



A LITERATURE REVIEW: MOTOR CONTROL ACTIVATION OF GLOBAL MUSCLES IN ANTERIOR SACROILIAC JOINT DYSFUNCTION

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ABSTRACT

Background

The major source of low back pain is dysfunction of the sacroiliac joint. Form closure and force closure are two main mechanisms that enhance SI joint stability. Biceps femoris & gluteus maximus are the key muscles contributing force closure of the SI joint, as well as promote stability through attachments with the Sacro tuberos ligament. Those with dysfunction of the anterior sacroiliac joint have been identified to have altered gluteus maximus function. However, there is a paucity of literature showing evidence on role of gluteus maximus and latissimus dorsi in SI joint dysfunction.

Purpose

To review the impact of motor control muscle activation on function, pelvic tilt, pain in anterior rotated SIJ dysfunction.

Search method

Articles were selected from PubMed , goggle scholar, pedro, research gate, science direct, Cochrane by using the key words.

Selection criteria

Articles emphasizing on motor control of gluteus maximus and latissimus dorsi activation in patients with anterior innominate SI joint dysfunction are the selection criteria.

Results

After reviewing the included articles, the motor control activation of global muscles will improve force closure of SI joint which provide great stability.

Conclusion

A literature review done on motor control activation on global muscles showed that they improve stability of the sacroiliac joint, enhancing physical function, reducing pain, and maintaining normal pelvic angle.

Key words

Motor control activation, global muscles, gluteus maximus, anterior sacroiliac joint dysfunction.

INTRODUCTION

Low back pain is caused primarily by the sacroiliac joint. Patients with low back ache often have 10% to 25% sacroiliac joint dysfunction. Form closure and force closure are the two basic mechanisms that increase SI joint stability¹. Form closure is caused mainly by the bony features of the sacrum and the surfaces of the joints, which allows the SIJ to withstand shear stresses². For such pelvis to remain stable, force closure must ideally generate a perpendicular reflex compressive force for preserving the pelvis stable. The musculature around the SI joint provide dynamic stability called force closure². The SI joint must be compressed in order to control the pelvis, which requires the muscle-ligament-fascia system. The biceps femoris, gluteus maximus, and erector spinae, latissimus dorsi are the main muscles that attach to the sacrotuberous ligament and thoracolumbar fascia, respectively providing the stability of SI joint.

Muscles that cause forceful closure

The pelvic stabilizers are composed of three main muscle slings: a longitudinal sling, a posterioroblique sling, and an anterior oblique sling.

- The posterior oblique sling is made up of the contralateral gluteus maximus, latissimus dorsi, as well as biceps femoris.
- The longitudinal sling is made up of the multifidus attaching to the sacrum, the deep layer of the thoracolumbar fascia, as well as the long head of the biceps attaching to the Sacro tuberos ligament.
- The pectoralis, external oblique, transverse abdominis, and internal oblique muscles constitute its anterior oblique sling⁴.

The proper management of the neural system is essential for the muscle force to contribute to the active control of intrapelvic motion. The specific moment when lumbopelvic muscles contract to stabilize intrapelvic motion against vertical loading. The central nervous system regulates the timing and pattern of muscle recruitment in response to the stresses placed on the lumbar spine. This result in stability of intersegmental lumbar motion. Co-contraction of the transverse abdominis, oblique internus, and multifidus via connections to the posterior layer of the thoracolumbar fascia may help influence stability of intrapelvic motion during single leg standing.⁵

Active daily activities require the trunk and pelvis to be twisted and lifted, which often causes anterior innominate rotation. The activation of the gluteus maximus during load transfer through the pelvis will be changed in SI joint dysfunction. In order to maintain stability, the electromyography study on individuals with sacroiliac joint dysfunction found that the gluteus maximus is delayed in activating and the biceps femoris is overactive as a compensatory muscle.

