EFFECT OF TRIGGER POINT MANUAL PRESSURE RELEASE TECHNIQUE APPLIED TO THE ILIACUS MUSCLE ON PELVIC TILT ANGLE

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ABSTRACT

Purpose: The purpose of this study was to determine the effects of iliacus trigger points on anterior pelvic tilt angles.

Methods: 52 healthy students aged 18 to 25 years at Marmara University Faculty of Health Sciences recruited, and 45 students with iliacus trigger points were included in the study. Anterior pelvic tilt angles of participants were measured before and after use of an iliacus trigger point release technique. Additionally, all participants underwent pain pressure threshold measurement and the Thomas Test pre- and post-release. Paired t test was used to analyze differences in anterior pelvic tilt pre- and post-release**.**

Results: At baseline, participants' average anterior pelvic tilt was 10.16 ± 3.85, which refers a high value. After use of the iliacus trigger point release technique there was a statistically significant decrease in this angle (7.82 ± 2.64; $p < 0.05$). Before use of the iliacus trigger point release technique, both males and females showed asymmetry in pelvic tilt angle between sides. Especially, pelvic asymmetry of males (2.3 ± 1.96) was higher than females (1.75 ± 1.06). After use of the iliacus trigger point release technique, there was a significant reduction in pelvic asymmetry of males ($p= 0.01$). Additionally, post trigger point release, we observed a significant decrease in the average Thomas Test score ($p= 0.001$) and a significant increase in pain pressure threshold ($p = 0.001$).

Discussion: The observed changes in the angle of anterior pelvic tilt may have resulted from decreased iliacus activation and muscle spasm release. This could also explain the significant decreases in Thomas Test results. Increased pain pressure threshold may have resulted from decreased muscle tenderness post-release.

Conclusion: Use of the iliacus trigger point release technique for problems such as hip flexor muscle shortening and increased anterior pelvic tilt warrants additional investigation.

Key words: Iliacus muscle; Pain, Pelvis; Trigger point.

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Introduction

There are 22 muscles in and around the human hip joint. These muscles permit rotational movements in all directions and help to stabilize the hip (Byrne et al., 2010). The iliacus is a muscle that cooperates with the psoas major and psoas minor. It has a major role in hip flexion and adheres to the lateral wall of the pelvis and the upper two-thirds of the iliac fossa (Simons et al., 1999; Eland et al., 2002). The iliacus is one of the most highly active muscles during gait. It is active during some phases of the normal gait cycle, including the terminal stance, the pre-swing, the toe-off, and at mid-swing (Turgut, 2015). The iliac crest is a joint that works in coordination with the hip, lumbopelvic, and thoracolumbar joints, and lower extremities. Consequently, dysfunction of iliacus muscle that attaches to this joint may cause functional changes in these structures (Simons et al., 1999).

Myofascial trigger point syndrome is one cause of iliac dysfunction (Byrne et al., 2010; Nourbakhsh and Arab, 2002). In a study conducted in young healthy individuals, the prevalence of myofascial trigger point syndrome was found to be high in iliacus muscle (Liu and Palmer, 2012). Myofascial Pain Syndrome (MPS) is a generally under-diagnosed and inoperable condition characterized by musculoskeletal pain and weakness. Individuals with MPS often exhibit reduced joint range of motion (ROM), as well as local and referred musculoskeletal pain (Borg-Stein and Simons, 2002).

Trigger points can be found in a single skeletal muscle, or simultaneously in more than one muscle. These trigger points and strained muscle bands can be relieved by muscle strengthening and relaxation exercises, superficial and deep warming methods (such as therapeutic ultrasound), laser therapy, and trigger point relaxation techniques (Gül and Onal, 2009).

The pelvic tilt angle is expressed as the anteroposterior position of the pelvis in the sagittal plane during static standing. An increase in this angle is called anterior pelvic tilt, and decrease of this angle is called posterior pelvic tilt (David and Whittle, 1996; Malarvizhi et al., 2017). The effects of pelvic tilt angle on patients with chronic low back pain were previously investigated and appear to play a substantial role in back health (Evcik and Yucel, 2003). Kendall and colleagues found that lumbar lordosis may be result from pelvic tilt due to disrupted balance among the thoracal, hip, and abdominal muscles (Kendall et al., 2005). Increased anterior pelvic tilt also increases lumbar lordosis (Arab et al., 2017), which in turn increases the risk of lumbar disc herniation (Evcik and Yucel, 2003). Samuel et al. found that there was a relationship between lumbar disk problems and myofascial trigger points (Samuel et al., 2007).

