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Research Article

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Effect of Physiotherapeutic Intervention Using TECAR Therapy on Pain Self-Awareness and Hip Joint Function in Hip Impingement Syndrome: A Case Study

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| Abstract |

PURPOSE: The current case study focuses on identifying the effects of the independent application of TECAR therapy and physiotherapeutic intervention using TECAR therapy on pain self-awareness and hip joint function in patients with hip impingement syndrome caused by nonstructural changes.

Subjects: The research subject was a 34-year-old woman struggling with acute pain in her left hip, difficulty in actively moving the hip, and a problem in its overall function.

METHODS: The subject's pain awareness and hip joint function were measured using a Visual Analog Scale (VAS) and passive range of motion (PROM), respectively. The experimental intervention was carried out in 24 sessions of 16 minutes each, three times a week, for eight weeks.

RESULTS: The VAS score decreased to 0 cm on the post-test from 4.3 cm, 6.5 cm, and 7.2 cm in the pre-test at the rest, standing, and gait positions, respectively. The index of PROM measured hip joint flexion, extension, abduction, adduction, internal rotation, external rotation, and passive straight leg raise. The values increased to 122.5°, 24.5°, 78°, 33°, 65°, 42°, and 96.5° in the post-test compared to 88.5°, 15°, 39°, 21.5°, 23°, 22°, and 46.5° in the pre-test, respectively.

CONCLUSION: TECAR therapy and physiotherapeutic intervention using TECAR can help reduce pain and enhance the hip joint function in patients with hip impingement syndrome.

Key Words: Hip, Impingement syndrome, Self-awareness, TECAR

Ⅰ. Introduction

Hip impingement syndrome, or femoroacetabular impingement syndrome, refers to the pathological phenomenon in which impingement caused by a morphological abnormality in the acetabulum and femoral head causes damage to the acetabular labrum and articular cartilage during hip joint movement [1].

Hip impingement syndrome might result from congenital structural anomalies, alignment problems, or damage to the soft tissues that control movement. Hip impingement syndrome attributable to structural anomalies can be categorized into three types: cam, pincer, and combination

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type [2,3]. The impingement is of the cam-type when it is present between the abnormal bone spur of the femoral head and limbus acetabuli. On the other hand, the pincer type occurs when the abnormal bone spur on the acetabulum causes impingement between the limbus acetabuli and femoral neck on flexion of the hip joint. Some cases involve a combination of the cam and pincer types.

Dynamic impingement results from hip joint alignment problems and damage to the soft tissues, which are often caused by excessive exercise or mental stress, even without structural abnormalities of bones [4]. This type of dynamic impingement was reported to result from changes in the glide of the femoral head and altered patterns of muscle activities, which might be due to overload and excessive stimuli [5]. Young people in their 20's and 30's often suffer from hip impingement syndrome, which is the main symptom being pain in the groin region. This condition can worsen, leading to limited movement of the hip joint [6,7]. In addition, hip impingement syndrome can damage the hip cartilage, acetabular labrum and cause degenerative arthritis. Hence, it is necessary to accurately identify and diagnose the various forms and causes early [8].

Early detection and diagnosis of hip impingement syndrome without degenerative arthritis can be treated by non-surgical, conservative treatments [9-12], such as anti-inflammatory medicine, physical therapy, and exercise limitation, which can alleviate symptoms and prevent further damage [13]. On the other hand, surgical treatments might be considered for cases where damage to the acetabular labrum and hip cartilage is identified by imaging checkups [14]. A variety of treatment methods have been reported that help reduce pain and improve hip joint movement, including kinesiotherapy [5], Oriental medicine approaches [15], ultrasound-guided steroid injection [16], arthroscopic treatments [17], arthroscopic osteoplastic operation and incision of the anterior articular capsule [18], and physical therapy after arthroscopic treatments [19]. Despite this, few studies have identified the effect of the independent application of non-invasive treatments [5].