Coupled motion of contralateral latissimus dorsi and gluteus maximus. vleemin et al defined the posterior layer of the thoracolumbar fascia as a mechanism of load transfer from the ipsilateral latissimus dorsi and the contralateral gluteus maximus. the study focused on the effect of unilateral activation of biceps femoris, gluteus maximus and erector spinae and contralateral activation of latissimus dorsi muscle. Gluteus maximus and latissimus dorsi were found to be partially coupled by the posterior layer of the thoracolumbar fascia, creating

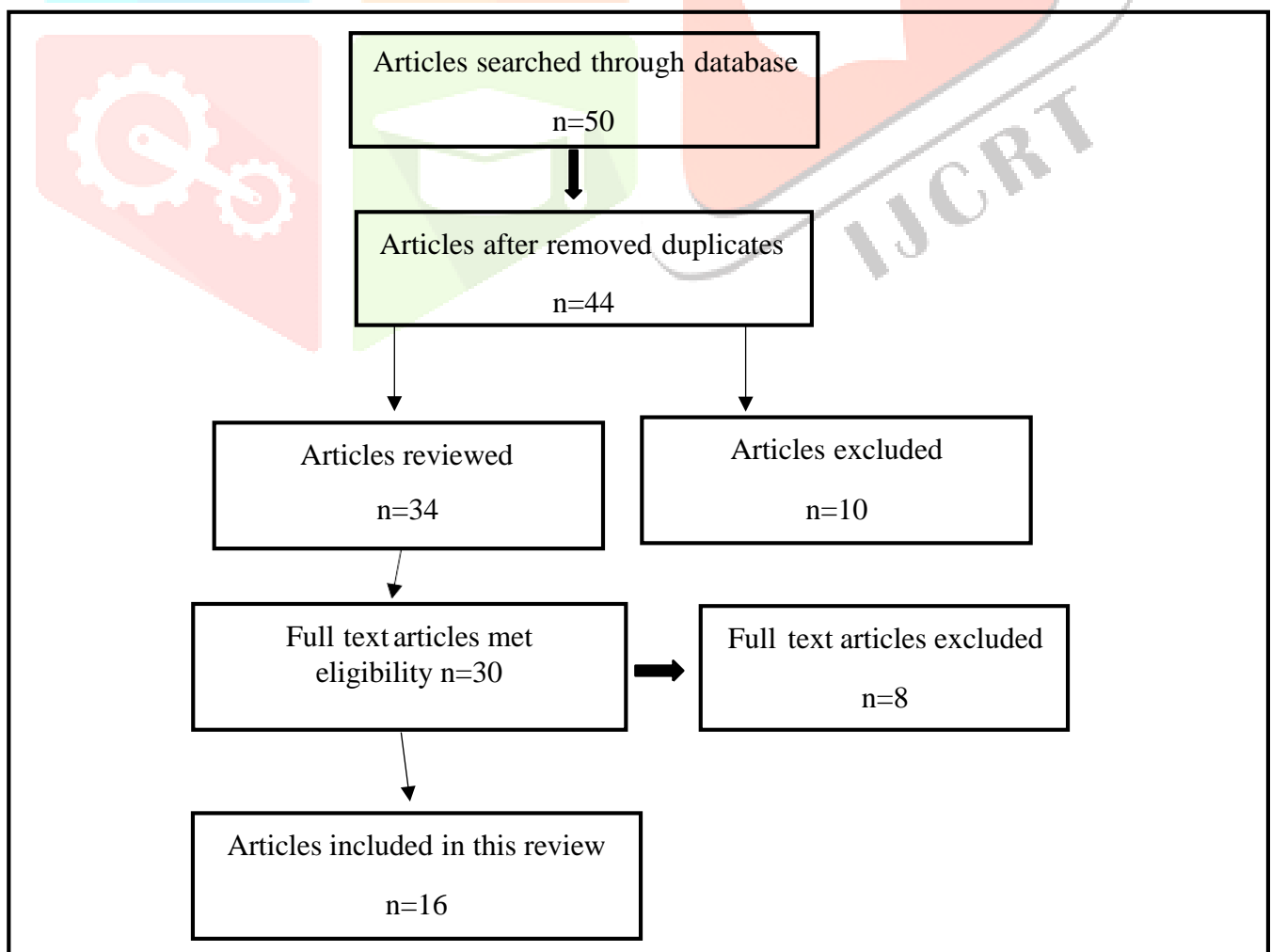
compressive forces acting perpendicularly on SIJ.^{6,7,8} This altered mechanics leads to pain around PSIS and lengthening of the affected limb making it difficult to maintain a neutral pelvic position. Enhancing physical function, reducing pain, and maintaining a normal pelvic angle are the key goals for individuals with dysfunction of the anteriorly rotated sacroiliac joint. This review was done to find out the motor control effects of activating the gluteus maximus and latissimus dorsi.¹