Many studies have investigated the relationship between the presence of iliacus trigger points and factors such as activities of daily living (ADLs) and back pain. On the other hand, studies examining the effects of trigger points on pelvic, lower extremity, and lumbar region ROM are limited (Nourbakhsh and Arab, 2002; Liu and Palmer, 2012). For this reason, the aim of this study was to determine if there is a relationship between the presence of iliacus trigger points and angle of pelvic tilt.

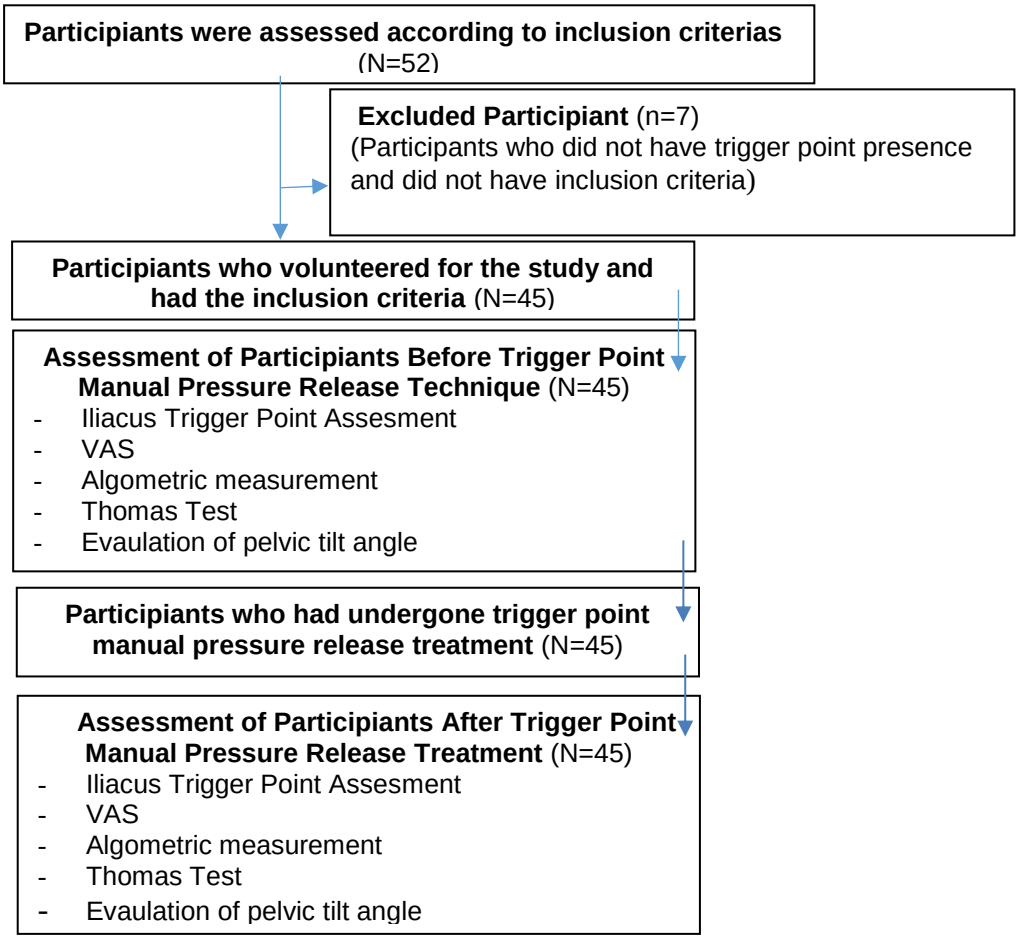
Subjects and Methods

Subjects

Subjects were 52 healthy students aged 18 to 25 years at Marmara University Faculty of Health Sciences who volunteered to participate in the study. Power analysis was performed by using the data of the preliminary study (mean and standard deviation) to determine the number of patients. At the 95% confidence interval (CI), the power value was calculated as 0.8, with a value of 0.78, the minimum number of patients to be received with a standard deviation of ± 1.67 (SD) was 38.

Each participant was examined for the presence of iliacus trigger point. Forty-five students (35 female, 11 male) who had iliacus trigger point were included in the study. Exclusion criteria included history of pelvic or spine surgery, current skin infection or wound in the inguinal region, current musculoskeletal injuries to the pelvic region, history of spine, pelvis, or lower extremity fracture, lumbar radiculopathy and nerve pressure, or history of orthopedic and neurological disorders. Consort flow diagram was used for this study (Table 1).

