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TO COMPARE THE EFFECTS OF CIRCUIT TRAINING PROGRAM AND STRETCHING IN SPASTIC DIPLEGIC CEREBRAL PALSY CHILDREN

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Abstract: BACKGROUND OF THE STUDY: The spastic diplegia is one of the common type in cerebral palsy and the child appear as poor postural control, lack of stability, not able to shift weight on other extremities and the child attains an typical sitting postures. As a result of these problems that child doesn't able to attain the gross motor function at the earlier period. Various therapeutic approaches has been used to improve gross motor functions.OBJECTIVE OF THE STUDY : Objective of the study was to find and compare the effect of circuit training program and stretching in spastic diplegia.METHODOLOGY : In this study total of 30 spastic diplegic children were selected under the age group of 3 to 12 years, who met an inclusion and exclusion criteria. They were randomly divided into two groups consist of 15 person in each group. Group A received circuit training program and Group B received stretching. Both groups were analysed using Gross Motor Function Measure 88 & 66 scale before and after the treatment.CONCLUSION: The statistical values shows an significant improvement in circuit training program with the probability value of <0.01. This study shows an more significant improvement in circuit training program under the age of 3 to 12 years of spastic diplegic children by improving the gross motor functions when compared to stretching.

I. INTRODUCTION

Spastic diplegia is the most common type in cerebral palsy and its prevalence is 1.5 to 2.5 cases per 1000 live birth in India. In Spastic diplegia spasticity is the major impairment in lower extremeties, pelvis and the child appear as poor postural control, lack of stability, not able to shift weight on other extremities, the child doesn"t able to walk and stand independently.

So, the Gross Motor Function Measure 88 & 66 scale is a validated and gold standard tool to measure the gross motor function in children with spastic diplegic cerebral palsy. The GMFM 88 and GMFM 66 was developed to assess how much a motor task a child can complete. The GMFM scale consist of five dimensions such as lying/rolling, sitting, crawling/kneeling, standing, walk/run/jump.

Despite the fact, various therapeutic approaches has been used to improve gross motor function in spastic diplegia but the circuit training program is one of the latest intervention to treat spasticity and muscle weakness as well as improved the gross motor function. Circuit training program which is a style of workout with high intensity and short term exercise to target muscle strength, endurance decrease aberrant motor control and prevent somatic.

Static stretching is the most common term used to describe a method by which effects soft tissue are lengthened just past the point of tissue resistance and then held in lengthen position for extended period of time with a sustained stretch force. There is evidence shows that manual stretching having positive effect in improving muscle flexibility in cerebral palsy children between age group of 5 - 12 years.

The stretching may be given for 15-30 seconds sometimes it may be extended upto 60 seconds. In manual stretching the therapist applies an external force to move the involved body segment slightly beyond the point of tissue resistance and available ROM. The therapist manually controls the site of stabilization as well as the direction, speed, intensity and duration of the stretch. It usually employs a control end range static and progressive stretch held for about 30 to 60 seconds Several studies has been proved that the stretching has better result as well as circuit training program also gave better result in spastic diplegic cerebral palsy.

2 AIM AND OBJECTIVES

2.1 AIM OF THE STUDY

- To find out the effect of circuit training program and stretching in spastic dipelgic cerebral palsy.

2.2 OBJECTIVES OF THE STUDY

- To find the effect of circuit training program in spastic diplegia.
- To find out the effect of stretching spastic diplegia.
- To compare the effect of circuit training program and stretching in spastic diplegia

3 NEED OF THE STUDY

Cerebral palsy of spastic diplegic results in loss of muscle strength and motor control and also it affect the gross motor function. This study focuses on circuit training program and stretching to improve muscle strength and endurance, balanced muscle contraction. In my knowledge, no study has been done to find the effect of both therapies on gross motor co- ordination and somatic dysfunction due to lack of mobility.

