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Effectiveness of Neurodevelopmental Therapy with Conventional Physiotherapy on Gross Motor Function and Spasticity in Spastic Diplegic Cerebral Palsy Children

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ABSTRACT

Background: Cerebral Palsy is a group of permanent, but not unchanging, disorders of movement, posture and of motor function, which are due to a non-progressive lesion, or abnormality of the developing brain. The term "cerebral" refers to the two halves or hemispheres of the brain and "palsy" refers to loss or impairment of motor function[1].

Materials and Methods: 20 children, aged 2-14 years, both males and females, diagnosed with spastic diplegic CP were included in the study. All children were assessed with Gross Motor Function Measurement (GMFM – 88) scale for rolling, sitting, crawling, standing and walking dimensions and for spasticity with Modified Ashworth Scale (MAS) before starting the treatment. Children were randomly divided into two groups: Group E (n=10) and Group C (n=10). Group E received conventional physiotherapy along with Neurodevelopmental Therapy and Group C received Conventional Physiotherapy alone. The duration of treatment was 16 weeks with 4 days/week. All the subjects were re-assessed for GMFM-88 Scale and MAS at the end of 8th week of treatment and at the end of 16th week of treatment.

Result: The result showed that there was a significant improvement ($p<0.05$) in GMFM-88 Scale and MAS scores in both Group E and Group C after 16 weeks of treatment. But when both Groups were compared, Group E show significant ($p<0.05$) improvement as compared to Group C.

Conclusion: This study showed significantly positive effect of NDT along with conventional physiotherapy on gross motor function and Spasticity in spastic diplegic CP children.

Keywords: Cerebral Palsy (CP), Conventional Therapy, Gross Motor Function, Gross Motor Function Measure-88, Neurodevelopmental Therapy (NDT), Spasticity.

INTRODUCTION

Cerebral Palsy is a disorder which is characterized by abnormal tone, posture and movement causing activity limitations[2]. The incidence of CP is 2-3 cases per 1000 live births[3].The topographic classification of CP is monoplegia, hemiplegia, diplegia and quadriplegia[4]. CP can also be classified based on the type of neuromuscular deficit into Spastic, Dyskinetic, Ataxic, and Mixed. Spastic diplegic cerebral palsy mainly affects muscle control and coordination and affected people have increased muscle tone which leads to tight muscles and exaggerated reflexes. The goal of management of cerebral palsy is

not to cure or to achieve normalcy but to increase functionality, improve capabilities, and sustain health in terms of locomotion, cognitive development, social interaction, and independence. Management of CP is divided into medical, orthopaedic and therapeutic management. Oral medications commonly used are baclofen, dantrolene, diazepam etc. to relax muscle and reduce spasm[1]. Orthopaedics surgeries include soft tissue release, tendon transfer etc.¨ Physical therapy interventions include NDT, Sensory Integration Therapy, Hippotherapy, Constraint -induced movement therapy, Vojta therapy, Conventional exercise therapy etc.[3]. Neurodevelopmental treatment. (NDT) is one of the most popular in the treatment of children suffering from CP with objective of progression of normal motor development and to prevent the development of secondary impairments due to muscle contractures, joint and limb deformities. Conventional exercise therapy encompasses the treatment regimen which includes passive movement, progressive resisted exercises, passive stretching and weight bearing exercise. The aim of this study is to evaluate the Effectiveness of Neurodevelopmental Therapy with Conventional Physiotherapy on Gross Motor Function and Spasticity in Spastic Diplegic Cerebral Palsy Children.

METHODOLOGY

After obtaining the Ethical approval for the study from Research & Ethics Committee of the institute, a total of 30 children, both males and females with age group 2 to 14 years, Spastic Diplegic CP, score of 3 or less in Modified Ashworth Scale and who were able to follow simple commands were included whereas children with congenital deformities, inability of child's parent or care giver participation, undergone any cardiac, hip, knee, and spinal surgeries, uncontrolled epilepsy, Ataxic, Athetoid CP and children with severe complications were excluded from the study. Written consent was obtained from the parents or caregivers who fulfilled the selection criteria.

