Effect of Core Stability Exercises on Low Back Pain and Disability in Mother's of Cerebral Palsy

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Abstract

Background: In mothers with Cerebral Palsy children,higher prevalence of musculoskeletal disorders are seen due torepetitive bending, lifting, and twisting activity while taking care of the child.Reduced core muscle strength especiallyof Transverse Abdominis&Multifidusmuscle will lead to increase in low back pain and disability in this population. Hence, the purpose of this study was to find out the effect of Core Stability exercises on low Back pain and disability in mothers of Cerebral Palsy Children.

Method: Thirty mothers with chronic low back pain who fulfilled the inclusion criteria were included in the study. Core muscle strength was assessed using pressure Bio-Feedback, pain was measured using Visual Analogue Scale and Disability was measured using Owestry Disability Index. Core stability exercises were given for 3 times a week for 6 weeks.

Result: The result showedthat there was significant improvement in Core muscle strength, and reduction in pain and disability in patients with Chronic Low Back pain.

Conclusion: The study concluded that there was significant improvement in the abdominal muscle strength, low back pain score and disability score post core stability exercises in mothers of cerebral palsy children having low back pain.

Keywords: *cerebral palsy mothers, Core Stability exercises, Pain, Disability.*

Introduction

Low back pain is defined as the pain that occurs in an area with boundaries between the lowest rib and the crease of the buttocks [1]. Patients with chronic low back pain present with altered psychomotor functioning such as delayed information processing for stimulus and poor postural control.[2,3]They also experience more frequent and severe pain leading to have poorer scores for physical and social functioning and it affects quality of life and there is financial burden.[4]The symptoms of chronic mechanical low back pain are usually worsened by activity like bending, extending, twisting, lifting and improved partially by rest.[5]Pain and muscle weakness are the most common obstacles in carrying out activities of daily living. [2]

Cerebral palsy is a non-progressive condition mainly with motor impairment. Mothers are mostly the primary caregivers. Children suffering from cerebral palsy are unable to do their daily activities and thus needs assistance. This activity involves frequent lifting and carrying of the child, carrying orthosis, assistive aids along with the child which may lead to musculoskeletal disorder. It was observed in a study by authers that the lumbar spine was the most common location of pain (n=104; 58.1%) and was followed by the cervical spine (n=58; 32.4%) and thoracic spine (n=32;17.9%). Intensity of pain in mothers of CP children depends on the functional ability of the child, the GMFCS level of

the child , body weight and age of the child and also the number of times the child is lifted by the mother.[6]

Several studies have shown that there is altered or delayed neuromuscular recruitment patterns in the core stabilizing muscles of the lumbar spine during active movement in individuals with low back pain. Recruiting the core muscles and training them to respond in co-ordination with the global muscles to various forces and demands helps to improve overall function. Core stability exercise can be defined as restoration or augmentation of the ability of the neuromuscular system to control and protect the spine from injury or re injury. [7]Activation of this stabilizing musculature is reinforced by progressing to muscular endurance and strength training. As the rehabilitation program progresses the muscle activation of the stabilizing muscles will become automatic during all the daily activities and functional tasks.[8] Hence core stability exercises are beneficial in patient with chronic low back pain. So purpose of this study was to assess effect of core stability exercises on back pain and disability in this population.

Materials and Method

Pre and Post experimental study with convenient sampling was done in Physically Handicapped Institute Pune and M.A. Rangoonwala college of Physiotherapy, Pune. Thirtysubjects i.e. mothers as primary caregiver of cerebral palsy child with medical certificate stating the diagnosis as cerebral palsy, age of mothers above 21 years having child between 3-15 years of age with Gross Motor Functional Classification System(III,IV,V) for cerebral palsywere included in the study subjects suffering with chronic low back pain for more than 3 months with Visual Analogue Scale (0-6). Patients suffering from Spondylolisthesis, Rheumatoid Arthritis, Neoplastic disorders, Disc degeneration facet joint,spondylarthosisand subjects involved in any exercise were excluded.

