Case Report

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# Traumatic knee dislocation

*Travmatik diz çıkıkları*

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**Abstract**

Traumatic knee dislocations are serious injuries that threaten the entire extremity, requiring urgent evaluation and a multidisciplinary approach. The high frequency of limb-threatening vascular injury, misdiagnosis of knee injury, or failure to assess the limb's vascular status will result in a large number of potentially preventable amputations. We tried to demonstrate with case examples that this situation should be investigated carefully and aggressive treatment is mandatory in our study. 8 patients who applied to Pamukkale University Orthopedics and Traumatology Clinic and Alasehir State Hospital Orthopedics and Traumatology Clinic in the last 3 years due to traumatic knee dislocation were evaluated. It was revealed that the group with multiple ligament injuries and neurovascular injuries, which is in the subgroup according to the Schenck classification, was the worst injury group according to the postoperative evaluation tests. It has been shown that postoperative Lysholm and Cincinnati scores of patients in the KD II group with isolated cruciate ligament injury without collateral ligament injury were better than other injuries. Among the patients in the KD I group, it was shown that the postoperative Lysholm and Cincinnati scores were relatively better in the group with anterior cruciate ligament (ACL) injury compared to the group with posterior cruciate ligament (PCL) injury. Management of these serious injuries, the importance of post-operative rehabilitation comes to the forefront with the early and appropriate intervention of experienced orthopedic surgeons with a multidisciplinary approach, as well as the high awareness in terms of neurovascular injuries.

**Keywords:** Knee dislocation, knee joint, vascular injury, trauma.

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**Öz**

Travmatik diz çıkıkları, acil değerlendirme ve multidisipliner bir yaklaşım gerektiren ciddi ve ekstremitenin tamamını tehdit eden bir yaralanmadır. Ekstremiteyi tehdit eden vasküler yaralanmanın yüksek sıklığı, diz yaralanmasının yanlış teşhisi veya ekstremitenin vasküler durumunun değerlendirilmesinin yapılamaması, çok sayıda potansiyel olarak önlenebilir amputasyonla sonuçlanacaktır. Çalışmamızda bu durumun dikkatli bir şekilde araştırılması gerektiği ve agresif tedavisinin zorunlu olduğu vaka örnekleriyle ortaya konulmaya çalışılmıştır. Pamukkale Üniversitesi Ortopedi ve Travmatoloji Kliniği ile Alaşehir Devlet Hastanesi Ortopedi ve Travmatoloji Kliniğine son 3 yıl içerisinde travmatik diz çıkığı nedeniyle başvurmuş olan 8 hasta değerlendirilmiştir. Çoklu bağ yaralanmasının yanı sıra nörovasküler yaralanmaların eşlik ettiği grubun operasyon sonrası değerlendirme testlerine göre en kötü yaralanma grubu olduğu ortaya konmuştur. Yan bağ yaralanmasının eşlik etmediği izole çapraz bağ yaralanmasının olduğu Schenck sınıflamasına göre KD II grubu hastaların operasyon sonrası Lysholm ve Cincinnati skorlarının diğer yaralanmalara kıyasla daha iyi olduğu gösterilmiştir. KD I grubunda yer alan hastalardan ön çapraz bağ (ACL) yaralanması olan grubun arka çapraz bağ (PCL) yaralanması olan gruba kıyasla operasyon sonrası Lysholm ve Cincinnati skorlarının daha iyi olduğu gösterilmiştir. Bu zorlu ve ciddi yaralanmaların başarılı bir şekilde yönetiminde nörovasküler yaralanma açısından farkındalığın fazla olmasının yanı sıra multidisipliner yaklaşımla diz ligaman yaralanmalarına özel ilgi duyan tecrübeli ortopedi cerrahlarının erken ve uygun müdahaleleriyle birlikte operasyon sonrası rehabilitasyonun önemi ön plana çıkmaktadır.

**Anahtar kelimeler:** Diz çıkığı, diz eklemi, damar yaralanması, travma.

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## Introduction

Knee dislocations are serious and threatening to the entire extremity and require an emergency assessment and a multidisciplinary approach. It is known that the incidence of traumatic knee dislocations, which is considered to be rare, is less than 0.02% among all musculoskeletal injuries [1, 2].