The most prevalent form of conservative treatment for anteriorly rotated sacroiliac joint problems is the MET muscular energy, joint mobilization, manipulations, electrotherapy modalities and flexion bias exercises.¹

Hence, the aim of the study is to review the effectiveness of motor control activation of gluteus maximus and latissimus dorsi on function, pain and pelvic tilt in anterior rotated SIJ dysfunction.

METHODOLOGY

An extensive literature search was done, the search was from PubMed, Google Scholar, Medline, Pedro, Cochrane. included studies were randomized control trial, systematic reviews, comparative studies, experimental studies, case study, descriptive study, cohort and cross-sectional study, Key words used for search were sacroiliac joint dysfunction, gluteus maximus, motor control exercises, anterior innominate rotated SI joint dysfunction. Articles discussing the effectiveness of motor control activation of gluteus maximus muscle exercises and importance of gluteus maximus and latissimus dorsi in the sacroiliac joint dysfunction were included.



	AUTHOR	YEAR	TYPE OF STUDY	PARTICIPANTS	OUTCOMES	METHODOLOGY	RESULTS
1	Sivakumar.s	2022	Randomized control study	185	ODI Pressure biofeedback NPRS	GRP 1-mulligan mobilization+MCE GRP 2-MCE GRP3-aerobic exercises Treatment given for 45 min 5days per week for 6 weeks	Study concluded mulligan mobilization with motor control exercises were effective
2	Jean Mapinduzi	2022	Systematic review	1407	VAS PDQ DRI ODI	12 randomized controlled trials reviewed. intervention and follow-up durations from 1 week to 2years.	The most effective approach was combining MCE with other MSK treatments.
3	Vaidya sanika	2021	Comparitive study	48	ODI, VAS, PALM	EXP GR Preceived GM activation and MET CONTROL GRP received flexion biased exercise,MET. 4 weeks.	Study concluded that both techniques were equally effective in preserving a normal pelvic angle, reducing pain, and enhancing physical function.
4	upendrakarki	21	Experimental study	10	VAS ODI	GrpA- piriformis stretch, muscle activation exercises(4 weeks) Grp B- muscle activation exercises (3weeks)	Piriformis stretch and muscle activation exercises gives better results in management of sacroiliac joint dysfunction.
5	Farwasad	2021	Experimental study	36	MODI NPRS	Grp A-post isometric relaxation of GM and hot pack. Grp B-stretching of hip flexors for 12 sessions.	post-isometric relaxation and static stretching are has shown effective results in anterior innominate dysfunction.
6	aghalar javadov	2021	Comparitive study	69	ODI VAS	1st group -SIJ manipulation+ SIJ home-based exercise program 2nd group - SIJ manipulation+ home-based lumbar exercise program 3rd group with lumbar exercises	study concluded combination of manual therapy and exercise therapy is more efficient
7	Andry vleeming	2019	Descriptive study	-	-	Study discussed in detail about form and force closure and principal muscles of SIJ force closure	This study concluded that form closure is not sufficient to overcome the shear force , in order to stabilize the pelvis ,the muscles contract and ligaments tighten to force close the pelvis
8	Muammad salmanbashir	2019	Experimental study	88	ultrasonography	44 with SIJD ,44 healthy. resting muscle thickness of the latissimus dorsi and gluteal maximus was measured using and data compared between ipsilateralsides and contra lateral side.	The results showed that contralateral latissimus dorsi were reduced significantly among subjects with SIJD when compared to the other side

