Case Report

Physical therapy of a patient with right anterior thigh pain during seiza after right total hip replacement

正座の際に右大腿前面に疼痛を認めた右人工股関節全置換術後患者の理学療法

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Abstract Seiza is a traditional Japanese sitting style that involves kneeling and sitting with knees bent. However, there have been reports that patients who underwent total hip replacement have difficulty performing seiza in daily life. Since they are concerned about dislocation, they tend to alter their lifestyle as a preventative measure. A disease indicated for total hip replacement is developmental dysplasia of the hip, which causes secondary osteoarthritis due to joint pain and destruction of articular cartilage. Total hip replacement can repair osteoarthritis of the hip by removing pain and improving function. However, in patients with a medical history of developmental dysplasia of the hip, shortening of soft tissues, such as the hip adductor muscle group, quadriceps, and sciatic nerve, has been observed. Therefore, it is necessary to consider the condition of soft tissues and their impact on activities of daily life after total hip replacement. We administered physical therapy to a patient who underwent total hip replacement to resolve developmental dysplasia of the hip. After total hip replacement, the patient experienced difficulty performing seiza due to a limited knee range of motion, which was thought to be caused by soft tissue shortening. Therefore, we treated the shortening of the muscle. As a result, the patient's limited range of motion was resolved, and she was able to perform seiza without pain. In patients with developmental dysplasia of the hip, treatment of the soft tissues is recommended as an important measure to complications such as pain and dislocation when returning to everyday activities after total hip replacement. This report discusses the treatment process leading to the patient's progress in performing seiza. We believe that applying this technique will achieve better outcomes of physical therapy that will enable a patient to perform seiza after total hip replacement.

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Introduction

A traditional Japanese sitting style that involves kneeling and sitting with knees bent is called "seiza." However, there have been reports of patients who experienced difficulty performing seiza after total hip replacement (THR)[1]. Moreover, dislocation is a common and major complication after THR, and patients who have undergone THR have been reported to be anxious about dislocation and change their lifestyles to prevent dislocation[2].

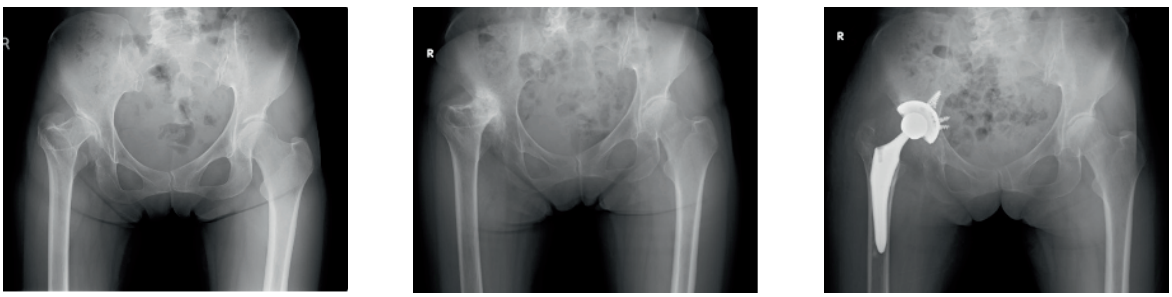
A disease that is indicated for THR is developmental dysplasia of the hip (DDH), which causes secondary osteoarthritis due to joint pain and destruction of articular cartilage[3]. For end-stage osteoarthritis of the hip due to DDH, THR is expected to alleviate pain and improve function[4]. However, in patients with a medical history of DDH, anatomical disruption of the hip joint and shortening of soft tissues such as the hip adductor muscle group, quadriceps, and sciatic nerve have been observed[5-7]. Shortening of the adductor muscles after THR affects functional recovery after THR, which impacts hip abductor muscle strength during walking[6, 8]. Therefore, when administering physical therapy to rehabilitate the patient toward a successful return to activities of daily life (ADL) after THR, we need consider the influence of soft tissues around the hip joint.

We performed physical therapy on a DDH patient who underwent THR. The patient had performed seiza as a routine part of her ADL. However, the patient experienced difficulty performing seiza due to limited knee range of motion (ROM), which was thought to be caused by soft tissue shortening after THR. Herein, we discuss the treatment process leading to the patient's progress in performing seiza. We believe that applying this technique will achieve better outcomes of physical therapy that will enable a patient to perform seiza after THR. We obtained approval from the institution to publish this paper. The patient was explained about the purpose of this study and informed about the protection of personal information before obtaining her signed consent.

Case Discription

The patient is in her early sixties (height 155cm, weight 45.7kg). Her medical history was significant for osteoarthritis of the hip, DDH, and osteoarthritis of the knee and lumbar spine. She was treated with orthosis during infancy; however, there were no additional details regarding the same.

