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Case Report

Epicondylar Osteotomy with Heterotopic Bone Removal after Retrograde Femoral Nail and Sliding Hip Screw: A Case Report

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Abstract

Case: A 16-year-old female sustained multiple injuries from a motor vehicle accident. One year after injury, she had limited mobility, flexion contracture, and varus alignment of the knee with instability. She was taken to the operating room for removal of femoral nail and heterotopic bone, lateral epicondylar osteotomy with proximal advancement, and medial opening wedge proximal tibial osteotomy.

Conclusion: This case documents the use of a lateral epicondylar osteotomy to treat soft tissue laxity after a traumatic injury and another case of heterotopic bone formation in the knee after retrograde femoral nailing.

Keywords: *heterotopic ossification, lateral epicondylar osteotomy, retrograde intramedullary femoral nail, proximal tibial osteotomy*

Introduction

Retrograde intramedullary femoral nailing with a sliding hip screw is an option for ipsilateral femoral neck and shaft fractures [1,2]. The retrograde technique provides stability, early weight bearing, and has been associated with decreased incidence of complications in patients with multiple injuries [3]. Watson et al. lists complications associated with retrograde femoral nailing including the following: arthrofibrosis, knee pain, nonunion, and malunion [3]. Other authors have noted that heterotopic ossification (H.O.) is an unlikely complication associated with retrograde femoral nailing [4-8].

Heterotopic ossification is the rapid development of ossified bone in soft tissue normally free of calcification. H.O. is associated with neurologic head and spinal cord injury, major joint surgery, and burns [9]. H.O. is more commonly reported in the hip and elbow joints and is associated with procedures including total hip arthroplasty, open reduction and internal fixation of acetabular fractures, and antegrade intramedullary femoral and tibial nailing [6].

Proximal tibial varus deformity is commonly associated with medial compartment osteoarthritis of the knee [10]. Lateral ligament instability may also lead to varus alignment and accentuate the effects of tibial varus [11]. Proximal tibial osteotomy is a widely accepted treatment for varus knee deformity and it may be useful for young active individuals to delay joint degeneration [12,13].

Epicondylar osteotomy has been reported as a tool for exposure and reconstruction during total knee arthroplasty [14-17]. Advantages of this technique are relative ease, bone to bone healing, and adjustment of tension in soft tissues which are intact but in a relatively lengthened or contracted condition.

Case Report

A 16-year-old female was a restrained driver of a high-speed motor vehicle crash transferred 115 miles to our institution from an outside hospital. Injuries included an open left femoral shaft fracture, left femoral neck fracture, left comminuted scapula fracture, left clavicle fracture, bilateral pneumothoraces, pelvic hematoma, and transverse colon injury. There were no documented head or spinal cord injuries and her Glasgow Coma Score was 15. Eighteen hours after the accident, she was taken to the operating room for internal fixation of the left femur with a sliding hip screw and retrograde intramedullary nail (Figure 1). Nine days later, she had open reduction and internal fixation of her left clavicle fracture.