Physical therapy is a typical non-invasive treatment. Transfer of Electricity-Capacitive and Resistive (TECAR) therapy, a type of physical therapy, utilizes high-frequency electromagnetic currents to generate heat in the deep tissues, vitalizing the physiological metabolism. Hence, the therapy leads to a set of physiological effects, including vasodilation, oxygenation, enhanced microcirculation, and increased temperature of the deep tissues [20]. TECAR therapy is an effective therapeutic intervention in many clinical areas, including alleviation of pain in patients with injury, enhancement of flexibility, functional recovery of the spine and joints, and musculoskeletal diseases [5,21-26]. On the other hand, no empirical study has examined the application of TECAR therapy to patients with hip impingement. Thus, the present case study aims to identify the effects of physiotherapeutic intervention based on TECAR therapy on the pain self-awareness and hip joint function in patients with hip impingement syndrome.

Ⅱ. Methods

1. Participants

The subject of the present case study was a 34-year-old woman with left hip impingement syndrome and acute pain in the left side of her groin. She was employed in a sedentary job, working as an office clerk for 10 years, for approximately seven to eight hours every day, except on the weekends. Over the past two years, she regularly received TECAR therapy, manual therapy, and extracorporeal shockwave therapy. As the pain decreased, she started yoga exercises to prevent pain recurrence. While performing the Baddha Konasana posture, she found that she could not move her left leg well compared to her right leg. She tried to perform stretching exercises for a while and felt a pricking pain in the left side of her groin, which has continued since then.

The pain worsened, and she faced difficulty walking;

therefore, she visited the authors' clinic. Her chief complaint was the continuous pain in the left side of her groin. The most severe sensitivity was found on the attachment point of the iliopsoas to the femur. She felt the most pain while standing, walking, and trying to stand up from a sitting position. The subject was diagnosed with hip impingement syndrome after testing positive in a hip impingement test [27] and Patrick's test [28]. The present study was conducted in a hospital located in S-city. The pain medicine specialist did not find any signs of structural change in the subject's hip joint from the X-ray and ultrasound tests. The patient had not undergone surgery. She received a prescription for nonsteroidal anti-inflammatory drugs and physiotherapy treatment using TECAR therapy. She was informed by the specialists that she might require an in-depth medical examination, including magnetic resonance imaging (MRI) or a surgical procedure, if the pain persisted even after the previous treatments. The subject refused the prescription for the drugs, but wanted to participate in the TECAR therapy program. The research ethics committee approved this study. The patient was provided with sufficient information, and she provided a signed consent form.

2. Experimental method

Two tests were conducted to evaluate the subject's pain self-awareness and hip joint function: visual analog scale (VAS) and passive range of motion (PROM). A VAS is a tool that measures the level of subjective pain with very high reliability (ICC = .97) [29]. It was measured on a scale of 0 (no pain) to 10 (extreme pain), with the subject being asked to mark her subjective pain within that range [30]. Her first VAS varied with position: it was 4.3 cm, 6.5 cm, and 7.2 cm in the rest, standing, and gait positions, respectively. The hip joint PROM test was based on Norkin and White's model [31] and measured using a goniometer (Sammons Preston, USA). The test indicated high reliability with an average of .91 (.84 in the test and .95 in the re-test) [32]. After an exercise measurement, the hip PROM was measured twice, and the average was recorded. The hip joint flexion, extension, abduction, adduction, internal rotation, external rotation, and passive straight leg raise were evaluated; the initial measurements were 88.5°, 15.0°, 39.0°, 21.5°, 23°, 22°, and 46.5°, respectively, indicating an overall limitation in PROM due largely to pain. Her hip flexion PROM could not exceed 88.5° because of growing pain in the groin region with a burning feeling. When the pressure was applied in the posterior-inferior direction on the inguinal crease of the groin region, the subject's pain decreased slightly, and the range increased to 93°. The flexion + passive straight leg raise PROM was obtained at 46.5°, which increased to 53° when pressure was applied to the inguinal crease of the groin in the posterior-inferior direction to maintain the axis of rotation. Such measurements suggested that the subject might have hip joint impingement due to the anterior glide of the femoral head [33]. The plan was to conduct an additional test of active range of motion (AROM) to identify the glide direction of the femur based on the movement of muscles and greater trochanter while performing hip flexion. On the other hand, as the subject experienced pain and a heightened feeling of pulling of the groin, her isometric contraction was examined instead because she had pain and a tightened feeling of pulling of the groin. As a result, the activity of the hamstrings rather than that of the gluteus maximus was increased, but the movement of the greater trochanter could not be captured during isometric contraction for hip flexion. Based on the professional opinion of the specialist and the physical examination, her hip impingement was attributed to the anterior glide of the femoral head resulting from soft tissue damage, hip joint misalignment, and changes in the muscle activity pattern [5,33].