The patient visited our hospital for the first time in 2012, and presented with right hip pain and lower back pain. She was diagnosed with DDH and early-stage osteoarthritis of the hip (Figure 1－a), for which the patient received pharmacotherapy as an initial treatment. Although her right hip pain improved, it began to worsen again in July 2020. At that time, she was informed about THR. In January 2021, when she had reached end-stage osteoarthritis, she requested THR (Figure 1－b). She was admitted to our hospital and underwent right THR to alleviate hip pain in March 2021 (Figure 1－c).



a b c

Figure 1: Simple radiographic (A-P) images of the patient's hip joint at the time of (a) first visit in 2012, (b) before THR, and (c) after THR.

Table 1 : Altered motor function in a patient

		Preoperative		After THR		Before discharge	
		Right	Left	Right	Left	Right	Left
ROM (degree)							
Hip	Flexion	70	115	80	115	90	115
	Extension	0	10	− 5	10	0	10
	Abduction	0	20	5	20	10	20
	Adduction	10	15	10	20	10	20
Knee	Flexion	150	150	120	150	150	150
	Extension	0	0	0	0	0	0
MMT (stage)							
Hip	Flexion	fair	normal	fair	normal	good	normal
	Extension	good	normal	fair	normal	fair	normal
	Abduction	fair	good	poor	good	fair	good
	Adduction	good	normal	poor	good	fair	good
Knee	Flexion	normal	normal	normal	normal	normal	normal
	Extension	good	normal	good	normal	normal	normal
Leg Length (cm)							
	SMD	75.5	78.5	78	78.5	78	78.5
	TMD	81	81	81	81	81	81
JHEQ Score		16/84	−	−	−	74/84	−
JOA Hip Score		43/100	−	−	−	62/100	−
FIM Score		123/126		124/126		124/126	
CRP (mg/dL)		0.03		0.45		0.15	
WBC ($10^3/\mu L$)		3.9		3.5		4.3	

ROM; Range of Motion, MMT; Manual Muscle Testing, SMD; Spino-Malleolus Distance
TMD; Trochanter-Malleolus Distance, JHEQ; Japanese Orthopedic Association Hip Disease Evaluation Questionnaire
JOA Hip Score; Japanese Orthopedic Association Hip Score, FIM-Score; Functional Independence Measure Score
CRP; C-reactive protein, WBC; White Blood Cell

Progress

Table 1 depicts the patient's progress in loss and restoration of function. Her preoperative functional independence measure score (FIM score) was 123/126. She did not use any walking aid, was unable to walk 50 m, nor was she able to climb or descend stairs, which decreased her score. The patient's right hip condition was assessed using the Japanese Orthopedic Association Hip Disease Evaluation Questionnaire (JHEQ)[9], which revealed that the HIP-JOINT CONDITION was 86/100 mm and the total score was 16/84 for each category (PAIN 6, MOVEMENT 3, MENTAL 7). The patient right hip condition was further assessed using the Japanese Orthopedic Association Hip Score (JOA Hip Score)[10], which scored her right hip as 43/100 (PAIN 10, ROM 7, GAIT 10, ADL 16). Her subjective pain score during gait maneuvers was 7/10 based on the Numerical Rating Scale (NRS). Her passive ROM (right/left) were as follows: hip flexion, 70°/115°; extension, 0°/10°; abduction, 0°/20°; adduction, 10°/15°; right and left knee flexion, 150°; and extension, 0°. Regarding leg length, the spino-malleolus distance (SMD) was 75.5cm/78.5cm, and the trochanter-malleolus distance was 81cm/81cm; thus, the right leg was shorter than left. The Thomas test was positive for both sides, and the Ely test was negative for both sides. Details on the complete examination are shown in table 1.

The patient underwent THR seven days after

admission. The anterolateral-supine approach with a high-offset system was applied (Figure 1－c). After two days, we began treating the patient with physical therapy after THR. She complained of wound pain but did not complain of hip pain. Eight days after THR, she achieved independent movement in performing ADL in the hospital, and her FIM score improve to 124/126. She used a T-cane but could not climb or descend stairs, which decreased her score. We expanded her physical therapy program to help her perform ADL at home. Then, she wished to perform seiza, because she performs seiza as part of her ADL, especially when taking a bath. During bathing, she performs seiza for about 10 minutes. Therefore, physical therapy was conducted with the goal of enabling the patient to perform seiza with ease.

Physical Therapy

After THR

Posture

Depicted in Figure 2 is the patient performing seiza. Seiza was performed from a half-kneeling position to a kneeling position. After that, she flexed both knees. However, she complained of right anterior thigh pain, giving a subjective 10/10 NRS score. As a result, she had difficulty in performing seiza. Therefore, we evaluated the pain of her right anterior thigh, which she had complained of while performing seiza.

