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CASE REPORT

Effect of physiotherapy after quadricepsplasty for knee extension contracture: a case report

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Knee stiffness with extension contracture due to femoral fracture impedes the activities of daily living and impairs the normal gait pattern. Quadricepsplasty surgery is one of the most popular methods to resolve the lack of the flexion movement.
A 59-year-old male patient with a history of knee extension contracture after femoral fracture was included in the study. Knee flexion and extension range of motion (ROM), pain levels, Lower Extremity Functional Scale and Short Form-36 (SF-36) were evaluated before quadricepsplasty surgery and 8th weeks after surgery. A quadricepsplasty-specific rehabilitation program was applied to improve the functional activities.
The ROM, pain levels, and functional outcomes improved with the rehabilitation after surgery.
A physiotherapy protocol specific to symptoms after quadricepsplasty should be applied to the patient to improve the functional outcomes.
Keywords: M. Quadriceps femoris, Quadricepsplasty, Contracture, Physiotherapy.

Diz ekstansiyon kontraktürü sonrası quadrisepsplastide fizyoterapinin etkinliği: bir olgu raporu

Femoral kırık nedeniyle gelişen ekstansiyon kontraktürü ile birlikte diz sertliği günlük yaşam aktivitelerini zorlaştırır ve normal yürüyüş paternini bozar. Quadrisepsplasti cerrahisi fleksiyon hareketinin kaybını gidermek için kullanılan en popüler yöntemlerden biridir.
Femoral kırık sonrasında diz ekstansiyon kontraktürü hikayesi olan 59 yaşında erkek hasta çalışmaya dahil edildi. Diz fleksiyon ve ekstansiyonuna ait normal eklem hareket açıklığı (NEH), ağrı seviyesi, Alt Ekstremite Fonksiyonel Skalası ve Kısa Form-36 (KF-36) quadrisepsplasti cerrahisi öncesinde ve cerrahiden sonra 8. haftada değerlendirildi. Fonksiyonel aktiviteleri geliştirmek için quadrisepsplastiye özgü bir rehabilitasyon programı uygulandı.
NEH, ağrı ve fonksiyonel sonuçlar rehabilitasyonla birlikte cerrahiden sonra gelişti.
Quadrisepsplasti sonrası hastada fonksiyonel sonuçları geliştirmek için, semptomlara yönelik spesifik bir fizyoterapi protokolü uygulanmalıdır.
Anahtar kelimeler: M. Quadriceps femoris, Quadricepsplasti, Kontraktür, Fizyoterapi.

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Range of motion (ROM) limitations in knee lead to biomechanical abnormalities in daily routine activities.[1,2] While in the swing phase of walking 67°, stair climbing and descending 83-84°, getting up from sitting 93° knee flexion is requiring, activities such as squatting or sitting cross-legged are needed more knee flexion.[3,4] In addition to this, full extension of knee at heel strike and foot-flat are very important.[5]

Extension contracture of the knee is more common than flexion contracture, and it is a disabling condition that can impair daily living activities.[6,7] A 90° flexion range is necessary for daily activity such as sitting, stair climbing, and using public transport but not for squatting or kneeling. Thus, even minor degree of flexion loss in movement can impose social problems in communities where squatting, kneeling and floor sitting area social routine.[6]

Quadricepsplasty is developed to solve knee stiffness with extension contracture after femoral fractures.[8] Achievement of the appropriate knee flexion range is possible with both surgery and a surgery-specific rehabilitation applied after the operation.[6-8] Postoperative rehabilitation is important and also depending mainly on a motivated and suitable patient for the physiotherapy protocol.[7] However, no previous studies mention a quadricepsplasty-specific rehabilitation protocol. Therefore, the aim of this case study was to present the findings related to the effects of a quadricepsplasty-specific rehabilitation protocol of a patient with extension contracture. The hypothesis of the present study was that a surgery specific rehabilitation protocol would improve the knee ROM, pain and the functional outcomes in a patient with quadricepsplasty surgery.

CASE

A 59-year-old male patient with a history of knee extension contracture after femoral fracture three years ago was included in the study. The patient was informed about the aims of the study, and the evaluating procedure before the participation. Written informed consent was obtained. The main complaint of the patient was having difficulties in daily activities such as walking, climbing stairs and sitting due to the knee extension contracture. The quadricepsplasty surgery was applied to the patient.

