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Effect of Motor Skills Acquisition Training on Gross Motor Skills of Autistic Children

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Abstract: ***Objective: The purpose of the study was to evaluate the effect of motor skills acquisition training on gross motor skills of autistic children. Methodology: Totally 30 subjects, 15 in experimental group and 15 in control group with age of 3 to 10 years participated in the study. The experimental group underwent motor skills acquisition training on gross motor skills. Statistical 't' test gives us the processed result. Results: Statistical significance is present in experimental group than control group with regard to effect of motor skills acquisition training. Conclusion: Motor skills acquisition training has significant effect on improving Gross Motor Skills.***

Keywords: Autism, Gross Motor Skills, TGMD-2, Motor Skills Acquisition Training.

1. Introduction

Autism is characterized by disturbance of social relationship limited to use of language to communicate and fixed repetitive interest and routine [Kenner 1943].Prevalence of motor symptoms in autistic children is 54%. (Ming wagner 2007). Autism children have marked difficulty with gross motor movement and they many show obvious problems with balance, walking. Running, getting up or down, Imitating action, getting strike in are repetition, etc.

Delay of gross motor development mostly seen in Autistic children, the child expiate poor gross motor movement and maintaining skills like walking, kicking, jumping, hopping, climbing, etc .delay in these is the are one of the typical symptoms usually show the deficit in motor skills. Among they autistic children often manifest in coordination of movement and balance and vision motoric coordination

The acquisition frame of reference focus on the acquisition. That Learning of specific skills required for the optimal performance with in the environment and activities given solely for the purpose of acquisition specific skills. Mastering each skills or sub skills required and activity in the primary goal [Mosey 1986].

Therefore this study in intended to find the effect of motor skills acquisition training on gross skills of autistic children.

The purpose of the study was to assess the gross motor skills. From which mild to moderate autistic children are selected. Hence the present study aimed to do a research on motor skills acquisition training in gross motor skills of autistic children.

2. Aims and Objectives

2.1 Aims

The aim of the study to find out the effect of motor skills acquisition training on gross skills of autistic children.

2.2 Objectives

- To assess the gross motor skills among autistic children
- To Evaluate the effectiveness of motor skills acquisition training. by Gross motor skills of autistic children

2.3 Hypothesis

Alternative hypothesis
Effect of motor skills acquisition training will have significant effect on gross motor skills of autistic children.

Null hypothesis
Effect of motor skills acquisition training will have no significant effect on gross motor skills of autistic children.

3. Review of Literature

Staples KL[1] Reid G. J autism Dev Disord (2010) "Fundamental movement skills and ASD"
In this study they examined Delays and deficits may both contribute to atypical development of movement skills by children with ASD. Fundamental movement skills of 25 children with autism spectrum disorders (ASD) (ages 9-12 years) were compared to three typically developing groups using the Test of Gross Motor Development (TGMD-2). The group matched on chronological age performed significantly better on the TGMD-2. Another comparison group matched on movement skill demonstrated children with ASD perform similarly to children approximately half their age. Comparisons to a third group matched on mental age equivalence revealed the movement skills of children with ASD are more impaired than would be expected given their cognitive level. Collectively, these results suggest the movement skills of children with ASD reflect deficits in addition to delays.(11)

Claudia Hilton, lyndsay wente, research in ASD 2007 "Relationship between motor skill impairment and severity in children with asperger syndrome."
This study examined the between severity and motor impairment in children with asperger syndrome [AS]. Children, ages 6-12with AS (N=51) and control group of

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typical children (N=56), were assessed using the social Responsiveness scale (SRS) and the movement assessment battery for children (MABC) A bivariate correlation design was used to compare the scores (Spearman rank correlation coefficient). Significant difference were seen between typical, mild to moderate and severe categories of SRS scores, based on the Kruskal – wallis one way analysis of varience by ranks *(p<.0.5)*.Strong correlation were found between the MABC motor impairment level and the SRS severity levels. This study adds a clear understanding of the relationship between motor impairment and severity for children with AS.[12]

