

Ultrasound-Guided Hydrodissection Combined with Peripheral Nerve Block for the Treatment of Post-Traumatic Knee Stiffness

Travmatik Diz Eklem Sertliğinde Ultrason ve Periferik Sinir Bloğu Eşliğinde Hidrodiseksiyon

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ABSTRACT Knee stiffness is an important complication of knee injury and commonly affects natural ambulation. We demonstrated a case of 29-year old male who presented with knee stiffness following femur fracture and knee surgery and underwent ultrasound-guided hydrodissection into the fibrotic tissues. The patient's history revealed an open reduction internal fixation surgery after femur fracture and graft surgery for the tissue defect in the popliteal region. Although the patient had a 2-month physical therapy program including range of motion (ROM), stretching and strengthening exercises, and underwent arthroscopic lysis of adhesions after while, the left knee ROM continued to be seriously limited. Ultrasound-guided hydrodissection procedure around fibrotic tissues and common peroneal nerve block were performed once a week, 4 times in total. The patient underwent a total of 20 training sessions including ROM, stretching and strengthening exercises. The improvement of the knee flexion from 60° to 70° and extension from -35° to -15° were detected. This case report demonstrates that ultrasound-guided hydrodissection combined with peripheral block is a minimally invasive and a safe method in the treatment of patients with joint stiffness after knee trauma/surgery.

ÖZET Diz sertliği diz yaralanmasının önemli bir komplikasyonudur ve sıklıkla doğal ambulasyonu etkiler. Burada femur kırığı sonrası diz sertliği olan ve sonrasında diz cerrahisi ve ultrason eşliğinde hidrodiseksiyonun uygulandığı 29 yaşındaki erkek olguyu sunmaktayız. Hastanın hikayesinde femur kırığı sonrası açık reduksiyon, internal fiksasyon ve popliteal bölgedeki doku defekti için greft cerrahisi mevcuttu. 2 ay süreyle uygulanan eklem hareket açıklığı (EHA), germe ve güçlendirme egzersizlerinden oluşan fizik tedavi programına ve akabinde uygulanan artroskopik gevşetmeye rağmen sol diz kısıtlılığı devam etti. Fibrotik dokulara ultrason eşliğinde hidrodiseksiyon haftada bir kez toplamda 4 kez uygulandı. Hastaya EHA, germe ve güçlendirme egzersizlerinden oluşan toplam 20 seans tedavi uygulandı. Diz fleksiyonu 60°'den 70°'ye, ekstansiyonu -35°'den -15°'ye gelişti. Bu vaka diz travması/cerrahisi sonrası gelişen eklem sertliğinin tedavisinde periferik blokla birlikte uygulanan ultrason eşliğinde hidrodiseksiyonun minimal invaziv ve güvenli bir yöntem olduğunu göstermektedir.

Keywords: Knee; stiffness; hydrodissection; ultrasound; surgery

Anahtar Kelimeler: Diz; sertlik; hidrodiseksiyon; ultrason; cerrahi

Knee plays an important role in the human movement.^{1,2} Knee stiffness, in another word a limitation in range of motion (ROM), is a potential complication after intra-articular or extra-articular injuries involving articular structures. It is primarily

due to intra- and extra-articular fibrosis and scarring adhesions in the quadriceps-femoral apparatus. Patients with diabetes mellitus, poor compliance to exercise therapy, and joint immobilization are at an increased risk for forming knee stiffness.^{1,3,4}

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Hydrodissection is a minimally invasive and a safe procedure that involves the use of anaesthetics, corticosteroids or saline solutions to separate the anatomic planes and tissue spaces non-traumatically from fibrotic adhesions.^{5,6} Hydrodissection has been reported to be useful for expanding tissue areas to improve localization of injected solutions, protecting neurovascular elements and resolving fibrotic adhesions.^{7,8}

Although ultrasound (US)-guided percutaneous hydrodissection has been described for nerve entrapment, to the best of our knowledge, the current literature is scarce reports on targeting fibrotic tissues.

Herein, we aimed to present a 29-year-old male patient who developed knee stiffness following femur fracture and knee surgery and underwent ultrasound-guided hydrodissection into the fibrotic tissues.

CASE REPORT

A 29-year-old male patient was admitted to orthopaedic rehabilitation clinic with complaints of limitation of left knee ROM and weakness in the left leg. The patient's medical history revealed a fracture of the distal part of the left femur after a gunshot injury. Therefore, an open reduction internal fixation procedure was performed to the left femur and graft surgery was applied for tissue defect to the posterior distal thigh-popliteal-proximal crural region. Despite a 2-month physical therapy program including ROM, stretching and strengthening exercises and contracture device, an improvement was not recorded in the ROM. Then the patient underwent an arthroscopic lysis of adhesions under anaesthesia but the knee stiffness persisted despite the release surgery.

Physical examination at the time of admission after surgery revealed that the left knee ROM was painful, with a flexion of 60° and an extension of -35°. The knee flexion and extension, and the ankle dorsiflexion, plantar flexion, inversion, and eversion were 4/5 muscle strength. There were multiple fibrotic tissues in the graft area on the popliteal region.

Partial axonal degeneration of the common peroneal and tibial nerves were detected distal to the lesion site by electromyographic examination. Therefore, ultrasound-guided hydrodissection was

planned to the posterior distal thigh-proximal crural region where the fibrotic tissues were excessive. Informed consent was obtained from the patient for the procedures after the possible risks of these procedures had been explained.

