53.88± 7.06	51.66 ± 3.52	2.114 (S)	0.00
3	Knee F(R)	131±3.57	128 ± 7.44	- 2.822 (S)	0.000
	Knee F(L)	131± 3.57	128 ± 7.44	- 2.822 (S)	0.000
4	Hip F (R)	122± 6.94	121± 5.4	0.552 (S)	0.01
	Hip F (L)	122± 6.94	121 ± 5.4	0.552 (S)	0.01
5	Hip E (R)	31± 2.73	30.83 ± 2.78	0.305 (NS)	0.315
	Hip E (L)	31± 2.73	30.83 ± 2.78	0.305 (NS)	0.315
6	Hip Ab (R)	49.88± 10.68	48.00 ± 3.70	1.273 (S)	0.000
	Hip Ab (L)	49.88± 10.68	48.00 ± 3.70	1.273 (S)	0.000

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7	Hip Add (R)	40.58± 3.06	37.44 ± 5.28	- 3.823 (S)	0.000
	Hip Add (L)	40.58± 3.06	37.44 ± 5.28	- 3.823 (S)	0.000
8	Hip IR (R)	47.22± 3.92	48.16 ± 3.67	- 1.265 (NS)	0.864
	Hip IR (L)	47.22± 3.92	48.16 ± 3.67	- 1.265 (NS)	0.864
9	Hip ER (R)	47.11± 4.45	48.91 ± 3.62	- 2.268 (NS)	0.08
	Hip ER (L)	47.11± 4.45	48.91 ± 3.62	- 2.268 (NS)	0.08

*the range of motion is calculated from zero degree

(ASD- Autism spectrum disorders, TDC-typically developing children, DF-dorsiflexion,PF-plantar flexion, F-flexion,E- extension, Ab-Abduction, Add-Adduction, IR-Internal rotation,ER- external rotation,S-significant,NS-non significant)

Table 1 describes that the ASD group presented increased ankle joint mobility with mean value (35.11±5.7) as compared to the TDC group (31.33±3.03) ($p<0.05$). Similarly, significant difference was observed in Knee Flexion with mean value (131±3.57) as compared to TDC (128±7.44) ($p<0.05$). Likewise a significant difference was observed for right and left hip flexion of ASD and TDC. Children in Group A depicted mean value (122±6.14) as compared to Group B (121±5.4) ($p<0.05$) for hip flexion. The value of mean and standard deviation of Right and Left Hip Abduction for Group A is 48.88 ±10.68 with $p<0.05$ and for Group B is 48 ±3.70 $p<0.05$ showing that the children in Group A have more hip abduction range as compared to the control group. Also, significant difference exists in the values of Hip Adduction in Group A and Group B. The value of mean and standard deviation of Right and Left Hip Adduction for Group A is 40.58 ±3.06 with $p<0.05$ and for Group B is 37.44 ±5.28 $p<0.05$ showing that the children in Group A have more hip adduction range as compared to Typically Developing Children of same age group.

On the contrary, no significant difference was observed for the values of right and left Hip Extension of both the groups with mean values (31±2.7) and (30.83±2.78) respectively for Group A and B ($p>0.05$). Similarly, no significant difference was seen in the values of right and left Hip Internal and External Rotation in Group A and B. The value of mean and standard

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deviation of Hip Internal Rotation for Group A is 47.22±3.92 with (p>0.05) where as for Group B the value of mean and standard deviation is 48.16± 3.67 (p>0.05). The value of mean and standard deviation of Hip External Rotation for Group A is 47.11 ±4.45 with (p>0.05) and for Group B is 48.16 ±3.67 with p>0.05.

DISCUSSION

The present study was performed to rule out the joint hyperlaxity in the children with ASD when compared to the typically developing children of the same age group. The study highlighted increased passive joint range of motion in ASD population as compared to children achieving normal milestones for all ranges except hip extension and rotations bilaterally. The increased joint laxity may be linked with hypotonia. Numerous studies have highlighted the presence of hyptonia in children with ASD. The finding in this study that ASD children have increased passive range of motion for hip , knee and ankle is in agreement with a study done by Klein *et al* (2012) in which they concluded that children with ASD have toe walking and increased maximum range of passive joint extensibility. Similar findings were recorded for mobility of finger, wrist, elbow and ankle in ASD children than their typically developing peers [7].

Previous literature highlighted comparable outcome for increased passive joint mobility [8-11]. One of the reasons behind increased passive joint laxity is possibly due to hypotonia and ligamentous laxity which has been mentioned in the past evidences [12]. In the same vein, another study depicted more than 50% of hypotonia in toddlers and 36% in late childhood and adoloscents [13].

The findings in this work were contradictory for one parameter discussed in *Calhoun et al* (2005) who suggested that population with autism have shown decreased plantar flexion moments and increased dorsiflexion angles associated with hypotonia [14] . In addition to this another study reported marked hypotonia in 25% of pre-school children with Autism on a standardized neurological examination as compared to IQ matched language Disorder[15].

The literature explored the genetic basis of ASD children is associated with hypotonia phenotype [16] and supports the suggestion that some specific genes are responsible for ASDs. Carolina et al.(2018) concluded the association of ASD with Hypermobility Related Disorder and Ehlers-Danlos syndromes (EDS) which are genetic disorders affecting the normal mobility of the joints in the body. This also describes the potential symptoms of pain

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in this population.

The presence of hypotonia in ASD may also be related to cerebellar involvement as shown by previous studies [17-18]. Further more in cerebellar involvement diminished resistance to passive movement may be noted along with abnormal soft palpation of muscles [19]. This study was a pioneer step towards investigating the joint laxity in lower limbs among ASD children in the state of Punjab. The reason for increased joint laxity may be linked to hypotonia. It was found that hip extension and rotations have depicted contradictory results. The hip extension, internal rotation along with external rotation passive range of motions were recorded to be similar with the control group. One of the reason behind this may be the bulk of muscles present around hip joint. In this study the tone could not be evaluated for each and every muscle groups due to limited time provided by the special schools and institutions. This study tried to divert the attention on physical impairments seen in ASD children so that rehabilitation fraternity can focus also focus on tone, balance and gait parameters.

CONCLUSION

The findings of this study concluded that children with ASD presents with increased joint laxity in ankle dorsiflexion and plantarflexion, knee flexion, hip flexion, extension, abduction and adduction as compared with the same aged typically developing peers.

FUTURE RECOMMENDATION

It strongly recommends that there is an urgent need to explore the prevalence of other physical and motor impairments in order to devise an optimal physiotherapy intervention for ASD children.

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