4 HYPOTHESIS

4.1NULL HYPOTHESIS:

There is no significant effect of circuit training program and stretching to improve gross motor function in spastic diplegic cerebral palsy.

4.2 ALTERNATE HYPOTHESIS:

There is a significant effect of circuit training program and stretching to improve gross motor function in spastic diplegic cerebral palsy.

5 REVIEW OF LITERATURE

Stuberg et al conducted a study on subjects of manual stretching on hamstring flexibility in children with spastic cerebral palsy and they concluded that improvement in range of motion (angle when maximum subject tolerance was reached) on the treated side was primarily due to increase stretch tolerance (torque at Amax)since angle at the highest common torque level achieved across test didn't change significantly.

Katrin Baxter, Todd E. Davenport (2012) A study conducted on passive stretching and its effect on spasticity and range of motion in children with cerebral palsy. A total of 13 articles on stretching in children with cerebral palsy were found from the years 1990 – 2011. 2 individual studies were found in which manual stretching was the intervention. 9 individual studies were found in which positional stretching was the intervention, 4 of which serial casting was the intervention. 2 systemic reviews exist in the last two decades that explore the effect of stretching in children with CP, however neither encompass all of the studies reviewed in this paper nor do they discuss serial casting as a form of positional stretching. Taken together, the individual studies using positional stretching and the small randomized controlled trial using electrical stimulation in addition to manual stretching led to better outcomes for reducing spasticity and increasing passive range of motion compared to manual stretching alone.

Pin T, Dyke P, Chan M. (2006 OCT) The aim of this review was to evaluate the evidence on the effectiveness of passive stretching in children with spastic cerebral palsy. There was limited evidence that manual stretching can increase range of movements, reduce spasticity, improve walking efficacy in children with spasticity. It appeared that sustained stretching of longer duration was preferable to improve range of movements and to reduce spasticity of muscles around the targeted joints.

MathewB, **Miller et al**., **2014**."effect of short term high intensity circuit training program on work capacity, body composition, blood profiles in sedentary obese men". In this study 8 healthy sedentary obese male were taken and the experimental group received high intensity circuit training program and statistically analysed by ANOVA. The result showed that significant improvement in high intensity circuit training program. In closing that high intensity circuit training program could positively improve several physiological health markers in obese males.

DanielMayorgaVega, **Jerusalem Viciana**, **et al**., **2013**. "Effect of circuit training program on muscular and cardiovascular endurance and their maintenance in school children". In this study 72 children were included and randomly divided into two group.The experimental group received four week maintanence training program and control group received usual physiotherapy. The participants were evaluated by muscular and cardiovascular endurance test. The result showed that circuit training program was effective to increase and maintain both muscular and cardiovascular endurance among school children.

JulioPerez-Julio Perez-lopez et al., **2013**. "effectiveness of vojta therapy in motor development of preterm children". It is an interventional type of study they included 120 participant and assigned into two group. Experimental group received vojta therapy along with sensory motor stimulation for two weeks and the control group received sensory motor stimulation and global physiotherapy. The participants were assessed with Bayley scale of infant and toddler development then statistically find the difference by ANOVA and the result showed that significant difference of Vojta therapy in motor development of preterm children.

MadaviAlotaibi, **ElizabethKennedy**, **et al**.,**2013.** "the efficacy of GMFM 88 and GMFM 66 to detect changes in gross motor function in children with cerebral palsy" This study was systematic review and included 62 articles but they took 21 studies and analysed by data collection sheet. The result showed that the studies were included generally of moderate to high methodological quality. To finish with that the review suggest that both GMFM 88 AND GMFM 66 version are useful valiable in assessing functional motor abilities of children with cerebral palsy.

IngridGLVandeport et al., **2012**. "the effect of circuit training program as alternative to usual physiotherapy after stroke". In this study 126 participants were included and randomly divided into two groups. The intervention group received circuit training program and control group received traditional physiotherapy. The participants were assessed with mobility domain impact scale of stroke then the result showed that significant difference between two group of stroke impact of mobility domain scale. In general that the task oriented circuit training program can safely replace usual physiotherapy for patient with stroke who discharged from inpatient rehabilitation to the community need further in gait and gait related activities as an outpatient.

