

Degenerative Meniscus Lesions: An Expert Consensus Statement Using the Modified Delphi Technique



Erik Hohmann, M.B.B.S., F.R.C.S., F.R.C.S. (Tr&Orth), M.D., Ph.D., Richard Angelo, M.D., Robert Arciero, M.D., Bernard R. Bach, M.D., Brian Cole, M.D., Mark Cote, D.P.T., Jack Farr, M.D., Julian Feller, F.R.A.C.S., Brad Gelbhart, F.C.S. (S.A.) Orth., Andreas Gomoll, M.D., Andreas Imhoff, M.D., Robert LaPrade, M.D., Ph.D., Bert R. Mandelbaum, M.D., Robert G. Marx, M.D., Juan C. Monllau, M.D., Frank Noyes, M.D., David Parker, F.R.A.C.S., Scott Rodeo, M.D., Nicholas Sgaglione, M.D., Kevin Shea, M.D., Donald K. Shelbourne, M.D., Shinichi Yoshiya, M.D., Vaida Glatt, Ph.D., and Kevin Tetsworth, M.D., F.R.A.C.S.

Purpose: The purpose of this study was to perform an evidence-based, expert consensus survey using the Delphi panel methodology to develop recommendations for the treatment of degenerative meniscus tears. **Methods:** Twenty panel members were asked to respond to 10 open-ended questions in rounds 1 and 2. The results of the first 2 rounds served to develop a Likert-style questionnaire for round 3. In round 4, the panel members outside consensus were contacted and asked to either change their score in view of the group's response or argue their case. The level of agreement for round 4 was defined as 80%. **Results:** There was 100% agreement on the following items: insidious onset, physiological part of aging, tears often multiplanar, not all tears cause symptoms, outcomes depend on degree of osteoarthritis, obesity is a predictor of poor outcome, and younger patients (<50 years) have better outcomes. There was between 90% and 100% agreement on the following items: tears are nontraumatic, radiographs should be weightbearing, initial treatment should be conservative, platelet-rich plasma is not a good option, repairable and peripheral tears should be repaired, microfracture is not a good option for chondral defects, the majority of patients obtain significant improvement and decrease in pain with surgery but results are variable, short-term symptoms have better outcomes, and malalignment and root tears have poor outcomes. **Conclusions:** This consensus statement agreed that degenerative meniscus tears are a normal part of aging. Not all tears cause symptoms and, when symptomatic, they should initially be treated nonoperatively. Repairable tears should be repaired. The outcome of arthroscopic partial meniscectomy depends on the degree of osteoarthritis, the character of the meniscus lesion, the degree of loss of joint space, the amount of malalignment, and obesity. The majority

From the Department of Orthopaedic Surgery and Sportsmedicine, Valiant Clinic/Houston Methodist (E.H.), Dubai, United Arab Emirates; Woodinville, Washington, U.S.A. (R. Angelo); Department of Orthopaedic Surgery, University of Connecticut (R. Arciero, M.C.), Farmington, U.S.A.; Midwestern Orthopaedics at Rush, Rush University Medical Center (B.R.B., B.C.), Chicago, Illinois, U.S.A.; Cartilage Restoration Center of Indiana (J. Farr), Indianapolis, Indiana, U.S.A.; OrthoSportVictoria, Epworth Healthcare (J. Feller), Melbourne, Australia; Linksfield Orthopaedic Sports and Rehabilitation Centre, Centre for Sports Medicine and Orthopaedics (B.G.), Johannesburg, South Africa; Hospital for Special Surgery (A.G., R.G.M.), New York, New York, U.S.A.; Department of Orthopaedic Sports Medicine, Technical University Munich (A.I.), Munich, Germany; The Steadman Clinic (R.L.), Vail, Colorado, U.S.A.; Santa Monica, California, U.S.A. (B.R.M.); Barcelona, Spain (J.C.M.); Cincinnati Sportsmedicine and Orthopaedic Centre (F.N.), Cincinnati, Ohio, U.S.A.; Sydney Orthopaedic Research Institute (D.P.), Sydney, Australia; Sportsmedicine and Shoulder Service, Hospital for Special Surgery (S.R.), New York, New York, U.S.A.; Northwell Health Orthopaedics, Great Neck (N.S.), New York, U.S.A.; Department of Orthopaedic Surgery, University of Connecticut (K.S.), Farmington, Connecticut,

