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MANAGEMENT OF COMPLEX CASES

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FROM THE EDITOR



Patellofemoral problems often begin with instability in young patients and become progressively disabling. Effective treatment requires understanding a complex combination of knee alignment, soft tissue influences on patellar tracking and stability, joint forces and the condition of articular surfaces. Management of patellofemoral conditions usually begins with directed physical therapy, various forms of bracing and activity modification. When these measures are not successful, increasing pain and disability, with progressive damage to articular surfaces, are strong indications to intervene.

Three cases presented by Beth Shubin Stein and Sabrina Strickland, members of the **Hospital for Special Surgery Women's Sports Medicine Center**, and Sports Medicine and Shoulder Service Fellow Jacqueline Munch, demonstrate the importance of addressing all of the mechanical and joint surface issues underlying patellofemoral conditions. The authors identify treatment options and the rationale for a well thought out combination of surgical measures to correct alignment, patellar tracking and stability, and damaged joint surfaces. They address patellofemoral overload and evolving cartilage restoration procedures to treat significant chondral defects. In the final case the authors contend with the challenge of treating an unstable patella with end-stage patellofemoral arthritis and intact tibiofemoral compartments.

This and past volumes of Grand Rounds from Hospital for Special Surgery are available on the HSS Web site, www.hss.edu, where you will find additional images and references as well as links to related articles. We hope you find these cases to be of interest and the principles presented informative. Comments may be emailed to complexcases@hss.edu and are always welcome.

— Edward C. Jones, MD, MA, Assistant Attending Orthopaedic Surgeon

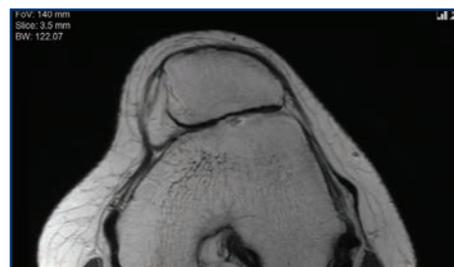
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Combined Proximal and Distal Realignment for Recurrent Patellofemoral Instability

Case presented by Beth E. Shubin Stein, MD, Sabrina M. Strickland, MD and Jacqueline Munch, MD

CASE REPORT: A 15-year-old female began dislocating both patellae at the age of five. Her problem worsened when she began to play sports; at the age of twelve she began figure skating competitively and sustained multiple dislocations when landing jumps. By the time she presented to our office, she was dislocating her right patella approximately once monthly and her left patella bimonthly. Her treatment thus far had been conservative; she had done extensive physical therapy and tried many different braces over the years.

On examination, the patient had valgus knee alignment with hypermobile patellae bilaterally. Her lateral retinaculæ were not felt to be excessively tight. She had obvious bilateral patella alta (abnormally high patellae in relation to their femoral trochlear grooves), and her patellae were not captured in the trochlear groove until 65 degrees of knee flexion. She had bilateral positive patellar apprehension tests and significant J signs (patellar subluxation laterally in active terminal extension). Otherwise, her ligamentous and physical examinations were within normal limits.

On imaging of her right knee, the patient had valgus alignment and patella alta, as measured by a Caton Deschamps ratio of 1.34 (Figure 1A). She had evidence of severe trochlear dysplasia (Figure 1B), and her tibial tubercle-trochlear groove distance (TT-TG) was measured to be 17mm (Figure 2A). The TT-TG is a measurement of extensor mechanism alignment that has replaced the previously relied upon Q angle; it is measured from the midportion of the tibial tubercle to the deepest portion of the trochlear groove. Her right patella showed an 8mm x 1cm chondral lesion located centrally and laterally (Figure 2B).

Given her significant patella alta and relatively high TT-TG in the setting of recurrent patellofemoral instability, both proximal and distal patellar realignment were recommended. Since her right knee was dislocating more frequently, the patient underwent a right knee medial patellofemoral ligament (MPFL) reconstruction using semitendinosus allograft, along with tibial tubercle osteotomy. Her tibial tubercle was moved distally to correct the patella alta, medially to correct the TT-TG and anteriorly to

unload the damaged articular cartilage (1, 2) (Figure 3). At the time of this surgery, particulate cartilage allograft was not yet available as a treatment option. Given the patchy nature of the cartilage loss, the patient underwent microfracture of the grade IV areas of chondral loss.

Six months later, the patient underwent the same combination of procedures on the left knee, as she had similar malalignment as well as articular cartilage damage to the distal facet of her left patella and the lateral aspect of her left trochlea. Postoperatively, her osteotomy sites healed well, and she maintained patellar stability (Figure 4).