Knee dislocation is predominantly seen in the young population and the male/female ratio is 4:1 [3]. 75% of these injuries are caused by high-energy traffic accidents. 25% are caused by low-energy sports injuries and falls [4]. The risk of vascular damage can reach 65% in high-energy injuries [5].

When the knee dislocations are seen as isolated injuries, the diagnosis is relatively easy; diagnosis may be delayed, especially if spontaneous reduction occurs in multi-trauma patients. This may cause the accompanying popliteal artery injury to go undetected and even cause loss of the extremity.

Knee dislocation is the deterioration of the tibiofemoral joint integrity. Knee ligaments that provide joint integrity: anterior cruciate ligament (ACL), posterior cruciate ligament (PCL), posterolateral corner (PLC) (lateral collateral, popliteus and popliteofibular ligament), medial collateral ligament (MCL). Disruption of joint integrity is considered a multiple ligament injury in which two or more of the knee ligaments are injured.

Anatomical classification was developed by Kennedy [6] in 1963 based on the relative orientation of the tibia to the femur (anterior, posterior, lateral, medial, rotatuvar / anteromedial, posteromedial, posterolateral). Although this classification is simple, it was not sufficient in terms of prognosis and treatment plan. The most widely accepted classification was made by Schenck [7] (Table 1).

**Table 1.** Schenck anatomic classification system for knee dislocations

| Type | Description |
|---|---|
| **KD I** | Knee Dislocation with either cruciate intact |
| **KD II** | Bicruciate injury with collaterals intact |
| **KD III** | Bicruciate injury with one collaterals ligament injury |
| | KD IIIM Bicruciate injury with medial collateral ligament injury |
| | KD IIIL Bicruciate injury with lateral collateral ligament injury |
| **KD IV** | Bicruciate injury with both collaterals ligament injury |
| **KD V** | Periarticular fracture dislocation |

Associated injuries: C: Arterial injury, N: Neural injury

Multiple ligaments injured knee dislocation treatment continues to be a challenging situation with many unanswered discussions. The management of this serious trauma and operational procedures can be challenging.

There are still discussions on the time of surgery, reconstruction technique and appropriate graft selection. The result, complications may be common and the morbidity rate of these injuries is high [8].

This study reviews the treatment processes of patients who applied to our clinic with multiple ligament injuries of the traumatized knee and evaluates their clinical outcomes.

## Materials and methods

8 patients who applied to the Orthopedics and Traumatology Clinic of Pamukkale University and Alaşehir State Hospital in the last 3 years due to post-traumatic knee dislocation were evaluated in our study. First of all, informed consent forms were obtained from all patients. The patients were checked in the 1st, 3rd and 6th months after the operation.

Lysholm, Cincinnati, Visual Analogue Scale (VAS) and Tegner Activity Level scores were determined before and after the operation and at the 3rd and 6th months.

## Results

The first patient with knee dislocation who was operated on in the last 3 years by us was a 27-year-old male patient who was brought to the emergency room after a motorcycle accident, and the dislocated knee was reduced by us in the first examination. The patient whose general condition is stabilized is in the KD I group according to the Schenck classification. The lateral collateral ligament (LCL), medial collateral ligament (MCL), anterior cruciate ligament (ACL), lateral meniscus and biceps femoris tendon of the patient who underwent surgical intervention were repaired. The operation was performed on the 7th day of admission to the hospital. The patient also has a subtrochanteric fracture of the left femur was repaired. Lysholm and Cincinnati scores of the patient before and after treatment are given in Table 2 and Table 3. The patient's VAS score was found to be 1 (0-no pain, 10-severe pain). Tegner Activity Level was found to be 4.