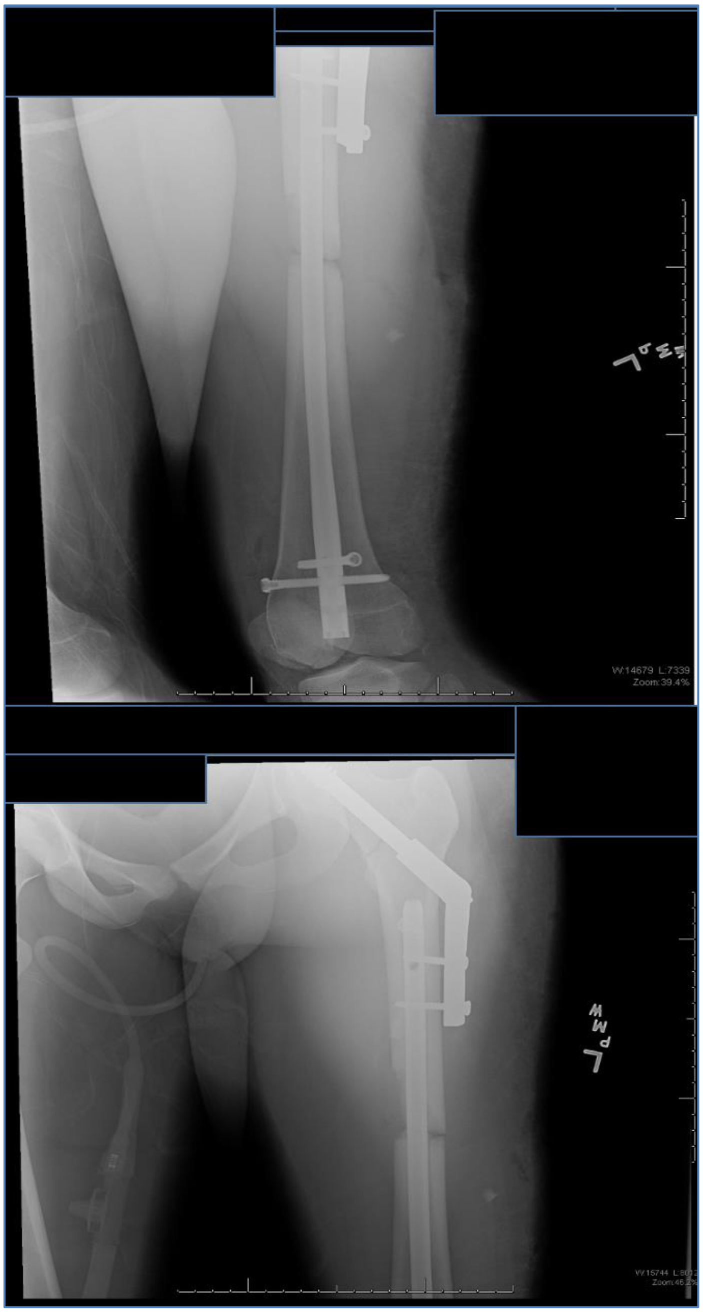

Figure 1. Post-operative A/P radiographs following surgical fixation of ipsilateral femoral neck and shaft fracture. Top image demonstrates distal femur with proper alignment and fixation of retrograde femoral nail. Bottom image demonstrates proximal femur with proper fixation and alignment of sliding hip screw.

She was next seen in the clinic roughly three months after the accident complaining of left knee pain and stiffness. Left knee total range of motion was 20 degrees, from 30°-50°. Radiographs showed intact reduction and hardware, callous at the femoral shaft fracture, and H.O. in the knee. Arthroscopy was performed with lysis of dense adhesions, removal of H.O. from the intercondylar notch and suprapatellar pouch, and partial medical meniscectomy. Arthroscopically, a partial tibial avulsion of the ACL and a stable minimally displaced medial femoral condyle fracture were also noted. In the operating room, the knee had full range of motion after manipulation. After physical therapy, at three months follow up, her range of motion was much improved at 100–1100. As she lived 100 miles away, follow up appointments were limited.

