Journal of Spinal Disorders
Vol. 11, No. 4, pp. 341–345

Pain Provocation Tests for the Assessment of Sacroiliac Joint Dysfunction

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Summary: A double-blind trial was carried out to determine the sensitivity and specificity of three commonly used pain provocation tests for sacroiliac joint dysfunction. The trial involved 40 patients, all of whom reported pain when they were subjected to each of the three tests. Half of the patients (20) had the symptomatic sacroiliac joint injected with 4 ml of 1% lignocaine, whereas the other 20 patients received 4 ml of normal saline to the painful joint. The level of pain produced by each of the three tests was assessed pre- and posttest injection using a visual analogue scale of 0–100. If the pain could be suppressed by 70% with injection of either normal saline or 1% lignocaine into the symptomatic sacroiliac joint under image intensification, the test was considered to be positive for pain arising from the sacroiliac joint. None of the patients receiving normal saline had their pain suppressed to any significant degree, whereas those patients receiving 1% lignocaine had their pain suppressed sufficiently for the three pain provocation tests to have a specificity of 100% for each test and a sensitivity range of 77–87%. This study indicates that the three tests, when used in combination, have a high predictive value for pain arising from the sacroiliac joint. **Key Words:** Sacroiliac joint—Pain provocation—Image intensification.

The pathology of the sacroiliac joint (SIJ) has been well documented in a variety of conditions such as ankylosing spondylitis or joint infection, yet there appears to be a large number of people who experience disabling very low back pain, of which the sacroiliac joint may be the source and for which no definitive test has been forthcoming (13,18).

Schwarzer et al. (17) have demonstrated that the SIJ is a likely cause of low back pain in up to 30% of patients presenting to a clinic specializing in assessments of chronic low back pain. This study found that the SIJ was likely to be the source of pain if the pain arose below L5, S1, and in particular if there was associated groin pain, whereas Daum (4) stated that the SIJ is an underappreciated cause of low back and pelvic pain, as well as a source of pain referred to the proximal lower extremities.

Received August 26, 1997; accepted December 17, 1997.
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Magnetic resonance imaging has been the only radiologic investigation reported to establish the cause of pain in the SIJ, and this was in the presence of sepsis (15,16). This means that reliance cannot be placed on radiology to establish chronic dysfunction of a SIJ, and even if this expensive modality could be proven to be reliable, not all patients can afford the cost of this procedure. Moreover, not all medical practitioners have ready access to this type of investigation. Other reports highlight the inadequacy of radiologic investigations for differentiating low back pain and SIJ disease (19). Thus, there is a need to establish simple tests that can be used at the time of consultation to determine the presence or not of sacroiliac pain, further proof being established by intraarticular blocks as suggested by Dreyfuss et al. (7).

Potter and Rothstein (14) clearly indicated that intertester reliability using measurements of movement of one SIJ in respect to the other was poor in 11 of the 13 tests they used. The tests used in this series were either looking at mobility impairment or producing pain by palpating the bony sur-

faces of the pelvis. However, reproduction of the patient's symptoms was not mentioned as an important factor. More recently, Dreyfuss et al. (8) concluded that no currently used diagnostic sacroiliac test had any predictive value. Their criteria of 90% resolution of pain was very demanding and possibly too exclusive for clinical purpose.

The fact that the joint is part synovial and part syndesmosis should lend itself to the study of dysfunction of the joint by eliciting pain using passive movements (1). The joint is not crossed by any muscle; hence, active resisted movements would be more difficult to assess. Pain provocation tests have been used by Laslett and Williams (12), who concluded that five of the seven tests used were reliable for establishing the diagnosis of sacroiliac dysfunction. However, sensitivity and specificity studies were not included.

A critical review of SIJ dysfunction by Walker (22) indicated that the likelihood of pain arising in females more than males is a function of structure and distribution of forces, especially in the early postpartum period. The predominance of pain arising out of the SIJ in females versus males is supported by studies of Davis and Lentle (5), Waisbrod et al. (21), and Boyle (3).

The usual presentation of sacroiliac pain consists chiefly of deep seated pain in the distribution of the 1st and 2nd sacral nerve roots with some localization to the medial quadrant of the buttock and possible radiation toward the hips and posterior aspects of the thigh (2). Lying on the affected side in bed often exacerbates the discomfort, as does prolonged sitting, a long car journey, or negotiating stairs and inclines. Obviously, several of these features can also be attributed to the zygoapophyseal joint (Z joint) and pelvic disease. However, Fortin et al. (9) have mapped pain referral patterns using provocative injections into the SIJs in asymptomatic volunteers. They mapped an area of 3 × 10 cm just inferior to the posterior superior iliac spine as a common area of pain production in all 10 volunteers. Beyond this area the referred pain was variable, a fact that has been substantiated by Dreyfuss et al. (8).