**Table 2.** Patients Cincinnati scores

| CINCINNATI SCORE | Before Treatment | After Treatment | After 3 Month | After 6 Month |
|---|---|---|---|---|
| **1st Patient** | 0 | 6 | 28 | 28 |
| **2nd Patient** | 0 | 0 | 6 | 9 |
| **3rd Patient** | 0 | 0 | 17 | 24 |
| **4th Patient** | 0 | 6 | 28 | 28 |
| **5th Patient** | 0 | 6 | 28 | 28 |
| **6th Patient** | 0 | 6 | 21 | 22 |
| **7th Patient** | 0 | 6 | 23 | 28 |
| **8th Patient** | 0 | 6 | 21 | 22 |

**Table 3.** Patients Lysholm scores

| LYSHOLM SCORE | Before Treatment | After Treatment | After 3 Month | After 6 Month |
|---|---|---|---|---|
| **1st Patient** | 25 | 37 | 100 | 100 |
| **2nd Patient** | 0 | 7 | 34 | 42 |
| **3rd Patient** | 0 | 12 | 34 | 55 |
| **4th Patient** | 25 | 37 | 100 | 100 |
| **5th Patient** | 25 | 37 | 100 | 100 |
| **6th Patient** | 0 | 17 | 50 | 73 |
| **7th Patient** | 9 | 26 | 64 | 83 |
| **8th Patient** | 0 | 17 | 50 | 66 |

The second patient was a 40-year-old male patient and his lower extremity was stuck in the agricultural machine. After the patient's emergency department admission, the popliteal artery was repaired urgently by the cardiovascular surgery unit and then an external fixator application was performed by us. The patient is in the subgroup C+N according to the Schenck classification. The patient underwent fasciotomy due to the development of compartment syndrome in the right lower extremity. Following the regression of the patient's circulatory problems, fasciotomy closure was performed. The peroneal nerve, posterolateral corner elements and medial collateral ligament (MCL) were repaired 10 days after the injury. Debridement procedures were performed many times due to the patient's wound problems. Therefore, anterior cruciate ligament (ACL) and posterior cruciate ligament (PCL) repairs had to be left to the next session. Lysholm and Cincinnati scores of the patient before and after the treatment are given in Table 2 and Table 3. The patient's VAS score was 8 (0-no pain, 10-severe pain). Tegner Activity Level was found to be 0. Preoperative and postoperative knee radiographs and preoperative MRI of the patient are shown in Picture 1.


**Picture 1.** Preoperative and postoperative knee radiographs and Preoperative MRI of the 2nd patient

The third patient was a 46-year-old female patient who applied to the emergency department after motorcycle accident. The dislocated knee was reduced in the first examination of the patient. Further examinations of the patient included medial collateral ligament (MCL), lateral collateral ligament (LCL), anterior cruciate ligament (ACL), posterior cruciate ligament (PCL), lateral meniscus were found to be ruptured and repaired. The operation was performed on the 5th day of admission to the hospital. The patient is in the KD IV group according to the Schenck classification. Lysholm and Cincinnati scores of the patient before and after the treatment are given in Table 2 and Table 3. The patient's VAS score was found to be 2 (0-no pain, 10-severe pain). Tegner Activity Level was found to be 4. Preoperative MRI, radiographs and postoperative radiographs of the patient are shown in Picture 2.

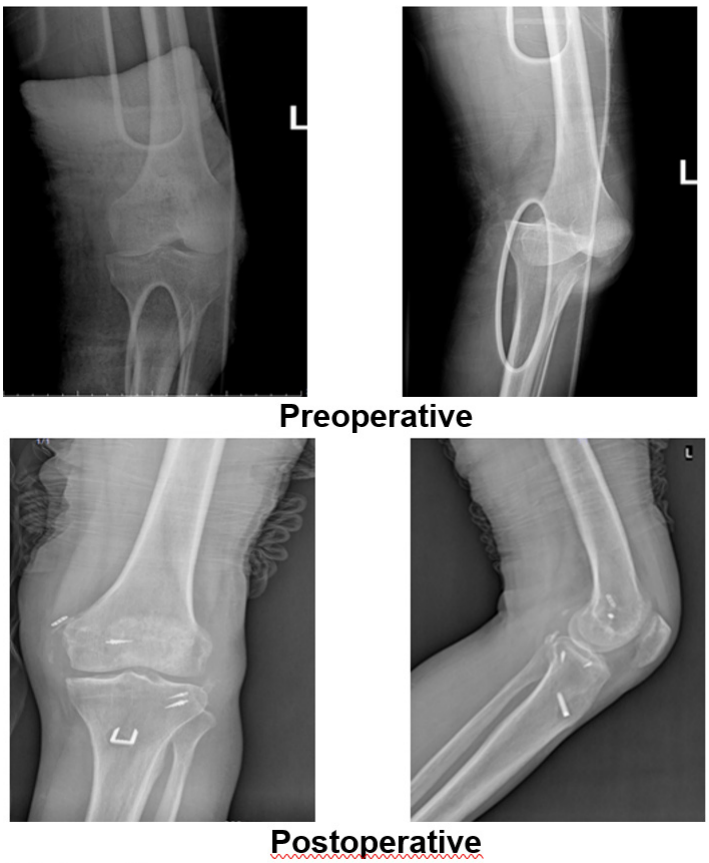
**Picture 2.** Preoperative MRI, radiographs and postoperative radiographs of the 3rd patient