9	Marco Aurélio N.,	2018	Case study	8	VAS ODI Dynamometer	Mean age (18-43) pain duration 13months.5 weeks strengthening program of gluteus maximus.	Inclusion of gluteus maximus exercises in patients with lumbopelvic pain will improve sacroiliac dysfunction.
10	Daniel Feeney	2018	Cohort study	6	EMG	Experimental group -6 Control group -6. Participants walk on dual belt force measuring treadmill for 30 sec in 2 sessions.	Study concluded that compromised synergy between the affected side's gluteus maximus and the opposite side's latissimus dorsi.
11	Robyn A Capobianco	2018	Cohort study	12	EMG	Cohort group -6 women with unilateral SIJD. Control -6 healthy	The onset of muscle activity was disrupted in key muscles providing force closure of the joint.
12	Moayad Al- subahi, Mohamed Alayat	2017	A systematic review	9	VAS NPRS PROVOCATION TESTS ODQ NPRS PALM	3 evaluate the impact of exercise on SIJD, 3 evaluated KT, and 4 research focused at the influence of manipulation. Results included measurements of the (pelvimeter and photogrammetry).	manipulation seems to be more efficient than kinesio tape or therapeutic exercise.
13	Amir Massoud Arab	2014	Comparative study	159	SLR Pressure meter	1: no low back pain (n53) 2. backpain with SIJ (n53) 3. LBP without SIJ (n53)	In patients with SI joint dysfunction (66%) compared to those with LBP without SI joint dysfunction (34%), the proportion of people with gluteal weakness was considerably higher (P=0.02).
14	Won gyu yoo	2014	Casestudy	1	VAS	strengthening exercises of gluteus medius for 3 weeks	This study concludes individual strengthening exercises of the gluteus medius were effective in reducing SI joint pain
15	P.gunnar Brolinson	2003	Descriptive study	-	-	Article explained the issues by presenting a model of SI joint anatomy and function, a systematic approach to the diagnosis of dysfunction, and a comprehensive treatment plan.	This study discussed coupling motion between contralateral latissimus dorsi and gluteus maximus to provide force closure to SI joint dysfunction.
16	Barbara Hungerford	2003	Crosssectional study	28	EMG	SIJ Pain Subject Group- 14 men(24-47yr) posterior pelvic pain Control Subjects-14 men (22-50yr), Inclusion -no LBP for last 12 months,	The delayed onset of obliquus internus abdominis, multifidus, and gluteus maximus EMG activity of the supporting leg during hip flexion, in subjects with sacroiliac joint pain.

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RESULTS

16 articles were included in the study, 8 articles shown the motor control exercises along with other manual therapy and exercise therapy approaches were more effective. 5 articles proved the altered recruitment of gluteus maximus and latissimus dorsi in anterior SIJD. 3 articles proved delayed activation and coupling mechanism of gluteus maximus and latissimus dorsi in anterior SIJD.

DISCUSSION

Study aimed to review the effectiveness of activation of gluteus maximus and latissimus dorsi in patients with anterior rotated Sacro iliac joint dysfunction. In anterior SI joint dysfunction there is evidence of altered recruitment of gluteus maximus during load transfer through pelvis. The electromyography investigation on patients with sacroiliac joint dysfunction found that there is delayed activation of gluteus maximus and latissimus dorsi, EMG studies showed that ipsilateral gluteus maximus and contralateral latissimus dorsi were affected due to coupling mechanism in patients with anterior rotated SIJ dysfunction. So proper activation of ipsilateral gluteus maximus and contralateral latissimus dorsi will restore self bracing mechanism of SI joint there by leading to increase in stability.

Total number of patients were included in the mentioned articles were around 700 and proven null hypothesis. The outcome measures used in the articles were VAS for pain, Oswestry disability index (ODI) for functional disability, PALM to evaluate pelvic tilt, leg length discrepancy with measuring tape.

CONCLUSION

This literature review analysed the importance of global muscles in anterior SIJD, that proper activation of gluteus maximus and latissimus dorsi will restore self bracing mechanism and increase stability of SI joint, since the results shown that motor control activation of these two muscles will reduce pain, improve function and restore normal pelvic tilt.

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