International Journal of Health Sciences and Research
Volume 14; Issue: 7; July 2024
Website: www.ijhsr.org
Original Research Article *ISSN: 2249-9571*

Effectiveness of Myofascial Release Technique (MFR) With Action Observation Therapy (AOT) On Hand Function Among Children with Hemiplegic Spastic Cerebral Palsy – A Randomized Control Trial

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DOI: https://doi.org/10.52403/ijhsr.20240705

ABSTRACT

Introduction: Cerebral palsy (CP) is a group of disorders affecting the development of movement and posture causing activity limitation due to non-progressive disturbances that occur in the developing fetal or infant brain. It develops due to damage to CNS and this damage can take place before, during or immediately after the birth of the child. CP involves a group of motor & sensory impairments as well as postural dysfunctions caused by a non-progressive lesion in the immature brain.
Method: Randomized control trial was conducted on 35 hemiplegic CP individuals which were divided into two groups as Group A: Intervention group and Group B: Control group. Pre intervention Quality of Upper Extremity Skills Test (QUEST) was taken. Individuals in group A were given myofascial release therapy (MFR) along with action observation therapy (AOT). Individuals in group B were given conventional therapy. Post intervention QUEST result was taken.
Result: Paired t test was performed. The test revealed statistically significant difference among both the groups between pre and post scores. The mean value of post treatment in QUEST scale in group A is more than group B indicating more improvement in hand function in group A than group B. The difference between pre and post values of QUEST scale were noted and they were compared between two groups with the help of unpaired t test. The test revealed statistically significant difference in group A than group B.
Conclusion: It is concluded that MFR along with AOT is more effective to obtain the improvement in hand function among children with hemiplegic spastic CP.

Keywords: Hemiplegic Cerebral palsy, spastic cerebral palsy, myofascial release, action observation therapy, Quality of Upper Extremity Skills Test, hand function

INTRODUCTION

Cerebral palsy (CP) is a group of disorders affecting the development of movement and posture causing activity limitation due to non-progressive disturbances that occur in the developing fetal or infant brain. It develops due to damage to CNS and this damage can take place before, during or

immediately after the birth of the child. Cerebral palsy involves a group of motor & sensory impairments as well as postural dysfunctions caused by a non-progressive lesion in the immature brain. Cerebral palsy is mainly classified based on type of movement disorder as spastic, ataxic, athetoid and mixed. It is also classified based on topography as hemiplegia, diplegia and quadriplegia. [(1)] In Cerebral Palsy, the lesion in CNS frequently results in spasticity of various muscle groups. Spasticity is characterized by velocity dependent increase in muscle tone with increased resistance to stretch. [(2)] Spasticity occurs as a result of loss of upper motor neuron inhibition on lower motor neurons which results in increased or impaired motor unit firing & altered muscle tone.

Hemiplegic spastic CP is mainly the result of middle cerebral artery infarct, periventricular lesions or brain malformations and integrity of motor areas and corticospinal tract is compromised. [(3)] Children with hemiplegic spastic CP often have marked hand involvement which often lead to limitations in ADLs. The severity of hand impairments depends on the extent of damage to corticospinal tracts. Corticospinal tracts directly innervate hand motor neurons, which provide the capacity for upper limb motor control. [(3)] Andrew Gordon et. al. studied the pathophysiology of impaired hand function in hemiplegic cerebral palsy. The study described relation between corticospinal tract damage and hand function. The study showed impairments in motor execution, sensorimotor integration, motor planning and bimanual coordination beyond dexterity impairments. [(3)] Marianne Arner studied various aspects of hand function in cerebral palsy. The study described that mainly hand function is hindered by an increased or varying muscle tone causing imbalance and sometimes contractures. Some surgeries are also done like muscle tendon lengthening for spasticity reduction. Also new techniques are available for functional training. [(7)]

Myofascial release (MFR) technique is a manual therapy that includes stretching the myofascial complex for treating myofascial limitations. [(4)] Myofascial therapy can be defined as “the facilitation of mechanical, neural and psycho physiological adaptive potential as interfaced by the myofascial system”.[(4)] MFR is application of long duration stretch to myofascial structure in order to restore optimal length, decrease pain and improve function. [(5)] The purpose of deep myofascial release is to release restrictions within the deeper layers of fascia. This is obtained by a stretching of the muscular elastic components of the fascia.