Table 1- The flow diagram



Data Collection Tools

Sociodemographic and Physical Data Form

Data pertaining to subjects' sociodemographic characteristics such as age, gender, height, weight, presence of low bac pain and body mass index (BMI) via a non-standardized questionnaire was collected (Table 2).

At first the presence of iliacus trigger point was examined. Participants who had iliacus trigger point underwent measurement of pelvic tilt angle, VAS (pain) scale, PPT and Thomas test before and after use of the iliacus trigger point release technique. After the iliacus trigger point release technique, the presence of iliacus trigger point was reexamined.

Iliacus Trigger Point Assesment

Iliacus trigger point assessment was used used for very few studies (Liu and Palmer, 2012). Evidence for the diagnostic reliability of trigger points is available from only a limited number of studies (Lucas et al., 2009). Iliacus trigger point assessment should be performed by a physiotherapist with experience in this regard.

An experienced physiotherapist palpated the Spina Iliaca Anterior Superior (SIAS) region of all participants, who were placed in a supine position with bilateral knee flexion. The physiotherapist then moved her thumb five centimeters medial and slightly caudal, and palpated laterally into the area of the iliac fossa. After palpating the iliac fossa, physiotherapist applied pressure to the area with an algometer (Liu and Palmer, 2012; Chao et al., 2016).It was recorded the pressure value at the point where the participant reported experiencing pain, and pain severity was measured using a Visual Analogue Scale (VAS) (Gaston and Gustafsson, 1990). The VAS is a scale with a 10-centimeter horizontal line bound by "no pain" on the left (score of 0) and "worst pain possible" on the right (score of 10). The participants marked this horizontal line according to the severity of the pain. The distance between the place marked by the person and the starting point of the horizontal line was recorded as a numerical value (Chao et al., 2016; Bijur et al., 2001). An algometer (JTECH Medical Industries, Commander TM Algometer, 801-478-0680) is a device for quantifying soft tissue tenderness that records the force (in kilograms per square centimeter) required to cause painful pressure over tissue, called PPT (Pain Pressure Threshold). In this study, the algometer which had 1cm2 diameter rubber tipped probe was used to measure soft tissue sensitivity (Chao et al., 2016; Nussbaum and Downes, 1998). Algometric measurement was made 20 minutes after the relaxation technique, taking into account tissue sensitivity.

Thomas Test

The Thomas Test assesses tightness in the hip muscle flexor muscles. During the Thomas Test, each participant was asked to lay in a supine position on the examination table and bring one knee to his or her chest, while holding the knee with both hands. Meanwhile, the contralateral lower extremity was maintained in an extended position on the examination table. The physiotherapist observed the angle of the lumbar region and the amount of hip extension. When the extended leg was elevated above the

table, the test was considered positive and the angle between the table and the leg was measured (Liu and Palmer, 2012; Hoppenfeld, 1976).

Evaluation of Pelvic Tilt Angle

The angle of pelvic tilt was measured with a pelvic inclinometer, a device with high intergroup and intra-group reliability (Herrington, 2011). The pelvic inclinometer is a tool used by adding an electronic inclinometer (Baseline® Digital Inclinometer) to measure the tilt angle, which is between −45° and +45°(Richard et al., 1994). The normal pelvic tilt angle for anterior superior iliac spine to posterior superior iliac spine 0-23 degrees with a mean of 13 and standard deviation of 5° (Malarvizhi et al., 2017). When evaluating the pelvic tilt angle, the physiotherapist marked the participants' Spina Iliaca Anterior Superior (SİAS) and the Spina İliaka Posterior Superior (SİPS) while the participant was standing upright. The inclinometer was then situated in the frontal plane. Anterior tilt was positive and posterior tilt was recorded on a digital screen as negative value. The test was repeated three times and the average value was recorded. Participants rested 30 seconds between tests (Richard et al., 1994; David et al., 1997).

Iliacus Trigger Point Manual Pressure Release Technique

Participants were placed in a supine position with semiflexion of both knees. While the physiotherapist was applying pressure to the iliac muscle using four fingers, which were in an upright position, she was checking the intensity and extent of the pain according to the VAS scale. The physiotherapist continued to apply progressively greater pressure, for at least 60 seconds, or until the participant's pain level was registered as a VAS score of 2-3 (Chao et al., 2016).

Statistical Analysis

Data were analyzed using the SPSS statistical package (Version 11.5). Results are expressed as means, standard deviations (SD), or 95% confidence intervals (95% CI). We used the one sample Kolmogorov-Smirnov test to assess data distribution. Paired t tests were used to compare variables of interest pre- to post-release.

