14 Patellofemoral Pain, Chondrosis, and Arthritis in the Young to Middle-Aged Patient: A 32-Year-Old Woman with Lateral Patella and Trochlear Chondrosis

Sabrina M. Strickland, Francesca De Caro, and Robert A. Magnussen

14.1 Case

14.1.1 History

A 32-year-old female physical education teacher and competitive lifeguard presents with a 10 year history of right knee pain. She denies history of frank dislocation but reports one episode 1 year prior to presentation of subluxation. She underwent a chondroplasty 2 years prior to presentation which did not relieve her symptoms. A full course of physical therapy was completed which included quadriceps strengthening, McConnell taping, and hip abductor and core strengthening. She rates her pain as 5 with activity. She received one series of hyaluronic acid injections which resulted in temporary relief of her symptoms.

14.1.2 Physical Examination

Hip ROM 90/40/30
Knee ROM 0-135
Apprehension: Negative
J-sign: Negative
Crepitus: Positive
Tenderness to palpation lateral patellar facet
Medial patellar translation: 2 quadrants
Lateral patellar translation: 2 quadrants
Lachman: 1a

14.2 Imaging Findings (Figs. 14.1, 14.2, and 14.3)

14.3 Proposed Plan of Treatment

Arthroscopic evaluation, open lateral lengthening with lateral facetectomy, cell-based cartilage resurfacing lateral facet, osteochondral allograft lateral trochlea, anteromedializing tibial tubercle osteotomy.

14.4 Intra-operative Photos (Figs. 14.4 and 14.5)

14.5 Results

Pain score 1/10 VAS with high impact exercise. Full range of motion, no effusion. Negative apprehension. Minimal crepitus with knee extension and single leg squat (Figs. 14.6, 14.7, and 14.8).

S. M. Strickland (✉)
Hospital for Special Surgery, New York, NY, USA
e-mail: stricklands@hss.edu

F. De Caro
Department of Orthopedics, Istituto di Cura Città di Pavia, Pavia, Italy

R. A. Magnussen
Ohio State University Wexner Medical Center, Columbus, OH, USA

© ISAKOS 2022

J. L. Koh et al. (eds.), *The Patellofemoral Joint*, https://doi.org/10.1007/978-3-030-81545-5_14

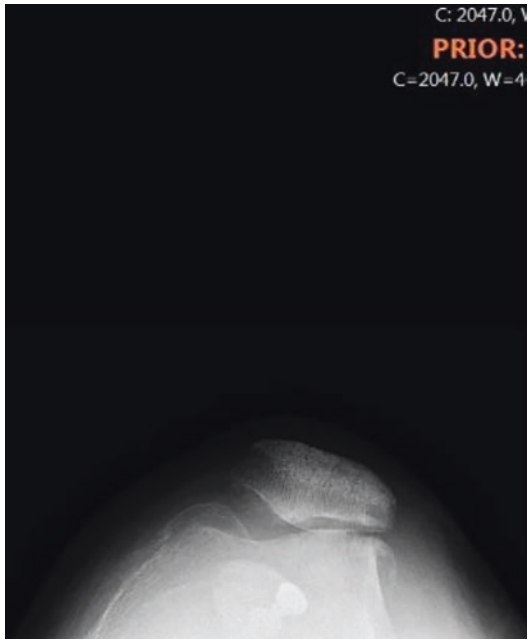

Fig. 14.1 Pre-operative X-ray, merchant view

Fig. 14.3 Pre-op MRI, sagittal view. *Lateral patellar osteophyte with complete 2 cm × 2 cm chondral loss on the lateral facet, 3 cm × 1 cm chondral lesion on the lateral trochlea*

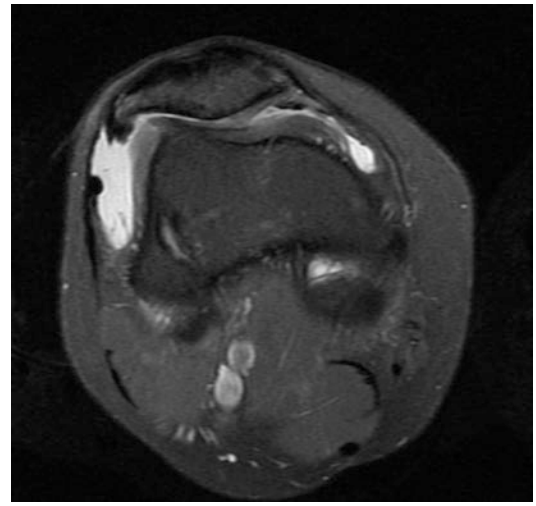

Fig. 14.2 Pre-operative MRI, axial view. TT-TG is measured 18 m and Caton-Deschamps ratio is 1.2