Action observation therapy (AOT) is a rehabilitation technique which involves observation of purposeful actions by the patient with intention to imitate and then perform those actions. [(6)] It involves 2 phases:

a. Observation phase: In this phase, patient is asked to carefully observe the video clip.
b. Execution phase: During this phase, patient is asked to perform the observed motor task at the best of his/her ability.

Giovanni Buccino et.al conducted a pilot study to assess whether action observation therapy may improve upper limb motor functions in children with cerebral palsy. The study showed that action observation therapy can be an effective part of rehabilitation programme in children with cerebral palsy. [(8)]

The aim of the study was to find the effectiveness of Myofascial Release Technique (MFR) with Action Observation Therapy (AOT) on hand function among children with hemiplegic spastic Cerebral Palsy with the help of Quality of Upper Extremity Skills Test (QUEST) within 6 weeks.

MATERIALS & METHODS

METHODS

This was a randomised control trial conducted on 35 hemiplegic cerebral palsy individuals which were divided into two groups as Group A: Intervention group and Group B: Control group. The study was double blinded study. Participants were divided into groups with the help of chit method. Cerebral palsy individuals were selected based on the inclusion and exclusion criteria. Inclusion criteria was both males and females within 6 to 20 age group, hemiplegic spastic type of cerebral palsy, spasticity grade 2 or less by Modified Ashworth Scale, children with sensory integrity, visual ability level I and II by Visual Function Classification System(VFCS), fine motor activity level I, II and III by Manual Ability Classification System (MACS). Exclusion criteria was musculoskeletal deformities or contractures in upper limb, any previous orthopaedic surgery of upper limb, severe limitations in PROM, fractures of upper limb, cognitive impairment assessed by Modified Mini Mental Scale for children, sensory loss in upper limb, children with hyperactivity and unable to follow commands.

PROCEDURE

The study was started with the presentation of synopsis and ethical clearance from the ethical committee. Participants were selected according to the criteria. The study was explained and intervention was informed to the parents and written consent was taken.

Pre intervention Quality of Upper Extremity Skills Test (QUEST) was taken. All the four domains were considered and hand function was assessed. Individuals in group A i.e. Intervention group was given myofascial release therapy along with action observation therapy. Myofascial release therapy was given for 90 to 120 secs to each muscle. Targeted muscles were biceps brachii, deltoid, brachioradialis, pronator teres, flexor carpi radialis, flexor carpi ulnaris, thenar muscles, hypothenar muscles, interossei and lumbricals. After this action observation therapy was given. A video clip of 12 mins was shown to the participants which included all the upper limb goal-oriented tasks. Participant was asked to carefully watch the video clip of 12 mins which showed 15 different daily routine tasks. Each action in each task was subdivided into 3 to 4 segments. E.g. drawing with a pencil. It was subdivided as holding a pencil in one hand → drawing a simple shape → keeping the pencil back on the table.

15 tasks performed were [8]

1. Grasping and moving an object in the horizontal plane
2. Grasping and moving an object in the vertical plane
3. Using a pencil
4. Eating a candy
5. Eating an icecream
6. Manipulating a cube with both hands
7. Playing with two small cars
8. Reading a book
9. Using an hourglass
10. Opening and closing a jar
11. Opening a house game with key
12. Drawing with a pencil, after sharpening it
13. Playing with Lego
14. Playing a piano with both hands
15. Writing with a pen

The whole therapy (MFR + AOT) was given for 4 weeks, 5 days per week, 30 – 45 min/session.

Individuals in group B i.e. conventional group were given conventional therapy as follows:

1. Passive stretching
2. Graduated active exercise for upper limb muscles
3. Passive movements for upper limbs
4. Strengthening of upper limb muscles
5. Functional exercises for upper limb
6. Rigid plaster application to reduce spasticity