All the children were randomly divided into 2 equal groups. Pre and post-test design with comparison treatments was chosen. GMFM-88 and Modified Ashworth scale were used as outcome measures. During pre- test, each child of both groups was evaluated by using GMFM- 88 and Modified Ashworth scale. The Gross Motor Function Measure-88 (GMFM-88) is used to measure changes in gross motor function in children with CP and consists of 88 items in five dimensions: lying and rolling (GMFM-A); sitting (GMFM-B); crawling and kneeling (GMFM-C); standing (GMFM-D); and walking, running and jumping (GMFM-E)[5]. MAS is a 6-point rating scale that is used to measure spasticity. Scores range from 0 (no increase in muscle tone) to 4(affected part rigid in flexion or extension)[6]. Group E of 15 participants, received (NDT with conventional therapy) and Group C of 15 participants received conventional therapy alone. Study duration was of 16 weeks. Post-test was performed 8 weeks and 16 weeks after the treatment using GMFM-88 and Modified Ashworth scale and the results were compared.

Group E

The subjects in Group E received NDT interventions[7] such as sit to stand, weight shift to stand from half kneeling, Standing (Symmetrical Stance), forward walking, facilitation from the rib cage and pelvis. Passive stretching to Quadriceps, Hip flexors and adductors, ilio-tibial band, Hamstring and Gastrocnemius, Four treatment sessions per week for four months. Along with NDT Group E received conventional physiotherapy.

Group C

The subjects in Group C received only conventional physiotherapy exercises such as Stretching, sitting to

standing, long sitting practice, Cross sitting practice, weight -bearing, staring practice, standing and walking[8]. Group C also received 4 treatment sessions per week for 16 weeks.

Components	Parameters
• Stretching of both lower limbs	1set/ 10 rep
• Sitting to standing	1set/ 10 rep
• Long sitting practice	5 min
• Cross sitting practice	5 min
• Weight -Bearing	5 min
• Staring practice	5 min
• Standing	10 min

RESULTS

Overall, 20 children completed the complete duration of the treatment for 16 weeks. 10 in Group E (6 males, 4 females, age range 2-14 years; mean age 3.3 years) and 10 in Group C (5 females, 5 males, age range 2-14 years; mean age 3.9 years). Paired 't' test was used to compare the pre- test and post- test scores of GMFM- 88 and Modified Ashworth scale within each group (E and C). Independent t-test was used for the comparison between Pre and post treatment scores of GMFM- 88 and Modified Ashworth scale in between the Group E and C. An alpha level of $p < 0.05$ was the level of significance for the test.

Figure 01: Graphical representation of Comparison of Mean and Standard Deviation of GMFM-88 scores at 0^{th} week, at the end of 8^{th} and 16^{th} week between Group E and Group C.

Figure 02: Graphical representation of Comparison of Mean and Standard Deviation of MAS scores of Right and left Hip Adductor muscles at 0^{th} week, at the end of 8^{th} and 16^{th} week between Group E and Group C.

Figure 03: Graphical representation of Comparison of Mean and Standard Deviation of MAS scores of Right and left Hamstring muscles at 0^{th} week, at the end of 8^{th} and 16^{th} week between Group E and Group C.

Figure 04: Graphical representation of Comparison of Mean and Standard Deviation of MAS scores of Right and left Gastrocnemius muscles at 0^{th} week, at the end of 8^{th} and 16^{th} week between Group E and Group C.

DISCUSSION

Cerebral palsy describes a group of permanent disorders of the development of movement and posture, causing activity limitation i.e. attributed to non-progressive disturbances that occurred in the developing infant brain[9]. There is abnormal muscle tone and less gross motor functions which effects control of head and overall posture[10]. According to Bobath concept changes in the nervous system may be organized. With behaviour experiences, there is the potential to modulate cortical structure and function. Any changes in the task, individual or environment result in the adaption and re-organization of the nervous and muscular system[11]. The purpose of the study was to evaluate the effectiveness of NDT along with Conventional Physiotherapy on gross motor function and spasticity in spastic diplegic cerebral palsy children. The previous studies and evidences were more on effectiveness of NDT with Myofascial Release in improving gross motor function in children with Spastic CP. Less research data was available on the effectiveness of NDT along with Conventional Physiotherapy in spastic diplegic cerebral palsy children.