Patients were evaluated for core muscle strength using Pressure bio- feedback[9], pain using Visual Analogue Scale(VAS)[10] and Disability using the Oswestry Disability Index[11]. Before starting the exercisessubject did warm up exercises and cool down exercises after the session

Pressure bio- feedback

Subjects were asked to empty their bladder before the testand positioned supine crook lying with hip flexed at 45 degrees. Subjects were given proper instructions about activation of transverses abdominis muscle. It was confirmed with palpation. The inflatable cuff was placed under the hollow of the lumbar spine (between L1 and S1).The cuff was inflated to the baseline pressure of 40mmHg. The subjects were then asked to take a relaxed breath and while expiration to draw in the abdominal wall towards the spine so as to contract the deep abdominal muscles, raising the pressure up to 10mmHg and recommence the breathing and hold up to 10 seconds. The test was repeated three times and the maximum pressure was recorded.(12)

CORE ACTIVATION

(1st and 2nd weeks) **LEVEL 1:**	**Draw in and hold for 10 seconds**
LEVEL 2 : Hold for 5 sec. Repetition 10.	Opposite lower extremity on plinth; bent leg fall out
(3rd and 4th week) LEVEL 3 : Hold for 10 sec. Repetition 10.	Opposite lower extremity on plinth a)Lift bend leg to 90˚ hip flexion b)Slide heel to extend knee c)Lift straight leg to 45˚
(5th and 6th weeks) LEVEL 4 : Hold for 10 sec. Repetition 10	Hold opposite lower extremity at 90˚ of hip flexion with upper extremity a)Lift bend leg to 90˚ hip flexion b)Slide heel to extend knee c)Lift straight leg to 45˚

MULTIFIDUS

(1st and 2nd week) LEVEL 1: QUADRIPOD POSITION LEVEL 2:QUADRIPOD POSITION LEVEL 3:QUADRIPOD POSITION Hold for 5 sec. Repetition 10	Multifidus Activation Flexion of one upper extremity Extension of one lower extremity by sliding it along the plinth
(3rd and 4th week) LEVEL 4 :QUADRIPOD POSITION LEVEL 5:QUADRIPOD POSITION Hold for 10 sec. Repetition 10	Extend one lower extremity and lift 6-8 inches off the plinth Flexion of one upper extremity and extension of contralateral lower extremity
(5th and 6th week) LEVEL 6 :PRONE LYING POSITION Hold for 10 sec. Repetition 10	Extension of one lower extremity

Results

Table 1: Demographic characteristics of the study participants (N=30)

Variables	Sub-groups	N	%
Child GMFCS level	3	6	20.0
	4	15	50.0
	5	9	30.0
Age (Mean ± SD) years		33.23 ± 7.542	

	Pre	Post	t value	P value
VAS SCORE (Mean)	4.997(±0.78)	2.38(±0.68)	19.151	<0.001**

Table 2 shows comparison of VAS score of pre and post by unpaired T test. This shows statistical significant reduction post treatment in VAS score

	Pre	Post	t value	P value
PRESSURE BIO-FEEDBACK SCORE IN mmHg (Mean)	40.00(±2.53)	42.53(±1.04)	13.321	<0.001**

Table 3 shows comparison of the effect of core strengthening exercises on core muscle strength in mothers of cerebral palsy children using pressure bio feedback. It shows statistical significance which suggests oblivious strength improvement in core muscles.

Group	Pre	Post	t value	P value
ODI SCORE (Mean)	30.378(±5.33)	20.556(±3.7)	9.619	<0.001**

Table 4: Comparison of the effect of core strengthening exercises on disability in mothers of cerebral palsy children using the Oswestry Disability Index. This suggests statistical significance which suggests improvement in disability score of caregivers

Discussion

Low back pain contributes significantly to morbidity in general population and it has a high rate of disability associated with it. [13]Women, specially mothers have to do all such activities which results in persistent back pain in them. As children with CP have impaired motor function, sensory and intellectual impairments and limitations in self care such as mobility, this long term dependency places physical and psychological strain on the caregivers.[8]

Table 3 shows the effect of core stability exercises on low back pain in mothers of cerebral palsy children using Visual Analog Scale. There was significant reduction in pain measured by VAS.

Pain causes reduced motor control and also reduced motor control can cause pain.[13,14] Reduced motor control causes reduced stability in the spinal level and also in the proprioception. All these deficits in the motor control lead to delayed activation and loss of coordination in the abdominal musculature.[13] If not restored, this malfunctioning and regulation of dynamic movement leads to inappropriate muscle activity and lead to muscle tightness , imbalance, delayed activation , poor posture which lead to musculoskeletal pain in lumbar region.[13-15] Reduced motor control increases incidence of micro trauma to passive stabilisers leading to pain. This pain leads to functional disability which arises because of pain and fear of pain with functional task. Stability of spine is comprised of mainly 3 components, Neuromuscular control (neural elements) & Passive subsystem (osseous and ligamentous elements) & Active subsystem (muscular elements). In other words, stability of the spine is not only dependent on muscular strength, but also proper sensory input that alerts the central nervous system about interaction between the body and the environment, providing constant feedback and allowing refinement of movement. (9)Chronic low back pain is contributed by reduction in neutral zone, reduced active stability and delayed contraction of deep core muscles.