Post intervention QUEST result was taken

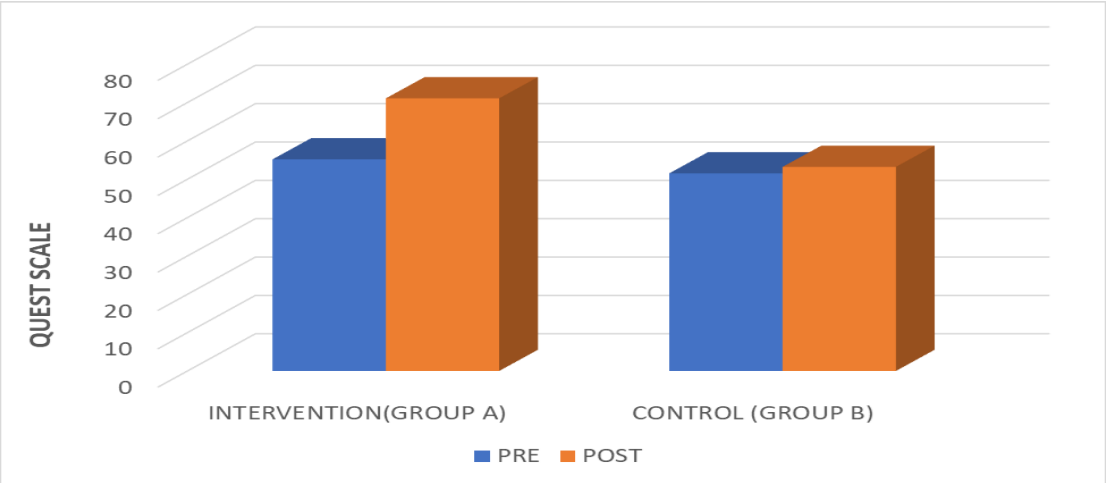
RESULT

35 subjects were selected according to the inclusion and exclusion criteria. They were divided into two groups A and B by chit method. Group A received MFR along with AOT and group B received conventional therapy only. Pre and post values of QUEST scale were noted and they were compared within the group with the help of paired t test. The test revealed statistically significant difference among both the groups between pre and post scores. The mean value of post treatment in QUEST scale in group A is more than group B indicating more improvement in hand function in group A than group B. The difference between pre and post values of QUEST scale were noted and they were compared between two groups with the help of unpaired t test. The test revealed statistically significant difference in group A than group B.

PRE AND POST COMPARISON OF QUEST SCALE

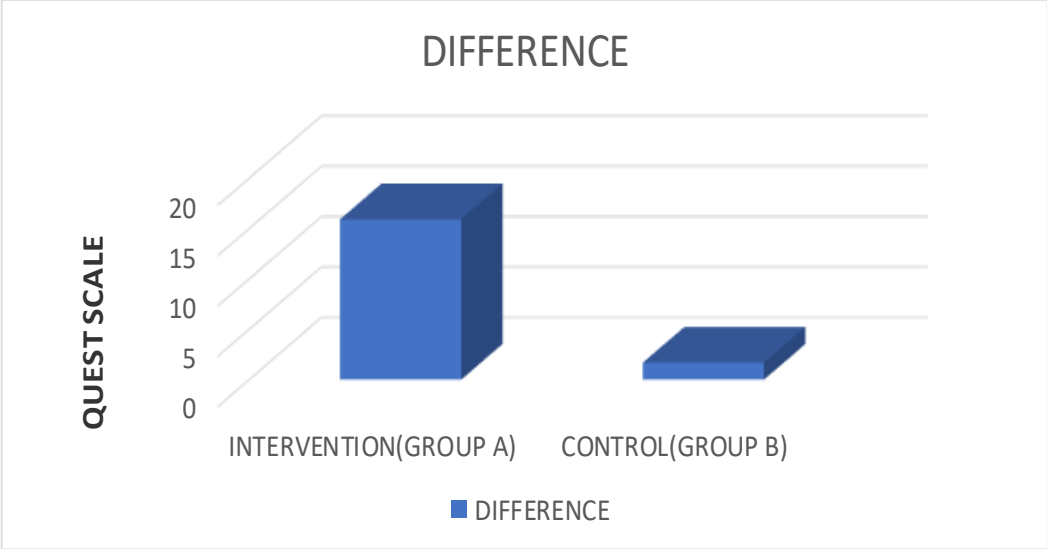
	INTERVENTION (GROUP A)	CONTROL (GROUP B)
PRE-TREATMENT	55.1744 ± 5.62186	51.52353 ± 5.005438
POST TREATMENT	71.0872 ± 7.69058	53.21176 ± 5.097902
t value	11.99	2.667
p value	<0.05	<0.05
RESULTS	HIGHLY SIGNIFICANT	SIGNIFICANT

The mean values for post treatment of group A and group B indicate that there was considerable improvement in hand function in group A than group B.