Ultrasound examinations were performed by a physiatrist (with more than 6 years of experience in musculoskeletal US imaging) using a 5-12 MHz linear array transducer (GE LOGIQ S7; GE Healthcare, China). After appropriate sterile preparation of the skin with chlorhexidine, proper needle positioning was provided, the syringe was aspirated to make sure there was no blood return, and hydrodissection was performed slowly into the fibrotic tissue, with 1 ml betamethasone, 20 mg/2 ml of lidocaine hydrochloride, and 7 ml saline (Figure 1, Figure 2). In addition to fibrotic tissue hydrodissection, femoral and common peroneal nerve (CPN) blocks were applied, for pain relief during stretching exercises. This process was applied once a week, 4 times in total, for 4 weeks. The patient was applied active and passive stretching and repetitive weight-bearing loads for 2 hours after each injection. Between hydrodissection injections, the patient continued daily stretching and loading exercises. At the 4-week supervised exercise program, the patient underwent a total of 20 training sessions, on each day started with hot packs on the affected knee for 10 minutes followed by the ROM and stretching exercises for hamstring, quadriceps and gastrocnemius muscles, lasting approximately 45 minutes. Physical examination after previously de-



FIGURE 1: Hydrodissection into the fibrotic tissues under ultrasound guidance.

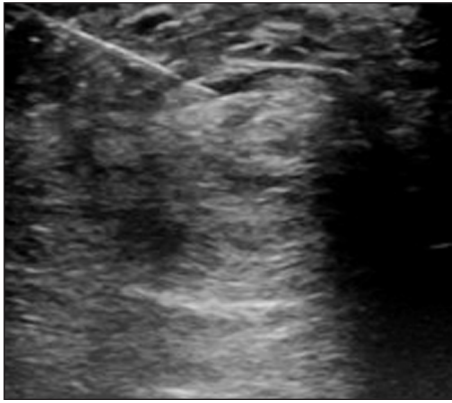


FIGURE 2: Sonographic needle introduction and visualization of hydrodissection. Transverse image using in-plane approach demonstrated the needle and the mixture (star) creating a space, pushing away the swollen common peroneal nerve (CPN).

scribed treatment regimen showed that the left knee was more painless, with a flexion of 70° and an extension of -15° , showing 30° gain.

DISCUSSION

Knee stiffness usually occurs after surgery and is associated with lower functional outcome scores, increased pain and decreased patient satisfaction.^{1-3,9} After treatment of knee fracture; fasciotomy, extensor mechanism disruption, the need for more than two surgical procedures and on-going wound management are reported as the factors related with increased knee stiffness.¹⁰ Although many factors may contribute to joint limitation, the development of post-traumatic arthrofibrosis or intraarticular scar tissue adhesions are considered to be the causes of joint stiffness.^{1,9} This case report demonstrated improvement in active knee ROM following hydrodissection around the CPN and within the surrounding fibrotic tissues in a young male patient who had knee stiffness due to femur fracture and knee surgery.

Hydrodissection has been described in the treatment of adhesiolysis in preoperative treatment by the insertion of saline under pressure into dissection planes.⁷ It has also been applied for treatment of stiff hands caused by scleroderma.⁸ It is concluded that hydrodissection with lidocaine followed by injection of triamcinolone reduces pain and vasomotor changes

in the scleroderma hand. Additionally, hydrodissection is one of the treatment methods used in peripheral nerve entrapment.⁵ There are studies showing that ultrasound-guided hydrodissection reduces symptoms in carpal tunnel syndrome.^{6,11} Nerve hydrodissection's therapeutic effect is based on the theory that the risk of adhesion and chronic compression injury can be decreased by reducing the compression of nerve from the surrounding soft tissue.^{5,12} Advantages of the procedure are that injection may be applied using sterile saline solution or physiologically similar fluid and it may be performed in office conditions.¹³ Rosales et al. have applied a perisciatic US-guided infiltration technique.¹⁴ They used a mixture containing 20 mL saline, 4 mL local anaesthetic and 1 mL corticosteroid and infiltrated in the perisciatic region between the gluteus maximus and pelvotrochanteric muscles. In this report, ultrasonographic imaging was employed both to visualize the peripheral nerves including femoral and CPN and fibrotic tissues surrounding the nerve, and to guide the processes of hydrodissection containing 10 mL injectate. With sonographic guidance, the needle placement was confirmed, and no complications were observed.

Current joint stiffness treatments include use of continuous passive motion devices, stretching exercises, splinting and restorative surgery.¹ Manipulation under anaesthesia and other techniques like genicular nerve block depending on the severity of postoperative stiffness may be the treatment options for the cases that irresponsive to physical therapy.¹⁵ A supervised physical therapy program should be started in the early postoperative period.^{1,9} In order to strengthen and reinforce the results of hydrodissection procedure, a supervised physical therapy including stretching and ROM exercises was combined and significant improvement was achieved.

We hope that this case report may encourage physiatrists to use sonographically guided hydrodissection, which is a minimally invasive procedure and may be an effective alternative method in the treatment of patients with joint stiffness exposed to difficult and long-term rehabilitation after knee trauma/surgery.

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Conflict of Interest

No conflicts of interest between the authors and / or family members of the scientific and medical committee members or members of the potential conflicts of interest, counseling, expertise, working conditions, share holding and similar situations in any firm.

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