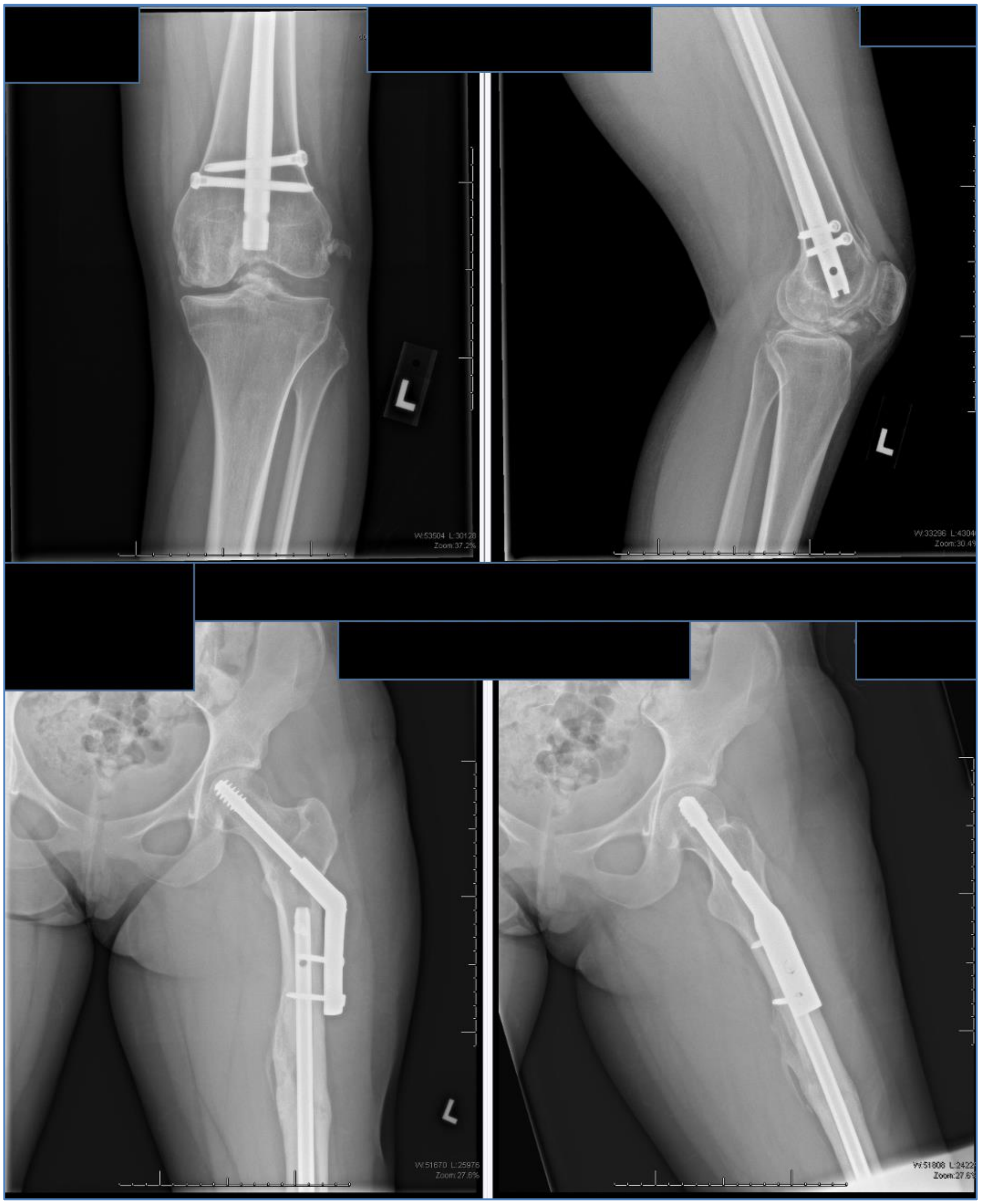

Figure 2. Radiographs of knee and hip one year after initial injury. Top images include an A/P and lateral knee film that indicate H.O. in the intercondylar notch, proximal tibial varus alignment of 9 degrees, opening of the lateral joint space, and bone formation in the lateral epicondyle area consistent with a previous ligamentous injury. Bottom images includes an external and internal rotation hip films that demonstrate proper fracture healing with cortical thickening of the proximal thigh.