6 MATERIALS AND METHODOLOGY

6.1 STUDY TYPE **:** Comparative study.

6.2 STUDY POPULATION **:** Spastic diplegia of both male and female.

6.3 SAMPLING METHOD **:** Randomised sampling Method

6.4 STUDY SETTING **:** Sathya special school, Puducherry

6.5 TOTAL STUDY DURATION **:** 4 months.

6.6 TREATMENT DURATION **:** 30 minutes per session , 3 session per week, Totally 6 week

7 MATERIALS USED FOR THIS STUDY

- Treadmill
- Bicycle ergometer
- Stair step
- Mat
- Towel
- Bed sheet

8 SELECTION CRITERIA

8.1 INCLUSION CRITERIA

- Children with cerebral palsy of spastic diplegia.
- Spastic diplegic children under the age of 3 to 12 years
- Gross motor function classification system of grade 1, 2, 3.
- The ability to walk unaided without assisted device for more than 10m.

8.2 EXCLUSION CRITERIA

- Undergoing botox injection
- Cardiac or pulmonary dysfunction
- Uncontrolled seizure
- Other neurological disorder
- Children with hyperpyrexia

9 OUTCOME MEASURE

- GROSS MOTOR FUNCTION MEASURE (GMFM88 and GMFM66).
- The GMFM is a standardised observational instrument Designed and validated to measure change in gross motor function in children with spastic diplegic cerebral palsy.
- Scoring key:
- 0=does not initiate
- 1=initiates

10 PROCEDURE

The participants were included in this study 3 to 12 years of age group of spastic diplegia. Total participants of the study were 30 spastic diplegic children.

Group A = 15 sample (circuit training program)

Group B = 15 sample (stretching)

Both group were assessed with GROSS MOTOR FUNCTION MEASURE (GMFM 88&66) before and after the treatment.

GROUP A:

30 minutes, 3 days per week totally 6 week.

Circuit training program consist of aerobic and strength training exercises along with warm up and cool down phases were included. The duration of this exercise was 30 minutes, 3 days per week, totally 6 week.

In this study four exercise were selected under graded circuit protocol thereby increasing the strength of larger muscle groups of both lower limb. The participant were trained at each station for two to ten min and transferred to next station following completion of each exercise in order to reduce neuromuscular detraining effects

11 PHYSIOTHERAPY INTEVENTION FOR GROUP (B) STRETCHING:

This method of treatment is mainly focusing on the specific muscles that are useful for increasing the ROM and muscle power, which are the primary goals of treatment for the functional independence of the spasticity patient. The following stretching techniques were given for the control group.

12 RESPONSE TO STRETCH:

When a muscle is stretch and elongates the stretch force is transmitted to the muscle fibres via the connective tissue in and around the fibres. During passive stretch both longitudinal and lateral force transduction occurs. The elements of stretching include the alignment and stabilization of the body is important. At the same time the intensity, speed, duration, frequency and mode of stretch are also important. While selecting the safe and effectiveness of the patient needs, goals and capabilities are considered.

13 MANUAL STRETCHING:

Manual stretching was performed with an external force beyond the point of tissue resistance and available range of motion and held for about 30 to 60 seconds.

While applying manual stretching the extremity was moved slowly through the free range, to the point of tissue restriction, the proximal segment was stabilized firmly and the distil segment was moved. The stretch force was applied in a low intensity, slow sustained manner and the direction of the stretching movement is directly opposite to the line of pull and within the muscle range. The stretch position was maintained for the 30 to 60 seconds and gradually the stretch force was released.

A. TEND0-ACHILLES STRETCHING:

Action: Flexion of knee planter flexion of ankle.