Ming X [1] Brimacombe M, Wagner GC. (2017) "Prevalence of motor impairment in ASD"
The objectives of this was to describe the prevalence of motor deficits in ASD. Specifically, using retrospective clinical record review, we report the prevalence of hypotonia, motor apraxia, reduced ankle mobility, history of gross motor delay, and toe-walking, as well as the improvement of these symptoms with age, in a cohort of 154 children with ASD. The possible association of motor deficits with epilepsy or developmental regression was also assessed. To address whether the motor deficits in children with ASD were properly identified and treated, we evaluated whether the children with the motor deficits were more likely to receive physical and/or occupational therapies as compared to the children with ASD who did not show motor deficits.[13]

Sun SH[1], Sun HL, Zhu YC, (2010) "Concurrent validity of preschooler gross motor quality scale with test of gross motor development-2."
The purpose of this study was to establish the concurrent validity of PGMQ using Test of Gross Motor Development-2 (TGMD-2) as the gold standard. One hundred and thirty five preschool children aged from three to six years were recruited from three kindergartens in central Taiwan. Two independent evaluators who were unaware of each other's results evaluated all the children separately in their kindergartens using standardized setting and procedures. Concurrent validity was examined using correlation analysis with Pearson-Production Moment correlation coefficient. The results show that the total scores and subscale total scores (r = .82 for locomotion, r = .0.76 for object manipulation, of the two tests correlated well. Analysis of similar items in the locomotion subscale found significant but weak correlations in the running, jumping and galloping items of the two tests There were moderate to high correlations in hopping, sliding and leaping between the two tests. Low to moderate correlations were found between the similar items in the object manipulation subscale of PGMQ and TGMD-2. The total scores of similar items in the locomotion subscale of PGMQ and TGMD-2 showed a similar high relation (r = .79, p < .001) likewise in the object manipulation subscale (r = .75, p < .001) The PGMQ proved to have adequate concurrent validity with TGMD-2.[14]

Liu, T., Hamilton, M., Davis, L., & Elgarhy, S. (2014) "Gross motor performance by children with ASD and typically developing on TGMD-2"
In this study they examine the gross motor skill performance using the Test of Gross Motor Development-2 (TGMD-2) on children with autism spectrum disorder (ASD) and their age matched peers (5-10 years). Methods: A total of 21 children with ASD (M=7.57 years) and 21 age matched typically developing children (M=7.38 years) participated in this study. TGMD-2 is a standardized test to assess 12 gross motor skills for children. All study participants completed the TGMD-2 assessments. A MANOVA was conducted on TGMD-2 scores to compare motor performance of children with ASD and typically developing children. Results: For the locomotor subtest, 67% children with ASD received poor standard scores and 40% of scores were very poor. About 60% children with ASD had poor standard scores and 33% of scores were very poor on object control skills as described in the TGMD-2 manual. It is important to note that children with autism spectrum showed significant delays in gross motor skill performance when compared to their age matched peers.[15]

Whyatt CP [1], Craig CM (Journal Autism Dev Disord. 2013) "Motor skills in children aged 7-10 years, diagnosed with ASD"
This study used the movement Assessment Battery for Children (M-ABC2) to assess motor skills in children aged 7-10 years with autism in comparison to two groups of age-matched typically developing children. The results supported previous work, as indicated by a significant general motor impairment in the group with autism. Hence in this study it universal significant for the autism group. Hence the results suggest that motor skill deficits associated with autism may be pervasive and more apparent in activities demanding complex, interceptive actions or core balance ability.[16]

Meghann Lloyd, Megan MacDonald, (2017) "Motor Skills of Toddlers with ASD"
Autism spectrum disorder (ASD) is a complex development disorder that generally in early childhood and is defined by marked delay and impairment. Although stereotyped and repetitive motor behavior are a criterion for ASD, parents and individual who work with children with ASD also describe their gross motor and fine motor skills to be atypical and/or delayed. Recent empirical research has investigated the motor development and motor skill proficiency of children with ASD. The research has consistently found that infants and children with ASD experience both gross and fine motor delays, and/or atypical motor pattern. The motor skills of 12 children with autism, 12 with Asperger syndrome, and 12 with PDD- NOS, using The Bruininks-Oseretsky Test of Motor Profiency (Bruininks, 1978). The most significant findings of this study was that all children with ASD showed problem with motor coordination. Results indicated that all children with ASD met criteria for a diagnosis of motor impairment (Green, et al, 2002). In sum, the research has demonstrated that older children with ASD have difficulties in the motor domain.[17]

