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Sacroiliac joint involvement among low back dysfunction: A cross-sectional study

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To explore the percentage of sacroiliac joint (SIJ) involvement in patients diagnosed with low back dysfunction. A cross-sectional study was conducted on 140 patients diagnosed with various low back dysfunctions and referred to receive physical therapy. SIJ involvement was clinically diagnosed using a cluster of 5 clinical tests. SIJ was considered positive if at least 3 out of the 5 tests were positive. The overall percentage of involvement and the percentage of involvement within each diagnosis was determined. Of the entire sample, 74 subjects (52.8%) demonstrated positive SIJ involvement. On the level of specific diagnoses, 50.8% of subjects diagnosed with discogenic LBP and 34.3% of those diagnosed with nonspecific LBP demonstrated positive SIJ involvement. SIJ involvement was positively associated with age, weight, and BMI while it was negatively associated with height. SIJ involvement is one of the major contributing factors in subjects with low back dysfunctions. Assessing SIJ should be performed in the basic examination of subjects having low back dysfunction.

Keywords: Sacroiliac, Low Back Pain, dysfunction, prevalence

INTRODUCTION

The sacroiliac joint (SIJ) is the joint located in the posterior part of the pelvis and joins the sacral bone of the spine to the iliac bone of the pelvis. This bilateral joint receives the weight of the upper body and transfers it to both lower extremities (Kiapour et al. 2020). The literature is unclear whether the primary function of the SIJ is supportive or to provide mobility (Thawrani et al. 2019).

The dysfunction of the SIJ could be attributed to various etiological factors such as direct trauma, inflammatory diseases, rheumatoid arthritis, malalignment of the spine, or discrepancy in the length of the lower limbs. A thorough history taking in addition to using a cluster of clinical provocative tests could provide a safe, and noninvasive method for diagnosing SIJ dysfunction. Yet other researchers argue that using injection techniques is superior to clinical provocative tests in diagnosing SIJ lesions (Gusfa et al. 2021).

Due to the proximity between the SIJ and lumbosacral spine, injuries and dysfunction that takes place in the low back could affect the SIJ and vice versa. Moreover, the pattern of pain distribution could be very confusing which in turn might lead to miss diagnosis and faulty treatment of the source of the dysfunction (David et al. 2020). For example, Thawrani and colleagues suggested that sciatica could be attributed to the irritation of the sciatic nerve roots caused by inflammatory mediators leaked from the nearby SIJ. Such a situation could be easily misdiagnosed as primary sciatica (Thawrani et al. 2019).

The similarity in presenting symptoms between SIJ and LBP raises the need to distinguish the association between both problems and elaborate on to which extent the subject could present with both problems.

Various attempts tried to determine the percentage of SIJ involvement among subjects presenting with LBP. Yet contradicting results have been reported; a previous study conducted in 1995 (Schwarzer et al. 1995), reported that SIJ was one of the major causes of LBP with 30 % of the studied sample demonstrating SIJ symptoms. Yet, they recommended further studying of this topic. Another study (Sembrano et al. 2009) found that 14.5 % of the LBP patients had SIJ involvement. On the other hand, Depalma and colleagues (Depalma et al. 2011) found that SIJ was the main source of pain in 40 % of the patients having lumbar spine fusion. In addition to the contradictory results of the previous literature, the method of diagnosis used in these studies were mainly invasive medical injection which could lead to joint infection, increased LBP,

and irregularity of menstrual cycle in females (Bale et al. 2021). Moreover, it needs special training which makes it not easily accessible in rehabilitation settings.

As the aim of any rehabilitation process is to improve its effectiveness in treating patients, the first stage in achieving this aim is to recognize the characteristics and the potential source of pathology. The accuracy in localizing the site of the original problem might improve the specificity of treatment and consequently the rate of its success.

The current study aims to determine the incidence of SIJ involvement among patients presenting with low back dysfunction and to determine the risk factors associated with SIJ dysfunction.

MATERIALS AND METHODS

Design

This cross-sectional multicenter study was conducted in the period between June and October 2021 in three governmental hospitals located in Ha'il City, Saudi Arabia. After calculating the sample size, 140 subjects diagnosed with low back dysfunction were recruited. The ethical approval was granted from the Ha'il region research ethics committee before starting the recruitment process (2021-20).

