



# EFFECTIVENESS OF CORE STABILIZATION EXERCISE VS. STRENGTHENING OF GLUTEUS MAXIMUS IN SUBJECTS WITH SACROILIAC JOINT DYSFUNCTION- A RANDOMIZED CLINICAL TRIAL

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## **Abstract:**

**BACKGROUND AND PURPOSE:** Previously various studies have been conducted on assessing the effectiveness of core stabilization exercise & gluteus maximus strengthening on sacroiliac joint dysfunction (SIJD). But no significant study, has been done comparing the effect of core stabilization exercise & gluteus maximus strengthening on sacroiliac joint dysfunction (SIJD). So, purpose of this study is to assess and compare the effect of core stabilization exercise and gluteus maximus strengthening on sacroiliac joint dysfunction (SIJD).

**METHOD:** A total of 60 patients having sacroiliac joint dysfunction, confirmed through physical examination tests for SIJD, Patients were randomly assigned in two groups through lottery method. Patients were given core stabilization exercise in group A and gluteus maximus strengthening exercise in group B for 4 weeks. Pre intervention and post intervention assessment was carried out using VAS (visual analogue scale) and ODI (oswestry disability index) scale. The data was collected and analyzed with MedCalc.

## **RESULTS:**

Results indicate that both groups improved in all measures of physical functional disability and pain. However, upon intergroup analysis the mean changes in the scores of VAS & ODI was highly significant ( p value <0.0001, significant at 95% confidence level), at 4 weeks for gluteus maximus strengthening exercises.

## **CONCLUSION:**

Gluteus maximus strengthening exercise is more effective in improving pain and functional disability. And this can be effectively used for patients with sacroiliac joint dysfunction in physiotherapy setups and community based rehabilitation.

**Key words:** Si joint dysfunction, Lower back pain, Gluteus maximus muscle, Core stabilization

## **INTRODUCTION**

The sacroiliac joint dysfunction (SIJD) has been found to be the primary culprit for low back pain (LBP), but it is still overlooked and treated as LBP. There are no guidelines or appropriate therapeutic protocols for SIJD. Thus, there is a need for an effective treatment strategy for SIJD. The incidence is estimated to be in the range of 15%–30% in patients with non radicular low back pain. The signs and symptoms of SIJ pain mimic pain arising from other causes of low back pain. <sup>1</sup> There is good evidence suggesting that a combination of three or more positive

provocative tests strongly suggests SIJ dysfunction. Intra-articular injection with local anesthetic is considered the gold standard for diagnosis of SIJ pain. Many treatment modalities are available for SIJ pain, ranging from conservative management to surgical.<sup>2</sup> Various treatment options include like SIJ fusion, pharmacotherapy, manual therapy, pelvic stabilization exercise, orthosis, injection and surgery.<sup>8</sup>

The sacroiliac joint (SIJ) forms the lowest segment of the spinal axis and distributes the forces coming from the upper body. The SIJ is formed by the articular surfaces between the sacral and iliac bones. The stability of the joint is maintained by the union of the two bones, along with numerous muscles and ligaments.<sup>7</sup> The SIJ is the largest axial joint in the body at an average of 17.5 cm<sup>2</sup>. It's a true diarthrodial joint with articular surfaces surrounded by a fibrous capsule containing synovial fluid. The two joint surfaces move correlatively together and are considered to be bicondylar joints. The primary purpose of the SIJ is to maintain stability. This is accomplished through multiple mechanisms. The primary mechanism however is through the expansive ligamentous network attaching to the SIJ. Another, the muscles surrounding the SIJ serve to provide muscular force, guide movement and enhance stability to the pelvis bones.<sup>12</sup> Movements occurring in the sacroiliac joint play an important role in distributing forces and is influenced by the movement of the lumbo-sacral spine.<sup>11</sup> The sacroiliac joint has been implicated as the primary source of pain in 10% to 27% of patients with mechanical low back pain below L5. Sacroiliac joint can be affected by various degenerative, inflammatory and destructive pathologies. And its diagnosis was based on the SIJ provocation tests. SIJ pain can present through localized and/or referred pain in the lower back, buttocks, leg, groin and hip. Symptoms such as transient numbness/tingling have also been reported. Different treatments that have been tried for SIJD include pharmacotherapy, manual therapy, and pelvic stabilization exercises, balancing exercises, orthosis, injection and surgery.<sup>2, 27</sup>