U.S.A.; Shelbourne Knee Center, Community East Hospital (D.K.S.), Indianapolis, Indiana; Department of Orthopaedic Surgery, Hyogo College of Medicine (S.Y.), Nishinomiya City, Hyogo, Japan; University of Texas Health Science Center (V.G.), San Antonio, Texas, U.S.A.; Orthopaedic Research Centre of Australia (V.G., K.T.), Brisbane, Australia; and Department of Orthopaedic Surgery, Royal Brisbane Hospital (K.T.), Herston, Australia.

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Address correspondence to Prof. Erik Hohmann, Valiant Clinic/Houston Methodist Group, Dubai, United Arab Emirates. E-mail: ehohmann@hotmail.com

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of patients had significant improvement, but younger patients and patients with short-term symptoms have better outcomes. **Level of Evidence:** Level V — expert opinion.

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Introduction

The treatment of degenerative meniscal lesions is controversial, and recent publications have advocated conservative treatment.¹⁻⁷ Earlier randomized levels I to III studies have reported that arthroscopic treatment has no advantage over nonoperative treatment.^{3-5,8-10} Nonoperative management has therefore been suggested to be the initial treatment of choice.^{11,12} The 2016 European Society of Sports Traumatology, Knee Surgery, and Arthroscopy (ESSKA) meniscus consensus suggested that patients undergo at least 3 months of conservative treatment as a threshold for failure of treatment.^{11,12} If patients present with a history of considerable mechanical symptoms such as locking and catching, early surgery can be considered.¹

The current concept that operative treatment should not be the first choice is supported by recent meta-analysis and systematic reviews.^{6,13} Thorlund et al⁶ could not demonstrate any clinical or functional benefit of arthroscopic surgery at 12 and 24 months after surgery and concluded that knee arthroscopy is associated with harm and not recommended for middle-aged or older patients with or without signs of osteoarthritis. Brignardello-Petersen et al¹³ concluded that patients who undergo knee arthroscopy for degenerative disease do not have important benefits in pain and function. The potential benefit of arthroscopic surgery for degenerative knee disease remains highly controversial.¹⁴⁻¹⁷ Opponents of arthroscopic surgery in degenerative knee conditions argue that surgeons may have confirmation bias or myside bias (the tendency to evaluate evidence in a manner biased toward one's own opinion), ignoring robust and high-quality evidence,^{15,18} but also admit that the available evidence is of low quality and therefore unconvincing.¹⁵ In contrast, proponents argue that the current evidence is inherently flawed, based on poorly designed studies, questionable eligibility criteria, and dubious indications for surgical intervention.^{16,17} Certainly the conclusions of those analyses demonstrating little, if any, evidence supporting knee arthroscopy have been criticized for the inclusion of poorly designed and nonrelevant studies.¹⁶ Recent critical reviews of the literature have determined that valid conclusions cannot be drawn with regard to surgical versus nonoperative treatment of degenerative meniscal tears.^{19,20} Finally, there may also be editorial bias against arthroscopic surgery, with some editors accepting studies limited by potential selection bias, design flaws, and β error.²¹⁻²³

Because of the biases, poor study quality, and weaknesses of the current literature, current treatment

algorithms lack clarity.^{11,12,24} Given the potential limitations and difficulties with randomized clinical trials in reaching valid conclusions, an evidence-based, expert consensus structured research survey may be able to provide more direct answers to complex clinical questions.²⁵

The purpose of this study was to perform an evidence-based, expert consensus survey using the Delphi panel methodology to develop recommendations for the treatment of degenerative meniscus tears. We hypothesized that despite high-level evidence, there would be agreement on how to approach degenerative meniscus tears in clinical practice.