DIFFERENCE IN PRE AND POST RESULTS OF GROUP A AND GROUP B QUEST SCALE

	DIFFERENCE
INTERVENTION (GROUP A)	15.9128 ± 5.62943
CONTROL (GROUP B)	1.688235 ± 1.200459
p value	10.19
t value	<0.05
RESULTS	HIGHLY SIGNIFICANT



DISCUSSION

This study shows effectiveness of myofascial release therapy along with action observation therapy on hand function in spastic hemiplegic cerebral palsy individuals. The statistical analysis of the study shows that the combined therapy of myofascial release and action observation therapy has significant effect on pre and post hand functioning. The difference between pre and post values of QUEST scale which measures hand function is

found to be statistically significant. The difficulties while using hand in day-to-day activities that the children face is the main focus of the study. Hemiplegic CP is most common motor disorder in children and the most common complication in these children is movement and function of the affected side especially the hand. In CP, hand function is affected by change in muscle tone causing difficulty in obtaining independence in daily activities and if not treated leads to contractures. The muscle tone is most commonly increased causing spasticity. The spasticity in upper extremity muscles restricts the gross as well as fine motor functioning and movement of hands which enables the child to carry out his day-to-day activities. Myofascial release is application of low load sustained stretch which allows the myofascial tissue to elongate and relax thus reducing the hyperactive reflex which eventually helps to reduce spasticity. Myofascial release technique targets the fascia surrounding the muscles. Spasticity is involuntary muscle contraction and stiffness. Myofascial release helps to reduce spasticity by breaking up the adhesions, increasing blood flow and improving the flexibility. The gentle stretching and the pressure given in myofascial release technique helps to break the fascial restrictions thus decreasing the muscle hypertonicity. However gentle stretching and soft tissue manipulation given in myofascial release can help the hypertonic muscles to relax by stimulating the muscle spindle fibres. This relaxation response can reduce spasticity.

Sandra L. Whisler et al in 2012 conducted a study on effects of myofascial release on children with cerebral palsy. The study was showed decrease in muscle tone in both upper extremity as well as lower extremity. The study also noted a more symmetrical body position, decrease in muscle tone and increase in ROM. [9]

However, Chandan Kumar et al in 2014 conducted a study on effectiveness of myofascial release on spasticity and lower extremity function in diplegic cerebral palsy which showed that MFR along with other physiotherapy technique reduces spasticity. [5]

Action observation therapy is a rehabilitation technique which includes observation of goal-oriented tasks with intention to imitate and then performing those tasks.

Giovanni Buccino et al in 2012 conducted a study on improving upper limb motor functions through action observation treatment: a pilot study in children with cerebral palsy. The study concluded that AOT is a promising rehabilitation tool in children with CP. [8]

AOT targets mirror neuron system. Mirror neurons in humans are present in inferior parietal lobe and caudal part of inferior frontal gyrus. AOT facilitates activation of mirror neuron system through video observation. The sensory representation of observed motor acts is transformed into motor representation. [10] Mirror neurons are discharged during execution of goal-directed actions as well as during observation of goal- oriented actions through video clips. The observation of actions performed by other individuals recruits in the observer in the same areas involved in actual execution of those same actions.

Giovanni Buccino et al in 2018 concluded that AOT has potential to become a routine approach in rehabilitation of children with CP and could be easily applied by physiotherapists.

Abayneh Alamer et. al in 2020 conducted a study suggesting effectiveness of action observation therapy on upper limb motor function in children with hemiplegic cerebral palsy: A systematic review of randomized control trail. The study showed action observation therapy is found to be effective in improving upper limb motor function. [6]

In this study all the 35 subjects were assessed and divided into 2 groups A (intervention) and B (control) by the help of

chit method. The treatment was given and the individuals showed statistically significant improvement in hand function in 4 weeks of MFR with AOT treatment. According to the study results, the statistical reading of data shows that the improvement in hand function is more in group A than group B.

CONCLUSION

It is concluded that myofascial release therapy along with action observation therapy is more effective to obtain the improvement in hand function among children with hemiplegic spastic cerebral palsy.

The limitation of the study can be duration of protocol was less.

Future research can be done on diplegic and quadriplegic population. Also the research can be carried out by extending the duration of protocol. Another therapy along with action observation therapy can be added to study the combined effect.

Declaration by Authors

Ethical Approval: Approved

Acknowledgement: None

Source of Funding: None

Conflict of Interest: The authors declare no conflict of interest.

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How to cite this article: Siddhima Hardikar, Charuta Sinnarkar. Effectiveness of myofascial release technique (MFR) with action observation therapy (AOT) on hand function among children with hemiplegic spastic cerebral palsy – a randomized control trial. *Int J Health Sci Res.* 2024; 14(7):35-42. DOI: *https://doi.org/10.52403/ijhsr.20240705*

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