The WINBACK BACK 3SE equipment (WINBACK, Villeneuve Loubet, France) was used for the TECAR therapy program. This therapy can be classified into

Table 1. TECAR Therapy Program

Treatment sequence	Position	Return plate (fixed electrode)	WINBACK setting	Therapy method	Time(m) total 16
1	supine	low back	CET(dynamic), 40~50%	direct application on hip flexor muscle and hamstring, focusing on iliopsoas	3
2	supine	low back	RET, blade, 30%	relaxing tense hamstring fascia, using blades	3
3	supine	low back	RET, strap(thigh) low pulse, 30%	application of joint mobilization inducing posterior movement of femoral head	2
4	supine	low back	RET, strap(thigh) low pulse, 30%	extending hamstring with femoral head posterior glided	2
5	hook-lying	low back (flex patch)	RET, strap(thigh) low pulse, 30%	pelvic posterior tilting & external rotation of hip (3 sessions of 10 times)	3
6	hook-lying	low back (flex patch)	RET, strap(thigh) low pulse, 30%	bridging exercise with pelvic posterior tilting and external rotation maintained (3 sessions of 10 times)	3

capacitive electric transfer (CET) and resistive electric transfer (RET). CET indirectly induces the movement of electrons and generates heat mainly in the soft tissues, which are rich in electrolytes, such as the inner skin and the facial plane. In RET, the electric current flows directly through the body and generates heat in the hard tissues, which are poor in electrolytes, such as deep muscles, tendons, ligaments, and bones [34].

The present therapeutic program applied both CET and RET to cure the damaged tissues causing pain, leading to hip joint impingement, to build a normal movement of the hip joints. The therapeutic intensity was set to 40–50% for CET and 30% for RET when using blades and 30% with straps and low pulse applied. The frequency of treatment was set to .3–.5 MHz, and the return plate (fixed electrode) and one of the therapeutic electrodes were attached to the subject's waist in both CET and RET modes. A flex patch electrode was used when necessary, and the therapeutic tools of the CET electrodes, RET blades, and RET strips were used for their respective purposes. With a focus on solving hip joint impingement due to the anterior glide of the femoral head, the TECAR therapy program consisted of six treatment sequences. In sequences 1 and 2, TECAR therapy was applied independently, while sequences 3 to 6 combined manual therapy and therapeutic exercise with TECAR energy. Table 1 and Fig. 1 provide detailed information on the therapy program.

This therapeutic program was administered by a professional specialist in physical therapy, who is knowledgeable about the pathology of hip joint impingement and TECAR therapy. The program was conducted for 24 sessions, of 16 minutes each, three times a week, for eight weeks. The post-test was conducted 24 hours after the intervention was completed.

Ⅲ. Results

Table 2 lists the changes in VAS and PROM after the eight-week TECAR therapy intervention. The VAS decreased to 0 cm in all positions from 4.3 cm, 6.5 cm, and 7.2 cm at the rest, standing, and gait positions, respectively. Regarding PROM, the flexion, extension, abduction, internal rotation, external rotation, and flexion and knee extension, and passive straight leg raise were measured at 88.5°, 15°, 39°, 21.5°, 23°, 22°, and 46.5°, respectively, in the pre-test. These increased to 122.5°,