Ahmed MA et al[12] concluded in their study that NDT is a more effective method to improve fine motor function in hemiplegic cerebral palsy. SHAMS AA et al[13] conducted a study whose results also showed that the neurodevelopment treatment and sensory integration therapy improved gross motor function in children with cerebral palsy in four dimensions (rolling, sitting, crawling, and kneeling, standing) This study is relevant with our study for the use of NDT in spastic diplegic cerebral palsy children.
Knox and Evans[14] reported that children with CP showed a significant improvement in gross motor function following Bobath Therapy. Tsorlakis et al[15] reported that gross motor function improved significantly after 15 weeks of NDT intervention. Ramya Ramasamy Sanjeevi et al[16] conducted a study to compare the effectiveness of Neuro-Developmental Therapy (NDT) with Myo-Fascial Release (MFR) and NDT on gross motor function in children with spastic Cerebral Palsy. Their study concludes that NDT with MFR therapy is greater in improving the gross motor function than NDT alone in improving gross motor function in children with spastic CP. So, the results of these studies emphasized on the need for studies involving NDT along with Conventional Physiotherapy in cerebral palsy child. Eun Young Park et al[17] investigated the effect of Neurodevelopmental treatment based physical therapy on the change of muscle strength, spasticity, and gross motor function in children with spastic cerebral palsy in which it was concluded that NDT based physical therapy in children with CP seems to be effective in reducing spasticity, but does not improve gross motor function. Their study is consistent with our present study in reducing spasticity but it is not consistent in the results of gross motor functions. Small sample size, gender discrepancy in group E where males were more in number than females were some limitations of the study. Our study also provides an idea of utilizing NDT & conventional therapy in an effective manner to improve Gross Motor Function and to reduce spasticity in different types of CP.

CONCLUSION

This study concluded that Neurodevelopmental Technique combined with conventional physiotherapy is more effective in reducing spasticity and improving gross motor functions than Conventional Physiotherapy alone. Although Conventional therapy also showed significant improvement in treating these patients. It is reasonable to conclude that NDT combined with Conventional physiotherapy has slight edge over Conventional therapy alone. Thus, NDT should be implemented in physiotherapy protocol of Spastic Diplegic Cerebral Palsy children, as it will be helpful in reducing spasticity and improving gross motor functions.