Pancy CY[1] Tsai CL, Chu CH. J Autism Dev Disord (2009)
The purpose of this study was to compare the movement skills of children with autism spectrum disorders (ASD), attention deficit hyperactivity disorder (ADHD), and those without disabilities. Ninety-one children ages 6-10 years,

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were of average IQ participated. After controlling for age, both ASD and ADHD groups scored significantly lower than controls (p's < .05) on overall gross motor development as well as locomotor and object control subtests, and the ASD group performed more poorly than the ADHD group (p's < .01) on both subtests.[18]

A. Pappa. C. H. Evaggelinou, (2004) "Fundamental motor skills in children with moderate mental retardation."

In this study "Fundamental motor skill in children with moderate mental retardation". In this study they included 35 students (26 boys and 9 girls) with moderate MR aged from 9 to 15 years old. The examined for Test of Gross Motor Development (TGMD, Ulrich, 1985). These result may be due to the absence of specific curriculum programs, in special schools with emphasize in the improvement of those skills. However previous research has supported changes in qualitative performance as age increases in children with MR and their non handicapped peers. Therefore adapted physical educators, should emphasize in a special designed adapted physical education program which is geared forward the development of fundamental motor skills for the children with moderate mental retardation.[19]

Wafaa Abd Elhafez Abd Elmaksoud Ghaly,et all (2010), "The effect of movement education program by using movement pattern to develop fundamental motor skill for pre-School.

In this study "the effect of movement education program by using movement pattern to develop fundamental motor skills for children lower scores in the retention measure, compared to their acquisition scores, Skill concepts acquisition and retention was achieved by all children's. In this study 54 subjects of five to six year young children selected randomly after pre test by Test of Gross Motor Development – editions 2 (TGMD-2), gross motor skill, locomotor and object control motor skills, subjects were divided by random matching into two groups. The first group as experimental group performed Unstructured and Structured movement Pattern and the second group as Control group performed daily activities. Then children in first group performed unstructured and structured movement pattern 16 sessions. After applying the program, unstructured and structured movement pattern and daily activity groups participated in the post tests. Data were analyzed by paired sample T-Test and independent samples T-Test, the results showed that unstructured and structured movement pattern with mean difference in fundamental motor skill development (20.61, P<0.01) and also with mean difference in locomotor (18.31, P<0.01) and mean difference in object control skill development (11.31, P<0.01) significantly are more effective than daily activities. This study concluded that unstructured and structured movement pattern program is appropriate for a fundamental motor skill development.[20]

PavelZikl, Nikola Holoubkova (2013) "Gross motor skills of children with mild intellectual disability"

In this study "Gross motor skills of children with mild intellectual disabilities". In the article the research results focused on comparing the level of gross motor skills in children with mild intellectual disabilities and intact children. The research sample consisted of a total of 114 students with an average age of 10 years. Using the standard test of Test of Gross Motor Development The results present the differences between the two groups of students in locomotor skills and object control skills. The results can serve as a basis for better targeting special-pedagogical support for children with mild intellectual disabilities as well as a basis for further research activities in this area.[21]

Vassiliki Derri, Maria Pacha et al.,(2007) "Comparative study between two style of teaching

In this study A Comparison between two styles of teaching. They included 59 children, 6 to 7 years of age, were randomly assigned into two treatment groups. The test of gross motor development (TGMD) Ulrich, (1985) was used for the assessment of motor performance. Results showed that both groups significantly improved skill performance. However, children in the command group, contrary to those in the guided discovery group, exhibited significantly lower scores in the retention measure, compared to their acquisition scores, Skill concepts acquisition and retention was achieved by all children's. It seems that both styles are effective for the concepts acquisition but the guided discovery style contributes to better motor learning gains.[22]

4. Methodology

Research design

The study was done with two group pre-test and post-test of quasi experimental design

Sampling

Totally 30 subjects were taken in this study. The subjects were divided into two group as experimental and control group. The control group consists of 15 subjects, and experimental group consists of 15 subjects. Convenient sampling technique was adopted.