Methods

The Delphi panel technique used a 4-round approach with international experts in the field of knee surgery. The Delphi method is an accepted scientific technique and must include 3 distinct features: anonymity, controlled feedback, and statistical group response.²⁶⁻²⁹ The principle of Delphi includes definition of the problem, panel selection, question development, open questions for round 1, feedback between rounds, and further rounds until either consensus or an impasse is reached.^{26,29-31}

For this project, a degenerative meniscus lesion was defined as a lesion in patients older than 35 years with or without a history of trauma. The project commenced in July 2017 and was concluded in May 2018. The level of agreement for consensus was defined based on previous recommendations as 80% to reduce selection bias and achieve valid results.^{32,33}

Table 1. Round 1 Open-Ended Questions

| | |
|------|---|
| Q 1 | What is a degenerative meniscus lesion? What characteristics distinguish these from an acute injury in an older patient? |
| Q 2 | How should we best diagnose these lesions, both clinically and radiographically? |
| Q 3 | Do these lesions cause symptoms? |
| Q 4 | What is the role of conservative treatment in their management? |
| Q 5 | What are the current indications for surgery, if any? |
| Q 6 | Please comment on your surgical technique. |
| Q 7 | How do you address chondral defects? |
| Q 8 | What are the anticipated functional and patient perceived outcomes after surgery? |
| Q 9 | The current evidence suggests nonoperative treatment is preferred. How would you argue for or against operative treatment, based on the published evidence? |
| Q 10 | Please comment on the cost-effectiveness of knee arthroscopy for the possible treatment of these lesions. |

Question Development

The steering group consisted of 4 experienced researchers (E.H., K.T., V.G., M.C.). An extensive literature review was performed on MEDLINE, Embase, Scopus, and Google Scholar with the following terms: “meniscus tear” AND “degenerative” AND/OR “knee arthroscopy”; “partial meniscectomy” AND “physical therapy” AND/OR “physiotherapy.” Articles were manually cross-referenced to ensure that all potential studies were included. No specific restrictions were used for age in order to capture all published literature, and full-text review was performed for all eligible articles. Based on the review of the published literature, the first round of open questions were developed (Table 1).

Panel Selection

Delphi recommends a mix of practitioners and academics with an initial panel list of 15 to 35 experts.^{29,30} To select suitable experts, the abstracts of the 2015 and 2017 ISAKOS, the 2014 and 2016 abstract books of the ESSKA, and the 2015 and 2016 abstracts of the *Journal of Arthroscopy, American Journal of Sports Medicine, and Knee Surgery Sports Traumatology Arthroscopy* were searched for authors who had either published on this topic or were members of the Knee Committee of the 2 organizations. An initial list of 23 experts was compiled. Of those experts, 22 responded and agreed to participate in the project.

Rounds 1 and 2

In round 1, the 10 open questions were sent via email to the panel members. The instructions were to strive to answer the questions as detailed and specific as reasonably possible using the recently published literature to argue their case. The results of round 1 were then summarized. The steering committee highlighted controversies and agreements from the first round responses, and open and semi-open ended questions were developed to explore the items further (Table 2). The summarized results from round 1 and the questions for round 2 were then again sent via email to the panel.

Rounds 3 and 4

Similar to round 1, the results of round 2 were summarized. The controversies and agreements were analyzed, and based on the results, a Likert-style questionnaire was developed for round 3 (Table 3). The questions were grouped under subheadings to simplify the Likert-style approach. In round 4, panel members who were outside consensus or outside a level of agreement of 80% were contacted and asked to reassess their responses and re-rank their agreement to each item. This allowed them the opportunity to change their score in view of the group’s response or to argue their case why there was no change in ranking.