Two and half years after both knee surgeries, she was very satisfied with the outcome, having returned to all her normal activities with no further instability events, yet felt that it had been too long of an absence to return to competitive figure skating.

DISCUSSION: Patellofemoral instability is a multifactorial disorder, and our understanding as an orthopaedic surgery community is incomplete regarding the

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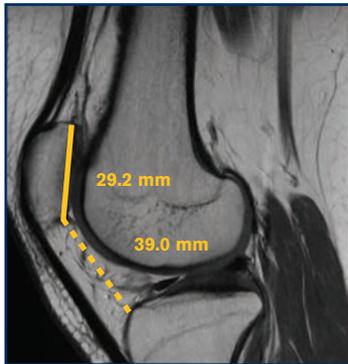


FIGURE 1A

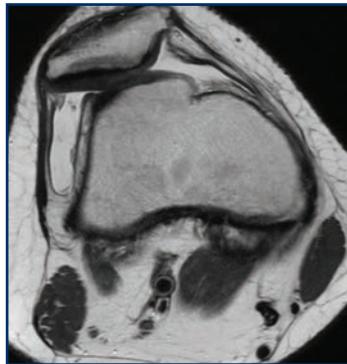


FIGURE 1B



FIGURE 2A

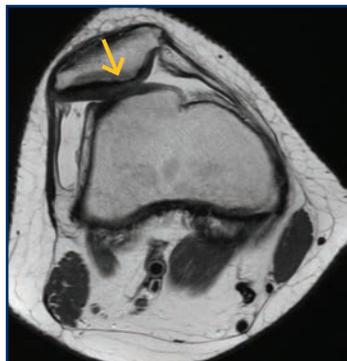


FIGURE 2B



FIGURE 3

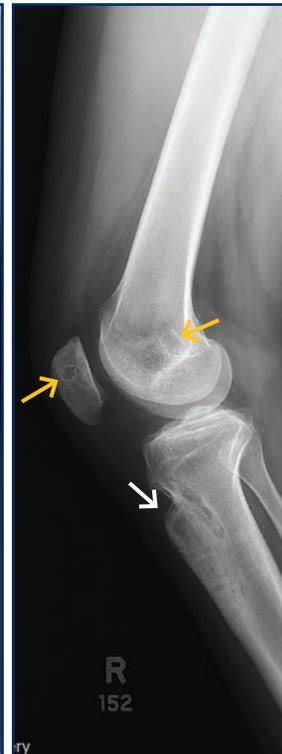


FIGURE 4

FIGURE 1A and 1B: MRI depictions of patella alta (1A, Caton Deschamps ratio=1.34) and trochlear dysplasia (1B).

FIGURE 2A: Tibial tubercle-trochlear groove distance as measured on MRI.

FIGURE 2B: Central cartilage lesion on undersurface of right patella (arrow).

FIGURE 3: Postoperative x-ray of right knee depicting tibial tubercle osteotomy and corrected patella alta.

FIGURE 4: Lateral view of the right knee depicting the patellar and femoral bone tunnels for MPFL reconstruction (yellow arrows) and the healed osteotomy site with evidence of distalization of the tibial tubercle (white arrow).

Proximal Realignment with Cartilage Restoration for Patellar Instability and Chondromalacia

Case presented by Beth E. Shubin Stein, MD, Sabrina M. Strickland, MD and Jacqueline Munch, MD



FIGURE 1: Axial MRI depicting trochlear hypoplasia, lateral patellar subluxation, and central patellar cartilage lesion (arrow).

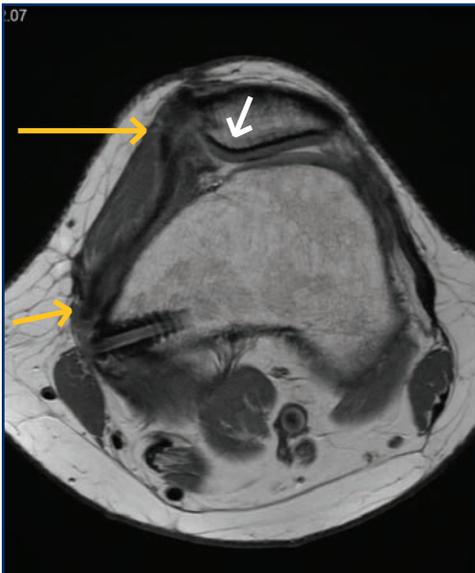


FIGURE 2: Postoperative MRI depicting reconstructed MPFL (yellow arrows) with improved patellar alignment and excellent fill of cartilage defect (white arrow).