One year following her initial injury, she again presented to the clinic with mild pain and limited ambulation. She had a flexion contracture of 13 degrees, flexion to 90 degrees, genu varum of 15 degrees, lateral soft tissue laxity of 5 degrees at maximum extension and 10 degrees at 30 degrees of flexion, a negative "dial test" [18], and a lateral thrust with weight bearing. Weightbearing radiographs revealed remaining H.O. in the intercondylar notch, proximal tibial varus alignment of 9 degrees, opening of the lateral joint space, and bone formation in the lateral epicondyle area consistent with a previous ligamentous injury (Figure 2). The femoral neck and shaft fractures had healed with good alignment. Surgery was again offered with the goals of increasing range of motion, correcting alignment, and restoring stability. The femoral nail would also be removed as hardware may be a source of pain [8].

A lateral parapatellar approach to the knee was performed, extending from the superior pole of the patella to just proximal to the intermeniscal ligament. H.O. fragments were removed from the retropatellar fat pad and the intercondylar notch. Bone at the base of the tibial spines, consistent with the partial ACL avulsion, was also removed. The ACL appeared functional and the articular cartilage appeared intact. The knee was gradually brought into full extension during the operation, both clinically and radiographically. The femoral nail and locking screws were removed.

The lateral collateral ligament felt loose and there was a boney prominence at the lateral epicondyle consistent with a previous injury. Using a curved osteotome, an osteotomy fragment, 3.5 cm circular, 7 mm thick, was raised from the epicondyle. The fragment was advanced proximally 5 mm which seemed to create normal tension in the LCL, and temporarily clamped with a large pointed reduction clamp. Oblique drill holes were made through the fragment and across the femoral epiphysis, distal to proximal, so that #5 sutures could be retrieved through an incision previously made for removal of a medial locking screw.

Next, an oblique opening wedge osteotomy was performed. A separate posteromedial proximal tibial incision was made, the pes anserinus tendons were identified, and the osteotomy was made using a wire as a guide. The 10-degree opening wedge plate was used, placing the larger portion of the trapezoidal metal box posteriorly in the osteotomy. (Figure 3) Postoperatively, she was placed in a hinged knee brace for 6 weeks, toe-touch weight bearing for six weeks, and she used crutches for 8 weeks. She then progressed with weight bearing and gradually resumed normal activities.