Recruitment and subject selection:

Subjects were allowed to join the study after signing the consent form and after they meet the following inclusion criteria; 1) ≥17 to 45 years old, 2) all types of low back dysfunctions were allowed to join the study such as non-specific pain, discogenic, spondylolisthesis, sciatica, scoliosis related LBP, post-laminectomy syndrome.

Subjects were excluded if, they did not meet the age range, had a history of low back trauma, pelvic surgery, leg length discrepancy, systematic or autoimmune diseases affecting SIJ such as systemic lupus, pregnant women, subjects who have health problems preventing them from performing the diagnostic tests.

Flyers and written announcements containing a contact number were used to spread the idea and purpose of the study among patients and clients visiting the outpatient clinic in the selected hospital. Interested subjects were interviewed to explain more details about the study and answer any questions they might have. Upon agreement, subjects were checked against the inclusion and exclusion criteria. Eligible subjects were asked to sign a consent form, then more information was collected through direct questions, patient medical records, and clinical examination. No financial remuneration was given to any of the included subjects.

Outcome measures:

All outcome measures were obtained during a single session, through interviewing the subjects, the assessor obtained necessary personal, present, and past history. Subjects' medical diagnosis, results of diagnostic imaging, and any other related lab tests were also obtained from the subject's medical record.

Clinical Examination: The physical examination of a patient with presumed SIJ disability begins with gait analysis, and a lower lumbar examination to rule out any obvious deformity affecting SIJ symptoms secondarily (Thawrani et al. 2019).

Confirmation of SIJ dysfunction was performed using a cluster of five clinical tests: FABER test, standing flexion test, palpation of posterior superior iliac spine heights while sitting, Supine Long sitting Test, and Prone Knee Flexion Test. Although, any single clinical test lacks enough specificity and reliability to determine SIJ dysfunction (Telli et al. 2018), using a group of clinical tests demonstrated appropriate validity, reliability, in addition to the advantage of avoiding invasive diagnostic procedures (Telli et al. 2018).

Flexion abduction, external rotation (FABER) test:

The assessor placed the subject's leg so that the foot of the tested lower limb was on the top of the knee of the opposite lower limb. Then, the assessor slowly pushed the knee downward (toward the examination bed), while stabilizing the contralateral pelvis to keep the lower back in the neutral position. Inability to lower the bent knee and elicited pain which is well recognized by the subject indicated a positive test. A positive test is indicated by the test leg's knee remaining above the opposite straight leg with the reproduction of the patient's exact pain. The validity, reliability, positive, and negative predictive values of this test were described previously (Thawrani et al. 2019).

Standing flexion test

The standing flexion test was performed by palpating the posterior-superior iliac spines (PSISs) while the participant was assuming trunk flexion. A superior movement of one of the PSIS compared to the other indicates a positive standing flexion test. When positive, this test indicates a limited movement of the ilium on the sacrum, displaying limited sacroiliac joint motion on the side of the superior posterior superior iliac spines. A minimum distance of 25 mm should be determined to consider the test as positive (Cibulka & Koldehoff, 1999).

Palpation of PSISs heights while sitting

Subjects were asked to assume sitting position on a wooden chair/bed then the examiner palpated the PSISs and marked their level. Unleveled PSISs indicate a positive test. ≥ 2.54 cm difference in the levels of PSISs considered a significant difference (Cibulka et al. 2019). The presence of the lower PSISs while sitting suggests that the ilium is rotated posteriorly on the sacrum, while the opposite ilium concomitantly may be anteriorly rotated.

Supine Long sitting Test

This test compares apparent leg lengths in the supine and long-sitting positions. The patient first assumes supine position and the location of both medial malleoli were compared. A shorter leg when compared to the opposite side, suggests, but does not confirm, a posteriorly rotated innominate. While the therapist held the medial border of the medial malleoli with the thumbs, the subject was asked to raise the trunk to the long sitting position. Any apparent lengthening of the short leg indicated SIJ dysfunction. The minimum acceptable change should be 2.54 cm (Cibulka & Koldehoff, 1999).

