THE EFFECT OF SACROILIAC MANIPULATION ON HIP FLEXION RANGE OF MOTION

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Abstract: Chiropractors claim to be able to influence sites far removed from the point of application of spinal adjustment. Little scientific research has, however, been conducted showing conclusively that the spine and associated structures have an influence on distal function. Demonstration of such influence on distal tissues would aid in the scientific validation of Chiropractic by other health professionals and facilitate treatment of peripheral injuries such as hamstring strains. This study aimed to investigate the effect of a manipulation of the sacroiliac joint on the mechanical function of the hip joint. The results demonstrate that the sacroiliac joint manipulation did not statistically alter the range of motion of the hip joint.

Key Indexing Terms: Chiropractic, manipulation, hip, sacroiliac joint, range of motion.

INTRODUCTION

The sacroiliac joint is a joint that chiropractors frequently treat. As these joints make up the major articulations of the pelvis, they are often implicated in anomalous function of the lumbar spine and the hip (1).

Biomechanists suggest that the function of the sacroiliac joint is intrinsically linked with that of the lumbar spine and the hip joint (2). This probably occurs through the action of the thoracolumbar fascia (3, 4). Based on this understanding, some clinicians suggest that treatment of all components of the lumbopelvic rhythm should be strongly considered in any dysfunction of any one component of this kinematic chain (1).

Furthermore, many forms of therapy have been constructed to treat the sacroiliac joint. These include, but are not limited to, passive and active procedures directed at either the sacroiliac joints or these surrounding soft tissues. Of these many treatments, chiropractors frequently report the success of managing non-specific low back and leg pain syndromes with the use of sacroiliac manipulation (5, 6).

Opposition to the use of such methods for the reduction of non specific back pain syndromes occur for two main reasons. Firstly, evidence shows that reliability in the examination of the sacroiliac joint is poor (7-9). The reason that treatment is by definition haphazard if one cannot reliably locate the region to be treated. Secondly, most researchers feel that only small movement in the range of 2-12°, and frequently less than 2° is possible at the sacroiliac joint, and they are unable to see evidence how such minimal movement impacts upon the lumbopelvic region to produce pain (10, 11).

These facts about the sacroiliac joint should be balanced by other pragmatic information about sacroiliac joints. The sacroiliac joint has been shown to be able to produce back, buttock and leg pain in characteristic locations following injection with saline solutions (12). These pain maps are distinctive and reproducible (12). This fact, together with the many reports of success with treatment of non specific back pain by manipulative treatment (5, 6) and corticosteroid injection treatment delivered to the sacroiliac joint (13), have allowed the sacroiliac joint to reach ‘quiet achiever’ status with some clinicians whilst others wonder what all the fuss is about.

The practitioners that support the notion that the sacroiliac joint is causative in some back pain feel that it likely develops restriction of movement (14). According to the untested theory of lumbopelvic rhythm, such restriction of motion should impact upon the overall function of the lumbopelvic kinetic chain potentially causing problems of function that may manifest as pain syndromes. Therefore it was the purpose of this study to investigate the effect of a sacroiliac manipulation on the mobility of the hip joint (as measured in flexion).

MATERIALS AND METHODS

This study was performed as one study in a group of consecutive studies performed by Pollard & Ward (15) utilising similar methodology.

In this study thirty four chiropractic university students acted as subjects, and were limited to the ages of twenty one to thirty-three years. Subjects were randomly allocated into two groups. Group 1 received a sacroiliac manipulative procedure. Group 2 was a control group which received digital pressure over the mastoid processes bilaterally. Subjects were excluded if they had reported acute low back, neck or hip pain, or leg referral or hamstring muscle injury within the two weeks prior to the investigation. All subjects provided informed written consent prior to participation.

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A digital goniometer (Ortho Ranger II MI Technic Inc.) was used to measure straight leg raise (SLR) and a digital force transducer (Nicholas Manual Muscle Tester Model 01160 Lafayette Instruments) was used to standardise the SLR. Both the electrogoniometer and the hand held force transducer were calibrated prior to use.

This study had received approval by the Macquarie University Human Ethics Committee prior to experimentation.

MEASUREMENT

Initially each subject performed a five minute warm-up at an intensity of 75 revolutions per minute (metered by a metronome) on an exercise bike based on a procedure by Golden & Dudley (16). Following this, subjects were weighed and then taken to a separate room where they lay supine on the treatment couch.

Subjects in both groups layed supine on the treatment table and the goniometer was attached to the lateral aspect of the calf in the sagittal plane. The force transducer was placed at 90° to the long axis of the leg at the level of the calcaneus on the unshod foot. The first examiner drew a line between the lateral malleolus and the greater trochanter of the leg to be examined. This line represented the longitudinal axis of the leg and provided a reference for the accurate placement and replacement of the goniometer during SLR measurements. The end point of measure in the pre- and post - tests were determined by the second examiner using the force transducer. The passive end point goniometer reading (end point of ROM) was defined as that point reached by an application of 5% of the subject’s body weight. Such a determination of end point was essential to ensure an accurate reproduction of the measurement. In all measurements of straight leg raising the pelvis was secured to the treatment table. The subjects were strapped to the treatment table at the level of the anterior superior iliac spine (ASIS) to stop unwanted pelvic rotation.

