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REVIEW

Established practices and future insights into patellar instability surgery: A review

Batuhan Bahadır, MD[1], Erdem Aras Sezgin, MD[2], O. Şahap Atik, MD[3]

[1]Department of Orthopedics and Traumatology, Bilkent City Hospital, Ankara, Türkiye
[2]Department of Orthopedics and Traumatology, Gazi University Faculty of Medicine, Ankara, Türkiye
[3]President, Turkish Joint Diseases Foundation, Ankara, Türkiye

Management of patellar instability poses a significant challenge, as the condition stems from a combination of static and dynamic abnormalities of bone or soft tissue structures. The conventional diagnostics focus on the physical examination findings of patellar maltracking and assessment of anatomical abnormalities such as trochlear dysplasia, patella alta, and increased tibial tubercle-trochlear groove (TT-TG) distance on plain X-rays and magnetic resonance imaging, which are static, two-dimensional modalities.[1] Depending on the underlying anatomy, the surgical treatment typically includes a medial patellofemoral ligament (MPFL) reconstruction and a combination of accompanying procedures such as tibial tubercle osteotomy, trochleoplasty or other osteotomies. However, contemporary research points out the necessity of a more comprehensive evaluation of different concepts, bringing intense discourse regarding surgical choices.

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Correspondence: O. Şahap Atik, MD. Turkish Joint Diseases Foundation, Mustafa Kemal Mah., Dumlupınar Bul., 274/2, C2 Blok, Ofis 5, 06900 Çankaya, Ankara, Türkiye.
E-mail: satikmd@gmail.com

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Patellar instability is currently increasingly being evaluated as a dynamic problem of the extensor mechanism, whose behavior varies depending on the position of the hip and knee joints and the amount of weight the extremity bears at any given time.[2] With the utilization of dynamic imaging, parameters such as TT-TG distance, patellar tilt, height and bisect offset have been shown to significantly change with the flexion of the knee and weight bearing.[3] These findings raise questions about the validity of traditional imaging.

The entire extensor mechanism, including the dynamic and static structures that generate a force vector or provide resistance are currently being evaluated as parameters for disruption of normal patellar tracking.[4] Moreover, rotational deformities in the proximal femur and between the distal femur and proximal tibia should also be recognized as commonly overlooked culprits of low energy or recurrent dislocations since they affect the system in a way which produces a force vector influencing the patellar stability.[5]

Despite the increasing debate on appropriate management of these patients with more advanced deformities or failed surgeries, biomechanical outcome of the proposed surgical corrections remains largely unexplored. It should be kept in mind that a combination of surgeries may restore patellar tracking in expense of natural patellofemoral loading, which ultimately leads to unsatisfactory outcome. Biomechanical studies on cadavers are commonly performed to answer such questions; however, testing a vast number of deformities and clinical scenarios poses challenges in feasibility and cost. At this point, finite element analysis offers unique opportunities to comprehend the complex three-dimensional

geometry, the dynamic effect of structures with varying mechanical characteristics as well as accurate assessment of contact pressures.[6-8] On top of its potential future use in testing various surgical methods for various deformities, it can be speculated that computational simulation demonstrates a merit in becoming a tool for planning patellofemoral surgery in the future, even on an individual basis.

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