The fourth patient was a 23-year-old female patient. She applied to the emergency service due to traffic accident. It was learned from the primary emergency physicians that the knee dislocation had spontaneous reduction in the first application of the patient. Anterior cruciate ligament (ACL) and posterior cruciate ligament (PCL) tears were detected and repaired. The operation was performed on the 5th day of admission to the hospital. The patient is in the KD II group according to the Schenck classification. Lysholm and Cincinnati scores of the patient before and after the treatment are given in Table 2 and Table 3. The patient's VAS score was found to be 1 (0-no pain, 10-severe pain). Tegner Activity Level was found to be 5. Preoperative MRI, radiographs and postoperative radiographs of the patient are shown in Picture 3. Postoperative radiographs were taken after PCL surgery was performed before ACL surgery was performed.

**Picture 3.** Preoperative MRI, radiographs and postoperative radiographs of the 4th patient

The fifth patient was a similar patient to the previous patient and he was 30 years old. He was brought to the emergency room after traffic accident. Anterior cruciate ligament (ACL) and posterior cruciate ligament (PCL) tear was detected and repaired. The operation was performed on the 3th day of admission to the hospital. The patient is in the KD II group according to the Schenck classification. Lysholm and Cincinnati scores of the patient before and after the treatment are given in Table 2 and Table 3. The patient's VAS score was found to be 1 (0-no pain, 10-severe pain). Tegner Activity Level was found to be 4.

The sixth patient was a 32-year-old male patient who applied to the emergency department after falling from the stairs. Knee dislocation was diagnosed in the patient with severe knee pain and a reduction was performed. The patient also has a distal radius fracture. The patient's posterior cruciate ligament (PCL), medial collateral ligament (MCL), lateral collateral ligament (LCL) tear was detected and repaired. The operation was performed on the 6th day of admission to the hospital. The patient is in the KD I group according to the Schenck classification. The patient's Lysholm and Cincinnati scores before and after treatment are shown in Table 2 and Table 3. The patient's VAS score was found to be 5 (0-no pain, 10-severe pain). Tegner Activity Level was found to be 3. The knee radiographs of the patient before and after the operation are shown in Picture 4.




**Picture 4.** Preoperative and postoperative knee radiographs of the 6th patient

The seventh patient was a 27-year-old male patient. He was brought to the emergency room after traffic accident. The knee dislocation of the patient who was unconscious was reduced. The patient had pneumothorax and emergency treatment was applied. Further examinations revealed damage to the anterior cruciate ligament (ACL), medial collateral ligament (MCL) and lateral collateral ligament (LCL). It was subsequently repaired. The operation was performed on the 12th day of admission to the hospital. The patient is in the KD I group according to the Schenck classification. Lysholm and Cincinnati scores of the patient before and after the treatment are given in Table 2 and Table 3. The patient's VAS score was found to be 2 (0-no pain, 10-severe pain). Tegner Activity Level was found to be 5. Preoperative and postoperative radiographs of the patient are shown in Picture 5.

**Picture 5.** Preoperative and postoperative knee radiographs of the 7th patient

The last patient was a 33-year-old female patient who applied to the emergency service after motorcycle accident. Anterior cruciate ligament (ACL), posterior cruciate ligament (PCL), lateral collateral ligament (LCL), lateral meniscus tears were detected and repaired. The operation was performed on the 9th day of admission to the hospital. The patient is in the KD III L group according to the Schenck classification. Lysholm and Cincinnati scores of the patient before and after the treatment are given in Table 2 and Table 3. The patient's VAS score was found to be 3 (0-no pain, 10-severe pain). Tegner Activity Level was found to be 3. Preoperative radiographs, MRI and postoperative radiographs of the patient are shown in Picture 6.