Position of patient: Supine lying

Position of the Therapist: Standing beside the patient

Procedure: The therapist holds the lower thigh region with his left hand and flexing the knee. The therapist right hand holds the heel in neutral position. Slowly extending the knee with the left hand and dorsi flexes the heel with the right hand.

B. QUADICEPS STRETCHING:

Action: Hip flexion and Knee extension

Position of the patients: prone lying

Position of the Therapist: standing beside the patient

Procedure: patient knee is flexed and the therapist holds the anterior position of the knee with left hand and the right hand holds ankle of the patient while forearm and elbow stabilizing the patient pelvis. Lifting the thigh up with the left hand of the therapist extend patients hip.

C. HAMSTRING STRETCHING:

Action: Flexion of the knee and extension of the knee

Position of patient: Supine lying

Position of the Therapist: Standing beside the patient and the patient leg kept over the shoulder.

Procedure: With the knee extension therapist flexes the hip of the joint.

D. GLUTEUS MAXIMUS:

Action: Hip Extension

Position of the patient: Supine lying

Position of the therapist: Therapist is standing besides the patient and facing the limb Procedure: Therapist right hand grasping the ankle while the left hand holds the knee posteriorly.

The leg lifted with hip and knee flexed towards the cranial side of the patient.

E. ILLIACUS AND PSOAS MAJOR:
Action: Hip flexion
Position of the patient: Side lying
Position of the therapist: Standing behind the patient
Procedure: Therapist left hand stabilizes the pelvis and right hand grasps the lower thigh and knee, with forearm supporting the leg region of the patient.

F. HIP ADDUCTORS:
Action: Hip Adduction
Position of the patient: Crook lying
Position of the therapist: standing beside the patient facing the limb
Procedure: Both the heels are kept together and then drawn apart.

14 STATISTICAL ANALYSIS

Statistical Formula

In this study, pre and post interventional differences within the two groups were analyzed using paired 't' test and between the two groups were analyzed using unpaired 't' test for each of the outcome measures. Statistical significance was set at p<0.0001.

The paired "t" test is formulated as: $t = \frac{\bar{d}}{S/\sqrt{n}}$ $\boldsymbol{Where\ S} = \sqrt{\frac{\sum(d-\bar{d})^2}{n-1}}$

Where,

d=mean difference, a

d= mean,

n= total no. of sample.

For the between group analysis, unpaired 't' test is used.

The unpaired "t" test is formulated as: $t = \frac{x1-x2}{S\sqrt{\frac{1}{n1}-\frac{1}{n2}}}$

$$S = \sqrt{\frac{n1s1^2+n2s2^2}{n1+n2-2}}$$

Where,

x1&x2 are means of group A and group B;

n1 and n2 are sample sizes of two groups. Variance of sample 1 $(s1^2) = \frac{\sum(x1-x)^2}{n1-1}$

Variance of sample 2 $(s2^2) = \frac{\sum(x2-x)^2}{n2-1}$

The outcomes values obtained were manually calculated.

In this study, to find out the effects of circuit training program and stretching in Spastic diplegia was founded by comparing the significant difference between the both groups. The pre-test and post-test interventional differences within the two groups were analyzed using paired test „„GMFM 88& 66"" for outcome measures. Statistical significance was set at p < 0.01 was considered as a significance difference.

The p-value was chosen as per the description given by research book.

15 RESULT

The mean and standard deviation of pre and post test values of GMFM Score for both groups.

For Group A the mean and SD for GMFM, pre and post values is 59.54±6.09and 69.53±16.51,,t" value is 6.73. The mean and SD for GMFM, pre and post values is59.54±16.09 and 69.53±16.51 and,,t" value is 6.73 . The statistical analysis is done with paired

,,t" test within the group A analysis of GMFM 88 & 66 shows significance (p <0.001).

For Group B the mean and SD for GMFM 88 & 66 scale, pre and post test values is53.6±14.81 and 55.2±15.23 ,,t" value is 5.99 . The statistical analysis is done with paired ,,t" test within ten group B for GMFM 88 & 66 shows significant (p <0.01).