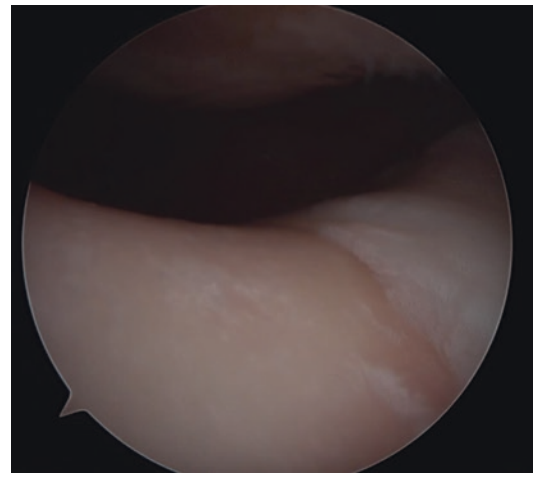

Fig. 14.4 Arthroscopic image of the lateral trochlea with complete chondral loss

14.6 Perspective: Francesca De Caro

Anterior knee pain is a very frequent disorder often associated with patellofemoral cartilage lesions. During routine arthroscopy patellofemoral cartilage defects are found in almost 44% of the cases. Moreover, in professional athletes, up to 37% of all knee cartilage lesions are located in the patellofemoral joint [1, 2]. Most of these

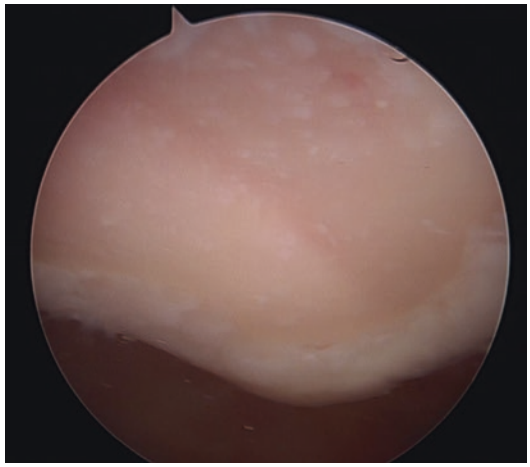

Fig. 14.5 Arthroscopic image of the inferolateral aspect of the patella demonstrating exposed bone

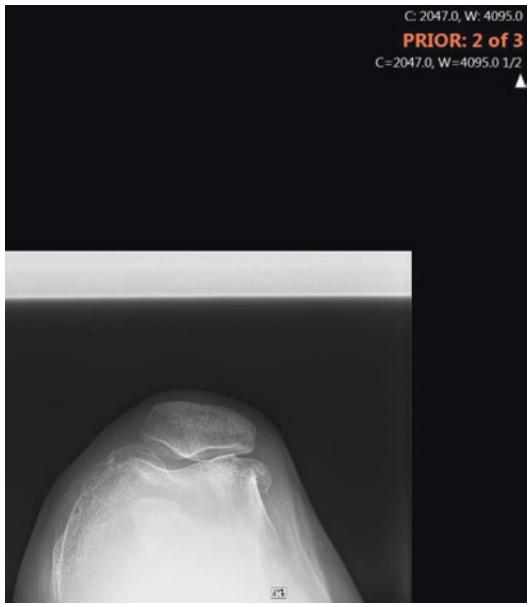

Fig. 14.6 Post-operative X-ray, merchant view

lesions are asymptomatic, but when symptomatic, patients are burdened by a debilitating disease, with high impairment and low quality of life [3]. The treatment of patellofemoral cartilage is not easy and surgeons should always consider that often these lesions are secondary to patellar instability, maltracking, malalignment, acute or repetitive traumas, and that a combined approach must be taken into consideration [4].

