

PATELLAR INSTABILITY: A MODIFIED DELPHI CONSENSUS STATEMENT

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Members of the Patellar Instability International Consensus Group

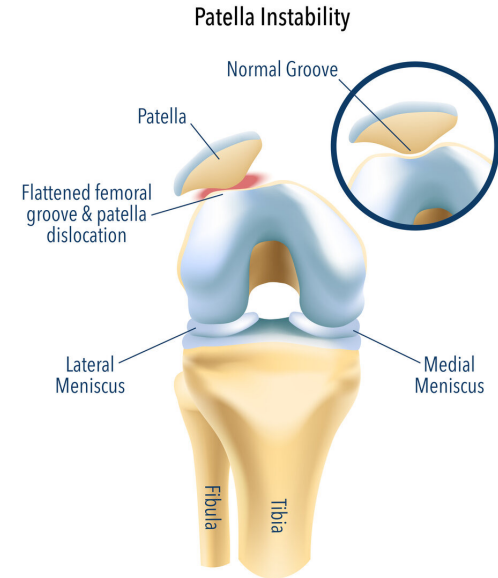
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Disclosures

- Michael J. Alaia: Bodycad, Arthrex, Inc, JRF Ortho, Mitek, Orcosa, Inc
- Kirk A. Campbell: Mitek and Stryker
- Miho J. Tanaka: DePuy, FujiFilm, Verywell
- Seth L. Sherman: Arthrex, BioVentus, CONMED Linvatec, Epic Bio, JRF Ortho, Kinamed, Reparel, Sarcio, Smith & Nephew, Vericel, Vivorte
- James L. Pace: Arthrex, JRF Ortho
- Mary K. Mulcahey: Arthrex
- Jorge Chahla: Arthrex, CONMED Linvatec, Ossur, Smith & Nephew
- Laith M. Jazrawi: Arthrex, Mitek, Smith & Nephew, and Wolters Kluwer Health

Background

- Patellofemoral instability is a debilitating condition that causes knee dysfunction and can lead to patellar dislocation
- Numerous societies have developed national and international consensus statements on a variety of topics utilizing the modified Delphi method
- The Delphi technique has four main characteristics:
 - Anonymity
 - Iteration with controlled feedback of group opinion
 - Statistical aggregation of group response
 - Expert input



Purpose

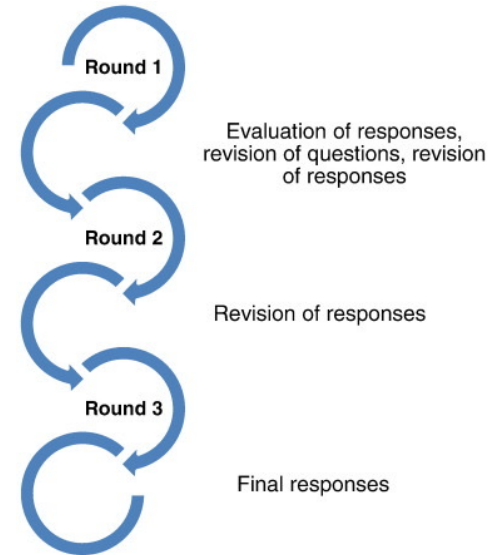
- The purpose of this study was to establish consensus statements via the modified Delphi process on the diagnosis, non-operative management, and MPFC repair for patellar instability.

Hypothesis

- Our hypothesis was that there would be a strong consensus on most statements regarding patellar instability.

Methods

- **60** board-certified surgeons (members of AOSSM, AANA, ESSKA, ISAKOS and the Patellofemoral Foundation) participated in consensus statements
- The project involved 7 working groups:
 1. Diagnosis
 2. Non-operative Management
 3. Medial Patellofemoral Complex (MPFC) Repair
 4. Medial Patellofemoral Ligament (MPFL) Reconstruction
 5. Tibial Tubercle Osteotomy (TTO)
 6. Trochleoplasty
 7. Rehabilitation and Return to Sport



Methods – Modified Delphi Method

- A steering committee compiled an initial set of questions pertaining to each working group based on their own knowledge and review of the current literature.
- The modified Delphi method was used to generate consensus statements for each working group, with groups completing 3 initial rounds of questionnaires, followed by amendments, and lastly a final vote.
 1. Questions progressed from an open-ended to a more structured format, progressing based on the prior round's answers.
 2. Once a preliminary consensus statement was generated within a working group, the liaisons anonymously polled the participants as to whether they “agreed” or “disagreed” with it.
 3. If there was unanimous agreement within a group on a preliminary consensus statement, this statement was elevated to a final vote.
 4. If the agreement was not unanimous, questions were subject to further discussion by members of the entire consensus group, with statements being amended where there was agreement with the proposed change.