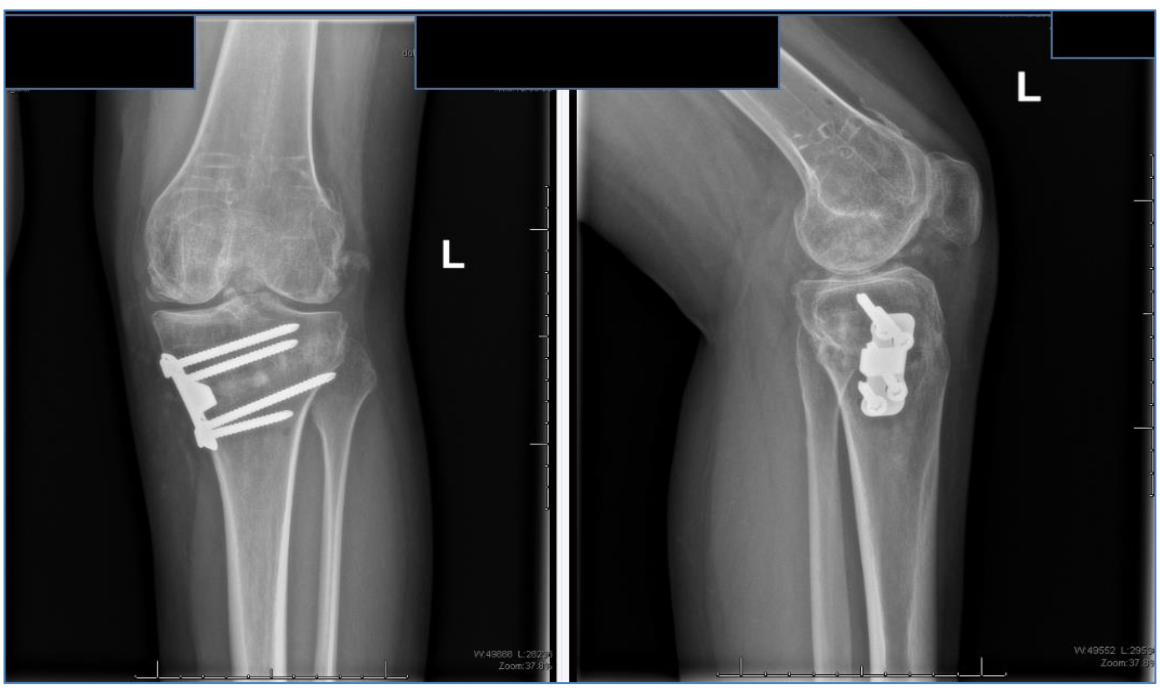

Figure 3. Final post-operative A/P and lateral knee radiographs that demonstrate removal of retrograde femoral nail, removal intercondylar H.O., and proper joint space alignment following proximal tibial osteotomy and lateral epicondylar osteotomy.

Three months after surgery, she was comfortable, had a level gait, and range of motion was 5°-115° and her knee was stable on exam. Follow up appointments were limited as she lived 115 miles from our clinic. At 2 years after surgery, by phone interview, she had no complaints: minimal discomfort and happy with her range of motion and function.

Discussion

H.O. is associated with many orthopedic procedures including total hip arthroplasty [6,19], open reduction and internal fixation of acetabular fractures [20,21], and antegrade intramedullary femoral and tibial nailing [22]. The cause of HO is not exactly understood but postulated theories include an event which leads to an environment promoting bone formation, deposition of bone forming mesenchymal cells in muscle and soft tissue, and humoral changes. Given this appropriate signaling, bone is formed in otherwise uncalcified tissue [23]. Head and spinal cord injuries are often found as inciting events to the formation of H.O. because of the presence of an alkalotic environment [24]. Although this patient did not have a significant head injury, her bilateral pneumothoraces may have created an alkalotic environment [9].

Ipsilateral femoral neck and shaft fractures present a therapeutic challenge that may be treated with different forms of fixation [25-27]. One approach is to stabilize both fractures with an antegrade nail and screws into the femoral head; however, it may be difficult to obtain optimal fixation of the femoral neck fracture with this technique. Another option is to focus attention on optimizing fixation of the femoral neck fracture with screws or a sliding hip screw and fixation of the shaft fracture with a retrograde nail. H.O. is a rare but known complication of retrograde femoral nailing and may lead to permanent loss of motion in the knee [4,5,7,9].

The initial exam of this patient did not reveal an ACL or lateral soft tissue injury and she consistently had a firm endpoints to anterior and varus stress. However, at three months, radiographs and arthroscopic findings were consistent with partial avulsions at the lateral epicondyle and at the tibial spines. Lateral ligament reconstruction with autograft or allograft are frequently used to treat traumatic injuries [28]. A reconstruction study demonstrated placement of the proximal fibular collateral ligament attachment 5 mm proximal to the original attachment; this point was determined to be an isometric location and provided adequate position for ligament reconstruction [28]. Femoral collateral ligament positioning is well studied anatomically [20,29,30] and repositioning of the epicondyle has been reported with total knee arthroplasty [28,31,32] and posterolateral instability [33]. This technique was a relatively simple option to adjust the tension of the existing soft tissues that already had a firm endpoint.

Proximal tibial osteotomy is a well-accepted treatment for knee varus in an active young adult population[12,13] This patient had 9 degrees of varus of her proximal tibia, lateral soft tissue laxity, and mild articular damage on the medial femoral condyle. The osteotomy was performed to protect the lateral soft tissue repair, unload the damaged portion of the joint, and hopefully delay the onset of arthritis. A medial opening wedge osteotomy may increase posterior slope and accentuate problems in an ACL deficient knee. The plate with the trapezoidal metal box was placed as posteriorly as possible and did not appear to increase her posterior slope radiographically.