Fig. 14.7 Post-operative X-ray, lateral view

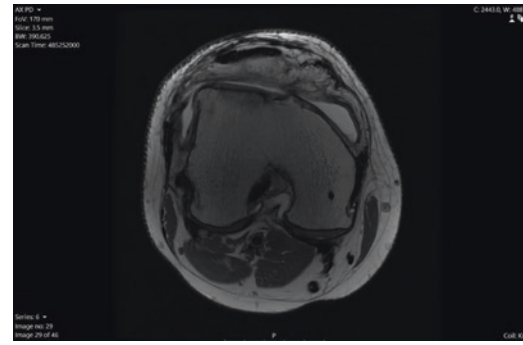

Fig. 14.8 Post-operative MRI, axial view

Considering our clinical case report, a first, non-surgical approach with a more advanced injective treatment would have been a good alternative option to hyaluronic injections. There is little evidence for the use of PRP for the treatment of osteoarthritis, moreover, a recent study by Filardo et al. reports a low rate of return to sport [5] by patients affected by early osteoarthritis and treated by multiple PRP injections. But among these emerging injective treatment options, the autologous protein solution (APS), a blood derivative that provides a milieu of bioactive factors and anti-inflammatory cytokines, seems to provide promising results in the treatment of osteoarthritis, specifically in the treatment of patellofemoral osteoarthritis, in one study there was a 30.5 point absolute improvement of KOOS pain at final follow-up [6]. In a young, active patient who already failed one surgical procedure, this single-step injective treatment could have been a valid non-surgical option instead of the hyaluronic infiltration.

Regarding surgical treatment, anteromedializing tibial tubercle osteotomy would be, in my opinion, the first step surgery.

This is the main similarity of treatment with the author.

A Fulkerson osteotomy, unloading the distal and lateral aspect of the patella can have, if you have a lesion in the lateral and distal aspect, 87% good results, reducing the need for cartilage treatment [7].

In Europe, as several regulatory burdens lead to the dismissal of ACI, advanced therapeutic options, such as the use of minimally manipulated adipose derived mesenchymal stem cells, or bone marrow derived stem cells are becoming more and more popular, even if there is a lack of high quality level studies in the literature, with only few randomized clinical studies [8]. These cells can be used by simple injections, in combination to other surgical procedures and added to a membrane for cartilage restoration. Sciarretta et al. and Gobbi et al. report good clinical results for the treatment of large patellofemoral chondral lesions both with a lipo-amic technique [9] and BMAC technique [10], reporting similar results to ACI in a randomized clinical trial for the treatment of large patellofemoral chondral lesions.

I would address the trochlear lesion of this clinical case report by a modified AMIC technique, taking in consideration that the two chondral surfaces of this joint respond to treatment in a different way, with a markedly good outcome in patients with trochlear lesions and less satisfactory results for cartilage lesions of the patella [11]. Moreover, Dhollander et al. reported good clinical outcomes after autologous matrix-induced chondrogenesis over a short-term follow-up (mean, 2 years) for the treatment of isolated patellar or trochlear cartilage defects, but no case presented bipolar defects [12].

For sure, the most frequently used treatment in Europe, in case of a lower grade of cartilage pathology, with unipolar lesions, would be the implantation of osteochondral scaffolds, an "off-the-shelf" approach with different biomaterials designed to replace the entire damaged osteochondral unit in a single-step procedure [13]. Good clinical results have been reported at mid-term follow-up for a biomimetic scaffold of type I collagen and hydroxyapatite in different concentrations to reproduce the structure and composition of the osteochondral unit [14]. A new innovative aragonite scaffold has shown an almost complete reconstruction of the osteochondral unit even in early osteoarthritis and diffuse lesions of the trochlea, but at the moment this implant is not used for patellar lesions [15].

At last, in Italy, joint replacement is becoming more and more frequent, even at younger ages. This is mainly due to the high costs of cartilage repair and reconstruction surgeries, but also because of the increasing good results of new prosthetic implants. Patellofemoral arthroplasty (PFA), as a transition operation before total knee arthroplasty, has become a more appealing option for patients and orthopedic surgeons because of an easier recovery and good survivorship [16].