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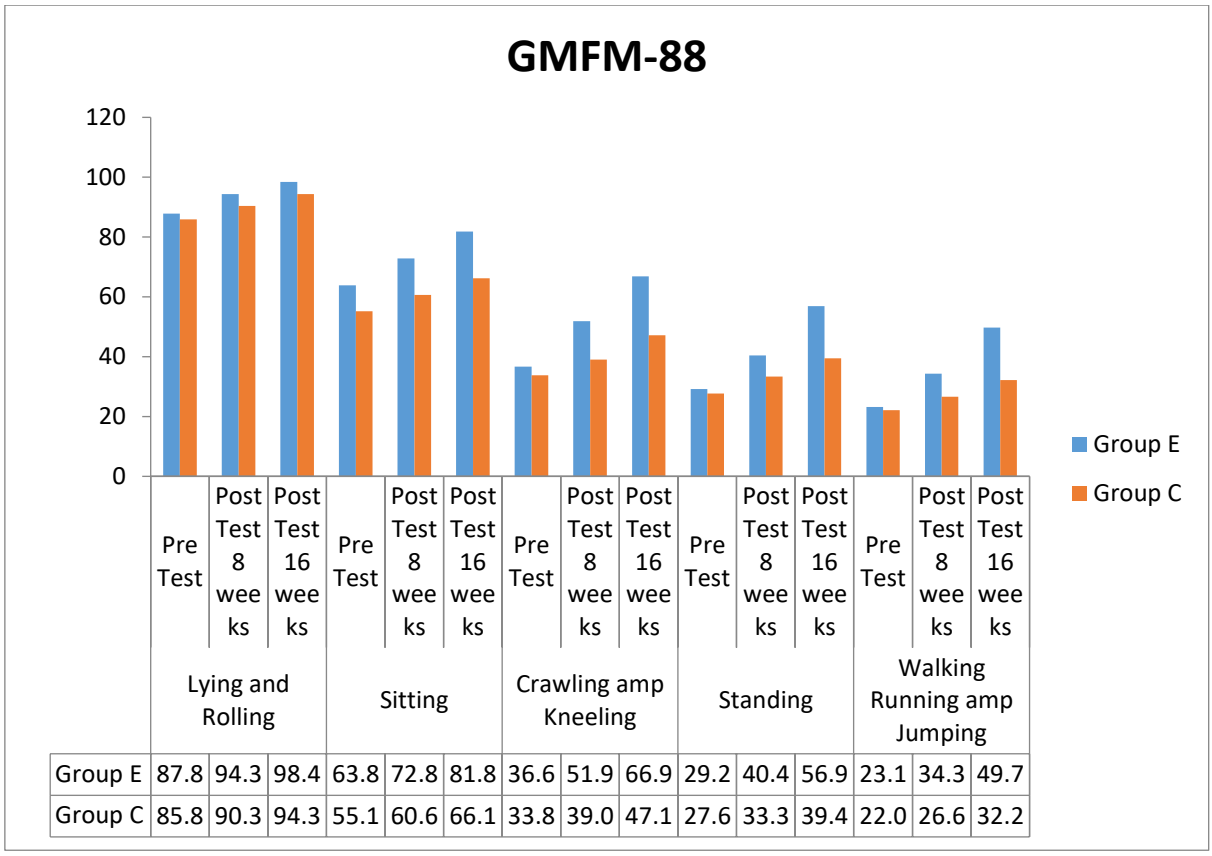
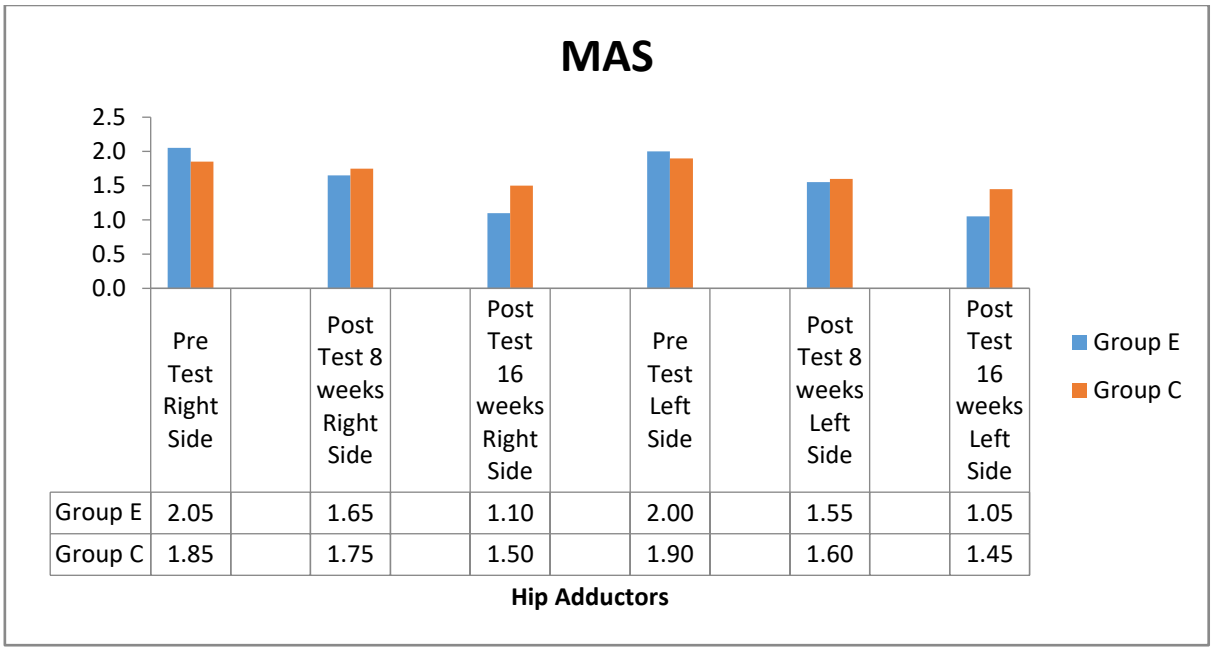