Group A Control Group
This group received digital pressure on the mastoid processes bilaterally for 30 seconds. This procedures was repeated a total of three times. The side receiving the range of motion assessment was chosen at random.

Group B Sacroiliac Manipulation
A chiropractic manual manoeuvre (lumbar roll position pisiform contact) consistent with O’Neil and Esposito (17) was applied to the sacroiliac joint. The side of the manipulation was chosen at random. The side receiving the manipulation received the range of motion assessment. The rationale for the random allocation and assessment is given at the end of this section.

Following the intervention, the second examiner again determined the hip flexion range of motion within 30 seconds. All post treatment assessments took place 30 seconds after the intervention so that the elapsed time between intervention and assessment could be standardised. This was performed immediately following the intervention on all subjects in the same fashion as it was prior to the intervention. Pre-treatment measurement, treatment, and post-treatment measurement were all performed within a five minute period.

The unilateral range of motion assessment of the hip was chosen on the basis that hip flexion range of motion is considered to be representative of the general state of mobility in the short term (tables 1-3). This result is in opposition to popularly held views that sacroiliac joint manipulation in a healthy population, to which later studies involving pain sufferers and other populations of specifically lesioned joints could possibly be compared. As the reliability of the palpation of the sacroiliac joint has been reported to be poor (7, 8), and as we were using an asymptomatic group, we could not use pain mapping as a guide to locate the lesion (12). This approach is supported by the findings of Dreyfuss et al (20) who suggest that 20% of asymptomatic individuals test positive with many sacroiliac joints. As such, there was no guarantee that a side deemed to be lesioned was in fact lesioned. Thus, it was not possible to definitively determine the side receiving the intervention, and control of side was not then possible in such circumstances.

RESULTS

Data was analysed using descriptive statistics, student t-tests, and Analysis of variance (ANOVA) tests of significance. Significance was set at Alpha equal 0.05.

DISCUSSION

This project investigated the effects of a sacroiliac joint manipulation on hip flexion range of motion. The results demonstrate that manipulation of an asymptomatic sacroiliac joint could not significantly alter the mobility of the hip in the short term (tables 1-3). This result is in opposition to popularly held views that sacroiliac joint
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Table 1: Post treatment differences in average group ROM measured in degrees (Paired t-test)

| Group          | n | mean | StdDev | SE | Mean | T value | P value |
|----------------|---|------|--------|----|------|---------|---------|
| Control        | 16| -0.69| 4.51   | 1.13| 1.06 | -1.39   | 0.18    |
| Sacroiliac     | 18| -2.17| 4.50   | 1.06| 1.06 | -1.39   | 0.18    |

Table 2: Post treatment differences between the control and the sacroiliac groups measured in degrees (Analysis of variance).

| Source | SS  | df | MS  | F   |
|--------|-----|----|-----|-----|
| Groups | 18.50| 1.00| 18.50| 0.91^ |
| Error  | 649.90| 32.00| 20.30| |
| Total  | 668.50| 33.00| |

^ p>0.05

Table 3: Changes in ROM for control and sacroiliac groups (in degrees relative to the vertical plane).

| Group                        | Pretest | Posttest | % change | Group            | Pretest | Posttest | % change |
|------------------------------|---------|----------|----------|------------------|---------|----------|----------|
| Control Group n=16 (SE)      | 67.06   | 66.37    | 1.03     | Sacroiliac Group n=18 (SE) | 62.22   | 60.06    | 3.47     |
| n=16 (SE)                    | (3.23)  | (3.21)   |          | n=18 (SE)        | (2.40)  | (2.22)   |          |

function can directly effect the function of the biomechanically and structurally related hip and lumbar regions (21).

The sacroiliac joint is said to be important for transmitting forces to the hip in weight bearing (22). The application of the coupled movement (together with movement of the lumbars) in the sagittal plane is referred to as the lumbopelvic rhythm (1).

Proponents of this untested theory suggest that the closed kinematic chain of the lower limb can result in an increase in hip range of motion as a direct compensation for loss of movement at the sacroiliac and lumbar regions or vice versa (1). However, as recent research has demonstrated that the sacroiliac joint has a few degrees of motion (10, 23), and that the hip range of motion is much greater (approximately 120° of flexion), it is possible that the hip could absorb the extra motion into its range and not be significantly altered in terms of the range of motion. This could occur due to the presence of error associated with the measurement of the hip joint mobility. This error of mobility whilst small when compared to the overall excursion of hip movement is large when compared to the sacroiliac movement.

It is also possible that the sacroiliac joint does not contribute to hip range of motion in such a direct mechanical fashion. What cannot be answered by this research is the question that sacroiliac manipulation somehow affects the joint proprioceptors located in the sacroiliac joint through some neurophysiological mechanism. Support for the idea that joint or muscle proprioceptors of the sacroiliac joint are stimulated by sacroiliac joint manipulation was provided by Murphy et al (19). Their work demonstrated changes in H-reflex activity after desensitisation of cutaneous afferents through the use of an anaesthetic cream. They concluded that the changes in the H-reflex must be mediated by joint and or muscle afferents (probably at segmental level).