I would not treat this 32-year-old patient with a PFA, as she is too young and a clear candidate for a subsequent revision surgery. In the hypothesis of not having the chance to afford a more expensive surgery, with the use of membranes and cells, I would opt for an anteromedializing osteotomy associated with an intra-articular injection of microfractured adipose tissue [17].

14.7 Perspective: Robert Magnussen

The young patient with patellofemoral articular cartilage damage can be challenging to treat and there are multiple available treatment options. The comprehensive treatment approach utilized by Dr. Strickland has addressed all of the potential pain generators in this patient and resulted in a good outcome. While this treatment worked well for this patient, it required a large and complex surgery with significant downtime for the patient as well as access to advanced cartilage repair techniques. Many patients may be unable to commit to such a large procedure and these cartilage treatments are not available worldwide. Key questions are which parts of this procedure are most important and how does one identify which patients need which procedures.

There are numerous factors in a patient's history, physical exam, and imaging that should be considered when selecting treatment. From the patient's history, it is important to identify how much of a role instability plays in the patient's complaints. While this patient has a history of subjective patellar subluxation, many patients with this presentation will have a history of one or more dislocation events in the past that have ceased as their knee becomes more osteoarthritic. Some patients with this presentation have lateral tracking but have never felt unstable. On physical examination, patellar tracking, the presence of patellar apprehension, and the location of pain are crucial to identify. This patient lacks a large J-sign and significant apprehension. Fortunately, this patient's pain is focused on the lateral aspect of the patella and is consistent with the location of chondral damage and the large osteophyte. Imaging studies of the patient demonstrate a large lateral patellar osteophyte and primarily lateral patellofemoral cartilage loss. The axial radiographs demonstrate lateral patellar subluxation.

From my perspective, the patient's pain is centered over the large lateral patellar osteophyte. I would start my treatment here and plan for a lateral patellar facetectomy via an open approach. I would perform a lateral retinacular lengthening during the approach and closure if I felt that lateral retinaculum was tight (which it nearly always is in this situation). I would judge the retinaculum to be tight if I could not evert the patellar to at least neutral from its laterally tilted position. This procedure would remove the impinging osteophyte and the lengthened retinaculum would likely allow the patella to center a bit on the trochlea. One can allow weight bearing as tolerated after the procedure, complications are rare, and no cells or grafts are required. Published series have demonstrated good results of this procedure in this situation with fairly durable results [18, 19].

The next question is whether to add an anteromedialization osteotomy to the procedure. The osteotomy would likely improve patellar tracking and serve to unload the lateral patellar and trochlear cartilage. Seminal work by Dr. Fulkerson's group has shown good outcomes of anteromedialization osteotomies in the setting of lateral patellofemoral chondral damage [7]. The downside of this additional procedure is the increased recovery time and complication risk associated with an osteotomy [20]. Factors that influence this decision for me are: (1) The patient's desires and time available for recovery, (2) a history of patellar instability, (3) patellar tracking and patellar apprehension on exam, and (4) the tibial tubercle-trochlear groove (TT-TG) distance. In a patient with a history of true patellar dislocation, persistent patellar apprehension or j-tracking, and elevated TT-TG distance, I would strongly recommend the addition of an anteromedialization osteotomy. This would reduce the risk of post-operative instability as well as gain the benefits of offloading the cartilage damage. The patient in this case does not have apprehension or a large j-sign and has never dislocated, but she does have a history of subjective patellar subluxation. She has a slightly elevated TT-TG distance on MRI, but this study is known to underestimate the TT-TG distance relative to the values obtained from a CT scan [21]. Further, recent work using osteoarthritis initiative data has demonstrated that patients with an elevated TT-TG distance are more likely to experience a worsening of the lateral patellofemoral osteoarthritis over time [22]. The bottom line for me is that this patient would likely benefit from the osteotomy and the decision to proceed would be made based on a discussion with the patient regarding risks and benefits. I personally would prefer to add the osteotomy in this case to offload the lateral cartilage and hopefully buy some additional time before additional treatments are needed.