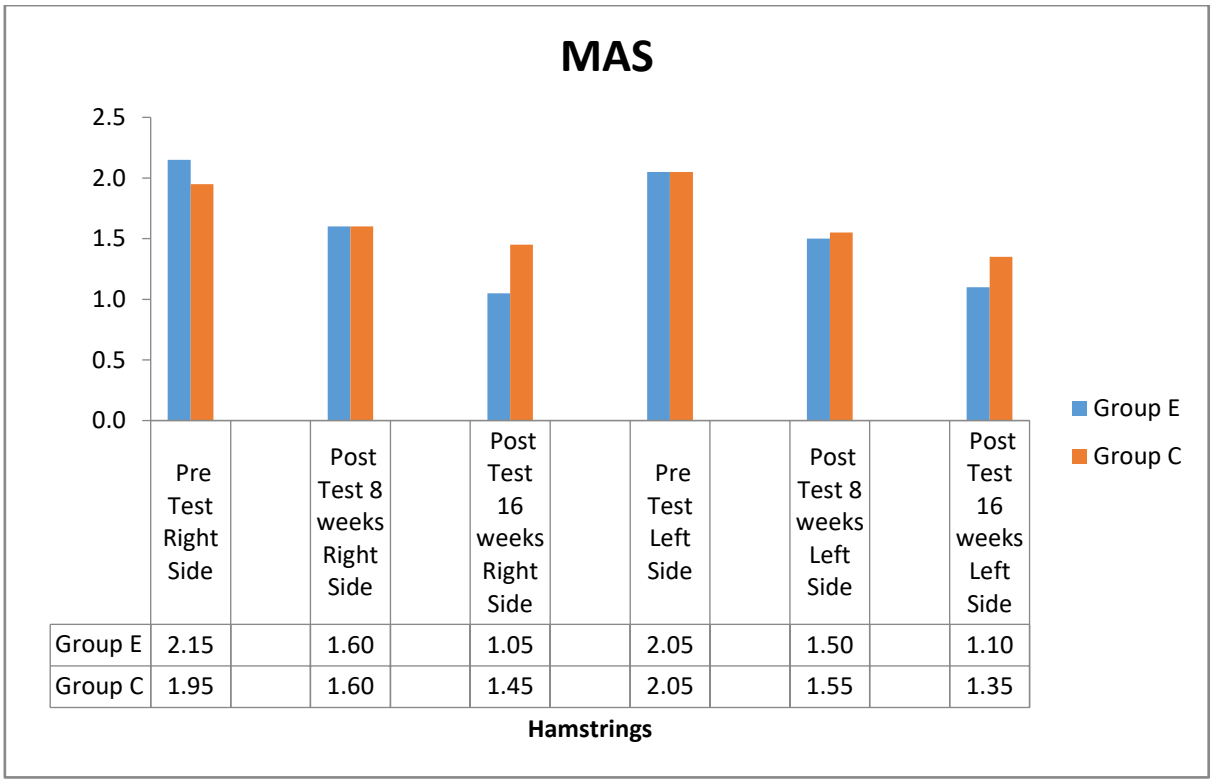
	Lying and Rolling			Sitting			Crawling amp Kneeling			Standing			Walking Running amp Jumping		
	Pre Test	Post Test 8 weeks	Post Test 16 weeks	Pre Test	Post Test 8 weeks	Post Test 16 weeks	Pre Test	Post Test 8 weeks	Post Test 16 weeks	Pre Test	Post Test 8 weeks	Post Test 16 weeks	Pre Test	Post Test 8 weeks	Post Test 16 weeks
Group E	87.8	94.3	98.4	63.8	72.8	81.8	36.6	51.9	66.9	29.2	40.4	56.9	23.1	34.3	49.7
Group C	85.8	90.3	94.3	55.1	60.6	66.1	33.8	39.0	47.1	27.6	33.3	39.4	22.0	26.6	32.2

Figure 01: Graphical representation of Comparison of Mean and Standard Deviation of GMFM-88 scores at 0th week, at the end of 8th and 16th week between Group E and Group C.