Variable under the study

Independent variable

- Motor skills acquisition training

Dependent variable

- Gross motor skills of autistic children

Study place

The study was conducted in **Occupational Therapy Foundation, ERODE.**

Selection Criteria

Inclusion criteria

- Children between ages of 3 to 10years are selected
- Both boys and girls are included in his study
- Only Autistic children are selected

Exclusion criteria

- Children with problem of visual and hearing impairment not selected
- Age group below 3 years and above 10 years are selected
- Other level of Autistic children and its associated conditions excluded.

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- Children with severe physical disability.

Measurement tools
Test of Gross Motor Development -2(TGMD-2)

Materials used
8"-10" playground ball,4" light weight ball ,Basket ball, Tennis ball, Soccer ball, Soft ball,4'-5' square beanbag ,Tape (plastic electrical), 2 traffic cones, Plastic bat, Batting tee

Procedure
Convenient sample of 30 subjects were selected from the age group between 3-10 years. The 30 subject were divided into two groups a control group and an experimental group. Consists of 15 subjects each group which is taken from occupational therapy foundation Erode. Sample of 15 subjects in the control group doesn't any management other then occupational therapy intervention, where the experimental group receive both occupational therapy and motor skill acquisition training. The therapy was given for 3 month duration comprising of 36 sessions, 12 sessions are given to each one month in total 3 month period.

During the intervention the phase the student were engaged in motor skill acquisition training for 45 minute by the therapist. After the 3 month intervention period last over. using the Test of Gross motor development (TGMD-2). Post test data collection was done using the Test of Gross Motor Development (TGMD-2). One Session extends upto1 hr 15 minute, Weekly 3 sessions ,Monthly 12 sessions .Total of 36 sessions have been conducted.

Sessions

BALANCE ACTIVITIES		
Session – 1 to 3		
1.	Walking along a narrow beam or line marked on the ground – forwards, backwards, sideways	
2.	Stand on one leg – can put one foot on a phone book, a ball if unable to hold balance and for fun try picking up marbles with one foot while standing on the other - place into container!	
3.	Stepping up and down or from one box/bucket to another	
4.	Walking along different surfaces – eg pillows, foam, mattress etc	
	Session – 3 to 6	
5.	Balance on wobble or balance board	
6.	Walking on toes and on heels	
7.	Follow a wriggly line – walk on line or feet either side	
8.	Stepping over rungs of a (horizontal) ladder or on the rungs or along the edges	
JUMPING AND HOPPING		
Session – 6 to 9		
1.	Jump on spot, jump forwards from a line two feet together	
2.	Jump over progressively higher stick/bar/obstacle	
3.	Jump down from a progressively higher height	
	Session – 9 to 12	
4.	Jump from hoop to hoop, circle to circle, over a rope stationary or moving (snakes)	
5.	Jump sideways – back and forth, forwards and back	
6.	Hop on spot or hop forwards progress to hopping sideways	
BALLS SKILLS/EYE HAND COORDNATION		
Session – 12 to 15		
1.	Catching a ball – start with 20cm ball and reduce to handball – start by throwing or bouncing ball directly to child, then as skill improves – throw in air, to sides etc to make harder	
2.	Throwing a ball – throw overarm, underarm and chest passes – progress to throwing through a hoop or at a target then into a basketball hoop	
3.	Kick a ball – once can kick, try dribbling ball around obstacles or kick at a target/goal	
	Session – 15 to 18	
4.	Hit a ball – start with a ball on a T or a stationary suspended ball, hitting with hand or bat then progress to a moving ball	
5.	Games are – skittles, scoop ball, grip ball, balloon games – hitting with hand or bat, beanbag toss, quoits	
CORE STRENGTH		
Session – 18 to 21		
1.	All fours – lifting one arm at a time, one leg at a time and then progress to lifting an arm on one side while lifting the opposite leg. Arm and leg being lifted should be straight	
2.	Kneeling – pushing a partner or throw and catch a ball	
3.	Kneeling on one knee with other foot forward – (half kneeling) – do same activities as above	
4.	Bridging – lying on back with knees bent and feet flat below knees – lift bottom up till tummy flat – hold and count or can roll a ball under bottom!	
	Session – 21 to 24	
5.	Standing on one leg – hold balance while change position of arms – stand tall like a tree!	
6.	Lunges- from standing – take a big step forward with one leg and slowly lower knee of back leg to hover above the ground – hold. Step back and repeat.	
7.	Bear walk – stand on hands and feet – head down and bottom up – walk forwards on hands and feet	
8.	Crab walk – sit on floor with hands on floor behind and feet flat on floor in front, lift bottom up and walk hands and feet backwards or forwards keeping bottom off the floor.	