The final question is whether it is required to address the articular cartilage damage directly as was done by Dr. Strickland or whether simply unloading the lateral patellofemoral compartment is sufficient. As mentioned above, work by Pidoriano et al. has demonstrated relatively good outcomes of unloading alone in situations with lateral patellofemoral damage [7]. However, most of the patients in that study did not have severe trochlear disease as is shown here. In the

setting of more diffuse articular cartilage damage beyond the lateral side, the addition of a cartilage procedure has been shown to be advantageous [23]. In this case I would probably hold off on the cartilage procedure, but this is certainly debatable. The specific cartilage restoration procedure that is chosen is also controversial, with the approach taken by Dr. Strickland very reasonable if a cartilage restoration procedure is undertaken. The osteochondral allograft option is particularly appealing with an uncontained lesion on the trochlea such as in this patient.

In summary, I feel that the priority in treating this patient is removing the painful osteophyte and unloading the area through lateral retinacular lengthening and an anteromedialization tibial tubercle osteotomy. Direct treatment of the articular cartilage lesion could also be considered.

Take Home Message

Young to middle-aged patients with moderate patellofemoral arthritis can be treated with a combination of unloading osteotomy, ligament stabilization, and cartilage restoration surgery.

Fact Boxes

1. Bipolar lesions can be treated with a combination of surface treatment and osteochondral allograft transplantation.
2. Unloading osteotomy should be tailored to specific anatomy. Normalize patellar lateralization (increased TT-TG), Patella alta, and in some cases Genu Valgum.
3. Lateral facetectomy can be considered in cases with an overhanging lateral facet.

Useful Resources/Websites www.patellofemoralfoundation.org

www.orthoinfo.org

Eliasberg C, Diduch D, Strickland S. Failure of patellofemoral joint preservation. Operative techniques in sports medicine. 2019.

Wang D, Shubin Stein B, Strickland S. Patellofemoral issues. In: Farr J, Gomoll A, editors. Cartilage restoration: practical clinical applications, 2nd ed. Springer Science; 2018. p. 103–117.

Strickland S, Pyne A, Connors K. Non-operative treatments for patellofemoral arthritis. In: ESSKA 2nd edition Patellofemoral pain, instability, and arthritis. To be published May 2020.

References

1. Flanigan DC, Harris JD, Trinh TQ, Siston RA, Brophy RH. Prevalence of chondral defects in athletes' knees: a systematic review. Med Sci Sports Exerc. 2010;42:1795–801.
2. Andrade R, Vasta S, Papalia R, Pereira H, Oliveira JM, Reis RL, et al. Prevalence of articular cartilage lesions and surgical clinical outcomes in football (soccer) players' knees: a systematic review. Arthroscopy. 2016;32:1466–77.
3. Hinman RS, Crossley KM. Patellofemoral joint osteoarthritis: an important subgroup of knee osteoarthritis. Rheumatology. 2007;46:1057–62.
4. Andrade R, Nunes J, Hinckel BB, Gruskay J, Vasta S, Bastos R, Oliveira JM, Reis RL, Gomoll AH, Espregueira-Mendes J. Cartilage restoration of patellofemoral lesions: a systematic review. Cartilage. 2019;1947603519893076.
5. Altamura SA, Di Martino A, Andriolo L, Boffa A, Zaffagnini S, Cenacchi A, Zagarella MS, Filardo G. Platelet-rich plasma for sport-active patients with knee osteoarthritis: limited return to sport. Biomed Res Int. 2020;2020:8243865. https://doi.org/10.1155/2020/8243865. eCollection 2020.
6. Van Genechten W, Vuylstek K, Swinnen L, Martinez PR, Verdonk P. Autologous protein solution as a treatment option for symptomatic patellofemoral osteoarthritis in the middle-aged female patient: a prospective case series with one year follow-up. Knee Surg Sports Traumatol Arthrosc. 29:988–97.
7. Pidoriano AJ, Weinstein RN, Buuck DA, Fulkerson JP. Correlation of patellar articular lesions with results from anteromedial tibial tubercle transfer. Am J Sports Med. 1997;25(4):533–7.
8. Di Matteo B, Vandenbulcke F, Vitale ND, Iacono F, Ashmore K, Marcacci M, Kon E. Minimally manipulated mesenchymal stem cells for the treatment of knee osteoarthritis: a systematic review of clinical evidence. Stem Cells Int. 2019;2019:1735242. https://doi.org/10.1155/2019/1735242.