Active knee flexion and extension ROM were measured with a universal goniometer. A visual analogue scale with end range descriptors of "0" = no pain, and "10" = extreme pain (0-10 cm) was used to assess the pain. The ROM and pain measurements were applied on the second day and on the eighth weeks after surgery.

Health Status Survey (SF-36) was used to determine the health related quality of life which consists of eight subscales including functional status, well-being and overall evaluation of health status (i.e., physical functioning, physical role, bodily pain, general health, vitality, social functioning, emotional role, mental health). Scores for each subscale range from 0 (poor) to 100 (good health).The physical and mental health scores were recorded separately.[9]

The functional activity level was assessed using lower extremity functional scale (LEFS), which includes 20 questions about the patients' ability to perform daily living activities.[10] The SF-36 and LEFS were applied preoperatively and 8 weeks after surgery.

A modified Judet method was applied for quadricepsplasty surgery. The patient was placed supine in the operating table under general anaesthesia and a distal posterolateral approach extending distally from the tibial tubercle as much as possible on the old surgical scars was applied. Release of rectus femoris, vastus lateralis from underlying vastus intermedius and release of intraarticular adhesions were performed. A distal myotomy was applied to the vastus intermedius muscle.

The lower extremity strengthening and ROM exercises, walking, and weight-bearing exercises were included in the rehabilitation program. The physiotherapy protocol of the patient after surgery is shown in Table 1.

The knee flexion ROM, extension contracture, pain level, LEFS and physical component score (PCS) of SF-36 were improved after surgery when compared to the findings obtained before surgery. There was no difference in mental component score (MCS) in SF-36 measured before and after surgery (Table 2).

Table 1. Physiotherapy protocol of the patient.

Day 1	
	Cold-pack (once every 2 hours during 15 minutes)
	Quadriceps isometric exercise (once every 2 hours 1×10)
	Weight bearing as tolerated
	Bandage for oedema control
	Ankle pump exercise
	Breathing techniques and exercises
	Continuous passive motion 0°- 45°
Day 2	
	Continue day 1 exercises
	Hip adductor isometric exercise (3 sets ×10 repeats)
	Active assistive heel sliding exercise in bed (3 sets ×10 repeats)
	Hip abductor isotonic exercise (3 sets ×10 repeats)
	Hip flexor isotonic exercise (3 sets ×10 repeats)
	Active assistive straight leg raises (3 sets ×10 repeats)
	Continuous passive motion 0°- 60°
Day 3	
	Continue day 2 exercises
	Continuous passive motion 0°- 75°
Day 4	
	Continue day 3 exercises
	Heel sliding exercise while sitting on chair (3 sets ×10 repeats)
	Continuous passive motion 0°- 90°
2st- 6th weeks	
	Patellar mobilization (on medio-lateral and superior inferior directions)
	Terminal quadriceps: Short-arc 0° - 30° knee extension (3 sets ×10 repeats)
	Three-way straight leg raises (3 sets ×10 repeats)
	Heel sliding exercise on the wall (3 sets ×10 repeats)
	Hip abductor isotonic exercise (with weight) (3 sets ×10 repeats)
	Hip flexor isotonic exercise (with weight) (3 sets ×10 repeats)
	Hamstring stretching exercise (3 sets ×10 repeats)
	Active knee extension (0°-90°) (3 sets ×10 repeats)
6th-12th weeks	
	Knee flexion in prone position
	Wall squat (3 sets ×10 repeats)
	Weight bearing exercises (forward and side)
	Low loading eccentric exercises such as step down and up (3 sets ×10 repeats)

Table 2. Results of knee range of motion, pain level, health status, and functional outcomes of the patient before and after surgery.