Study of movements of the SIJ by Sturesson et al. (20) and the function of the sacroiliac ligamentous apparatus by Gerlach and Lierse (10) have adequately substantiated the importance of the ligaments holding these joints together, as well as the fact that only small amounts of movement are possible in the SIJs. It is suggested that a slight derangement greatly alters the transmission forces through the joint and represents a potential source of ongoing discomfort. Based on pathomechanics, DonTigney (6) has suggested certain mobilizing techniques to restore normal function. Although compression testing of the SIJs is frequently used as a means of eliciting sacroiliac pain, other reports indicate that this method is not reliable (8,12).

The difficulty with SIJ pain is nicely summed up by Grieve, who concluded that "either the condition goes unrecognised or because of authoritarian and intimidating pronouncement upon its non existence, the likelihood of the condition is not included among the many factors for assessment. A careful comprehensive examination of the joint is therefore not conducted" (11).

AIM

This study has been designed to determine whether three commonly used pain provocation tests are sufficiently reliable to establish the SIJ as the likely cause of a patient's very low back or pelvic pain.

METHOD

For the purpose of this study, three tests were chosen that use the lower limb as a lever to move the SIJ, thereby producing pain. The three methods chosen are well known and are based on biomechanical principles for reproducing movement of SIJ structures.

1. FABER (*F*lexion *AB*duction and *E*xternal *R*otation). This test is also known as Patrick's test or the Figure-4 test. The advantage of this test is that the distal end of the femur is used as a lever to move the ilium anteriorly while the pelvis is stabilized with one hand. However, in such a position, other structures are also moved and it is therefore important to realize that not only will sacroiliac pain be reproduced, but also possible dysfunction of the iliolumbar ligament or lumbosacral motion segment may be elicited.
2. POSH (*PO*sterior *SH*ear). This test similarly uses the femur as a lever but on this occasion it is to push the ilium posteriorly. The posterior structures are stressed by flexing the hip to 90° and then adducting the femur to the midline before applying axial pressure along the length of the femur. This test depends on normal hip joints and requires the elimination of the lower lumbosacral structures as a possible source of pain.
3. REAB (*RE*sisted *AB*duction). On occasions patients have either knee or hip joint replacements, so a test is required that would be useful in establishing SIJ pain in the presence of joint replacement. This test is done with the patient supine and the leg fully extended as well as being abducted to 30°. The therapist pushes medially as the patient pushes laterally, with the therapist holding the ankle. This enables the leg to be used as a lever with the fulcrum at the inferior border of the SIJ, therefore stressing the cephalic aspect of the SIJ.

Forty patients were required for appropriate statistical power to ascertain the level of predictability of the three tests in determining the presence of sacroiliac pain.

Patients who were suspected of having SIJ pain on the basis of history and pain reproduction using the three tests were informed that to establish whether the pain was coming from the SIJ, they would have to be subjected to a double-blind block of the affected joint. The three stress tests were performed just before the injection and within 30 min after the injection.

The Committee on Clinical Investigation (Ethics) of the Flinders Medical Centre gave approval for the project, which was carried out over a 2-year period. Exclusion criteria included evidence of previous low back pain, metastatic disease, fractures, possibility of pregnancy, patients taking major tranquilizers, and patients with systemic disease. The characteristics selected for SIJ pain on history, included pain below the lumbosacral junction, pain with full weight bearing on one leg with no discomfort on internal and external rotation of the hip lying supine, pain worse going down hills or down inclines, and very low back pain associated with groin pain and the absence of lumbar symptoms.

Normal saline and local anesthetic were provided in sterile vials by the pharmacy department and marked as solutions A and B. A toss of a coin determined whether a patient would have A or B and then the next patient would have the alternate vial. This procedure was carried out until all 40 patients had been selected and injected. All patients in the study had single joint injection.

Before the injection, each patient underwent each of the three tests, and his or her pain response was measured using a visual analogue scale (VAS) of 0–100. The three tests were again used between 15 and 30 min after injection to assess the postinjection pain level using the VAS.

Care was taken to ensure that the patient was not likely to be allergic to any of the substances used. The patient was prepared and an aseptic nontouch technique was applied. No percutaneous skin analgesia preceded the insertion of a 22-gauge, 3½-in spinal needle that was positioned following the same technique as Schwarzer et al. (3) using image intensification in all cases.

