S.O.T CATEGORY II BLOCKING이 복근지구력과 어깨 통증에 미치는 영향

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THE EFFECT OF SACROOCCIPITAL TECHNIQUE CATEGORY II BLOCKING ON ABDOMINAL MUSCLE ENDURANCE AND SHOULDER PAIN

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요 약 본 연구는 카이로프랙틱 기법 중 누운 자세에서 시술되어지는 S.O.T category Ⅱ 골반 블록 중재가 골반의 불안정으로 인한 기울어짐을 회복시킴으로써 이에 따른 어깨통증을 줄이고 복근의 지구력을 향상시킬 수 있는지 알아보고자 한 것이다. 이 실험을 위해 엉치엉덩관절의 불안정을 가지고 있으며 허리의 통증이 있는 총 50명의 참여자가 실험군과 대조군에 각 25명씩 무작위 할당되었다. 실험군은 category Ⅱ 블록 중재를 받았고, 대조군은 거짓블록 중재를 받았으며, 이들 두 집단을 통해 중재 전, 중재 후, 그리고 중재 2주 후에 복근지구력과 어깨통증을 측정하여 그 결과를 반복측정 이원분산분석법으로 분석하였다. 분석결과 S.O.T category Ⅱ 골반 블록 중재 후 실험집단에서 복근지구력이 유의한 증가를 보였으며 중재가 끝난 2주 후에도 유지 되었다. 또한 어깨통증의 경우에도 실험집단에서 통증의 감소를 보였으며 역시 중재가 끝난 2주 후에도 유의한 감소를 보였다. 이상의 연구 결과를 종합해 볼 때 S.O.T category Ⅱ 골반 블록 중재는 골반의 안정성을 유도하여 복근지구력을 증진시키고, 어깨통증을 감소시키며 중재 후에도 지속효과가 있는 것으로 나타남으로, 골반의 불안정성이 원인이 되는 어깨통증이나 복근지구력을 회복시킬 수 있는 중재법으로 활용되어질 수 있을 것으로 사료된다.

주제어 : 복근, 엉치엉덩관절, 골반 관절의 불안정성, 카이로프랙틱, S.O.T

Abstract Objectives: The purpose of this study was to determine whether the sacrooccipital category II blocking technique may improve abdominal muscle endurance and alleviate shoulder pain caused by pelvic tilting.
Methods: A total of 50 subjects diagnosed with category II sacroiliac joint instability and lower back pain were randomly assigned to the control or treatment group. The sacrooccipital technique category II blocking procedure (2-min duration) was performed 3 times a week until the category II indicator of joint instability had subsided. The control subjects were subjected to a sham procedure of equal duration and frequency. We assessed abdominal muscle endurance using the partial curl-up test and shoulder pain using a visual analogue scale, before and immediately after the intervention and 2 weeks after the intervention. Results: On two-way analysis of variance with repeated measures on time factor, significant treatment and interaction effects on muscle endurance were found. A significant interaction effect, but not treatment effect, was found for shoulder pain. Post hoc test showed that the shoulder pain was reduced immediately after intervention (treated group) and 2weeks (control and treated group) after the intervention as compared to before the intervention. Conclusions: This study suggests that sacrooccipital category II blocking can be used to alleviate shoulder pain caused by pelvic instability. The mechanisms behind the long-term benefits may include an increase in abdominal muscle endurance.

Key Words : abdominal muscles, sacroiliac joints, Pelvic joint instability, chiropractic, S.O.T

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1. INTRODUCTION

Humans have been subjected to loading from gravity since they began to walk upright[23]. Therefore long term exposure of upright position exerts excessive load that increases the pressure in the pelvis and causes damage to the ligaments of the sacroiliac joints. This can cause pelvic instability, and the compensatory unbalanced muscle contraction may damage the ligaments adjacent to the sacroiliac joints.

Abdominal muscles are attached to the ribs above and to the pelvis below, enclosing the abdominal cavity and lending support to the trunk [6][28]; they are very important for posture and motion[23]. Abdominal muscles are important for sacroiliac joint stability and preventing joint separation[24][25]. Thus, abdominal muscle strength is crucial not only for sacroiliac joint stability but also for lower back pain, and maintaining stability of the trunk[3][16][18][21].

A recent study provided evidence of abdominal muscle complications resulting from laxity of the sacroiliac joint[20]. Earlier studies have reported the physiologic or functional outcomes of sacroiliac joint manipulation, which include reduced muscle inhibition, improved periarticular muscle performance, improved gait symmetry, and increased range of motion[22]. However, none of the studies have evaluated the effectiveness of sacroiliac joint manipulation on abdominal muscle endurance.

