EFFECTIVENESS OF HAND EXERCISES ON FUNCTIONAL ACTIVITIES IN DUCHENNE’S MUSCULAR DYSTROPHY

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ABSTRACT

BACKGROUND: Duchene’s Muscular Dystrophy (DMD) is the most common type of muscular dystrophy, caused by defect in the dystrophin gene located on X-chromosome. Arm functions have started to decrease in early ambulatory phase in childhood. Arm functioning is important to maintain independence in daily life. To delay and minimize the development of contractures and deformities occurring in boys with Duchenne’s Muscular Dystrophy, exercises were needed to cope up with the activities of daily living. The aim of the study is to find out the effectiveness of hand exercises on functional activities in Duchenne’s Muscular Dystrophy. METHODOLOGY: The study design was quasi experimental, pre and posttest type. 9 subjects with the age group of 10-20 years were selected based on the inclusion and exclusion criteria. The subjects were treated with hand exercises for 4 weeks and each week consists of progression of exercises. The outcome measure was Bruininks Oseretsky Test. RESULTS: The results showed that the mean value of pretest of fine motor precision was 34.56 and the mean value posttest of fine motor precision was 36.89. There is significant effect of hand exercises in improving fine motor precision in Duchenne’s Muscular Dystrophy children with p<0.05. The mean value of pretest of fine motor integration was 34.67 and the mean value of posttest of fine motor integration was 39.56. There is significant effect of hand exercises in improving fine motor integration in Duchenne’s Muscular Dystrophy children p<0.05. CONCLUSION: This study concluded that there was a significant effect of hand exercises on functional activities in children with Duchenne’s Muscular Dystrophy.

KEYWORDS: Duchenne Muscular Dystrophy, arm functions, Bruininks Oseretsky Test, dystrophin, hand exercises. fine motor precision, fine motor integration

I. INTRODUCTION

Duchenne’s Muscular Dystrophy (DMD) is the most common type of muscular dystrophy, caused by defect in the dystrophin gene located on x-chromosome.¹ This defect leads to shortage or absence of the dystrophin, a protein that helps to keep the muscle cells intact. The dystrophin gene is located on the short arm of chromosome X near the p21 locus and codes for the large protein Dp427, which contains 3685 amino acids. Dystrophin accounts for only approximately 0.002% of the proteins in striated muscle, but it has obvious importance in the maintenance of the muscle’s membrane integrity.¹

In the early stages, Duchenne’s Muscular Dystrophy affects the shoulder and upper arm muscles and the muscles of the hips and thighs.² These weakness led to difficulty in rising from the floor, climbing stairs, maintaining balance and raising the arms. Symptom starts in early childhood, usually between ages 3 and 5. The disease primarily affects boys but in rare cases it can affect girls. Boys with Duchenne Muscular Dystrophy usually did not survive much beyond their teen years.² The prevalence of Duchenne’s Muscular Dystrophy is 1 in 3500 boys in Asia. As a consequence, boys with Duchenne’s Muscular Dystrophy experience muscular weakness in early childhood. These children have functional limitations, in which the limitation in lower extremities are compensated using wheel chair. However, the limitations in upper extremities are much harder to compensate.³⁴
It is of importance although there is no known cure, physical therapy, braces, and corrective surgery may help with some symptoms. Duchenne’s Muscular Dystrophy children become non-ambulatory in their early life and the limitations increasing in strength and upper arm functions. The child becomes wheelchair bound permanently at the age of 10 years or about 14 years of age. The period of dependence to wheelchair can be as long as half their life span. The non-ambulatory Duchenne’s Muscular Dystrophy child has proximal muscle weakness and depend upon the hand and wrist function for performing the activities of daily living.

II. METHODOLOGY

The study design was quasi experimental, pre and post test type. 9 subjects with the age group of 10-20 years were selected based on the inclusion criteria. The children and the parents were fully explained about the procedure and a written informed consent was obtained from them. Departmental Ethical committee clearance was obtained before starting the study. The subjects were treated with hand exercises for 4 weeks and each week consists of progression of exercises. The outcome measure was BruininksOseretksky Test. A total number of 9 samples were selected by the convenient sampling method from Chennai Special School for Muscular Dystrophy Thousand lights. Inclusion criteria were age 10-20 years, children diagnosed with Duchenne’s Muscular Dystrophy. Children with the score of less than 15 percentile of Bruininks Oseretksky Test and wheel chair bounded children. The exclusion criteria were recent upper limb surgeries and recent upper limb soft tissue injuries. Pretest was done by using BruininksOseretksky Test-2 for fine motor precision and fine motor integration. The children were given hand exercises for 4 weeks and each week consists of different kind of hand exercises with progression.

First week the child was made to sit comfortably and a crayon was given to color a picture. The child was given a paper and asked to squeeze for about 30 seconds and the number of papers squeezed was noted. The child was given 10 balls and asked to throw it on a basket kept near them. The number of balls in the basket was noted. This was done separately by left and right hand. The child was given 16 coins and was asked to turn them first with right hand and then with left hand. The time taken by each of the hand to turn the coins was noted. The child was given 16 playing cards and was asked to turn the cards first with right hand and then with left hand. The time taken by each hand was noted.

In second week, progression of exercises done, the child was given a paper and was asked to squeeze for about 60 seconds and the number of papers squeezed was noted. The child was given 16 playing cards and was asked to turn them first with right hand and then by left hand. The child was given 16 coins and was asked to turn them within 30 seconds. This was done separately with right hand and left hand. The child was given a clay and was asked to mold it well and do some dolls.