Function

The patient's passive ROM (right/left) were as follows: hip flexion, 80°/115°; extension, －5°/10°; abduction, 5°/20°; adduction, 10°/20°; and knee flexion, 120°/150°. Postoperatively, limitation of right knee joint flexion was observed. When the patient flexed her right knee joint, she complained of right anterior thigh pain and gave a subjective NRS score of 7/10. She also resisted having her right knee joint flexed, which made further flexion difficult. Palpation revealed increased muscle tone and tenderness in the right rectus femoris, vastus medialis, adductor magnus, adductor longus, and pubococcygeus muscles. In assessing SMD, the lower limb length was 78/78.5cm, and the right leg was extended by 3cm on the affected side compared with the preoperative length. The Thomas test was positive bilaterally, and the Ely test was positive on the right side but negative on the left side. The patient did not complain of pain at rest or at night. For additional details of the examination, refer to table 1.

Hypothesis

We hypothesized the reason for the patient's difficulty in performing seiza. She was able to perform seiza before THR, but experienced difficulty after undergoing THR. We first observed her ROM when performing seiza. She had insufficient flexion angle of the right knee joint due to pain in the right anterior thigh. Physical therapy evaluation revealed increased muscle tone and tenderness in the right rectus femoris, vastus medialis, adductor magnus, adductor longus, and pubococcygeus muscles, which were not present before THR. The pain in the right

Figure 2 : Seiza at after THR

The patient's posture was observed from the sagittal plane. The dorsal side of both feet and her lower legs were grounded on the floor. Then, both knees were flexed. During the process, she complained of right anterior thigh. As a result, she had difficulty in performing further knee joint flexion and seiza.

rectus femoris muscle was especially severe when she was performing seiza. The results of the Ely test suggested that the right rectus femoris muscle was shortened.

We hypothesized that the main cause of pain was stretch pain in the rectus femoris muscle. Stretch pain was also observed in the vastus medialis muscle, which was thought to be caused by decreased extensibility of the vastus medialis muscle as a result of increased muscle tone in the hip adductor muscle group. We assumed that the stretch pain was due to several muscles becoming relatively shorter than the leg because of the effects of leg lengthening and THR-associated femoral offset. As a result, the patient's pain was thought to be induced by stretching of the knee joint extensor muscle groups that are associated with knee joint flexion. Therefore, she was able to perform seiza after the following problems were identified and treated: (1) relative shortening of the right rectus femoris muscle, (2) stretching pain of the right rectus femoris muscle, (3) relative shortening of the right adductor muscle group, and (4) stretching pain of the vastus medialis muscle.

Treatment

Seiza started 12 days after THR. To improve the ROM of knee joint flexion, isometric contraction of the rectus femoris muscle was performed repeatedly in the extended position. She was placed in a supine position with the hip and knee joint flexed. The angle of knee joint flexion was set to the point just before the appearance of pain caused by knee joint flexion. In this position, isometric contraction of knee joint extension by manual resistance was performed repeatedly. The patient was then placed in the prone position with an intermediate position of hip flexion and extension, and the knee joint was flexed. In this position, isometric contraction of knee joint extension by manual resistance was performed repeatedly. For the adductor muscle group, we abducted the hip joints on both sides in a supine position. From this position, manual resistance was applied to the medial side of the knee joint, and isometric contraction by hip joint adduction was performed repeatedly. If there was an increase in ROM during the set, we enlarged the knee joint flexion and hip joint abduction angles. As an immediate effect, the ROM of the knee joint improved, and the right knee joint flexion angle increased from 120° to 140°. The patient's subjective NRS score indicated that her pain had reduced from 10 to 5. On the 15th day after THR, the knee joint flexion angle changed to 150°, and her NRS score decreased to 4. On the 18th day after THR, she was able to perform seiza, although she complained of elongation of the right anterior surface thigh. On the 20th day after THR, she was able to perform seiza without pain.

Results

Before Discharge

Posture

Figure 3 shows the patient performing seiza prior to discharge. Seiza was performed from a half-kneeling position to a kneeling position. After that,

Figure 3 : Seiza at before discharge

The patient's posture was observed from the sagittal plane. The dorsal side of both feet and lower legs were grounded on the floor. Then, both knees were flexed. Her heels contacted her hips, and she was able to perform seiza without complaining of pain in the right anterior thigh.

she flexed both knees. Her heels contacted her hips, and she was able to perform seiza without complaining of pain in the right anterior thigh. She was also able to maintain this posture for more than 10 minutes.