Furthermore, ilium displacement stimulates the proprioceptors of the musculus latissimus dorsi, the muscle that connects the pelvic bones to the shoulder blades; this causes contraction towards the shoulder to support the unstable pelvis, which exerts strain on the shoulder girdle, which in turn leads to bursitis or shoulder pain[3]. Thus, sacroiliac joint subluxation is needed to maintain normal structure. In some cases, surgery and medication to treat shoulder pain are not efficient because they neglect the cause, one of which is pelvic instability. In contrast, there is a non-invasive technique, currently used by chiropractors for the treatment of lower back pain, which could also potentially address shoulder pain caused by sacroiliac joint instability: the sacrooccipital technique (SOT) category II blocking. The types of joint dysfunctions are classified into category I, II and III depending on their condition[5]. The indications included in category II are diverse, and include lateral sway, anterior/posterior tilting of the ilium, medial and visual signs of lateral knee tension and sphenoid tenderness, pain on the left side of the lamina of the fourth cervical vertebra, a negative reaction on the arm fossa test, unilateral rib pain due to neurological causes, unilateral shoulder pain, and other adult diseases[7].

The National Board of Chiropractic Examiners in the USA has reported that SOT is non-invasive and requires less force than other high velocity lower amplitude techniques in chiropractic, so 41% of the respondents used this as a therapeutic technique[10][27]. Hochman[10] reported that the supine SOT blocking procedure was the most effective way to stabilize the sacroiliac joints. It is likely that the block serves as fulcrum for the gravitational force acting on the sacroiliac joints and puts sacroiliac joints back[4][14]. This returns the joints to their original position, and probably leads to recovery of the normal functions of the proprioceptors, which facilitates normal physiological activity. For these reasons, the aim of this study was to test whether SOT category II blocking reduces shoulder pain and improves abdominal muscle strength in patients diagnosed with pelvic instability because of unstable sacroiliac joint.

2. METHODS

2.1 Criteria for selection of study participants

We selected 50 subjects, using a plumb line analysis and arm fossa test to determine their eligibility to participate in the study. The inclusion criterion was the presence of sacroiliac weight-bearing dysfunction; the exclusion criteria were being under chiropractic care at

the time of the study or a history of other orthopedic or neurosurgical disorders[3]. None of them took any medication for controlling pain for at least 10 days before the beginning of the experiment. The research was explained to all participants in advance and their written consent to participate was obtained before any study procedures were undertaken. The study received ethics approval from the Institutional Review Board of Jeonju University, Jeonbuk, Korea (JJIRBAPR-2010-002).

2.2 Preliminary examination

2.2.1 Plumb line analysis

The patient was asked to stand behind the suspended string with their feet aligned in the centre footplates and sacrum aligned with the strings. Excessive lateral movement from side to side is one of indications of category II. This test has been used as a tool of postural analysis in many studies[11][30].

2.2.2 Arm fossa test

The left and right inguinal ligaments were divided equally into 4 equal quadrants, and the upper fossa of the inguinal ligament was palpated using 4 fingers. The subjects' arm was extended with clenched fists at right angles to the table. The examiner explained to the subjects that he is going to pull the arm towards the foot, and that they are to resist his pressure only enough to keep the arm in its present position. If the subject was unable to hold this position, this was defined as a category II indicator. The same method was applied to the remaining fossae[15].

2.3 Tests of abdominal muscle endurance and shoulder pain

2.3.1 Partial curl-up test

We used this to test the endurance of the abdominal muscles when unassisted by muscles of the hip, which reduces strain on the waist [1][13]. We placed a tape on the mat and positioned a second tape 8 cm below the first in a parallel orientation. The subject was asked to lie supine on the mat with the knees bent and the soles of the feet flat on the floor, arms and fingers extended and the palms turned towards the floor. The subject was then asked to touch the first tape in the first place.

On lifting the head and the shoulders to an angle of 30-40 degrees, the subject was asked to touch the second tape, and then the head and shoulder were returned to the original position. On curl-down, the subject was required to let the shoulders, but not the head, touch the floor without lifting the chin (Figure 1, A).

An assistant applied pressure on both legs to prevent movement during the test. A metronome was used to keep pace consistently (40 beats per minute); on the verbal command to start the test, the curl-up was performed on the first beat, and the curl-down on the next, etc. This was repeated as many times as possible without interruption. We recorded the number of partial curl-ups. A single partial curl-up was defined as one curl-up and one curl-down. If the shoulders did not touch the floor on curl-down, or the subject failed to keep time with the metronome, the test was stopped. Subjects were instructed not to do curls or any form of abdominal exercise between the times.