Motor control is required for joint protection and need to be addressed that pain is treated with exercises [13]. With core stability exercises sensory input arises from the affected tissues. These tissues are richly innervated with mechanosensory and nociceptive neurons, this lead to modulation of nociceptor activity in response to change in innervated tissues. At tissue level inflammatory mediators influence sensory inputs to nervous system.These activation carries information to CNS via sensory C fibers and enhances production of histamine and cytokines from mast cells, monocytes and endothelial cells causes pain. The mechanism behind is activation of descending nociceptive inhibitory mechanism and release of endogenous opioids. Core stability exercises triggers the release of endorphine from pituitary &hypothalamus & activating opioid receptors peripherally & centrally triggering the endogenous opioid system which results in analgesic effects via descending nociceptive inhibitory mechanism.[13, 14].The increase in tissue blood flow during lumbar stabilization exercise in patients with chronic non-specific LBP could be suggested as an integrated mechanism for releasing spasm, improving blood flow, and decreasing the inflammation of local tissues in the lumbar spine, which in return reduced pain.(16)As seen earlier these exercises increases the strength of the abdominal muscles which helps in reducing pain as it prevents injury by preventing buckling of the spine, help in balancing external loading to the spine and pain level is reduced. This is in consensus with previous studies (17, 18)

Table 2 shows the effect of core stability exercises on core muscle strength in mothers of cerebral palsy children having low back pain which was measured by using Pressure Bio- Feedback. There was statistically significant increase in abdominal muscle strength.(19) During core stability exercises muscle contraction happens at the level of sarcomere. This is when powered by nerve impulse; force is generated by sarcomere and there is entire muscle contraction. Active contraction of muscles begins with chain of actions that influences all tissues of joints. In response to activation of muscle fibre, the muscle tissue maintains its normal physiology. These exercises improves muscle fibre hypertrophy, increases capillary bed density, mitochondrial density and volume of muscles.. Repetitive contraction of muscles increases motor unit recruitment and synchronization of movement [19,20].This is in accordance to study done by VenuAkuthota et al , where they checked Tranverseabdominis and multifidus muscle thickness by ultrasound in subjects which were given the targeted exercises.(21,22)Rantanenet al. demonstrated ‘moth eaten’ type I muscle fibersin the multifidus muscle of patients with chronic back pain (23)

which plays major role in lumbar stability. So targeted muscle activation and strengthening helps in stability of spine.

In mothers repetitive task, like lifting disabled child dominates most of their activities. Long term repeated afferent inputs have a negative effect on the sensorimotor system.(15) It hampers the motor control system which causes poor control of joint movement micro-trauma and pain. There is a slow reaction time associated with it which causes further injury and pain.

In a study by Fabio Removato Franca et al named "Segmental stabilization and muscular strengthening in chronic low back pain" , both techniques lessened pain and reduced disability. Increased muscle strength of deep muscles leads to increased intersegment stability, leading to reduced physiological excursion in spinal segment leading to reduced pain. Reduction in pain essentially reduces disability by increasing ease of movement.

Table 4 shows the effect of core stability exercises on disability in mothers of cerebral palsy children using the oswestry disability index. There was a significant reduction in the disability level in these mothers.Core stabilization exercises used in the study causes isometric contraction of the muscle of the spine which is required for functional activities.[26]

With core stability exercises higher demand are placed on the motor control system which is required for rehabilitation.(1) Motor control training causes deep intrinsic muscles of the spine to provide fine tuning of the intervertebral movement whenever performing any activity.(9) Contraction of the muscles stimulated the muscle spindle and golgi tendon organ which has effects on spindle system activating the motor neurons that control slow twitch fibers. These changes in turn cause proper timely activation of the muscles and also increase muscle strength, hence creating a girdle around the spine which protects the spine from undue perturbations and improves flexibility and also coordination between superficial and deep muscles.(1)Disability is also caused by pain and fear of pain . As pain reduced due to intervention, even disability improved. This improves quality of movement and reduced load on the spine. These exercises causes plastic changes in the motor cortex and in the motor system and hence improves the functional disability.(25) Also reduced pain allows the mothers to perform their functional activities with ease and they can also take proper care of their disabled child. Because of reduction in pain and increase in muscle strength there is reduced disability in this population.

Conclusion

This study showed significant improvements in the VAS, ODI & PBF scores post core stability training in mothers of cerebral palsy children. So targeted exercises are recommended in this population.

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