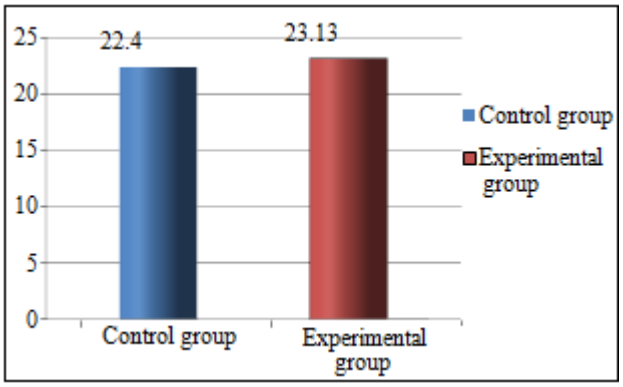
GENERAL STRENGTH		
Session – 24 to 27		
1.	Wall squat – stand with back against wall and feet out in front a step. Slowly slide down the wall till knees are nearly at right angle – hold for as long as can. (quadriceps strength)	
2.	Play with heavy ball or fitball – catch, bounce, push (upper limb and core strength)	
	Session – 27 to 30	
3.	Step-ups – step up and back down on a step – do a number of times (lower limb strength)	
4.	Wheelbarrows – walking on hands while feet are held (legs straight) (upper limb strength)	
	MOTOR PLANNING AND SENSOROY MOTOR	
	Session – 30 to 33	
1.	Obstacle courses, climbing and negotiating playground equipment. (motor plan)	
2.	Visual copy games like follow the leader (motor plan)	
3.	Verbal copy games such as Simon Says (motor plan)	
4.	Statues, freeze games, pretending to be… games (motor plan)	
5.	Bouncing on a trampoline – jump on feet, bounce on knees, all fours and on hands (body awareness)	
	Session – 33 to 36	
6.	Galloping and skipping, skip with a rope, hopscotch motor plan)	
7.	Dancing and actions to music (motor plan)	
8.	Bouncing and doing actions on a fitball (body awareness and motor plan) • Wheelbarrows as above (upper limb awareness)	
9.	Scooter board – pull on tummy or with feet in sitting, negotiate obstacles (motor plan and awareness)	
10.	Swing and spin often help with whole body awareness.	

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5. Data Analysis and Interpretation

Table 1: Comparison of Gross Motor Skills between Pre Test of Both Control and Experimental Group

S. No.	Group	Test	Mean	SD	"t" Value	P Value
1	Control	Pre test	22.40	11.43	0.1729	0.8640
2	Experimental	Pre test	23.13	11.81		