Prone Knee Flexion Test

While the subject assumes prone position, this test compares the apparent leg lengths while knees are in a right angle to fully extended knee. While both heels of the patient are held, the patient's knees are passively flexed to 90". An apparent lengthening of the short leg (≥2.54cm) indicated the presence of SIJ dysfunction (Cibulka & Koldehoff, 1999).

Statistical design:

Using Gpower software 3.1.9.7, with the following input data (effect size 0.3, power 0.95, two-tailed test, an alpha level of 0.05), the appropriate sample size was 134. In the current study, 140 subjects were recruited which slightly exceeded the predetermined sample size.

All data were expressed as mean ± SD and Percentages. The entire sample was further sub-grouped according to the character of interest in order to conduct the association between different demographic and clinical characteristics. For testing the association between dichotomous and continuous variables, point biserial correlation test was used, while Chi-squared test using Cramer's V was used when the association was conducted between two categorical variables. Statistical package of social science SPSS 23 was used to perform data analysis.

RESULTS

This study examined 140 Subjects who were referred to physical therapy departments in 3 different Hospitals. The mean± SD for the age, weight, height, and body mass index of the participants were [41.43±12.15], [69.83±11.51], [162.07±7.72], [26.92±3.54] respectively. All of them were experiencing low back dysfunction of different origins; Discogenic lesion was the diagnosis in 59 (42.14%), while 32 (22.8%) had chronic non-specific low back pain (CNLBP). Others were diagnosed with Sciatica, lumbar canal stenosis, and spondylosis; all these diagnoses represented about 35% of the study population.

Out of the 140 subjects, 74 (52.8%) were having SIJ dysfunctions as demonstrated by clinical tests. This percentage was variable among different diagnoses (Table 1). The highest percentages of SIJ involvement were evident among those diagnosed with spondylosis (100%). Yet the included number was low (n=9). The second-highest percentage of incidence was among those diagnosed with discogenic low back pain (50.8%). While the lowest percentage was evident among those diagnosed with spinal canal stenosis (20%) (Table 1).

There was a statistically significant positive correlation between the SIJ involvement and age, weight, BMI, and duration of symptoms. While the correlation was negative with the height. (Table 2).

The clinical diagnosis showed a statistically significant correlation with the involvement of SIJ (φc=.376, p=.001), with the increased tendency of the patients diagnosed with CNLBP to demonstrate SIJ problem. Additionally, SIJ status was statistically significantly correlated with the activity level, mode of injury, and smoking history. Both activity level and mode demonstrated an elevated odds ratio value of 7.87 and 4.9 respectively (Table 3).

Logistic regression showed that sudden mode of injury increased odds ratio of developing SIJ dysfunction by 4.9 times, (Likelihood of developing SIJ dysfunction increased 4.9 times with sudden injury in contrast to gradual mode, (OR 4.92, P <0.001, CI 95%: 2.39-10.14). Logistic regression showed that maintaining a sedentary lifestyle increased odds ratio of developing SIJ dysfunction by 7.9 times, (Likelihood of developing SIJ dysfunction increased 7.9 times with sedentary lifestyle, (OR 7.88, P <0.001, CI 95%: 3.13-18.72).

Logistic regression showed that sudden mode of injury and maintaining a sedentary lifestyle were significant predictors of SIJ dysfunction as shown in (Table 4).

Categorization by age:

The data was categorized by age into two groups, group A with age < 50 and group B ≥ 50 years old, SIJ was involved according to the (table 5).

Group B showed no significant difference between those with or without SIJ dysfunction, while those in group A showed significant differences in weight BMI, duration, activity level and mode of injury as shown in (Table 6).

Logistic regression showed that sudden mode of injury and maintaining a sedentary lifestyle were significant predictors of SIJ dysfunction in group A but not in group B, as shown in (Table 7).

Table 1: Number and percentage of SIJ involvement stratified per diagnosis.