Methods – Modified Delphi Method (cont.)

Final Voting

- The final voting process allowed all study participants to assess the consensus statements generated by the other working groups and vote on whether they “strongly disagree” or “disagree” or “agree” or “strongly agree” or were “neutral” with them.

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	2	3	4	5

- After the final votes for each question occurred, the degree of agreement was expressed using a percentage rounded to the nearest whole number.
 - “Unanimous consensus”: 100% of the votes in favor of a proposed statement.
 - “Strong consensus”: 90-99% agreeing or strongly agreeing
 - “Consensus”: 80-89% agreeing or strongly agreeing
 - “No consensus”: <80% agreeing or strongly agreeing

Results – Overview

Topic	Total Statements	Unanimous	Strong	Consensus	No Consensus
Diagnosis	8	1 (12.5%)	6 (75.0%)	1 (12.5%)	0 (0%)
Non-Operative Management	10	2 (20.0%)	4 (40.0%)	2 (20.0%)	2 (20.0%)
MPFC Repair	9	0 (0%)	4 (44.4%)	2 (22.2%)	3 (33.3%)
MPFL Reconstruction	15	0 (0%)	9 (60.0%)	4 (26.7%)	2 (13.3%)
Tibial Tubercle Osteotomy	10	0 (0%)	5 (50.0%)	5 (50.0%)	0 (0%)
Trochleoplasty	8	0 (0%)	2 (25.0%)	4 (50.0%)	2 (25.0%)
Rehabilitation & Return to Play	8	0 (0%)	3 (37.5%)	2 (25.0%)	3 (37.5%)

Results – Unanimous Statements

- *Diagnosis*
 - “In the diagnosis of pediatric patients with patellar instability it is important to assess the status of the physes.”
- *Non-operative management*
 - “When undergoing non-operative management for patellar instability, patients should start range of motion exercises as tolerated once comfort permits.”
 - “Patients should start resistance training exercises once range of motion is normalized and patients can perform the exercises without apprehension.”

**No unanimous consensus was achieved for statements on MPFC Repair, MPFL Reconstruction, TTO, Trochleoplasty, or Rehabilitation / Return to Sport

Results – Statements Not Achieving Consensus

- *Diagnosis*
 - “TTTG is superior to TT-PCL for diagnosing patellar distal malalignment. Either CT or MRI are acceptable for calculating the TTTG value.”
- *Non-operative management*
 - “Knee immobilization may be indicated for up to two weeks in the non-operative management of patellar instability for comfort, and the knee should be either locked in extension or allowed 30 degrees of flexion.”
 - “There is no role for orthobiologics in the non-operative management of patellar instability. However, orthobiologics may play a role if there is a concomitant cartilage injury.”
- *MPFC Repair*
 - “The primary indication for performing an MPFC repair for patients with patellar instability is a bony avulsion of the MPFC. Additionally, this is also the primary relative indication for performing a repair over an MPFL reconstruction.”
 - “The preferred technique for MPFC repair is by utilizing suture-anchors.”
 - “A VMO advancement may be beneficial to perform alongside an MPFC repair but not required.”

Results – Statements Not Achieving Consensus (cont.)

- *Tibial Tubercle Osteotomy*
 - “When using anchors, at least two should be used for fixation to the patella. Additionally, they should be kept at least 1cm apart.”
 - “It is advantageous to fix the patellar side first in MPFL reconstruction as it is easier to avoid overconstraint.”
- *Trochleoplasty*
 - “The indications for conducting a trochleoplasty in patients with patellar instability include a) Dejour B-D, Lateral trochlear inclination (LTI) < 5, and c) J sign Additionally, there is no role for an isolated trochleoplasty without MPFL repair/reconstruction.”
 - “Osteochondral flap elevation poses minimal risk in terms of cartilage viability.”
- *Rehabilitation & Return to Play*
 - “Patients should be allowed to weight-bear as tolerated following MPFL or reconstruction, and trochleoplasty does not impact this. In contrast with a TTO patients should be kept touch-toe weightbearing in a brace locked in extension, until there are radiographic signs of healing.”
 - “Patients should not be immobilized following MPFL or reconstruction, and trochleoplasty should not impact this.”