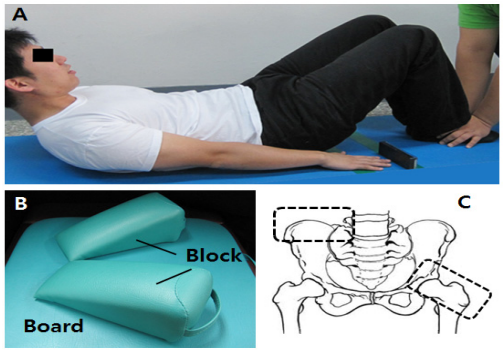

Figure 1. Abdominal muscle endurance measurement and SOT category II blocking.

2.3.1 Assessment of shoulder pain

Shoulder pain was assessed using a visual analogue scale (VAS), which is accepted as a valid and reliable tool for evaluating the intensity of pain by

scientists[12][13][31]. Subjects were asked to score their pain levels on a scale of 0 to 10, in which 0 represents absence of pain and 10 represents "deadly pain."

2.4 SOT category II blocking procedure

Twenty-five subjects with category II indicators identified by an arm fossa test (experimental group) were randomly assigned to undergo the SOT category II blocking procedure. Each subject was asked to lie supine with a straight spine on a pelvic board. The short leg block is inserted horizontally, perpendicular to the spine, and the long leg block is inserted through the acetabulum at a 45-degree angle, as shown in Figure 1, C. In the arm fossa test, we aimed to maintain both anterior superior iliac spines at the same height and to prevent lowering of the arms. The block was removed after 2 min, and then we repeated the arm fossa test. The subject was then asked to walk or stand for a minimum of 20 min to stabilize the pelvis.

2.5 Sham SOT category II blocking procedure

We performed a sham SOT category II blocking procedure in the 25 subjects randomized to the control group. We checked for category II indicators using the arm fossa test, asked the subject to lie supine, and placed a wedge-shaped block underneath the shoulders. After 2 min, the block was removed and the arm fossa test was repeated. During this time, the subject was not allowed to lower the arm. The subject was asked to walk or stand for a minimum of 20 min after the procedure.

2.6 Data analysis

Data were expressed as means and standard error of the mean (SEM). Statistical analyses were performed using the two-way (intervention and time) analysis of variance (ANOVA) with repeated measures on time factor. Two-tailed p values less than 0.05 were considered to be significant. Post hoc tests were carried out if needed. Participants who have the pre-test VAS score of zero were excluded from analysis since the purpose of the study was to determine whether the experimental intervention led to a decrease in shoulder pain.

3. RESULTS

3.1 Abdominal endurance

The impact of SOT category II block intervention on abdominal muscle endurance was determined by comparing data collected from the control and treated groups immediately before the first treatment, immediately after the last treatment, and 2 weeks later. ANOVA showed that the main effects of intervention [$F(1.\ 48) = 5.31$, $p < .05$] and time [$F(2, 96) = 150.89$, $p < .01$] were significant. Interaction effect between intervention and time was also statistically significant [$F(2, 96) = 13.07$, $p < .01$]. Post hoc test was separately performed on each group to analyze the interaction effect in more detail. The muscle endurance of the intervention group was increased immediately after the last time [$F(1, 24) = 34.66$, $p < .01$]. The benefits of this intervention lasted at least 2 weeks [$F(1, 24) = 13.59$, $p < .01$]. In contrast, the muscle endurance was not changed by the sham intervention (Figure 2).

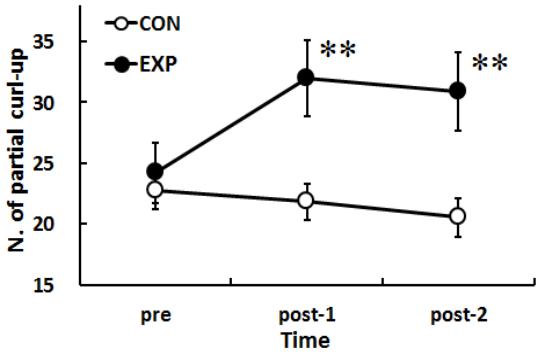

Figure 2. Number of partial curl-up measured as an index of the abdominal muscle endurance.

