Paper #79

The Classification of the Patellar Tracking in Patients With Recurrent Dislocation of the Patella Using Three Dimensional Computer Models

Yuzo Yamada, MD, PhD, JAPAN
Yukiyoshi Toritsuka, MD, PhD, JAPAN
Shuji Horibe, MD,PhD, JAPAN
Norimasa Nakamura, MD, PhD, JAPAN
Ken Nakata, MD, PhD, JAPAN
Masayuki Hamada, MD, JAPAN
Norinao Matsumoto, MD, PhD, JAPAN
Yoshiki Shiozaki, MD, JAPAN
Kazuomi Sugamoto, MD, PhD, JAPAN
Hideki Yoshikawa, JAPAN
Konsei Shino, MD, PhD, JAPAN

Osaka University
Osaka, JAPAN

Summary:
Patients with recurrent patellar dislocation can be classified into the four types based on the patellar tracking.

Abstract:
Introduction
Patients with recurrent dislocation of the patella (RDP) have a wide variety of individual pathologies due to various combinations of predisposing factors. For first-time dislocators, conservative treatments are commonly indicated while clinical results are not always satisfactory. For recurrent dislocators various operative procedures are performed, however, effectiveness of each procedure is still unclear. Thus, the treatment strategy to manage RPD should be established based not on the concept that RPD is a single entity of patellar disorder but on individual pathologies of the patellar mal-tracking syndrome. Here, we tried to classify RPD according to patellar tracking by in-vivo motion analysis using a three-dimensional (3-D) computer model, in hopes to improve clinical outcomes.

Methods
Our study included 50 patients (57 knees) with RDP and 10 healthy volunteers (HV). Three-dimensional MR images of the knee were taken at 10° intervals between 0° and 50° of knee flexion. Then, 3-D computer models were created from the MR data and superimposed over images taken at each position by voxel-based registration using 3-D movement analysis system. Patellar tracking was classified using the following two parameters expressed as percentages to the inter-epicondylar width standardizing the values according to individual knee size. One is % maximum translation of the patella (% MT), defined as the percentage of maximum change of mediolateral patellar translation from 0° through 50 ° of knee flexion. The other is % patellar off-center distance (% POCD), defined as the percentage of distance between the patellar reference point and the midsagittal plane, the plane passing through the mid-point between the medial and lateral femoral epicondyle and perpendicular to the trans-epicondylar axis. First, when a patient has % MT value of more than the average + 1 standard deviation (SD) of those in HV, the patella was defined as a substantially translated patella and less than that as a less translated patella. Next, among patients with a substantially translated patella when % POCD decreased with flexion, patellar tracking was defined as a substantially translated-medial shift (STMS) type. When the value increased with flexion, it was defined as a substantially translated-lateral shift (STLS) type. Finally, among patients with a less translated patella when the average value of % POCDs (0°-50°) was larger than the average + 1SD of those in HV, it was defined as a less translated-lateral path (LTLP) type. When the value was smaller, it was defined as a less translated-central path (LTCP) type.

Paper #79

Results

Each average value of % MT and % POCDs (0°–50°) in patients with RPD and those ±SD in HV were 14.0 and 15.6 in STMS, 14.4 and 25.3 in STLS, 6.4 and 18.0 in LTLP, 6.1 and 3.9 in LTCP and 5.5 ± 2.8 and 6.4 ± 10.9 in HV, respectively. Each average value of % POCD at 0° through 50° were 22, 18, 16, 14, 12 and 11 in STMS, 22, 20, 24, 26, 30 and 31 in STLS, 18, 19, 18, 17, 18 and 18 in LTLP, 8, 4, 2, 2, 4 and 4 in LTCP and 10, 8, 6, 5, 5 and 5 in HV, respectively. Twenty-nine knees (53%) were classified as STMS type, 10 (18%) as STLS type, 9 (18%) as LTLP type, 4 (7%) as LTCP type and 3 (5%) were unclassified.

Discussion

Our approach based on patellar tracking could classify 95% of the patients, suggesting usefulness of this classification system. While the patellae in patients with RPD are generally believed to move into medially with knee flexion to be treated with a medial stabilization procedure including medial patella-femoral ligament reconstruction (MPFLR), it was striking that only half of the patients showed this tracking type (STMS). It was worthy of notice that about 20% of the patellae moved laterally with knee flexion (STLS), which were regarded as the tracking pattern of habitual dislocation. Those may need MPFLR as well as lateral release. The LTLP type might be regarded as a kind of mild type of RPD because the patellae showed less change of mediolateral translation in spite of lateral tracking. While less than 10% of the subjects showed a very similar tracking pattern to that of the normal knee (LTCP), those may be good candidates for conservative treatment in view of patellar tracking. Thus, we should not manage RPD as a single entity in the patellar disorder but take the different subtypes of RPD into account at the time of treating them.

Conclusion

Patients with RDP can be classified into the four types based on the patellar tracking.