CASE REPORT: A 41-year-old female suffered her first left knee patellofemoral dislocation when she was 13 years old. From that time until she presented to our center, she suffered at least 12 more dislocations. The most recent dislocation had resulted in significantly more pain and persistent swelling than any of the previous events. She had tried physical therapy and bracing with limited benefit.

On physical examination, she had a neutral standing alignment, a 1+ left knee effusion, near full range of motion, and left knee crepitus. She had a significantly tight left knee lateral retinaculum, which did not allow eversion of her patella to neutral, and a positive J sign (patellar subluxation laterally in active terminal extension). She had no signs of generalized ligamentous laxity. She had markedly positive apprehension sign to lateral stress on the left patella that was not present on her right knee. Her motor and sensory exam was within normal limits.

On x-rays and MRI, there was no evidence of patella alta (abnormally high patella in relation to the femur), as her Caton Deschamps ratio was 1.1. Her tibial tubercle-trochlear groove distance (TT-TG) was 15mm. The MRI demonstrated a 10.6mm x 9.8mm, full-thickness, central articular cartilage defect on the left patella in the setting of a severely hypoplastic sulcus (Figure 1).

Given that the patient had neither patella alta nor a TT-TG over 20mm, and her cartilage lesion was in a central location and thus not ‘unloadable’, distal realignment was not indicated for her care. However, the cartilage defect was concerning as a potentially persistent pain generator. Thus, she was a candidate for a medial patellofemoral ligament (MPFL) reconstruction using semitendinosus allograft and a cartilage restoration procedure. In order to minimize donor site morbidity, as may occur with osteochondral autograft transplantation (OATS) procedure, and wait time for a potential osteochondral allograft donor, we decided to proceed with placement of juvenile articular cartilage allograft (1).

Postoperatively, the patient demonstrated good patella stability to lateral translation

with no further apprehension. She suffered initially with symptoms consistent with causalgia or complex regional pain syndrome, but was treated effectively with pregabalin and gentle physical therapy. Seven months postoperatively, her causalgia symptoms had resolved, and she reported a pain-free knee except for rare twinges of discomfort. MRI showed excellent fill of the cartilage defect after the allograft treatment, an intact MPFL and improved patellar alignment compared to her subluxed patella preoperatively (Figure 2).

DISCUSSION: Because this patient did not exhibit bony malalignment in the form of patella alta or high TT-TG, and her cartilage defect was central rather than lateral or distal on the patella, she was not a candidate for distal realignment (2). Thus, the most predictable option for treatment of her full-thickness central patellar cartilage lesion was a cartilage restoration procedure. Juvenile cartilage allograft transplant is a relatively new procedure for the treatment of full-thickness cartilage lesions, and it has shown early promise in the treatment of patellar lesions (1). For treatment of her recurrent patellofemoral instability, MPFL reconstruction was the procedure of choice, as the medial patellofemoral ligament is the primary restraint to lateral patellar translation (3). ■

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AUTHOR DISCLOSURES:

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Patellofemoral Arthroplasty for Isolated Arthritis in the Setting of Patellar Instability

Case presented by Beth E. Shubin Stein, MD, Sabrina M. Strickland, MD and Jacqueline Munch, MD

CASE REPORT: A 36-year-old Korean woman presented with a history of longstanding bilateral knee pain with recurrent multidirectional left patellar instability. Twenty years prior, at age 16 while living in Korea, she underwent bilateral Hauser procedures, along with medial imbrication and lateral release (Figure 1). The Hauser procedure involves medializing the tibial tubercle, which secondarily causes the tubercle to be located more posteriorly. The procedure fell out of favor due to evidence of over constraint across the patellofemoral joint, resulting in early osteoarthritis (1). The patient had persistent pain in both knees after the procedures, and continued to suffer from multidirectional instability on the left side. She had trouble with stairs, and had become so incapacitated by pain and instability that she had stopped participating in any activities other than simple activities of daily living.

On physical examination, she had well-healed scars, but marked quadriceps atrophy and hypertrophy of the gastrocnemius bilaterally—a combination of findings that indicates prolonged

ambulation with a flexed-knee gait, likely an unconscious attempt to engage the otherwise unstable patella in the trochlea. She could not perform a squat, for fear that her left patella would dislocate. She had positive patellar grind tests bilaterally, as well as tenderness to palpation of the lateral trochleae and patellae. Both patellae demonstrated fixed lateral tilt. She was apprehensive to lateral patellar translation on the left, and in fact demonstrated lateral dislocation in the flexed position, then relocation with progression from flexion to extension of the knee. In extension, her patella tracked, and could be subluxed, medially.