3.2 Shoulder pain

Figure 3 shows the shoulder pain measured before and after SOT category II block intervention. ANOVA showed that the main effect of time [$F(2, 72) = 18.28$, $p < .01$] and the interaction effect between intervention and time [$F(2, 72) = 8.00$, $p < .05$] were significant. The main effect of intervention, however, was not significant. Post hoc test was separately performed on each group to analyze the interaction effect in more detail. The pain level of the treated group was markedly decreased immediately after the last intervention [$F(1, 20) = 34.73$, $p < .01$]. The benefits of this treatment lasted at least two weeks [$F(1, 20) = 22.28$, $p < .01$]. In contrast, there was no effect of the sham intervention on the pain level of the control group measured after the last treatment. The pain level of the control group was reduced 2 weeks after the last false intervention [$F(1, 16) = 6.40$, $p < .05$].

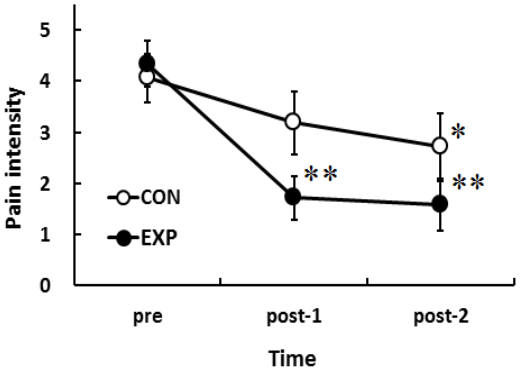

Figure 3. Level of shoulder pain before/after SOT category II block intervention.

4. DISCUSSION

There is evidence that the muscle generates excitatory and inhibitory effects during chiropractic treatment and that mechanical stimulation of joints stimulates the paraspinal muscles and joint mechanoreceptors, resulting in changes in the excitation of motor nerves[19][30]. In many cases, shoulder pain is not treated efficiently because the cause is not addressed by local therapy or surgery for patients diagnosed with sacroiliac weight-bearing dysfunction. In fact, in the anatomical position, the rectus abdominis and the latissimus dorsi muscles are directly related to the pelvis[6]. Thus, structural pelvic instability can cause shoulder pain or changes in abdominal muscle tone due to the abnormal muscle contractions[3]. The present study demonstrates that a therapeutic treatment aimed to resolve sacroiliac joint instability may effectively resolve shoulder pain and improve abdominal muscle endurance, probably by correcting sacroiliac joint dysfunction, and this effect persisted 2 weeks after the intervention. Our findings support the hypothesis that SOT category II blocking decreases pelvic instability, and that recovery of proprioceptor function will help restore normal muscle function and significantly improve abdominal muscle endurance. Conversely, other study showed that the supine blocking technique could alter the power of the muscles around the sacroiliac joints or the power of the latissimus dorsi among distant muscle groups[29], which may lead to changes in muscle strength[9]. This evidence supports the theory that the sacroiliac joints are associated with shoulder pain.

Meanwhile, with the SOT block intervention, we did not observe a significant reduction in shoulder pain between groups, but there was an interactive effect between groups and times, which persisted after 2 weeks. This is probably because the block intervention adjusted pelvic subluxation and the reduction of muscle stress led to a decrease in shoulder pain. Two weeks after the intervention, the pain was decreased in the control group. We estimate that it might have been due to the natural healing process of ligamentous tissue rather than the placebo effect. Three stages have been described in the biological response after ligamentous injury: bleeding and inflammation, active restoration through the proliferation of the associated materials, and structural alteration[8]. Amiel et al.[2] report that high levels of moisture are maintained during the repair

phase, and the synthesis ratio of collagen peaks 3 weeks after the injury. Early behavior may affect collagen adaptation later on, yet motion during this period may increase the tension in the ligaments during the recovery process[17]. There will, of course, be differences between individuals depending on the severity level of the injury or the time of onset. However, in our research, neither group scored their pain higher than 5 on the VAS. The ligamentous repair phase normally ranges from 2 days to 6 weeks, and in our study, the final measurement was made about 4 weeks after the first measurement. If there was no effect of sustained trauma, subjects in the control group were likely to sustain natural healing and there would not have been a significant difference between the groups. Nevertheless, the repair phase in the experimental group was shorter than that in the control group, despite the lack of a significant difference. We recommend a future study with a control group that does not receive any intervention.

5. CONCLUSION

In summary, this study demonstrates the long-term benefits of SOT category II block intervention for shoulder pain, including improvement of abdominal muscle strength, for patients diagnosed with sacroiliac weight-bearing dysfunctions. This non-invasive manual treatment stabilizes the patient's trunk through restoration of abdominal muscle tone within only a few weeks. Through this integrative approach of core healing, the patient gains the capacity to engage in preventive physical exercise, which will further strengthen their core and prevent a relapse.

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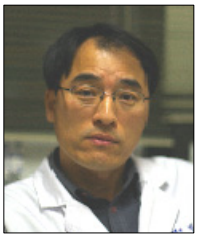

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