Within the group analysis it has been shown that the pre and post test values of GMFM 88 & 66 scale shows significant improvement in Group A than the group B.

Between the Group A & B, the mean and SD for GMFM 88 & 66 pre and post test values was 9.9±0.42 and 1.6±0.42 respectively.

The mean and SD for GMFM 88 & 66 pre and post test values is 9.9±0.42 and 1.6±0.42 respectively.

The statistical analysis done with unpaired ,,t" test within the group A and B analysis shows significance (p <0.0001).

Between group analysis with GMFM 88 & 66 scale in both groups shows that Group A is more significant than Group B after statistically analysed, it has been there is increase in Group A (circuit training program) than Group B (stretching).

Which shows that Group A must be significant than Group B, it has been concluded that group A shows improved gross motor function in spastic diplegia than Group B

16 DISCUSSION

Spastic diplegic children had many neurological deficit that may correlate with musculoskeletal problems and causes spasticity, muscle weakness, loss of motor control. These impairments lead to affect the gross motor function which is required in activities of daily living. **(Gormley 2001).** This study was selected for the purpose of finding the effectiveness of circuit training program versus stretching to improve gross motor function in spastic diplegia. The circuit training program focuses to improve the muscle strength, endurance, postural control, trunk stability and balanced muscle contraction as well as focuses on coordinated, rhythmic activation of musculoskeletal structure and central nervous system responses at various circuit levels.

Atlast the statistical values shows an significant improvement in circuit training program with the probability value of <0.01 when compared to stretching. Because stretching plays an major role on muscle relax and facilitate the normal activity but the circuit training program comprises lot of physical activity which is necessary for day to day life. It may be one of the reason the improvement seen on circuit training program with spastic diplegia among 3 to 12 years of age group people.

Most of the studies stated that circuit training program shows significant improvement in spastic diplegia and other conditions likewise the stretching shows significant improvement in spastic diplegia and other conditions. In my study, I was showed circuit training program was effective in improving the gross motor function among spastic diplegia when compared to stretching.

The identical study was done by **Pandey et al**., the aged between 5 to 10 years spastic diplegia children were taken and found a significant improvement in walking distance during 2 min walk test and walking time during 10m walk test in the intervention group Undergoing functional strength training but not in control group. However these effects were not maintained in the follow up session of following intervention. This study shows type 2 error because the sample size was low and did not incorporate any aerobic training in intervention.

In present study, All the spastic diplegic children were not similar they are all having different types of disability according to their condition and severity. So this study mainly focuses on

improving the gross motor functions like crawling, sitting, standing and walking which is necessary to that child.

This study shows an valid improvement in circuit training program among spastic diplegia under the age of 3 to 12 years rather than stertching.

From the statistical analysis it has been showed that circuit training was better significant than stretching. Circuit training improve the strength and co -ordination of lower limb muscles and weight bearing task than compared with stretching. Since stretching have little on effect on these functions it has more effect on reflex responses to the child which was less than 1 year, this therapy actually improve gross motor performance but it has more effect on decreased postural sway and excessive mobility. In this study circuit training not only improve the overall performance of spastic cerebral palsy it also improves the muscular tonus in lower extremities, isometric strength of lower extremities muscle, functional muscular strength of trunk and lower extremities, walking speed and main mobility functional motor performance. Due to lack of study duration, satisfaction from the exercises, activity and participation level and quality of life cannot be assessed this can also been evaluated in the next future study.

17 CONCLUSION

This study concluded that the circuit training program was effective to improve the gross motor function among spastic diplegia rather than stretching.

18 LIMITATIONS AND REECOMMENDATIONS

LIMITATIONS:

- Small sample size.
- Short study duration.
- Age factor is one of the difficulties to apply the therapy.

RECOMMENDATIONS:

- Structured circuit training used in further study.
- Try some play way type of exercises with stretching.
- Future study will be conducted with larger Population

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