On radiographic examination, there were hypoplastic trochleae, with significant bilateral patellofemoral arthritis. The left side demonstrated lateral tilt and subluxation of the patella relative to the trochlea. The lateral radiographs confirmed patella baja (inferior positioning of the patella relative to its femoral trochlear groove) (Figure 2). Left knee MRI demonstrated very mild medial compartment wear but otherwise an intact tibiofemoral joint space. There was full-

thickness chondral loss on the patella and the lateral trochlea (Figure 3).

At age 40, the patient underwent left patellofemoral arthroplasty with soft tissue proximal re-alignment (Figure 4). Once her patella and trochlea had been resurfaced, and the lateral portion of her quadriceps was advanced, the patellofemoral joint tracked well. Two years after her surgery, she has maintained patellofemoral stability, is pain free, and has resumed playing golf.

DISCUSSION: Arthroplasty procedures are generally reserved for patients over 60 years of age. This patient had early, very advanced patellofemoral arthritis from a procedure known to cause early degeneration—the Hauser osteotomy, which results in increased patellofemoral contact forces (1). Controversy remains regarding the treatment of isolated patellofemoral arthritis; early recommendations ranged from patellar shaving to patellectomy in severe cases, with mixed results (2). The first generation of patellofemoral arthroplasty fell out of favor due to its failure to improve the

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FIGURE 1: Preoperative radiograph demonstrating healed posteromedial tibial tubercle osteotomy sites.



FIGURE 2: Preoperative lateral radiograph of the left knee, demonstrating patella baja (Caton Deschamps ratio = 0.72).

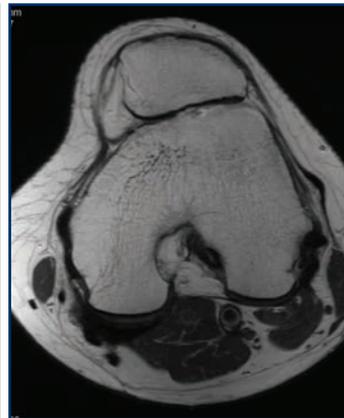


FIGURE 3: Axial MRI depicting end-stage patellofemoral arthritis in the setting of trochlear dysplasia.



FIGURE 4: AP and lateral postoperative x-rays demonstrating left knee patellofemoral arthroplasty.

contributions of factors such as patella alta, knee valgus malalignment, trochlear dysplasia, ligamentous laxity, rotational malalignment, and patient age (3,4). Open physes at the time of first dislocation increase the risk for recurrent instability (4). Acute patellofemoral instability is known to cause cartilage injury in approximately 70% of patients (3), thus recurrent instability is particularly concerning for ongoing articular injury and resultant early arthritis. Recent literature has focused on two major forms of malalignment as risk factors for pain and instability: patella alta, as defined by a Caton Deschamps ratio > 1.3, and increased tibial tubercle-trochlear groove distance (> 2cm) (5, 6). The normal range for the Caton Deschamps index is 0.8 – 1.2, and surgery is typically considered for patients with Caton Deschamps indices > 1.3. In patients with one or both of these risk factors (patella alta or high TT-TG), distal realignment is recommended: medicalization of the tibial tubercle to reduce the TT-TG distance, and/or distalization of the tibial tubercle to improve the patella alta. This patient had a borderline TT-TG measurement (17mm), in the setting of recurrent instability and grade IV cartilage injury. Tibial tubercle realignment anteriorly and medially is also utilized to reduce the forces across injured patellar cartilage, and given that this patient’s cartilage lesions involved the lateral and distal patellar facets, we were able to unload them by way of anteromedial tibial tubercle osteotomies (1, 7). While the combination of distalization and medialization of the tibial tubercle increases overall contact forces, it unloads cartilage injuries such as these by decreasing the contact forces at the distal and lateral poles of the patella. ■

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outcomes compared to standard total knee arthroplasty and because of maltracking and mechanical difficulties such as catching and clunking. Recent advances in the geometry of the implants and the surgical technique of removing an appropriate amount of subchondral bone in addition to the affected cartilage have resulted in a resurgence of isolated patellofemoral replacement, especially for active patients (3). We chose this procedure in this relatively young patient in order to alleviate her pain and instability, and allow a return to an active lifestyle, without compromising the bone in her tibiofemoral compartments by performing a total knee arthroplasty. ■

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