Table 2. Round 2 Questions

| | |
|--------|--|
| Q 2.1 | How do you differentiate between acute on chronic OA and meniscal tears on clinical examination? |
| Q 2.2 | How do you rate the reliability of joint line tenderness? |
| Q 2.3 | What is your view on radiographs? Should they be part of the work-up in all cases? |
| Q 2.4 | How reliable is clinical examination? |
| Q 2.5 | Do you think that a joint effusion is present? |
| Q 2.6 | What is your view on MR imaging? Should they be part of the work-up in all cases? |
| Q 3.1 | Are there only specific tear patterns that cause symptoms? |
| Q 4.1 | Do you believe there is a role for injection therapy as part of the conservative regimen? Please comment briefly on the value of steroids, hyaluronic acid, platelet-rich plasma, and adipose-derived stem cells |
| Q 5.1 | Do you believe that patients with mechanical symptoms should be offered early surgery rather than rehabilitation? |
| Q 6.1 | Do you believe that there are specific tear patterns that should be repaired? |
| Q 7.1 | Is there a role for microfracture, OATS, MACI/ACI at all? |
| Q 7.2 | Is there a scenario where you would avoid any intervention and ignore the lesion completely? |
| Q 7.3 | Is there a role for chondroplasty in cases with unstable and stable chondral flaps? |
| Q 8.1 | Do you believe that the outcome depends on the level of OA? |
| Q 8.2 | Do you believe that either the size, location or tear pattern of the meniscus lesion influences outcome? |
| Q 8.3 | In your opinion are there any variables that will result in better outcomes? |
| Q 8.4 | Patient selection: who should have surgery and who not? |
| Q 9.1 | Would you say that most of the current studies suggesting conservative treatment suffer from bias and should be viewed with caution? |
| Q 10.1 | Would you say that with clear surgical indications early surgery is more cost-effective than nonoperative treatment? |

ACI, autologous chondrocyte implantation; MACI, matrix-induced autologous chondrocyte implantation; OATS, osteochondral autologous transplant system.

The level of agreement was selected based on previous suggestion that a minimum level of agreement of 70% is sufficient.³⁴ However, for the purpose of this project, it was assumed that a level of agreement of < 80% demonstrated a lack of agreement and required further rounds to either achieve a higher degree of agreement or not reach consensus.²⁹

Statistical Analysis

The results of rounds 3 and 4 were described as calculated percentiles. Consensus was defined if a minimal level of agreement of 80% was achieved. If there was consensus against a specific item, the results were reported as consensus to disagree.

Results

All 22 selected panel members completed the first-round questionnaire. Of the 22 members, 20 (91%) completed the second, third, and fourth rounds.

Table 3. Round 3 Likert-Style Questions

| Definition of Degenerative Meniscus Lesions | Strongly Agree | Agree | Disagree | Strongly Disagree | |
|--|-----------------|------------|--------------|-------------------|-------------|
| Physiological and normal part of aging | | | | | |
| Insidious onset | | | | | |
| Mainly horizontal tears | | | | | |
| Often multiplanar tears | | | | | |
| Mainly in zones 2 and 3 | | | | | |
| Location middle and posterior thirds | | | | | |
| Nontraumatic | | | | | |
| Diagnosis of Degenerative Meniscus Lesions | Very Frequently | Frequently | Occasionally | Rarely | Very Rarely |
| History: gradual onset of activity-related pain | | | | | |
| History: pain with prolonged sitting | | | | | |
| History: pain with squatting and kneeling | | | | | |
| Joint line tenderness present | | | | | |
| Joint line tenderness must be localized | | | | | |
| Joint effusion present | | | | | |
| Lack of flexion present | | | | | |
| Lack of extension present | | | | | |
| McMurray sign is positive | | | | | |
| Payr sign is positive | | | | | |
| Localized pain, mechanical symptoms, short duration, normal radiographs: meniscus tear | | | | | |
| In the presence of OA (Kellgren 3 + 4) clinical examination in particular localized tenderness not reliable | | | | | |
| In the presence of OA (Kellgren 1 + 2) clinical examination in particular localized tenderness reliable | | | | | |
| Imaging of Degenerative Meniscus Lesions | Strongly Agree | Agree | Disagree | Strongly Disagree | |
| Radiographs needed | | | | | |
| Should include at least a weightbearing coronal view | | | | | |
| Rosenberg views very helpful | | | | | |
| Long leg standing views should be ordered | | | | | |
| MRI is needed | | | | | |
| MRI only needed if clinical examination positive and signs of radiographic OA | | | | | |
| MRI only needed if clinical examination positive and no signs of radiographic OA | | | | | |
| Symptoms | Strongly Agree | Agree | Disagree | Strongly Disagree | |
| All tears cause symptoms | | | | | |
| Only if mechanical symptoms (locking, reduced ROM) | | | | | |
| Present with displaced flap tears | | | | | |
| Present with bucket handle tears | | | | | |
| They are asymptomatic until a major tear occurs or there is extrusion | | | | | |
| Treatment | Strongly Agree | Agree | Disagree | Strongly Disagree | |
| Initial treatment should always be conservative | | | | | |
| Surgery is not indicated for at least 6 weeks whether there are mechanical symptoms or not | | | | | |
| If there are true mechanical symptoms (locking), surgery is the first line of treatment | | | | | |
| If there are mechanical symptoms (catching), surgery is the first line of treatment | | | | | |
| If there are mechanical symptoms (clicking, grinding), surgery is the first line of treatment | | | | | |
| A steroid injection is a good option | | | | | |
| Steroids are only helpful in the presence of osteoarthritis | | | | | |
| Viscosupplementation is effective with meniscus lesions | | | | | |