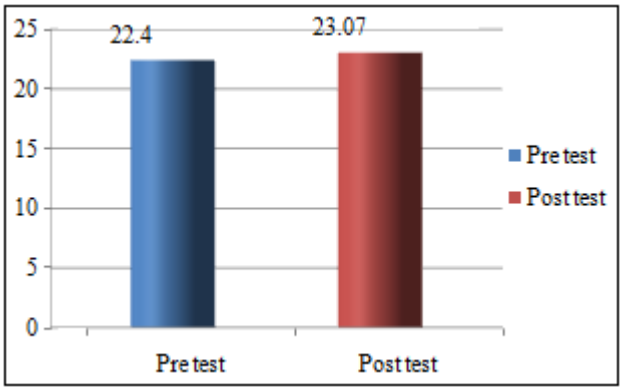


Graph 1

Table 1 and graph 1 shows the comparison between the control group pre test and experimental group pre test score mean values are 22.40 and 23.13 and respectively, The calculated "t" values is 0.1729 and "p" values is 0.8640.Hence it is considered to be not statistically significant.

Table 2: Comparison of Gross Motor Skills between Pre and Post Test in Control Group

S.No	Test	Mean	SD	"t" Value	P Value
1	Pre test	22.40	11.43	0.9075	0.3795
2	Post test	23.07	10.63		

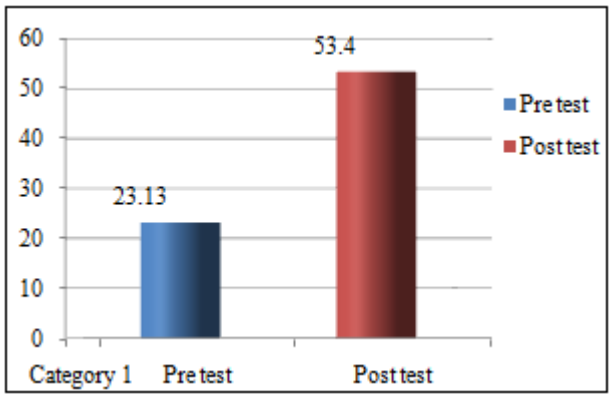


Graph 2

Table 2 and graph 2 shows the comparison between the control group pre-test and post test score mean values are 22.40 and 23.07 and respectively calculated "t" value 0.9075 "p" values 0.3795.Hence it is considered to be not statistically significant.

Table 3: Comparison Gross Motor Skills between Pre and Post Test in Experimental Group

S.No	Test	Mean	SD	"t" Value	P Value
1	Pre test	23.13	11.81	5.8450	0.0001
2	Post test	53.40	19.77		

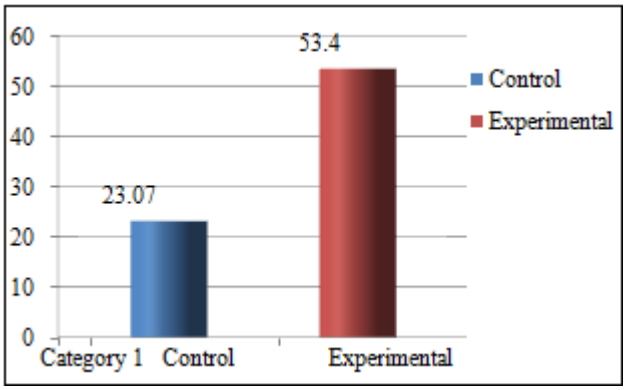


Graph 3

Table 3 and graph 3 shows the comparison between the experimental group pre-test and post test score mean values are 23.13 and 53.40 and respectively calculated "t" values 5.8450 "p" values is 0.0001 . Therefore it is extremely statistically significant. It shows that experimental group has significant improvement.

Table 4: Comparisons of Gross Motor Skills between Post Test of Both Control and Experimental Group

S. No	*Group*	*Test*	*Mean*	*SD*	*"t" Value*	*P Value*
1	Control	Post test	23.07	10.63	5.2328	0.0001
2	Experimental	Post test	53.40	19.77		



Graph 4

Table 4 and graph 4shows the comparison between the control group post test and experimental group post test score mean values are 23.07:53.40 and respectively calculated "t" values 5.2328 "p" values is 0.0001 so it is extremely statistically significant. It shows that experimental group has more improvement comparatively control group.