**Picture 6.** Preoperative radiographs, MRI and postoperative radiographs of the 8th patient

ACL reconstruction with arthroscopic transtibial femoral tunnel method and PCL reconstruction with arthroscopic transtibial tunnel technique were applied as operation techniques. Tibial avulsions of the PCL were repaired with cannulated screws with arthroscopic support. Posterolateral and posteromedial corner repairs could be primarily repaired with the help of anchors without the use of grafts.

As a physical therapy protocol, immobilization in extension and weight restriction were applied to all patients in the first 6 weeks after the operation. Then, controlled weight loss, increase in ROM, gain of proprioceptive sense and regaining joint range of motion were focused on under the control of the physical therapy unit.

VAS scores and Tegner Activity Level of the patients are given in Table 4 and Table 5.

**Table 4.** Patients Visual Analogue Scale scores

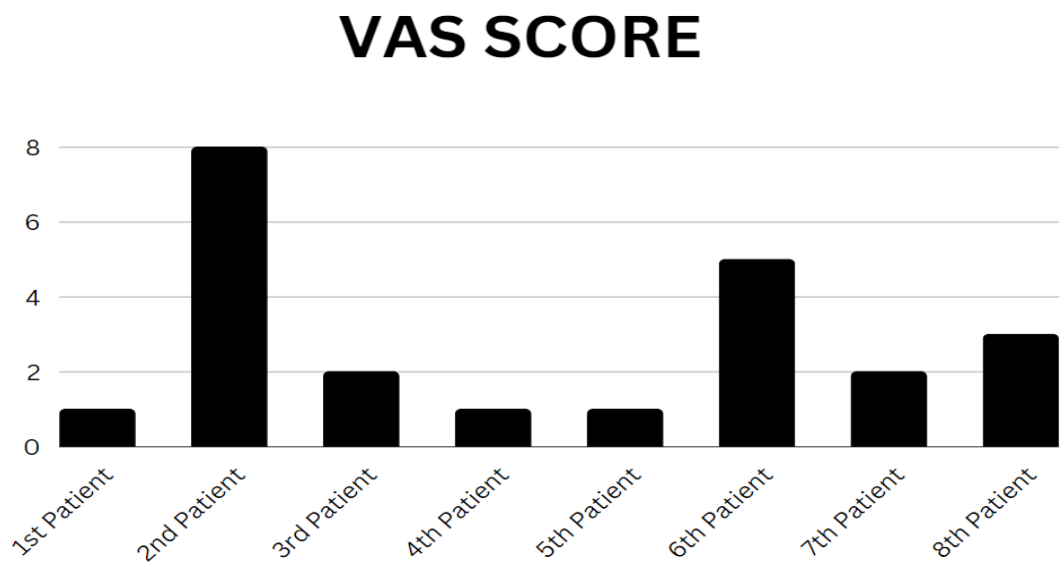
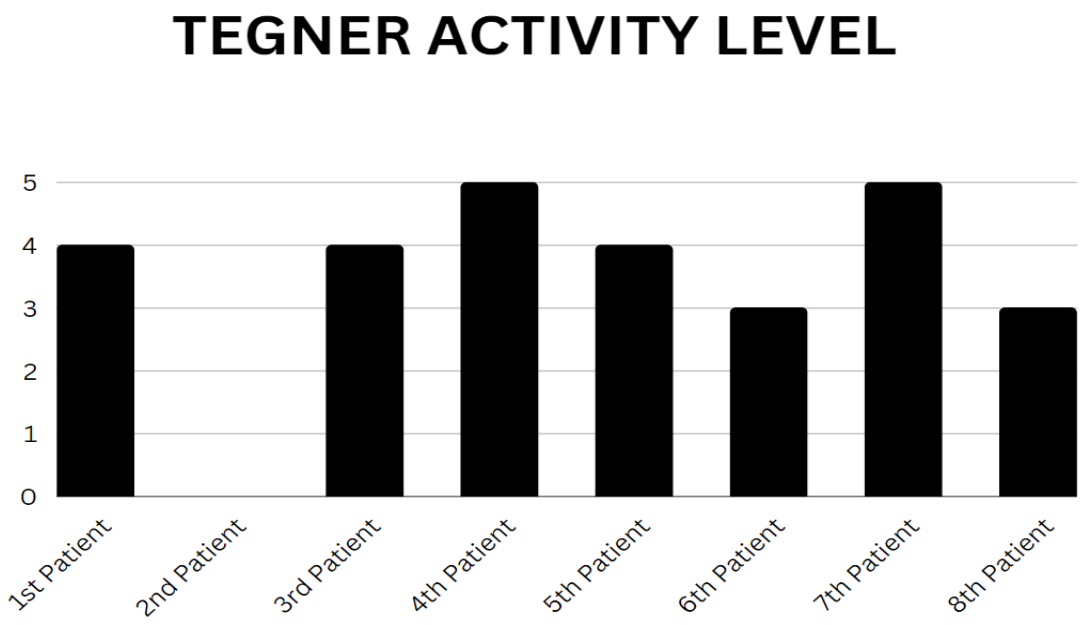