In third week, the child was given a sponge ball and was asked to squeeze for about 30 seconds. The child was given a water bottle cap and was asked to open and close it. The child was given chart paper and was asked to fold it. The child was asked to catch the ball thrown by the examiner. In fourth week, the child was given a dough and was asked to mix it well. The child was asked to catch the ball thrown by the examiner. The child was asked to squeeze the sponge which was soaked well in water. Posttest was done after fourth week using BruininksOseretksky Test for fine motor precision and fine motor integration.

III. RESULTS

Statistical analysis for effectiveness of hand exercises on functional activities in Duchenne’s Muscular Dystrophy using Bruininks Oseretksky Test-2 (BOT-2) was found to be significant. Bruininks Oseretksky Test-2 score was designed to measure fine motor skills. In this study hand exercise was performed by the Duchenne’s Muscular Dystrophy children. According to Table 1 and Bardiagram 1, the Bruininks Oseretksky Test-2 score for the fine motor precision pretest mean was 34.5556 and posttest mean was 36.8889. Thus, there is a significant effect of hand exercises in improving fine motor precision of Duchenne’s Muscular Dystrophy children with p<0.005. And Bruininks Oseretksky Test-2 score for the selected group for fine motor integration pretest mean was 34.667 and posttest mean was 39.556. Thus, there is a significant effect of hand exercises in improving fine motor integration of Duchenne’s Muscular Dystrophy children with p<0.005.

TABLE-I PRE AND POST TEST MEAN VALUE OFFINE MOTOR PRECISION AND FINE MOTOR INTEGRATION OF DUCHENNE’S MUSCULAR DYSTROPHY CHILDREN

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IV. DISCUSSION

The purpose of the study was to find out the effectiveness of hand exercises on functional activities in Duchenne’s Muscular Dystrophy. Statistical analysis for effectiveness of hand exercises on functional activities in Duchenne’s Muscular Dystrophy using BruininksOseretsky Test-2 (BOT-2) was found to be significant. BruininksOseretsky Test-2 score was designed to measure fine motor skills. In this study hand exercise was performed by the Duchenne’s Muscular Dystrophy children. The BruininksOseretskyTest-2 score for the fine motor precision there is a significant effect of hand exercises in improving fine motor precision of Duchenne’s Muscular Dystrophy children with \( p<0.005 \). And Bruininks OseretskyTest-2 score for the selected group for fine motor integration, there is a significant effect of hand exercises in improving fine motor integration of Duchenne’s Muscular Dystrophy children with \( p<0.005 \).

Alemdaroğlu et al., 2015 concluded that upper limb functional strength reduces in non-ambulatory DMD patients. And the study attempts to improve the upper limb functional strength in order to reduce their level of dependency. Fujiwara Tet al., 2009 suggested that preserving muscle strength and range of motion in Duchenne patients might be relevant for a better outcome of distal motor function of the upper limb. In Duchenne’s Muscular Dystrophy wrist and hand muscles are very important for performing residual activities of daily living. There is a severe, weakness in proximal shoulder and hip girdle muscles are present. Distal muscles are very important for physical function, since proximal muscles are weak.

Mattar FL et al., 2008 described that extension of weakness in hand and wrist occurs in Duchenne’s Muscular Dystrophy. They also found that wrist extension was limited by the age of 8 in the affected individuals. Therefore, this study has focused to reduce their level of dependency.

Fine motor precision is important for quick precise movements and coordination of the hands and fingers, thus exercises for example ball squeezing, dough mixing, clay modeling, the mean value of pre-test fine motor precision was found to be 34.56 and mean value of post-test fine motor precision was found to be 36.89,
therefore the mean value is improved compared to the pretest which proved that there is a significant effect of hand exercises in improving fine motor precision for Duchenne’s Muscular Dystrophy children with $p<0.005$.

Fine motor integration is important for the coordination of small muscles, in movements – involving the synchronization of hands and fingers-with eyes, thus exercises for example sponge squeezing, chart paper folding, coloring a picture and throwing balls into the basket, the mean value of pre-test fine motor integration was found to be 34.67 and mean value of post-test fine motor integration was found to be 39.56, therefore the mean value is improved compared to the pretest which proved that there is a significant effect of hand exercises in improving fine motor integration for Duchenne’s Muscular Dystrophy children with $p<0.005$.

Erwin JH, et.al 1991 documented that patients with distal myopathies are benefited from a program of isometric and resistive exercise for wrist and hand and for distal extremity of lower extremity.\(^{16}\)Wagner MB et. al 1993 documented that Hand exercises increase the progression of range of motion, muscle strength, daily function. The best-preserved muscles in patients with Duchenne Muscular Dystrophy are in the wrist and hand. The increase in longevity makes it important to focus on maintaining strength in the muscles of the distal upper extremity to allow as much independent function as possible for the child with Duchenne Muscular Dystrophy. Hand exercises maintains the range of motion of wrist extension, flexion, allowing weakened flexor and extensor muscles to function in optimal position.\(^{16}\) Strengthening exercises produce muscle contraction, thereby increase muscle strength, endurance and size of the muscle an also there increase in the energy level and reduce fatigue level.\(^{16,18}\) The study concluded that hand exercise is effective in improving functional activities in Duchenne’s Muscular Dystrophy.

V. CONCLUSION

The study concluded that there was a significant effect of hand exercises on functional activities in children with Duchenne’s Muscular Dystrophy. The recommendations of the study are, the study can be compared with control group, functional activities also be assessed by using other functional scales and the whole Upper limb muscles also treated with separate protocol. So, when Physiotherapist plan for intervention of DMD hand exercises should be included.

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CONFLICT OF INTEREST: Nil

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REFERENCES