Ethics

The study was conducted in compliance with the Helsinki Declaration, with the permission of the ethics committee of Marmara University Health Sciences Institute. All participants included in the study were informed about the purpose of the study and provided informed consent for participation.

Table 2- Sociodemographic Characteristics

	Mean- SD	Min-Max
Age (years)	20.87 ± 1.05	19-24
BMI (kg/m^2)	21.82 ± 2.83	17.01-30.48
	n	**%**
Gender		
Male	11	24.4
Female	34	75.6
Presence of low back pain		
Male	10	90.9
Female	18	52.9
SD: Standard deviation BMI: Body Mass Index		

Table 3 - Pelvic tilt, VAS, Pelvic asymmetry, Presence of İliacus Trigger point, Thomas Test and Pain Pressure Threshold values before and after use of the trigger point manual pressure release technique

	Before Treatment Mean±S.D	After Treatment Mean±S.D	P value
Pelvic Tilt Angle (^{0})			
Right	11.37 ± 3.85	8.63 ± 3.16	**0.000***
Left	9.21 ± 2.99	7.01 ± 2.64	**0.000***
Thomas Test (%)			
Right	11.31 ± 4.12	9.62 ± 3.65	**0.000***
Left	10.88 ± 3.98	9.57 ± 3.53	**0.000***
PPT (N)			
Right	20.8 ± 11.4	30.44 ± 12.5	**0.000***
Left	21.2 ± 13.05	31.5 ± 14.37	**0.000***
VAS (cm)			
Right	7,11 ± 1.33	2.4 ± 0,85	**0.000***
Left	7,33 ± 1,24	2,8 ± 0,92	**0.000***
Pelvic Asymmetry (^{0})			
Males	2,3 ± 1,96	1,06 ± 0,94	**0,01***
Females	1,75 ± 1,06	1,65 ± 1,02	0,28
	n (%)	**n (%)**	
Presence of Iliacus Trigger Point			
Right	5 (11.1)	1 (2.2)	
Left	10 (22.2)	2 (4.4)	
Bilateral	30 (66.7)	2 (4.4)	
SD: Standard deviation PPT: Pain Pressure Threshold			

Results

A total of 35 people were enrolled (17 males, 16 females; average age 20.8 ± 1.0 years; average body mass index 21.82 ± 2.83 kg/m^2). Trigger points were detected in the right iliacus muscle only in five participants, in the left iliacus muscle only in 10 participants, and in both the right and left iliacus muscles in 30 participants. Pelvic asymmetry was also found in all participants (Table 3). 90 percent of men and 50 percent of women had low back pain (Table 2).

There was a significant bilateral decrease in the average pelvic tilt angle, VAS scores, Thomas Test score and pelvic asymmetry ($p < 0.05$) post-release. Additionally, PPT significantly increased on both sides post-release ($p < 0.05$; Table 3).

Discussion

The iliacus and psoas major muscles are the main muscles of hip flexion (Eland et al., 2002). A significant decrease in Thomas Test score was observed post-release. These findings indicate that the trigger point manual pressure release technique attenuates muscle spasms by reducing iliacus muscle activation, thereby modifying the size of the sarcomeres in the shortened position. It is also possible to say that the shortness of the hip flexor muscle initially assessed by the Thomas test may result from the trigger point in the iliacus muscle. Because after the trigger point manual pressure release technique, presence of trigger point in iliacus muscle was reexamined and it was detected in only 6 percent of all participants. And a significant decrease in Thomas Test score was also observed post-release.

The trigger point manual pressure release technique is a manual method used to treat trigger points. This technique increases circulation in the trigger point region and modifies the positions of shortened sarcomeres (Sarrafzadeh et al., 2012).

Myofascial trigger points are hyperirritable regions, usually within a taut band of skeletal muscle or in the muscle fascia, which are painful on compression and can produce characteristic referred pain and motor dysfunction. Motor dysfunction causes decreased ROM and muscle weakness (Lavelle et al., 2007; Cummings and Baldry, 2007). Myofascial trigger points are also evaluated as either *active* or *latent*. Active trigger points are characterized by spontaneous pain, reduced muscle elasticity and strength, and referred pain. In contrast, latent trigger points do not cause spontaneous pain, and are only painful on palpation (Delgado et al., 2009). All of the participants in this study had active trigger points. Active trigger points are essentially areas of peripheral sensitization. These areas can feature higher levels of algogenic substances such as bradykinin, substance P, or serotonin. Hidalgo-Lozano and colleagues reported that this sensitization decreased and the PPT increased following trigger point pressure release treatment (Hidalgo-Lozano et al., 2011). PPT findings also support this hypothesis. In this study, a statistically significant increase in PPT was observed post-release. Decreased PPT values may be due to decreased sensitivity of the iliacus muscle with trigger point release technique.