**Table 5.** Patients Tegner Activity Level




It has been shown that postoperative Lysholm and Cincinnati scores of patients in the KD II group with isolated cruciate ligament injury without collateral ligament injury were better than other injuries.

It was revealed that the group with multiple ligament injuries and neurovascular injuries, which is in the subgroup according to the Schenck classification, was the worst injury group according to the postoperative evaluation tests.

Among the patients in the KD I group, it was shown that the postoperative Lysholm and Cincinnati scores were relatively better in

the group with anterior cruciate ligament (ACL) injury compared to the group with posterior cruciate ligament (PCL) injury.

There was not correlation between the VAS scores and Tegner Activity Level scores of the patients and the group they belonged to according to the Schenck [7] classification.

## Discussion

Traumatic knee dislocations are rare but serious injuries that may cause advanced functional problems and require an urgent and multidisciplinary approach. It has long-term negative effects that may disrupt the patient's return to routine life [9]. The term knee dislocation is known as the complete deterioration of tibiofemoral joint integrity. As a result of such injury, it should be noted that at least two of the main ligament structures responsible for the stability of the knee joint may be damaged and spontaneous reduction may be achieved.

Neurovascular injury is a common and serious limb threatening complication of traumatic knee dislocations. For this reason, neurovascular examination should be done primarily in every patient with suspicion of knee dislocation. If there is cyanosis, pallor and delayed capillary filling, major vascular injury should be considered [10]. If necessary, further examination should be performed by performing Doppler USG and CT angiography. Because of the severity of the management of vascular injuries accompanying knee dislocations, common protocols between vascular surgeons and orthopedic surgeons are required [11]. Nerve injuries occur most frequently in the peroneal nerve and have been reported in 16-50% of posterolateral corner injuries. It can occur in a range from only sensory loss to total motor loss and recovery can take up to 6-18 months. However, even if nerve continuity is preserved, recovery may not be complete in half of the cases [12].

The most important treatment aims are to define anatomical structures that contribute to instability and to shape or repair them in accordance with the original anatomy and isometry as much as possible [13]. There are few studies in the literature that provide long-term results for knee dislocation.

In the management of these serious injuries, the importance of post-operative rehabilitation comes to the forefront with the early and appropriate intervention of experienced orthopedic surgeons with a multidisciplinary approach, as well as the high awareness of neurovascular injuries.

**Conflict of interest:** The authors declare that there is no conflict of interest.

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**Informed consent:** Written informed consent was obtained from the patient.

**Authors' contributions to the article**

M.B. and K.G. have constructed/constructed the main idea and hypothesis of the study. M.B. and H.R.G. developed the theory and arranged/edited the material and method section. M.B., H.R.G. and K.G. have done the evaluation of the data in the results section. Discussion section of the article was written by M.B., H.R.G. and K.G. reviewed, corrected and approved. In addition, all authors discussed the entire study and approved the final version.