As the sacroiliac joint acts close to the centre of gravity of the body (usually located just anterior to the second sacral vertebra (24)), it is possible that any effects on the hip appear more in the way the sacroiliac joint pivots about the central axis of the centre of gravity. Hence, the effects of extra mobility may be magnified the further away from the epicentre one measures.

Whilst this idea is untested, it is supported by the idea that cervical manipulation is effective in increasing hip flexion range of motion (25). Another study by Pollard & Ward (15) demonstrated that a cervical stretching procedure was more effective in increasing hip flexion range of motion than is a locally applied stretch to the hip in flexion. Such results allude to the presence of a neurophysiological mechanism for improving joint range of motion at the hip, and that this effect is at least comparable to a local mechanical one.

Equally, much has been made of the effect of orthotics in lumbar range of motion and pain syndromes (26). We have been unable to locate any research that specifically related change in foot mechanics to the movement occurring at the sacroiliac joint, although research by Schuit and co-workers has described a fairly high degree of asymptomatic sacroiliac joint malalignment when leg length discrepancies were present (27). Research that measures both range of motion and joint/muscle afferents in the sacroiliac joint as well as more proximal and distal joint structures are needed to equivocally answer the questions about mechanism.

Some methodological factors undertaken in this study were important for its outcome. The standardisation of tissue heating effects is one such variable. A light pre-measure warm-up was used in this study to standardise the heat loading in the soft tissues. This was important because temperature differences in muscle are known to affect their extensibility (28), and therefore variability of temperature could have introduced an error into our range of motion (ROM) findings. A five minute warm-up consisting of light to moderate exercise was performed. This level of warm up has been deemed adequate to heat muscles for the purpose of standardisation for range of motion measures (16). Astrand and Rhodahl (29), have also reported that the warm up effect lasts for up to 45 minutes. It is for these reasons that all subjects were asked to warm up on an exercise bike immediately prior to their studies.
to participation in this study, and their assessments were all completed in less than 45 minutes.

The variables of sex and age have been shown to be important in the range of motion achieved by sacroiliac joints (30-32). The variable of age was controlled in this study as demonstrated by non-significant differences between groups (tables 4 and 5). A non-significant difference in sex ratios between the two groups was also achieved (p>0.05). Sacroiliac joint preparations from males over thirty five years of age display increased roughness of the joint surfaces with age. However, these features do not appear with female sacroiliac joints even of advanced age (30, 31). These findings suggest that not only is it likely that range of motion will be different between the sexes, but that range of motion would likely be different between men of young and old age groups. Vleeming and co-workers (32) have demonstrated that sex differences parallel differences in joint surface morphology. Therefore, standardisation of both age and sex as factors in research associated with the sacroiliac joint is essential.

It is acknowledged by the authors that studies utilising manipulative techniques and a placebo treatment group can encounter limitations. The effectiveness of a mock treatment in mimicking a ‘real’ treatment, but still have no treatment effect, has been a major problem for studies into manual therapy and particularly manipulation. The authors have attempted to provide a “hands on” placebo to adequately control for such factors, but we suggest a separate study be conducted into the placebo effect in manipulative therapy trials potentially using a mechanical manipulating instrument that can simulate a real manipulation. The authors also attempted to minimise bias resulting from subject knowledge of chiropractic procedures by using a control group consisting of junior students that were unfamiliar with chiropractic technique.

The results of this study should be further examined using different protocols including different sacroiliac manipulative procedures, and different populations of subjects including actual low back pain sufferers, as the results of the present group of subjects may differ to that of actual pain sufferers. Equally important is the establishment of a series of manipulations in a controlled randomised trial.

The sacroiliac joint is a large tightly bound ligamentous joint. Because of its anatomy, it may be appropriate to investigate methods of treatment that help the ligaments of the joint to undergo creep, and hence elongate causing increased sacroiliac range of motion. As it is known that creep of ligaments does occur under periods of prolonged load (33, 34), treatment methods such as prolonged mobilisation or the placement of triangular wedges under the innominates to effect a rotary torque at the pelvic region should also be examined to see if they have an influence on both sacroiliac and hip range of motion. These treatments should then be compared to manipulative trials to ascertain relative efficacy in improving hip and sacroiliac range of motion. To our knowledge, no such investigations have taken place.

**CONCLUSION**

That a single manipulation of the sacroiliac joint in healthy university students did not significantly effect the range of motion of the hip joint as measured in flexion. Further research should investigate the effect of sacroiliac manipulation on the hip in subjects actually suffering back or hip pain. Such research should also investigate other less common methods of achieving creep in sacroiliac ligaments in the treatment of sacroiliac joint dysfunction.

**ACKNOWLEDGMENT**

The authors wish to thank the following chiropractors for their assistance in conducting this project. They are: David Stransky, Evan Rogers, Ian Roberts, Paul Hillard, and Robert Koklich.

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