RESULTS

The population for the study consisted of 30 women and 10 men, with the average ages being 36 years (range 18–72) and 34 years (range 25–53), respectively. The prevalence of women over men presenting with SIJ dysfunction is similar to the findings in other studies (13–15).

The pretest and posttest VAS scores for the two test solutions used with each of the provocative tests are shown in Table 1. A bar graph of the results appears in Fig. 1.

To confirm the reduction in pain in the treated group relative to the control group, a 2×2 repeated measures factorial analysis of variance (ANOVA) was undertaken. The effect of interest was the interaction between treatment group and time, which demonstrates whether or not there has been a differential change in pain scores for the two groups across time.

Although there may be some debate as to whether parametric procedures such as ANOVA are appropriate for VAS data, the fact remains that no equivalent nonparametric statistic is available. Furthermore, comparisons of the means and medians in Table 1 suggest that, with few exceptions, they do not differ markedly. Thus, analyses using medians would be highly unlikely to produce results at odds with those presented below.

After the injection of 1% lignocaine, testing the SIJ by the FABER test indicated that 14 patients had 70% or better improvement in their pain, whereas 9 of the 20 patients had complete elimination of their pain. By contrast, there was no significant diminution of pain in the patients injected with normal saline, that is, no patient achieved 70% or better improvement in their pain. This test was found to have a sensitivity of 77% and a specificity of 100% on the basis that 70% or more of the pain was resolved using 1% lignocaine (Table 2). Using the 90% criterion of Dreyfuss et al. (8), the sensitivity was 50%, whereas the specificity remained at 100%.

The ANOVA interaction effect for the FABER test was significant ($F_{(1,38)} = 59.47$, $p < 0.001$), indicating that the

TABLE 1. *Visual analogue scale pre- and posttest responses to local anesthetic and normal saline*

	Pretest				Posttest			
Test	Range	Mean	SD	Median	Range	Mean	SD	Median
FABER								
1% Lignocaine	12–84	49.5	21.2	57.0	0–34	6.5	11.6	9.5
Normal saline	22–100	52.6	18.8	56.0	12–100	54.0	21.7	53.5
POSH								
1% Lignocaine	5–100	41.9	26.5	36.0	0–53	6.5	12.4	0.0
Normal saline	16–76	42.0	19.4	39.0	3–80	40.5	24.0	36.5
REAB								
1% Lignocaine	10–90	56.1	27.8	60.5	0–50	11.0	13.5	9.5
Normal saline	0–75	41.8	20.8	42.0	4–82	43.6	19.6	45.5

FABER, flexion abduction and external rotation; POSH, posterior shear; REAB, resisted abduction.

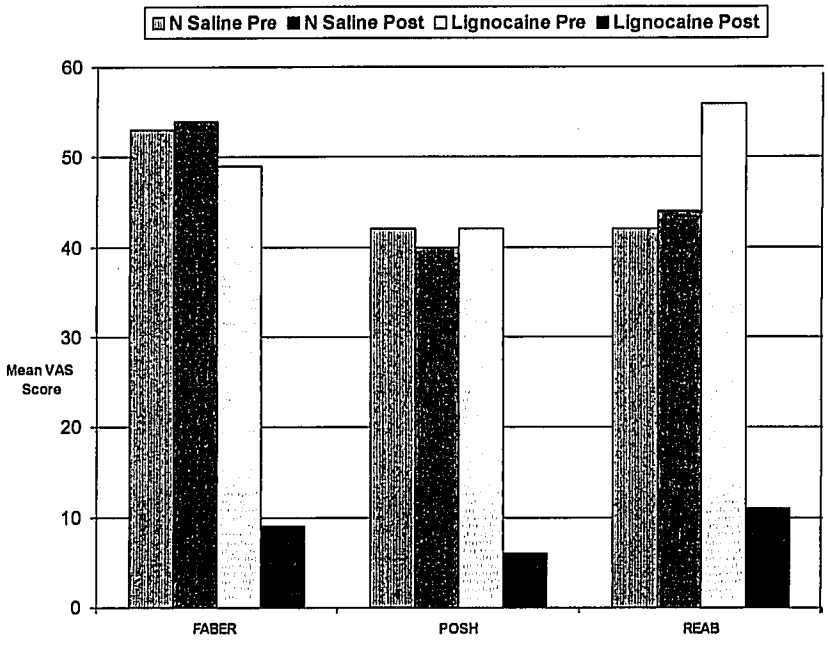

FIG. 1. Response of pain provocation for sacroiliac joint dysfunction using the posterior shear and resisted abduction tests when the sacroiliac joint was injected with either 4 ml of normal saline or 4 ml of 1% lignocaine.

change (reduction) in pain scores for the treated group was significantly greater than for the control group (Fig. 1).