All of the participants included in this study had anterior pelvic tilt, following measurement of their pelvic tilt angles. A forward rotation of the pelvis, referred to as anterior pelvic tilt, is accompanied

by an increase in lumbar lordosis and is believed to be associated with a number of common musculoskeletal conditions, including low back pain and anterior cruciate ligament deficiency. In addition, anterior pelvic tilt has been associated with a loss of core stability (Preece et al., 2008). In this study, a significant decrease was found in pelvic tilt angle after trigger point pressure release treatment. Anderson et al found a relationship between surface EMG iliacus muscle activation and pelvic tilt. As anterior pelvic tilt increases, surface EMG iliacus muscle activation also increases. On the contary, As posterior pelvic tilt increases, surface EMG iliacus muscle activation decreases. (Andersson et al., 1997). Results of this study also support this hypothesis. Clinically, preserving normal lumbar lordosis can help prevent a range of spinal disorders. Importantly, disrupted anterior pelvic tilt can increase lumbar lordosis, which in turn affects the physiological position of the entire spinal cord. (Neumann, 2002). Therefore, decreasing anterior pelvic tilt is important for spinal health. In this study, a statistically significant decrease in pelvic tilt angle was found post-release. The trigger point release technique therefore appears to decrease iliacus muscle activation in participants with anterior pelvic tilt. The mechanism of action of the release technique is described as follows: Myofascial trigger points reduce the local blood flow in the area where they are present. Temporary ischemia is created by applying short-time pressure to sensitive focal points at the trigger point release technique. And then a sudden increase in local blood flow occurs when the pressure is removed from the center. With this sudden increase in blood flow, the chemical mediators that cause pain are removed from the environment, thus reducing the excitability of pain receptors (Delgado et al., 2009). Present studies in the literature shows that the trigger point manual pressure release technique is an effective treatment when applied together with conventional treatment methods, and also has been shown to be a reliable method (Hidalgo-Lozano et al., 2011).

In this study, pelvic asymmetry was detected in all participants as well as anterior pelvic tilt. Pelvic asymmetry has been suggested to alter biomechanics of the body leading to musculoskeletal pain and significant correlations between pelvic asymmetry and low back pain have been described. Besides numerous studies demonstrating opinions that pelvic asymmetry is associated with pathology, it can also be observed in healthy subjects with no evidence of any dysfunction. According to some researchers that pelvic asymmetry can be a physiologic alteration which adapts the locomotor system to the transmission of asymmetrical mechanical loads (Gnat et al., 2009). Angle of pelvic asymmetry for men was higher than females in this study. After the trigger point release technique although there was a significant decrease in pelvic asymmetry in men, there was no significant decrease in women. Herrington also found that men had more pelvic asymmetry than women (Herrington, 2011). In this study, 90 percent of men and 50 percent of women had low back pain. It has been shown in the literature that there may be a relationship between pelvic asymmetry and low back pain (Bussey, 2010). The results of this study support this hypothesis. It is thought that the degree of pelvic asymmetry was reduced more by the releasing of the trigger point in the iliacus muscle in men with a higher rate of low back pain than women.

Although the presence of a trigger point in iliacus muscle in young healthy individuals were investigated (Liu and Palmer, 2012), the relationship between the iliacus muscle trigger point and the

pelvic tilt angle was not investigated. The efficacy of trigger point manual pressure release technique has been generally investigated in patients with migraine, impingement and neck pain (Hidalgo-Lozano et al., 2011; Gemmell et al., 2008). The effectiveness of the trigger point release technique in lower extremity dysfunctions, pelvis and lumbar spinal disorders has been less studied, but the issue of how the trigger point release technique may affect the trigger point presence in iliacus muscle has not been adequately addressed. From this point of view, we believe that this study will contribute to the literature due to the effects of iliacus trigger point release technique on pelvic tilt. This study has some limitations, although it is an original study because of being the first study in which findings of the trigger point release technique can change pelvic tilt. Only the immediate effects of the trigger point manual pressure release technique on the pelvic tilt was assessed and the control group was not. We think that there is a need about randomized controlled studies which in are investigated the long term effects of trigger point pressure release technique on pelvic tilt.

Conclusion

The trigger point manual pressure release technique is able to affect pelvic tilt angle, hip flexor muscle shortness, and PPT. Therefore, the presence of iliacus trigger points should be investigated for use as treatments for problems such as hip flexor muscle shortening and increased anterior pelvic tilt.

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