9. Sciarretta FV, Ascani C, Fossati C, Campisi S. LIPO-AMIC: technical description and eighteen pilot patients report on AMIC® technique modified by adipose tissue mesenchymal cells augmentation. GIOT. 2017;43:156–16.
10. Gobbi A, Chaurasia S, Karnatzikos G, Nakamura N. Matrix-induced autologous chondrocyte implantation versus multipotent stem cells for the treatment of large patellofemoral chondral lesions: a nonrandomized prospective trial. Cartilage. 2015;6(2):82–97.
11. Filardo G, Kon E, Andriolo L, Di Martino A, Zaffagnini S, Marcacci M. Treatment of "patellofemoral" cartilage lesions with matrix-assisted autologous chondrocyte transplantation. A comparison of patellar and trochlear lesions. Am J Sports Med. 2013;42(3):626–34. https://doi.org/10.1177/0363546513510884.
12. Dhollander A, Moens K, Van der Maas J, Verdonk P, Almqvist KF, Victor J. Treatment of patellofemoral cartilage defects in the knee by autologous matrix-induced chondrogenesis (AMIC). Knee Surg Sports Traumatol Arthrosc. 2015;23(8):2208–12. https://doi.org/10.1007/s00167-014-2999-0. Epub 2014 Apr 22.
13. Filardo G, Andriolo L, Angele P, Berruto M, Brittberg M, Condello V, Chubinskaya S, de Girolamo L, Di Martino A, Di Matteo B, Gille J, Gobbi A, Lattermann C, Nakamura N, Nehrer S, Peretti GM, Shabshin N, Verdonk P, Zaslav K, Kon E. Scaffolds for knee chondral and osteochondral defects: indications for different clinical scenarios. A consensus statement. Cartilage. 2020:1947603519894729. https://doi.org/10.1177/1947603519894729.
14. Perdisa F, Filardo G, Sessa A, Busacca M, Zaffagnini S, Marcacci M, Kon E. One-step treatment for patellar cartilage defects with a cell-free osteochondral scaffold: a prospective clinical and MRI evaluation. Am J Sports Med. 2017;45(7):1581–8. https://doi.org/10.1177/0363546517694159. Epub 2017 Mar 1.
15. Kon E, Robinson D, Verdonk P, Drobnic M, Patrascu JM, Dulic O, Gavrilovic G, Filardo GA. Novel aragonite-based scaffold for osteochondral regeneration: early experience on human implants and technical developments. Injury. 2016;47 Suppl 6:S27–32. https://doi.org/10.1016/S0020-1383(16)30836-1.
16. Strickland SM, Bird ML, Christ AB. Advances in patellofemoral arthroplasty. Curr Rev Musculoskelet Med. 2018;11:221–30.
17. Russo A, Screpis D, Di Donato SL, Bonetti S, Piovan G, Zorzi C. Autologous micro-fragmented adipose tissue for the treatment of diffuse degenerative knee osteoarthritis: an update at 3 year follow-up. J Exp Orthop. 2018;5:52.
18. Wetzels T, Bellemans J. Patellofemoral osteoarthritis treated by partial lateral facetectomy: results at long-term follow up. Knee. 2012;19(4):411–5.
19. Yercan HS, Ait Si Selmi T, Neyret P. The treatment of patellofemoral osteoarthritis with partial lateral facetectomy. Clin Orthop Relat Res. 2005;(436):14–19.
20. Payne J, Rimmke N, Schmitt LC, Flanigan DC, Magnussen RA. The incidence of complications of tibial tubercle osteotomy: a systematic review. Arthroscopy. 2015;31(9):1819–25.
21. Camp CL, Stuart MJ, Krych AJ, et al. CT and MRI measurements of tibial tubercle-trochlear groove distances are not equivalent in patients with patellar instability. Am J Sports Med. 2013;41(8):1835–40.
22. Haj-Mirzaian A, Guermazi A, Hakky M, et al. Tibial tuberosity to trochlear groove distance and its association with patellofemoral osteoarthritis-related structural damage worsening: data from the osteoarthritis initiative. Eur Radiol. 2018;28(11):4669–80.
23. Gillogly SD, Arnold RM. Autologous chondrocyte implantation and anteromedialization for isolated patellar articular cartilage lesions: 5- to 11-year follow-up. Am J Sports Med. 2014;42(4):912–20.