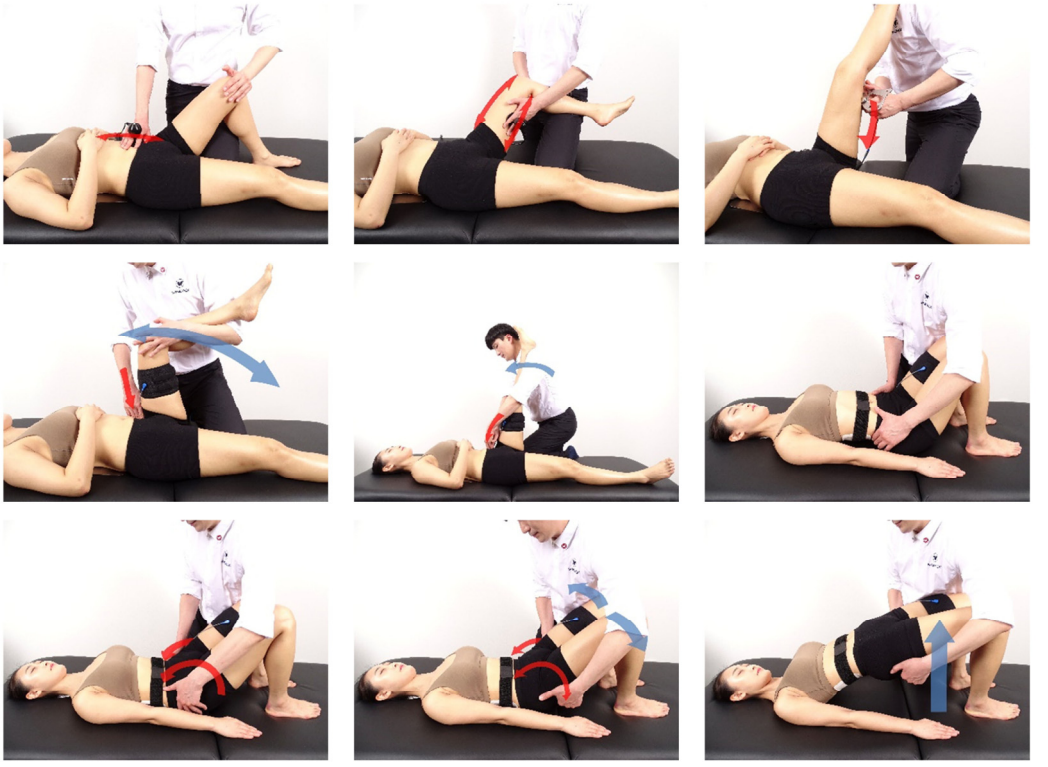

Fig. 1. TECAR therapy program.

Table 2. Changes in the Clinical Outcome after the TECAR Therapy Program

Variables	Pre-test	Post-test
VAS(cm)		
rest	4.3	0
standing	6.5	0
gait	7.2	0
PROM(˚)		
Flexion	88.5	122.5
Extension	15	24.5
Abduction	39	78
Adduction	21.5	33
Internal rotation	23	65
External rotation	22	42
Passive straight leg raise	46.5	96.5

VAS: visual analog scale, PROM: passive range of motion

24.5°, 78°, 33°, 65°, 42°, and 96.5°, respectively, in the post-test.

Ⅳ. Discussion

Hip impingement syndrome usually results from repeated impingement between the proximal femur and acetabular rim and is a common cause of hip pain [35]. Such impingement is often attributable to two main reasons. One involves structural changes involving anatomical deformation, and the other involves nonstructural changes with inappropriate activity patterns of muscles, which may be caused by damage to the soft tissues and hip alignment problems. Regarding the present patient, the professional opinion of a specialist and the physical examination results [27,28,33] suggested that damage to soft tissues and joint