In conclusion, we felt this patient presented with a relatively unusual situation, both stiffness and laxity, and "constitutional varus". We were happy with the result using a fairly simple epicondylar osteotomy technique that is used more commonly for arthroplasty patients.

Statement of Informed Consent

The patient gave written consent for publication of this case report.

Conflict of Interests

There are no conflicts of interest to be disclosed

References

1. Sanders R, Koval KJ, DiPasquale T, Helfe DL, Frankle M (2014) Retrograde Reamed Femoral Nailing. J Orthop Trauma 28: S15-S24.
2. Virkus WW, Kempton LB, Sorkin AT, Gaski GE (2018) Intramedullary Nailing of Periarticular Fractures. J Am Acad Orthop Surg 26: 629-639.
3. Watson JT, Moed BR (2002) Ipsilateral Femoral Neck and Shaft Fractures: Complications and Their Treatment. Clin Orthop Relat Res 399: 78-86.
4. Gosselin RA, Belzer JP, Contreras DM (1993) Heterotopic ossification of the patellar tendon following intramedullary nailing of the tibia: report on two cases. J Trauma 34: 161-163.
5. Horne LT, Blue BA (1999) Intraarticular heterotopic ossification in the knee following intramedullary nailing of the fractured femur using a retrograde method. J Orthop Trauma 13: 385-388.
6. Takemoto RC, Epstein D, McLaurin TM (2011) Intra- and Periarticular Heterotopic Ossification in the Knee After a Low-Velocity Gunshot Wound Treated With Retrograde Intramedullary Nailing of the Femur. J Orthop Trauma 25: e77-e82.
7. Kent WT, Shelton TJ, Eastman J (2018) Heterotopic ossification around the knee after tibial nailing and ipsilateral antegrade and retrograde femoral nailing in the treatment of floating knee injuries. Int Orthop 42: 1379-1385.
8. Tan L, Wang T, Li YH, Yang T, Hao B, et al. (2017) Patellar tendon ossification after retrograde intramedullary nailing for distal femoral shaft fracture: A case report and review of the literature. Medicine (Baltimore). 96: e8875.
9. Pape HC, Marsh S, Morley JR, Krettek C, Giannoudis PV (2004) Current concepts in the development of heterotopic ossification. J Bone Joint Surg Br 86: 783-787.
10. Gaasbeek RDA, Nicolaas L, Rijnberg WJ, van Loon CJM, van Kampen A (2010) Correction accuracy and collateral laxity in open versus closed wedge high tibial osteotomy. A one-year randomised controlled study. Int Orthop 34: 201-207.
11. Paley D (2002) Malalignment Due to Ligamentous Laxity of the Knees. Principles of Deformity Correction. Berlin, Heidelberg: Springer Berlin Heidelberg, Germany p. 451-464.
12. Schuster P, Gesslein M, Schlumberger M, Mayer P, Mayr R, et al. (2018) Ten-Year Results of Medial Open-Wedge High Tibial Osteotomy and Chondral Resurfacing in Severe Medial Osteoarthritis and Varus Malalignment. Am J Sports Med 46: 1362-1370.
13. Aalderink KJ, Shaffer M, Amendola A (2010) Rehabilitation following high tibial osteotomy. Clin Sports Med 29: 291-301.
14. Conjeski JM, Scuderi GR (2018) Lateral Femoral Epicondylar Osteotomy for Correction of Fixed Valgus Deformity in Total Knee Arthroplasty: A Technical Note. J Arthroplasty 33: 386-390.
15. Sim JA, Na YG, Go JY, Lee BK (2018) Clinical and radiologic evaluation of medial epicondylar osteotomy for varus total knee arthroplasty. Knee 25: 177-184.
16. Mihalko WM, Saeki K, Whiteside LA (2013) Effect of medial epicondylar osteotomy on soft tissue balancing in total knee arthroplasty. Orthopedics 36: e1353-e1357.
17. Mullaji AB, Shetty GM (2010) Lateral epicondylar osteotomy using computer navigation in total knee arthroplasty for rigid valgus deformities. J Arthroplasty 25: 166-169.
18. Bae JH, Choi IC, Suh SW, Lim HC, Bae TS, et al. (2008) Evaluation of the reliability of the dial test for posterolateral rotatory instability: a cadaveric study using an isotonic rotation machine. Arthroscopy 24: 593-598.