In general, evidence has shown that stabilization exercises can reduce pain and disability in chronic low back pain. Core stabilization exercise is the intervention that has proved to be effective in improving trunk stability, balance & mobility. Core stability is referred as the ability to stabilize the spine as a local muscle activity. Stabilizing co-contraction increasing intra-abdominal pressure via the control of local core muscles as the "stabilizing synergy" of the core<sup>6</sup>. Exercises for core stability serve as treatment for simultaneously activating the transverse abdominis (TA) and deep fibers of multifidus (MF)<sup>5</sup>. The abdominal drawing in maneuver was performed in conjunction with each of the dynamic exercises because of its ability to facilitate co-activation of the TA and MF muscles. Our aim was to improve core stability by improving the ability of the participant's control over the core region.<sup>7</sup> Core stabilization exercise can reduce pain and disability in chronic LBP, there is also some evidence for its benefits in patient with sacroiliac joint dysfunction (SIJD).<sup>5</sup>

Gluteus maximus has many different functions such as providing sacroiliac joint stability, strength for lifting and control of gait. Stability to the SIJ is provided by compression, thus creating a self-bracing mechanism<sup>9</sup>. Specifically, a relationship between the gluteus maximus and SI joint has been studied. Anatomical studies suggest the gluteus maximus can contribute to stabilizing the SI joint with muscle fibers being perpendicular to the joint surface.<sup>8, 9</sup> Additionally, activation of the gluteus maximus was found to increase compressive force across the SI joint. Altered function of the gluteus maximus has been found in those with SI joint dysfunction. Therefore it would seem appropriate that exercises should be directed at improving the gluteus maximus function<sup>10</sup>.

Despite the need to identify the most effective treatment options. The present study was designed to compare the effects of core stabilization exercise and gluteus maximus strengthening exercise on pain and disability in a subgroup of patients with non specific low back pain that had sacroiliac joint dysfunction.

## METHODOLOGY

**Population and Sample** Patients with localized pain in SIJ region with or without radiation to the buttocks, groin, thigh & knee referred from the Orthopedic Department to Physiotherapy Department (O.P.D-16), S .S. G. Hospital, Vadodara.

60 Number of patients referred from OPD-3 (Department of orthopedic) of S.S.G. Hospital to OPD-16 (Department of Physiotherapy), S.S.G. Hospital, and Vadodara during July 2019 to March 2020. After ethical clearance fulfilling the inclusion and exclusion criteria. Patients were randomly selected by the lottery method to group A and group B. Patients with SIJD fulfilling the inclusion and exclusion criteria were selected and assessed before starting the intervention. All patients were subjected to a standardized interview including details regarding the study.

- GROUP A: core stabilization exercises on sacroiliac joint dysfunction (SIJD).
- GROUP B: gluteus maximus strengthening on sacroiliac joint dysfunction (SIJD). The group did not received any other exercise program or any form of physical treatment (i.e., manipulation, mobilization, massage).

### Inclusion criteria:-

- Patients with age group 20 to 60 years.
- Pain persisting more than 4 weeks.
- Including both male and female.
- Patients referred to OPD-16, Department Of Physiotherapy, SSGH for having localized pain in SIJ region with or without radiation to the buttocks, groin, thigh & knee.
- Patients with positive clinical test for SIJD

[TESTS FOR SIJD: Compression test, Distraction test, Thigh thrust, Gaenslen's test, Patrick's /FABER or figure-4 test (\*at least 3 positive findings on 5 physical examination tests for SIJD) Patients willing to participate in the study.

### Exclusion Criteria:-

Patients having lumbar region dysfunction (spondylosis, spondylolisthesis, lumbar disc hernia). Subject undergone any spinal surgery. Participation an exercise program or any form of physical treatment (i.e., manipulation, mobilization, massage). Pregnancy, Malignancy, Patient having history of spine Fracture, Having spinal deformities (i.e. structural scoliosis, kyphosis) Refusal to give informed consent

### Outcome measures:-

**1) VISUAL ANALOGUE SCALE (VAS):** VAS is a unidimensional measure of pain intensity, which has been widely used in diverse adult populations. The pain VAS is a continuous scale comprised of a horizontal (HVAS) or vertical (VVAS) line, usually 10 centimeters (100 mm) in length, anchored by 2 verbal descriptors, one for each symptom extreme. The pain VAS is a single-item scale. Test-retest reliability has been shown to be good, but higher among literate ( $r = 0.94, P < 0.001$ ) than illiterate patients ( $r = 0.71, P < 0.001$ ). The correlation between vertical and horizontal orientations of the VAS is 0.99.<sup>43, 51</sup>

### 2) OSWESTRY DISABILITY INDEX (ODI):

ODI assesses symptoms and severity of low back pain in terms of disablement and degree to which back or leg pain impacts functional activities. However, it is relevant to determine whether ODI is valid for measuring disability due to SI joint pain. Questionnaire consisting of 60 items.

Each item consists of six statements to scores of 0 to 5 with the patient choosing the statement that matches his or her abilities. Test retest reliability and validity: -0.89-0.97<sup>44</sup>

## RESEARCH METHODOLOGY

All patients will be assessed before and after intervention. The differences between the outcomes before and after intervention within experimental group will be compared by using the PAIRED t-TEST and UNPAIRED t-TEST was utilized to measure the difference between the two groups.