	Overall (n=140)	CNLBP (n=32)	Disc (n=59)	Sciatica (n=37)	Spondylosis (n=9)	Stenosis (n=5)
Gender (Male)	47 (33.5%)	6 (18.8%)	16 (27.2%)	13 (35.1%)	7 (77.7%)	5 (100.0%)
Age	41.4±12.2	40.0±13.1	41.8±10.6	39.7±14.1	53.7± 12.1	51.8± 8.4
Height	162.1±7.7	160.7±5.3	162.7±8.3	159.1±5.4	169.0±8.7	164.2± 6.7
Weight	69.8±11.5	69.5±13.6	71.2±11.2	66.0±8.0	76.6±7.9	65.8± 4.5
BMI	26.9±3.5	26.2±3.3	27.6±3.7	26.3±3.8	27.3±1.5	26.5±1.7
Duration	8.0	10.5	10.5	7.0	15.0	23.0
SIJ involvement	74 (52.8%)	11 (34.3%)	30 (50.8%)	23 (62.1%)	9 (100%)	1 (20.0%)

CNLBP, chronic non-specific low back pain; SIJ, sacroiliac joint; BMI, body mass index. Numeric variables were expressed Mean±Standard Deviation. Duration was expressed as median value.

Table 2: Comparison between those with SIJ and those without SIJ dysfunction for biometric measurements.

	-ve SIJ dysfunction	+ve SIJ dysfunction	T value	P value
Age	137.9±9.7	42.5±13.7	-2.331	.021
Height	163.4±7.9	160.5±7.1	2.269	.025
Weight	67.2±9.9	71.9±12.4	-2.439	.016
BMI	25.8±2.6	27.7±4.0	-3.318	.001
Duration	15.2±18.2	28.3±31.1	-3.118	.002

-ve, negative; +ve, positive; SIJ, sacroiliac joint

Table 3: Results of Chi-Square test for SIJ involvement and clinical characteristics of the sample.

	-ve SIJ dysfunction	+ve SIJ dysfunction	X^2 or t value	P value
Smoking	12 (19.4%)	10 (12.8%)	1.117	0.205
Activity level (active)	54 (87.1%)	36 (46.2%)	25.221	<0.001
Mode of injury (sudden)	39 (62.9%)	20 (25.6%)	19.670	<0.001

X^2, Chi square value; t value, Student test value

*Significant at the level ≤0.05

Table 4: Logistic regression of SIJ involvement for activity level and mode of injury

	OR	p	95% CI	
Activity Level	4.322	.000*	1.968	9.491
Mode of injury	7.023	.000*	2.838	17.381

OR, odds ratio; p, significant level; CI, confidence interval

Table 5: Frequencies of SIJ involvement according to age

		Age < 50 N=105	Age ≥ 50 N=35
SIJ involvement	**Negative**	49.5%	28.6%
	Positive	50.5%	71.4%

N, number; SIJ, sacroiliac joint

Table 6: Results of Chi-Square (Cramer's V test) for the correlation between SIJ involvement and clinical characteristics of the sample.

Group A (Age < 50)	No SIJ dysfunction	SIJ dysfunction	X^2 or t value	P value
BMI	25.7±2.7	27.5±4.2	-2.661	0.009
Activity level (active)	47 (90.4%)	25 (47.2%)	22.745	<0.001
Mode of injury (sudden)	35 (67.3%)	11 (20.8%)	27.105	<0.001
Duration	15.7±18.6	26.5±29.5	-2.251	0.027

Table 7: Logistic regression of SIJ involvement for activity level and mode of injury according to age

		p	OR	95% CI	
Activity Level	age < 50	.000*	8.988	2.833	28.515
	age ≥ 50	.175	2.958	.244	5.405
Mode of injury	age < 50	.000*	6.788	2.572	17.915
	age ≥ 50	.862	1.148	.617	14.177

OR, odds ratio; CI, confidence interval

*Significant at the level ≤0.05

DISCUSSION

This study was conducted to explore the extent of SIJ involvement among patients having low back dysfunction. Additionally, the association between some demographic and clinical characteristics and SIJ involvement was investigated. According to the current results, more than half of the studied sample were having SIJ problems which were considered high prevalence rate compared to previous literature.

However, Eno and colleagues (Eno et al. 2015) reported higher about 65% SIJ involvement in a group of asymptomatic subjects. Eno study used imaging techniques to determine SIJ degeneration while our study used clinical testing to search for positive results. Additionally, O Shea et al (O'Shea et al. 2010) reported 30% involvement of SIJ in a group of LBP patients, O Shea study used clinical images as performed by Eno study, and explored the different types of SIJ pathologies.