19. Potter BK, Burns TC, Lacap AP, Granville RR, Gajewski DA (2007) Heterotopic ossification following traumatic and combat-related amputations. Prevalence, risk factors, and preliminary results of excision. J Bone Joint Surg Am 89: 476-486.
20. Kaempffe FA, Bone LB, Border JR (1991) Open reduction and internal fixation of acetabular fractures: heterotopic ossification and other complications of treatment. J Orthop Trauma 5: 439-445.
21. Wu XB, Yang MH, Zhu SW, Cao QY, Wu HH, et al. (2014) Surgical resection of severe heterotopic ossification after open reduction and internal fixation of acetabular fractures: A case series of 18 patients. Injury 45: 1604-1610.
22. Howell RD, Park JH, Egol KA (2011) Late symptomatic heterotopic ossification of the patellar tendon after medial parapatellar intramedullary nailing of the tibia. Orthopedics 34: 226.
23. McCarthy EF, Sundaram M (2005) Heterotopic ossification: a review. Skeletal Radiol 34: 609-619.
24. Pape HC, Lehmann U, van Griensven M, Gansslen A, von Glinski S, et al. (2001) Heterotopic ossifications in patients after severe blunt trauma with and without head trauma: incidence and patterns of distribution. J Orthop Trauma 15: 229-237.
25. Ostrum RF, Tornetta P 3rd, Watson JT, Christiano A, Vafek E (2014) Ipsilateral proximal femur and shaft fractures treated with hip screws and a reamed retrograde intramedullary nail. Clin Orthop Relat Res 472: 2751-2758.
26. Antekeier SB, Burden RL Jr., Voor MJ, Roberts CS (2005) Mechanical study of the safe distance between distal femoral fracture site and distal locking screws in antegrade intramedullary nailing. J Orthop Trauma 19: 693-697.
27. Huang SC, Lin CC, Lin J (2009) Increasing nail-cortical contact to increase fixation stability and decrease implant strain in antegrade locked nailing of distal femoral fractures: a biomechanical study. J Trauma 66: 436-442.
28. Buzzi R, Aglietti P, Vena LM, Giron F (2004) Lateral collateral ligament reconstruction using a semitendinosus graft. Knee Surg Sports Traumatol Arthrosc 12: 36-42.
29. Krackow KA, Brooks RL (1983) Optimization of knee ligament position for lateral extraarticular reconstruction. Am J Sports Med 11: 293-302.
30. Kernkamp WA, Van de Velde SK, Tsai TY, van Arkel ERA, Asnis PD, et al. (2017) An in Vivo Simulation of Isometry of the Anterolateral Aspect of the Healthy Knee. J Bone Joint Surg Am 99: 1111-1118.
31. Masri BA, Campbell DG, Garbuz DS, Duncan CP (1998) Seven specialized exposures for revision hip and knee replacement. Orthop Clin North Am 29: 229-240.
32. Engh GA, Ammeen D (1999) Results of total knee arthroplasty with medial epicondylar osteotomy to correct varus deformity. Clin Orthop Relat Res 367: 141-148.
33. Hughston JC, Jacobson KE (1985) Chronic posterolateral rotatory instability of the knee. J Bone Joint Surg Am 67: 351-359.