alignment problems were the cause of the changes in the muscle activity patterns. These changes resulted in an excessive anterior glide of the femoral head. Thus, her case can be classified under hip impingement because of nonstructural changes. Although there has been growing interest in complementary intervention methods to treat hip impingement syndrome [36], physiotherapeutic methods have been used along with other interventions [19]. In particular, it is difficult to find any application of WINBACK TECAR therapy to alleviate pain and improve the hip function in patients with hip impingement syndrome. This study examined the clinical effects of physiotherapeutic intervention using WINBACK TECAR therapy on hip impingement syndrome. To the best of the authors' knowledge, this is the first case study that applied WINBACK TECAR therapy to ease pain and improve the function of the hip joint. The therapy was effective in reducing pain due to hip impingement syndrome and increased the PROM. TECAR therapy uses a special form of non-invasive, high-frequency energy with a frequency range between .3–1 MHz that helps cells self-regenerate [34]. The physiological effects include reducing muscle spasms, reducing muscle contracture, enhancing the regional blood flow, vasodilatation, contribution to hemorrhagic reabsorption and oxygenation, activation of the major metabolic responses, and increased capacity [37]. This therapy delivers high-frequency energy to the body, generates heat, relaxes the muscles, tendons, and ligaments, and vitalizes the sympathetic and autonomic nerves [25]. Lee et al. [24] assessed the combined intervention of TECAR therapy and oriental medical approaches for a group of patients with cervical myotonic torticollis. They reported a positive result of the reduced numerical rating scale, an improvement of neck disability index, and ROM. Kwon et al. [23] examined patients with chronic lumbar pain and reported that undergoing a TECAR therapy program for four weeks (three times a week) produced a significant decline in VAS and the backache-related index of Oswestry Disability Questionnaire (ODQ). In addition, Park et al. [22] conducted a two-week program (six times a week) of a combination of TECAR therapy and correction exercise in forward head posture patients and reported that the experimental group showed significant improvement compared to the control group. In research on the immediate effects of TECAR therapy [21], the subject with tightness of the gastrocnemius exhibited a significantly positive change in the PROM and AROM. The present research found that the pain index of VAS reduced to 0 cm, indicating no pain in the post-test from 4.3 cm, 6.5 cm, and 7.2 cm at the rest, standing, and gait positions, respectively, in the pre-test. The index of the joint function of PROM also showed positive changes for all items. The results of the previous studies [21-24] are consistent with those of the current research, but they were not clinical interventions for patients with hip impingement syndrome, TECAR therapy induces positive changes in the variables of pain and hip joint function.

As mentioned above, the TECAR therapy program conducted on the subject consisted of two methods: (i) independent application of TECAR therapy with manual therapy and (ii) a combination of manual therapy and therapeutic exercise with TECAR therapy. The independent application of TECAR therapy helped relax the tension of the iliopsoas muscle, which is closely related to hip joint impingement; the other muscles, including the hamstrings, engaged in hip flexion. This suggests that TECAR energy disrupts pain delivery signals and increases the pain threshold by stimulating the secretion of endorphins, which leads to pain reduction [38,39]

The physical examination revealed a larger increase in hamstring activity than that of the gluteus maximus, as the subject performed isometric contraction for hip extension. This might be due to the biased recruitment of the hamstring via its increased tension, which gives rise to excessive anterior glide of the femoral head and accelerates hip impingement. As hip extension depends

more on the hamstrings than on the gluteus maximus, such an altered movement pattern would lead to an abnormal joint force in the sagittal plane [5].

In addition, the point of attachment of the gluteus maximus to the bone is closer to the rotation axis of the hip joint, while the hamstrings originate at the ischium and are inserted into the tibia and fibula. Thus, the femoral head rotates completely with hip extension, and this long lever produces an anterior glide of the femoral head [5]. To solve this problem, manual therapy and therapeutic exercise based on TECAR therapy were performed to yield the normal movement of the femoral head with hip flexion and enhance hip mobility and stability. The present intervention program showed that performing manual therapy and therapeutic exercise with the application of TECAR generates heat in the deep tissues, relaxes the hard tissues around the hip, and vitalizes the sympathetic and autonomic nerves [25]. After the intervention, the subject could move more comfortably with lower sensitivity to pain.

The therapeutic effect of joint mobilization, posterior pelvic tilting and external rotation, and bridging exercise was greater than without TECAR energy flow, which would lead to positive changes in all items of PROM. Ribeiro [34] reported that TECAR therapy is an outstanding method of physiotherapeutic intervention for musculoskeletal patients and can be a great supplement, being advantageous as both an independent application and a combined application with other rehabilitation programs for both short-term and long-term periods.

Ⅴ. Conclusion

This paper reported that physical therapy intervention based on TECAR therapy could produce a positive change in the self-awareness of pain and the function of hip joints in patients with hip impingement syndrome. As the causes and forms of the syndrome under discussion vary from patient to patient, accurate analysis, diagnosis, and therapy must be prepared for such patients. The limitation of the present research is that the case study was conducted on a single female subject. Nevertheless, it provides a new insight for treating hip impingement syndrome with the independent application of TECAR therapy and a combination of TECAR therapy with other physical therapy methods, such as manual therapy and therapeutic exercise. Further research on the intervention of TECAR therapy with a larger number of subjects will further elucidate its immediate and long-term effects.

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