A previous study conducted by Schwarzer and colleagues (Schwarzer et al. 1995) found that 30% of the patients having LBP (especially below S1 level) demonstrated SIJ problems. Yet their diagnosis depended on SIJ blocks while the current study used clinical tests to confirm the diagnosis. In another study, DePalma reported more than 40% involvement of SIJ among patients with a history of lumbar fusion. However, the sample joined study was quite small (n=28). On the other hand, SIJ was the source of LBP in about 14% of a sample consisting of 200 patients in another study (Sembrano, Jonathan; Polly, 2009).

Regarding the association between SIJ involvement and demographic characteristics, age, weight, and BMI were all positively associated with SIJ involvement while height demonstrated a negative association. This type of association has not been well addressed in previous literature. In a study conducted by Irwin and colleagues (Irwin et al. 2007), age has been linked to the incidence of SIJ pain with a tendency of the older population to demonstrate positive SIJ dysfunction. On the other hand, the same authors could not find any correlation between SIJ and either BMI or smoking status, which contradicts the current study results. Another study found that BMI was significantly associated with SIJ problems especially in female subjects (DePalma et al. 2012).

The association between body composition measures such as weight and BMI and SIJ involvement could be explained by the increased stresses imposed on SIJ by the weight of the upper body. These stresses can alter the mechanics and increase the opportunity of degenerative changes and consequently SIJ pain. Regarding age, it's well known that body joints, including SIJ, are at high risk of degenerative changes with increasing age; decreased flexibility of supporting ligaments and surrounding muscles could alter the mechanics and the function of the SIJ (Brolinson et al. 2003).

With a longer duration of symptoms, subjects tend to alter their posture to change the stress point in an attempt to reduce symptoms. This altered posture generates stress points through which most of the bodyweight passes. With time these points could be another source of pain. LBP patients sometimes demonstrate altered posture as seen in what's called sciatic scoliosis, this situation places abnormally increased pressure on the SIJ and predispose to dysfunction (Dontigny, 2020).

SIJ involvement was different among Clinical diagnoses, those with spondylosis, and disc lesion demonstrated the highest positive results. Due to the low number of patients diagnosed with spondylosis, the prevalence of SIJ among them might not be representative. However, it raises the need for further investigation. Spondylosis and degenerative changes of the spine are evident from the 3rd decade and increase with age as reported by Brolinson et al (Brolinson et al. 2003). Additionally, the increased prevalence rate of SIJ involvement among patients diagnosed with CNLBP could be an important determinant of one of the contributing causes of this common back problem.

The current findings argue that those who had an active lifestyle and experienced a gradual onset of symptoms had a higher prevalence of SIJ. This could be logical because hard workers usually underwent repetitive minor stress and trauma which can precipitate the gradual onset of symptoms (Guard et al. 2018) as those seen in the current study.

Our results showed that SIJ involvement was higher among nonsmokers. Yet this result could be misleading, due to cultural reasons, female subjects in Arabic countries tend to avoid mentioning their smoking habits so that all the females in this study described themselves as nonsmokers which could not be representative of the real situation.

This study was among the few that addressed the SIJ

as a potential or partial source of LBP. The current study found that more than half of the patients presenting with LBP dysfunction could have positive SIJ problems which might contribute to their complaints. Consequently, a thorough assessment of SIJ should be implemented in the routine assessment of patients who come to physical therapy with LBP dysfunction. Taking SIJ involvement into consideration in the assessment and treatment could improve the success rate and patient satisfaction.

The current study has a relatively low sample size which could limit the generalizability of the results. Yet sample size calculation was performed to include the least acceptable number of patients.

CONCLUSION

SIJ involvement is a major problem among subjects diagnosed with low back dysfunction. SIJ involvement increases with the increase with age, weight, and BMI and decreases in shorter subjects. SIJ involvement percentage was different according to the activity level, mode of injury, smoking history, and medical diagnosis.

CONFLICT OF INTEREST

The authors declared that the present study was performed in absence of any conflict of interest.

AUTHOR CONTRIBUTIONS

HMH designed and wrote the manuscript. AAI shared in data collection and analysis. ASA, AMA, and THA performed the experiment, data collection, and wrote the first draft. EMK shared in revision of final manuscript and conducted data analysis.

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