A written and informed consent about enrollment in the study and maintaining adequate privacy and confidentiality were taken from all participants included in the study. A clinical history and a complete Physical and Functional Physiotherapy examination were done in each case. Patients of having localized pain in SIJ region with or without radiation to the buttocks, groin, thigh & knee were selected that are referred by Orthopedic Department to Outdoor Physiotherapy Department of S.S.G. Hospital Vadodara. All patients were confirmed by at least 3 positive findings among 5 physical examination clinical tests for SIJD. All participants' bio-data and the particulars were taken before the first therapy session. Patient's outcome measures: visual analogue scale (VAS) and oswestry disability index (ODI) were taken before intervention and at the end of 4<sup>th</sup> weeks of intervention/treatment. All measures used are valid and shown to have acceptable reliability.

## INTERVENTION

- GROUP A will receive core stabilization exercise on SIJD.

**Table 1: Group A : (CORE STABILIZATION EXERCISE)**

NO	SESSION	EXERCISE	REPETATION
1	1-3	Abdominal drawing in manoeuvre ( supine, crook lying, quadruped position, sitting)	10 (5-10) sec hold with normal breathing
2	4 -12	Plank A:elbow extended B:knealing on the bench c:conventional plank	10
		Abdominal curl lifting scapulae and thorax A:arms horizontal B:across the chest C:behind to head	10
		Prone extension A:forearm support B:arm support	10
		Unilateral SLR	10
		Bird dog exercise A:elevated arm B:elevated leg C:elevated arm and leg	10

- GROUP B will receive gluteus maximus strengthening exercise on SIJD.
- The overall number of training session in the implemented program will be 12, with a frequency of 3 times per week, and duration of 20-25 minutes for each session for 4 weeks. Post- interventional assessment will be taken at the end of 4<sup>th</sup> week for each patient. The assessment will focus on visual analogue scale and oswestry disability index differences in the scores will be assessed by appropriate statistical methods.

**Table 2 : Group B (GLUTEUS MAXIMUS STRENGTHENING EXERCISE)**

NO	SESSION	EXERCISE	REPETATION
1	0-12	Gluteal muscle setting “squeeze”	10
2	0-12	Bilateral bridge	10
3	0-12	Unilateral bridge	10
4	0-12	Non weight bearing hip extension	10
5	0-12	Squat	10

## RESULTS AND DISCUSSION

All the tests and calculation were performed using MedCalc. The distribution of males and females in both the group is given. In group A (core stabilizing exercise) female are in 47% while males are 53%. In group B (gluteus maximus strengthening exercise) females are 39% male 61%. The distribution of unilateral SI joint in group A 74% and in group B 78% and bilateral SI joint in group A 26% and in group B 22% groups is given.

The distribution of SI Joint dominance in group A Right side 43% and left side 57% and in group B Right side 50% and left side 50% given

Paired sample t-test was to compare value of score in Group A and Group B

**Table 3: Intragroup comparison of VAS scores pre and post intervention**

VAS (VISUAL ANALOGUE SCALE)				
	GROUP A(CORE STABILIZATION EXERCISE)		GROUP B(GLUTEUS MAXIMUS STRENGTHENING)	
	PRE	POST	PRE	POST
<b>N</b>	19	19	18	18
<b>Mean</b>	6.11	4.32	5.89	2.94
<b>SD</b>	0.88	0.89	0.90	0.87
<b>p value</b>	<0.0001		<0.0001	
<b>t value</b>	14.5714		15.5692	

In the group A (core stabilization exercise) the average VAS score on 1<sup>st</sup> day was 6.11 and after 4 weeks were 4.32. There was highly significant difference between the VAS score in the subjects in group A ( $p < 0.0001$ ) at 95% confidence interval. In the group B (gluteus maximus strengthening exercise), the average VAS score on 1<sup>st</sup> day was 5.89 and after 4 weeks were 2.94. There was highly significant difference between the VAS scores in the group B ( $p < 0.0001$ ) at 95% confidence interval.

**Table 4: Intergroup comparison of ODI scores pre and post intervention**

ODI				
	GROUP A(CORE STABILIZATION EXERCISE)		GROUP B (GLUTEUS MAXIMUS STRENGTHENING EXERCISE)	
	Pre score	Post score	Pre score	Post score
<b>N</b>	19	19	18	18
<b>Mean</b>	42.668	25.705	45.550	13.733
<b>SD</b>	13.906	9.166	10.721	6.994
<b>P value</b>	<0.0001		<0.0001	
<b>t value</b>	10.7213		19.2687	

In the Group A (core stabilization exercise) the average ODI score on 1<sup>st</sup> day was 42.668 and after 4 weeks were 25.705. There was highly significant difference between the ODI scores in the subjects in Group A ( $p < 0.0001$ ) at 95% confidence interval. In the Group B (gluteus maximus strengthening exercise), the average ODI scores on 1<sup>st</sup> day was 45.550 and after 4 weeks 13.733. There was highly significant difference between the ODI scores in the subjects in Group B ( $p < 0.0001$ ) at 95% confidence interval.