	Preoperatively	Postoperative 2nd day	Postoperative 8th week
Flexion (range of motion) (°)	30°	46°	108°
Extension contracture (°)	35°	3°	0°
Pain level (Visual Analogue Scale)	1.4/10	5.4/10	4.3/10
Lower Extremity Functional Scale	37	-	54
Health Status Survey-36			
Physical Component Score	36.4	-	67.5
Mental Component Score	47.7	-	46.0

DISCUSSION

Knee stiffness with extension contracture is a common complication after femoral fractures. In this study, a surgery-specific rehabilitation program after quadricepsplasty was designed and showed that with the application of this protocol, the functional outcomes and pain levels were improved after surgery.

According to Judet criteria, the results after surgery is 'excellent' if flexion ROM is greater than 100°; 'good' from 80° to 100°; 'fair' from 50° to 80°; 'poor' if less than 50°.[11]Several authors reported satisfying results based on the Judet criteria after quadricepsplasty surgery. Mahranet et al reported fourteen excellent results, four good results and one poor result in their case series.[7] Merchan and Myong reported results of 21 cases had excellent (9.5%), good (57.1%), and poor (33.3%) knee flexion ROM.[12] Nicoll reported that 33% of the patients had knee flexion greater than 80°.[8] Masse et al indicated the knee flexion ROM of 21 patients were greater than 100° in eight patients, between 80° and 90° in nine patients, and between 50° and 80° in four patients.[13] Bellemans et al reported the results of 16 patients with a mean follow up of 22 months and the mean gain in knee flexion was 68°.[14] Although the previous studies indicated good knee ROM results, none of them mentioned a rehabilitation program after surgery.[7,8,12-14] The results of knee flexion ROM in the present study on the 8th week after surgery was 108° (excellent) and the mean gain was 78°. We believe that the improvement in the knee flexion ROM, in a short time (8th week), could be explained by the quadricepsplasty-specific rehabilitation program in the present study.

Mahranet et al indicated that the knee flexion range cannot be the only measure to assess the final outcome and that the overall functional outcomes are more important for patients with quadricepsplasty.[7] The authors used the Hospital for Special Surgery Knee (HSSK) score, and the mean preoperative results of 19 patients, was 15.83 and the mean postoperative HSSK score was 30.45. The functional outcome of the lower extremity of our case was measured using LEFS, and the results were good on the 8th week after the surgery.

Rehabilitation after knee surgery is a key factor for functional recovery. For example, it has been observed that quadriceps muscle strength may decrease from 50% to 60% after knee surgery such as total knee arthroplasty (TKA) and anterior cruciate ligament reconstruction (ACL-R).[15,16] Rehabilitation after both TKA and ACL-R focuses on recovery of knee ROM, restoration of knee and hip muscle strength, development of functional independence, and the ability to participate in daily activities. Previous studies on quadricepsplasty surgery were mostly focused on the surgery techniques and the rehabilitation was not mentioned in detail.[7,8,12-14] Therefore, in this case study, the rehabilitation protocol designed for the quadricepsplasty-specific exercises. Considering that the main problem after quadricepsplasty is the quadriceps inhibition, this protocol primarily based on the quadriceps strengthening and co-contraction of the Quadriceps-Hamstrings muscle groups to maintain the knee control after surgery. Secondly, it was aimed to retain the knee ROM because maintaining the exact gained intra operative flexion range is challenging at the final follow-up. Additionally, increasing the hip muscle strength and improving the gait were added in the protocol. The results of the patient were satisfactory and the health status improved after surgery (PCS: 67.5) when compared pre-surgery levels (PCS: 36.4).

Extension contracture due to the fracture of femur impairs the daily activities and normal gait pattern. Although the quadricepsplasty surgery is the primary solution for the stiff knee, the rehabilitation after surgery is still demanding. This case study showed that with a surgery-specific rehabilitation program and assessments the patient achieves excellent and good results. Patient's participation to the treatment is very important to see progress. It was observed that the patient was motivated when he saw the improvements. He indicated that he was glad to his functional statement at the end of the rehabilitation.

Limitations

The limitation of the study was that the patient could be followed up only 8th week. It would be better to evaluate the functional outcomes at the 3rd and the 6th months and also

at the first year after surgery.

Conclusion

A surgery-specific rehabilitation protocol would improve the pain, knee ROM and functional outcomes after quadricepsplasty surgery. Therefore, it is important to design a patient and surgery specific rehabilitation program after quadricepsplasty surgery.

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