Conclusions

- A majority of statements concerning diagnosis, non-operative, and operative management of patellar instability achieved strong consensus.
- There remains a lack of consensus regarding:
 - The role of knee immobilization in non-operative management
 - Use of orthobiologics in non-operative management
 - Indications for MPFC repair
 - Anchor use in MPFL reconstruction and order of graft fixation (patella versus femur).
 - Indications for trochleoplasty
 - Weightbearing vs immobilization post-operatively
 - Whether pediatric patients should avoid early return to play.

References

- Sanders TL, Pareek A, Hewett TE, Stuart MJ, Dahm DL, Krych AJ. Incidence of First-Time Lateral Patellar Dislocation: A 21-Year Population-Based Study. *Sports health*. 2018 Mar/Apr;10(2):146-51. Epub 2017/08/10.
- Harilainen A, Myllynen P, Antila H, Seitsalo S. The significance of arthroscopy and examination under anaesthesia in the diagnosis of fresh injury haemarthrosis of the knee joint. *Injury*. 1988 Jan;19(1):21-4. Epub 1988/01/01.
- Mehta VM, Inoue M, Nomura E, Fithian DC. An algorithm guiding the evaluation and treatment of acute primary patellar dislocations. *Sports Med Arthrosc Rev*. 2007 Jun;15(2):78-81. Epub 2007/05/17.
- Sillanpaa P, Mattila VM, Iivonen T, Visuri T, Pihlajamaki H. Incidence and risk factors of acute traumatic primary patellar dislocation. *Med Sci Sports Exerc*. 2008 Apr;40(4):606-11. Epub 2008/03/05.
- Fithian DC, Paxton EW, Stone ML, Silva P, Davis DK, Elias DA, et al. Epidemiology and natural history of acute patellar dislocation. *The American journal of sports medicine*. 2004 Jul-Aug;32(5):1114-21. Epub 2004/07/21.
- Sappey-Marini E, Sonnery-Cottet B, O'Loughlin P, Ouanazar H, Reina Fernandes L, Kouevidjin B, et al. Clinical Outcomes and Predictive Factors for Failure With Isolated MPFL Reconstruction for Recurrent Patellar Instability: A Series of 211 Reconstructions With a Minimum Follow-up of 3 Years. *The American journal of sports medicine*. 2019 May;47(6):1323-30. Epub 2019/05/03.
- Hurley ET, Colasanti CA, Anil U, McAllister D, Matache BA, Alaia MJ, et al. Management of Patellar Instability: A Network Meta-analysis of Randomized Control Trials. *Am J Sports Med*. 2021 Aug 2;3635465211020000. Epub 2021/08/03.
- Bitar AC, Demange MK, D'Elia CO, Camanho GL. Traumatic patellar dislocation: nonoperative treatment compared with MPFL reconstruction using patellar tendon. *Am J Sports Med*. 2012 Jan;40(1):114-22. Epub 2011/10/22.
- Straume-Naesheim TM, Randsborg PH, Mikaelson JR, Sivertsen EA, Devitt B, Granan LP, et al. Recurrent lateral patella dislocation affects knee function as much as ACL deficiency - however patients wait five times longer for treatment. *BMC Musculoskelet Disord*. 2019 Jul 8;20(1):318. Epub 2019/07/10.
- Schneider DK, Grawe B, Magnussen RA, Ceasar A, Parikh SN, Wall EJ, et al. Outcomes After Isolated Medial Patellofemoral Ligament Reconstruction for the Treatment of Recurrent Lateral Patellar Dislocations: A Systematic Review and Meta-analysis. *The American journal of sports medicine*. 2016 Nov;44(11):2993-3005. Epub 2016/02/14.
- Shamrock AG, Day MA, Duchman KR, Glass N, Westermann RW. Medial Patellofemoral Ligament Reconstruction in Skeletally Immature Patients: A Systematic Review and Meta-analysis. *Orthop J Sports Med*. 2019 Jul;7(7):2325967119855023. Epub 2019/08/07.
- McNeilan RJ, Everhart JS, Mescher PK, Abouljoud M, Magnussen RA, Flanigan DC. Graft Choice in Isolated Medial Patellofemoral Ligament Reconstruction: A Systematic Review With Meta-analysis of Rates of Recurrent Instability and Patient-Reported Outcomes for Autograft, Allograft, and Synthetic Options. *Arthroscopy*. 2018 Apr;34(4):1340-54. Epub 2018/01/26.