Using the POSH test, 15 of the 20 patients had a 70% or better improvement in their pain after the injection of 1% lignocaine. Eleven of the 20 patients had complete elimination of their pain, whereas there was again no diminution of 70% of pain for patients injected with normal saline. Calculation of sensitivity and specificity was found to be 80 and 100%, respectively, based on the same criterion for the FABER test (Table 2). At 90% resolution of pain, the sensitivity was 69% and specificity remained at 100%.

The ANOVA interaction effect for the POSH test was significant ($F_{(1,38)} = 34.78$, $p < 0.001$), indicating that the change (reduction) in pain scores for the treated group was significantly greater than for the control group (Fig. 1).

For the REAB test, 17 patients had their pain diminished by 70%, with 9 patients having complete relief. No patient receiving normal saline recorded pain relief to the level of 70%. Using the same calculation method and criterion, the sensitivity was 87% and specificity was again 100% (Table 2). Applying the 90% criterion, the sensitivity for this test was 65% with a specificity of 100%.

The ANOVA interaction effect for the REAB test was significant ($F_{(1,38)} = 62.37$, $p < 0.001$), indicating that the change (reduction) in pain scores for the treated group was significantly greater than for the control group (Fig. 1).

Most patients experienced minor to moderate pain as the joint was outlined using the 0.5 ml of contrast material. All patients experienced quite significant pain when the 4 ml of lignocaine or normal saline was injected. The patients after the posttest assessment were asked whether they experienced any weakness, numbness, or paresthesia after the injection. No neurologic deficit of any kind was reported. A period of 1 to several hours of significant pain relief was experienced by those patients who had received the 1% lignocaine injection.

TABLE 2. *Patient response to pain provocation postinjection*

Test	Substance injected	Pain not reduced 70%	Pain reduced 70%	Sensitivity	Specificity
FABER					
	N. saline	20	0	77%	100%
	1% Lignocaine	6	14		
POSH					
	N. saline	20	0	80%	100%
	1% Lignocaine	5	15		
REAB					
	N. saline	20	0	87%	100%
	1% Lignocaine	3	17		

For abbreviations, see Table 1.

DISCUSSION

This study supports the view that pain in the very low back area can come from the SIJ and that such pain can be significantly blocked by injecting local anesthetic into the SIJ under image intensification. The three pain provocation tests that can be readily applied were found to have a high degree of sensitivity and specificity in confirming the diagnosis of SIJ dysfunction. This is in contrast to the findings of Dreyfuss et al. (8), whose criterion of 90% pain relief could be considered too exclusive.

The total elimination of pain in some patients raises the question as to why this did not happen for all patients. It could be argued that because the SIJ is surrounded by strong ligaments and capsules, considerable forces are required to disrupt it, which would in turn strain surrounding tissues and joints (i.e., sacrospinous, interosseous, and iliolumbar ligaments and L5–S1 Z-joints). Patients in this study had pain-free lumbar extension, which would suggest that Z-joints were not contributing to their pain. However, many of these patients were tender over the iliac crests where the iliolumbar ligaments insert. Rectal examination revealed similar pain when the sacrospinous ligament was palpated. All three pain provocation tests would put some stress on these structures, which if damaged would be painful and thus could explain the reason for the failure to completely block the pain. It could be argued that SIJ dysfunction was intraarticular for those who had a complete block to their pain but extraarticular for those with residual discomfort.

There is no indication from these tests that there is a gold standard for clinical assessment of pain arising from the SIJ. Blocking the pain by intraarticular injections done with image intensification must continue as the gold standard. However, these tests are substantially reliable to be able to be used in a clinical setting, especially when special radiologic services are not readily available. These tests give the clinician a better indication that the pain the patient is having is likely to be sacroiliac in nature and therefore capable of being assessed. Further investigations such as injections of local anesthetic under image intensification would be indicated as opposed to wasting time and expense on unnecessary investigations, such as computed tomography scanning of the lumbar spine for lumbar disease. Using the pain referral maps of Fortin in conjunction with the three provocation tests will further add to the physician's diagnostic capabilities. It is emphasized that the gold standard for sacroiliac pain must be intraarticular injection under image intensification.

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