Function

Her FIM score was 124/126 at discharge. She used a T-cane but could not climb or descend stairs, which decreased her score. Her JHEQ scores were as follows: HIP–JOINT CONDITION was 4/100mm and the total score was 74/84 for each category, (PAIN 28, MOVEMENT 18, MENTAL 28). For her right hip, her JOA Hip Score was 62/100 (PAIN 35, ROM 11, GAIT 10, ADL 16). The pain in her right hip joint had disappeared, and her NRS score was 0/10. The passive ROM (right/left) were as follows: hip flexion, 90°/115°; extension, 0°/10°; abduction, 10°/20°; adduction, 10°/20°; and knee flexion, 150°/150°. No resistance was felt when the patient's right knee was flexed. The bilateral Ely test was negative. On palpation, tenderness in the right rectus femoris, vastus medialis, adductor magnus, adductor longus, and pubococcygeus muscles disappeared; however, the muscle tones for these were high. For additional details of the complete examination, refer to table 1. The patient was discharged on the 28th day after THR.

Discussion

The patient had difficulty performing Seiza, which she could perform well before undergoing THR. A knee joint flexion angle of approximately 130°－150° is required to perform seiza[11]. However, she complained of pain in the right anterior thigh at 120° of the right knee flexion after THR and had difficulty performing seiza. The patient had performed seiza as a routine part of her ADL, her difficulty in performing seiza would affect her daily life after discharge from the hospital. There for the right knee joint flexion restriction and pain were considered when assessing her difficulty level.

The patient complained of anterior thigh pain during flexion of the right knee joint. This was thought to be caused by stretch pain in the right rectus femoris and vastus medialis associated with flexion of the right knee joint. The knee extensors, rectus femoris, and vastus medialis were antagonists of knee joint flexion. Therefore, we thought that increased muscle tone in the rectus femoris and vastus medialis muscles could be a limiting factor for knee joint flexion. Increased muscle tone was thought to be caused by changes in soft tissue tone due to the effects of leg lengthening and THR-associated femoral offset.

In THR, leg lengthening is used to correct leg length differences and to maintain soft tissue tension, which can prevent dislocation. The presence of a leg length difference can increase the burden on adjacent joints and cause pain[12]. The correction of leg length difference is considered to be a critical step for achieving a comfortable condition after THR. However, hip dysplasia in adults includes contractures of the hamstrings, adductor muscles, and rectus femoris[6]. As a result, soft tissues around the hip joint, such as skeletal muscles, are thought to be elongated with leg lengthening.

In THR, the high-offset system is sometimes chosen to tense the soft tissues to prevent dislocation after THR, which was believed to produce excessive tension on the knee extension mechanism[13]. In addition, the vastus medialis is connected to the adductor magnus tendinous area. The shortened adductor muscle is stretched by leg lengthening; tension of the adductor muscle is transmitted to the vastus medialis muscle; and vastus medialis muscle tone is increased by the adductor muscle. Thus, we presumed that it would cause restriction of knee joint flexion[14].

These results suggest that leg lengthening by THR is associated with soft tissue tension around the hip joint and thus affects the ROM. Muscles that are associated with leg lengthening are considered to be in a relatively shortened position after THR than that before THR. Therefore, the goal of treatment was to improve the shortening of the rectus femoris and adductor muscles. For the rectus femoris muscle, isometric knee joint extension was performed in the knee joint flexion position, and for the adductor muscle, isometric hip joint adduction

was performed in the hip joint abduction position.

The extended muscle gradually adapts to the elongated length by extending the sarcomere length and increasing the number of sarcomeres[15, 16] . In an isometric contraction, the tendon is stretched as the muscle contracts[17] . Stretching of the muscle-tendon transition increases the number of sarcomeres and effectively improves muscle shortening[18] . Therefore, we hypothesized that the isometric contraction selected for treatment might be adapted for leg extension, in which the muscle length is elongated by the muscle-tendon transition and by an increase in the length of the sarcomere and sarcomeres in the muscle parenchyma. For these reasons, these treatments were performed on the patient. As a result, the ROM of hip abduction and knee flexion increased. We observed a reduction in the patient's muscle shortening. The pain associated with stretching of the rectus femoris and vastus medialis was alleviated, which enabled the patient to perform seiza comfortably. Therefore, it is important to improve the shortening of soft tissues in terms of the technique to help the patient perform seiza after THR.

Conclusion

We presented a case in which the patient complained of pain in the anterior thigh and limitation of knee joint flexion after THR, which led to the patient experiencing difficulty performing seiza. Generally, after THR, a leg-lengthening technique was used to correct the leg length difference and prevent dislocation. In this case, the elongated soft tissues were considered to be in a shortened position relative to the extended leg length. Therefore, we treated the shortening of the muscle. As a result, the patient's limited ROM was resolved, and she was able to perform seiza without pain. In patients with DDH, treatment of the soft tissues was considered as an important therapy after THR.

Conflict of Interest

None.

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