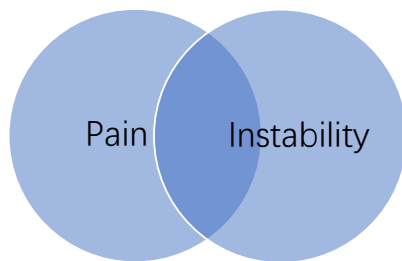


Supplemental questions

1. Dr. Sommer Hammoud: Can you provide a flow diagram or general guidelines for your preferred algorithm for when to add a tibial tubercle transfer and when to distalize the tubercle?

Author's answer: When determining the best surgical management for patients with patellar instability, the first step is to assess whether the patient is presenting with pain, instability or a combination of both. It is very important to determine if this is an isolated instability problem or if pain is a substantial part of the chief complaint. This does not refer to pain associated with the instability events, but rather the clinician should seek to determine if there is daily or sports-related pain associated with weighted bent knee activities that would indicate overload and or malalignment in addition to the instability.



This determination is essential for appropriate management because pain from malalignment and patella overload cannot be treated with an isolated MPFL reconstruction as this will only serve to stabilize the patella but not unload it. Chronic pain in addition to the instability can only be addressed with an unloading tibial tubercle osteotomy.

Tibial tubercle transfer can reduce the TT-TG and decrease the lateral vector on the patella by medializing the tubercle. Simultaneously via an oblique osteotomy, the tubercle can be anteriorized to help unload the patellofemoral compartment, decreasing pain or unloading cartilage injuries at the same time as addressing the coronal plane malalignment. In patients with severe Alta, the tubercle can be distalized so that the patella engages in the trochlea earlier in flexion to help decrease the risk of dislocation. The acuity of the angle of the TTO can be flattened to obtain more medialization or made steeper to obtain more anteriorization based on the patient's

pathoanatomy.

These are general guidelines but what is needed is a patient specific instability severity score to help guide what combination of procedures will provide them with the most stability, and if indicated, pain relief. The current ongoing work to create this predictive score will help determine what group of concomitant pathology leads to excessive forces that necessitate moving the tubercle.

Currently and in the absence of a scoring index, our opinion or preferred indication is to perform a tibial tubercle transfer on anyone with overload and pain, anyone who subluxes in extension (a “jumping J” sign) and anyone with a combination of a CDI greater than 1.4 with a TT-TG >20 as previous literature from our group has shown this combination of patella alta and lateral tracking to inhibit the ability to reconstruct the MPFL in an isometric fashion (5). Measurements such as the Patellar-Tendon-Lateral Trochlear Ridge Distance (PTLTR) can also help to better determine how the TT-TG may factor into maltracking of the patella (47). There are certainly many different variations of these anatomic variants that need to be taken into account as well as additional pathology such as ligamentous laxity and excessive femoral anteversion.

2. Dr. Sommer Hammoud: What is your preferred cartilage repair technique for patellar chondral lesions requiring repair associated with instability? (MACI, OCA, Denovo, etc.)

Author's answer: For patellar chondral lesions requiring repair that are associated with instability, we recommend addressing these lesions at the same time as their surgical stabilization. For patients with an isolated cartilage problem, this should be managed with an isolated cartilage repair with either a one-stage or two-stage cell-based repair. For patients with cartilage injury with concomitant subchondral architectural changes such as sclerosis and undulation, cysts and cavitation or bone loss, a structural approach must be taken that involves either an osteochondral autograft or allograft. However, it is important to note that subchondral edema does not necessarily indicate structural pathology within the subchondral bone that needs correction, and in appropriate situations, unloading this region will resolve the edema. For patellar lesions that have associated subchondral bone pathology, our preferred technique is osteochondral allograft utilizing a fresh patellar allograft due to the patella's unique chondral topography and cartilage thickness which would be unmatched with an autograft. For lesions

that do not have underlying structural bony pathology, our preferred technique is a one-staged approach utilizing particulated juvenile articular cartilage (PJAC) that is preformed using a small flexible mold created on the back table and which is then placed into the defect and gently shaped before sealing with fibrin glue.

References

47. Mistovich RJ, Urwin JW, Fabricant PD, et al. Patellar Tendon-Lateral Trochlear Ridge Distance: A Novel Measurement of Patellofemoral Instability. *Am J Sports Med* 2018;46:3400-6.