- Desai VS, Tagliero AJ, Parkes CW, Camp CL, Cummings NM, Stuart MJ, et al. Systematic Review of Medial Patellofemoral Ligament Reconstruction Techniques: Comparison of Patellar Bone Socket and Cortical Surface Fixation Techniques. *Arthroscopy*. 2019 May;35(5):1618-28. Epub 2019/04/20.
- Constant M, Trofa DP, Saltzman BM, Ahmad CS, Li X, Parisien RL. The Fragility of Statistical Significance in Patellofemoral Instability Research: A Systematic Review. *Am J Sports Med*. 2021 Oct 11;3635465211039202. Epub 2021/10/12.
- Tokish JM, Kuhn JE, Ayers GD, Arciero RA, Burks RT, Dines DM, et al. Decision making in treatment after a first-time anterior glenohumeral dislocation: A Delphi approach by the Neer Circle of the American Shoulder and Elbow Surgeons. *J Shoulder Elbow Surg*. 2020 Dec;29(12):2429-45. Epub 2020/08/29.
- Murawski CD, Hogan MV, Thordarson DB, Stone JW, Ferkel RD, Kennedy JG. Editorial. *Foot Ankle Int*. 2018 Jul;39(1_suppl):1S-2S. Epub 2018/08/14.
- Katz JN. Editorial Commentary: Degenerative Meniscal Tear: Sojourn to the Oracle. *Arthroscopy*. 2020 Feb;36(2):513-5. Epub 2020/02/06.
- Hohmann E, Angelo R, Arciero R, Bach BR, Cole B, Cote M, et al. Degenerative Meniscus Lesions: An Expert Consensus Statement Using the Modified Delphi Technique. *Arthroscopy*. 2020 Feb;36(2):501-12. Epub 2020/01/07.
- Hohmann E, Cote MP, Brand JC. Research Pearls: Expert Consensus Based Evidence Using the Delphi Method. *Arthroscopy*. 2018 Dec;34(12):3278-82. Epub 2018/12/05.
- Angelo RL, Ryu RK, Pedowitz RA, Gallagher AG. Metric Development for an Arthroscopic Bankart Procedure: Assessment of Face and Content Validity. *Arthroscopy*. 2015 Aug;31(8):1430-40. Epub 2015/08/05.
- Schumaier A, Kovacevic D, Schmidt C, Green A, Rokito A, Jobin C, et al. Defining massive rotator cuff tears: a Delphi consensus study. *J Shoulder Elbow Surg*. 2020 Apr;29(4):674-80. Epub 2020/03/22.
- Garrigues GE, Zmistowski B, Cooper AM, Green A, Group ICMS. Proceedings from the 2018 International Consensus Meeting on Orthopedic Infections: the definition of periprosthetic shoulder infection. *J Shoulder Elbow Surg*. 2019 Jun;28(6S):S8-S12. Epub 2019/06/15.
- Liu JN, Steinhilber ME, Kalbani IL, Post WR, Green DW, Strickland SM, et al. Patellar Instability Management: A Survey of the International Patellofemoral Study Group. *Am J Sports Med*. 2018 Nov;46(13):3299-306. Epub 2017/10/07.
- Harris PA, Taylor R, Minor BL, Elliott V, Fernandez M, O'Neal L, et al. The REDCap consortium: Building an international community of software platform partners. *J Biomed Inform*. 2019 Jul;95:103208. Epub 2019/05/13.
- McCrum E, Cooper K, Wittstein J, French RJ. Imaging of Patellofemoral Instability. *Clinics in sports medicine*. 2021 Oct;40(4):693-712. Epub 2021/09/13.
- Honkonen EE, Sillanpaa PJ, Reito A, Maenpaa H, Mattila VM. A Randomized Controlled Trial Comparing a Patella-Stabilizing, Motion-Restricting Knee Brace Versus a Neoprene Nonhinged Knee Brace After a First-Time Traumatic Patellar Dislocation. *Am J Sports Med*. 2022 Jun;50(7):1867-75. Epub 2022/04/20.
- Murray IR, LaPrade CM, Pullen WM, Sherman SL. Medial Patellofemoral Ligament Repair or Medial Advancement: Is There a Role? *Clinics in sports medicine*. 2022 Jan;41(1):157-69. Epub 2021/11/17.
- Hohmann E, Brand JC, Rossi MJ, Lubowitz JH. Expert Opinion Is Necessary: Delphi Panel Methodology Facilitates a Scientific Approach to Consensus. *Arthroscopy*. 2018 Feb;34(2):349-51. Epub 2018/02/08.