6. Discussion

Motor skill acquisition training is a procedure in training gross motor skills motor development and motor control. It is the process that the ability of a child to solve the movement problem to accomplish everyday functional task in the area self care, school, play, mobility and communication. The study supported by "the effect of movement education program by using movement pattern to develop fundamental motor skills with children, Waffa Abd Elhafez Abd Elmaksoud Ghaly,(2010)

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As individualized programme of gross motor skills training was recommended to improve the child motor control, coordination, mobility and communication (SCHMDT 1991). The purpose of this study is to find out the effect of motor skills acquisition training in gross motor skills of autistic children.

In this study results proved that gross training has beneficial effect in the improving motor skills in autism and occupational therapy has beneficial effect in improving in learning new skills in play, mobility and communication. However the study results received that acquisition training. When used in combination with conventional occupational therapy is more beneficial in improving gross motor skills among autism.

The results of the study showed that experimental group is better than the control group. As seen in table 4 and graph 4. Hence both experimental group and control group showed significant improvement. The control group received only occupational therapy. Where as the experimental group received occupational therapy combined with motor skills acquisition training. Hence there is a significant improvement in the post test of experimental group when compared to the control group.

Analyze of the pre and post test score of TGMD-2 TEST shows significant improvement in gross motor skills has seen in the table 3 and graph 3 however the pre test and post test score of the experimental group was higher than the control group. The improvement in the group got from the planned session during the duration of 3 month. Where the occupational therapy and acquisition motor skills training was given, Hence the finding of the study was supported by " The effect of motor education programme by using movement pattern to develop motor skills, using TGMD-2 (2010). The comparison of pre test gross motor a both control and experimental group shows mean score of 22.40 (control) and 23.13 (experimental) respectively, this is show in the table 1 and graph 1. The unpaired "t" test was obtained to 0.1729 and ($p > 0.005$). Hence there is the significant difference in the mean value for the acquisition training in both the group.

The comparison of gross motor skills between the pre and test of control group show the mean score 22.40 and 23.07 respectively this is show in the table 2 & graph 2. Paired "t" test value was obtained to be 0.9075 ($p > 0.05$). Hence there is no significant difference between gross motor skills pre & post test control group . Hence the null hypothesis proved.

The comparison of gross motor skills for experimental pre & post test mean score is 23.13 and 53.40 respectively and it is show table 3 & graph 3. The "t" test value obtained to the 5.8450 ($p > 0.05$) shows that there is high significant difference between pre and post test value. The experimental group showed improvement due to acquisition training to improve gross motor skills in adjunct to occupational therapy. Hence the alternative hypothesis is proved reject the null hypothesis.

The comparison of gross motor skills between post test of both control group and experimental group shows that mean score 23.07 and 53.40 respectively Independent "t" test value is found to be 5.2328 ($p < 0.05$). The performance of two group compared that the "t" and "p" value being statistically significant that the improvement in the experimental group was more than in the control group shows the present study expose the tremendous progress and impact that acquisition gross motor training can improve their quality of life in children with autism.

The results study shows that experimental group improved better than the control group , while both experimental and control group showed significant improvement in gross skills that occupational therapy & acquisition training when it is used in combination how much better effect and more beneficial in improving the gross motor skills. It is stated in the study. "the gross motor skills performance using the Test of Gross Motor Development (TGMD-2) on children with autism(2014).

Hence this study proves the alternative hypothesis that gross motor acquisitional training with occupational therapy has better effect in improving gross motor skills, hence this study shows that acquisition training and occupational therapy are often valuable that is ultimate goal of assessing gross motor skills is its role in remediation. Hence in this study its state that the alternative hypothesis is accepted and Rejected the null hypothesis.

7. Conclusion

From this study, it is concluded that there is a significant improvement in gross motor skills of autistic children through the motor skills acquisition training.

8. Limitation and Recommendation

8.1 Limitation

- Study was done on a small sample size.
- Study was conducted for shorter duration.
- Male and female comparison is not included in this study.
- Parent/caregiver session is not included in the study.

8.2 Recommendations

- The study can be done on larger sample size
- Study can be done on different age groups.
- Study can be done for longer duration.
- Male and female comparison can be included in the study
- Further follow up study can be done

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