**INTER GROUP CPMAPRISON**

Unpaired t-test is used for inter group comparison

**Table 5 : Intergroup comparison of VAS score**

VAS		
	GROUP A	GROUP B
<b>N</b>	19	18
<b>Mean</b>	4.32	2.94
<b>SD</b>	0.89	0.87
<b>P value</b>	<0.0001	
<b>t value</b>	4.7658	

**Table 6: Intergroup comparison of ODI score**

ODI		
	GROUP A	GROUP B
<b>N</b>	19	18
<b>mean</b>	25.705	13.733
<b>SD</b>	9.166	6.994
<b>p value</b>	<0.0001	
<b>t value</b>	4.4478	

**DISCUSSION**

Usually sacroiliac joint dysfunction is overlooked and treated as low back pain, so little attention is given to the core muscles and gluteus maximus. The Sacroiliac joint is the centre of the body's shock absorber system, it's the key joint involved in power transference.<sup>1</sup>The aim of the present study was to compare the effects of core stabilization exercise and gluteus maximus strengthening exercise in patients with SIJD.

This study consisted of two groups. Group A (core stabilization exercise) and Group B (gluteus maximus strengthening exercise).our main findings were both group showed significant improvement in pain(VAS) and functional disability(ODI) following 4 weeks of intervention period. When the post intervention values of both groups were compared Group B shows highly significant improvement in pain and functional disability. Macro Aurelia N.et al (2018) who found that following a strengthening program directed at gluteus maximus, subjects with persistent pain in lumbopelvic region and clinical tests positive for SIJD, demonstrated a significant increase in function, decrease in pain, and increase in strength.<sup>10</sup>However the reliability of positive SIJ provocation tests is similar to the invasive gold standard diagnostic method (Young et al 2003). Because there is no single specific and sensitive test to diagnose SIJD, we used a group in which the diagnosis was based on provocation tests. However research suggests that SI joint dysfunction is present when three out of five tests were positive.<sup>28,29</sup>The results showed that both group's p value (<0.0001) of VAS & ODI pre and post intervention were highly significant. Some previous study done by Sumit B. Inani and Sohan P.Selkar(2013) who concluded that core stability exercise leads to reduction in pain and functional disability in patients with non specific back pain<sup>68</sup>.

In addition to providing additional evidence for the beneficial effects of stabilization exercise for chronic LBP, Bystrom et al (2013) the study confirms the improvement in pain and disability can be seen in the subgroup of patients with sub acute and chronic SIJD.<sup>62</sup>

Without adequate control of core muscles, abnormal spinal movement, shearing forces and clinical instability might occur.<sup>54</sup>

Richardson and colleagues (2002) showed that TA and contraction of MF muscle significantly decreased sacroiliac joint laxity.<sup>63</sup>

According to Van winger den JP et al (2004), a relationship between the gluteus maximus and sacroiliac joint has been studied. Anatomical studies suggest the gluteus maximus can contribute to stabilizing the SI joint with muscle fibers being perpendicular to the joint surfaces. Stability to the SI joint is provided by compression, thus creating a self-bracing mechanism.<sup>64</sup>

According to Judy Wilson et al (2005) gluteus maximus has a role in walking and lifting activities as well as providing stability to the sacroiliac joint. Properties and function of it may be altered when changes to the kinetic chain of the lower limb occur as a result of injury or altered biomechanics.<sup>65</sup>

Recently, studies of low back pain, the hip joint and hip muscle strength have been reported, and Reiman(2009) noted that for lumbar pain, movement of the waist, pelvis, hip joint and lower limbs must be included in intervention plan.<sup>67</sup>

The comparison of core stabilization exercise and gluteus maximus strengthening exercise showed difference between the two treatments in the outcomes used here. Among group B showed highly significant for SIJD.

## CONCLUSION

In this study it is observed that there is reduction in pain and improvement in functional status of patients by the usage of both interventions.

Core stabilization exercise and Gluteus maximus strengthening exercise both bring about significant improvement in patients with SIJD. However, gluteus maximus strengthening exercise is more effective in reducing pain and improved functional status. As the functional status is improved, patients will indulge more in activity participation and this will help physiotherapist to use this training in physiotherapy setups and community-based rehabilitation to improve functioning in activities of daily living.

## LIMITATIONS

- Follow up of patients was not maintained after the completion of intervention duration; hence long term benefits of the intervention are unknown.
- This was a small scale study so the results may not be generalized to a wider population.

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