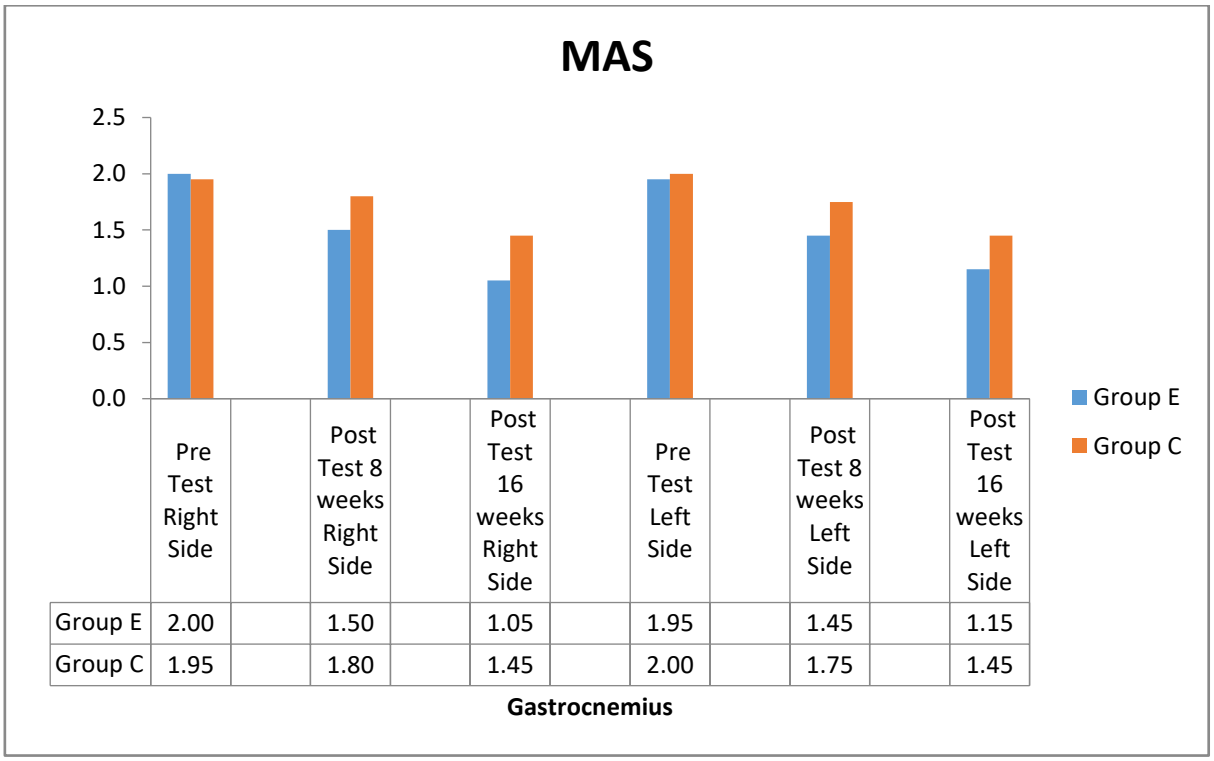
	Pre Test Right Side		Post Test 8 weeks Right Side		Post Test 16 weeks Right Side		Pre Test Left Side		Post Test 8 weeks Left Side		Post Test 16 weeks Left Side
Group E	2.05		1.65		1.10		2.00		1.55		1.05
Group C	1.85		1.75		1.50		1.90		1.60		1.45

Figure 02: Graphical representation of Comparison of Mean and Standard Deviation of MAS scores of Right and left Hip Adductor muscles at 0th week, at the end of 8th and 16th week between Group E and Group C.



	Pre Test Right Side	Post Test 8 weeks Right Side	Post Test 16 weeks Right Side	Pre Test Left Side	Post Test 8 weeks Left Side	Post Test 16 weeks Left Side
Group E	2.15	1.60	1.05	2.05	1.50	1.10
Group C	1.95	1.60	1.45	2.05	1.55	1.35

Figure 03: Graphical representation of Comparison of Mean and Standard Deviation of MAS scores of Right and left Hamstring muscles at 0th week, at the end of 8th and 16th week between Group E and Group C.



	Pre Test Right Side	Post Test 8 weeks Right Side	Post Test 16 weeks Right Side	Pre Test Left Side	Post Test 8 weeks Left Side	Post Test 16 weeks Left Side
Group E	2.00	1.50	1.05	1.95	1.45	1.15
Group C	1.95	1.80	1.45	2.00	1.75	1.45

Figure 04: Graphical representation of Comparison of Mean and Standard Deviation of MAS scores of Right and left Gastrocnemius muscles at 0th week, at the end of 8th and 16th week between Group E and Group C.