(continued)

Table 3. Continued

| Treatment | Strongly Agree | Agree | Disagree | Strongly Disagree | |
|--|----------------|-------|----------------------------|-------------------|-------------------|
| Viscosupplementation is only effective with osteoarthritis | | | | | |
| PRP a good option with meniscus lesions | | | | | |
| PRP is only a good option with osteoarthritis | | | | | |
| Persistent pain, effusion, failed conservative treatment (<3 months) should have surgery | | | | | |
| Surgery | Strongly Agree | Agree | Disagree | Strongly Disagree | |
| A degenerative lesion will not benefit from repair | | | | | |
| Repairable meniscal tears should be repaired | | | | | |
| Repairable meniscal tears should only be repaired in patients with a high activity level | | | | | |
| Posterior root tears should always be repaired | | | | | |
| Peripheral longitudinal tears should be repaired | | | | | |
| Horizontal tears deserve to be repaired | | | | | |
| Chondral Defects | Strongly Agree | Agree | Disagree | Strongly Disagree | |
| Should be ignored | | | | | |
| Microfracture is a good option | | | | | |
| Limited chondroplasty is effective | | | | | |
| Debridement of loose fragments is justified | | | | | |
| Light arthroscopic debridement is beneficial | | | | | |
| No debridement is ever indicated for grade 3 and above | | | | | |
| Outcomes with Surgery | Strongly Agree | Agree | Disagree | Strongly Disagree | |
| Majority of patients obtain a significant improvement | | | | | |
| Favorable short-term benefit only (<2 years) | | | | | |
| Depends on degree of OA | | | | | |
| If loss of joint space is present, the outcome is variable and often poor | | | | | |
| Improvement in pain | | | | | |
| Improvement in function with surgery variable | | | | | |
| Patient selection key (short-term and mechanical symptoms favorable) | | | | | |
| Depends on meniscus lesion | | | | | |
| Depends on size of resection | | | | | |
| With retention of >50% of meniscus tissue outcome is generally good | | | | | |
| Flap tears do well | | | | | |
| Meniscal root tears have poor outcomes(if not repaired) | | | | | |
| Obesity results in poorer outcomes | | | | | |
| Substantial malalignment (>10°) results in poorer outcomes | | | | | |
| Short-term symptoms have better outcomes | | | | | |
| Younger patients (<50 years) typically have better outcomes | | | | | |
| Current Evidence | Strongly Agree | Agree | Neither Agree Nor Disagree | Disagree | Strongly Disagree |
| Would you say that most of the current studies suggesting conservative treatment is the preferred option suffer from bias and should be viewed with caution? | | | | | |
| Cost-effectiveness | Strongly Agree | Agree | Disagree | Strongly Disagree | |
| Not cost-effective if diffuse OA | | | | | |
| Cost-effective as patients can return to work and physical activity earlier | | | | | |
| Needs to be compared to costs of PT, injections, and other conservative measures | | | | | |
| Currently there are insufficient data to allow a meaningful conclusion | | | | | |
| Cost-effective when considering time off work | | | | | |
| Not cost-effective when considering cost to society | | | | | |
| More cost-effective than physical therapy and continued failed nonoperative measures for >3 months | | | | | |

MRI, magnetic resonance imaging; OA, osteoarthritis; PRP, platelet-rich plasma; ROM, range of motion.

Fourteen members were based in North America, 2 were in Australia, and 1 member each was from Germany, South Africa, Spain, and Japan. All panel

members were fellowship trained in orthopaedic sports medicine and either worked in academic teaching hospitals or were university hospital based.

Table 4. Results for Likert-style Questions

| Definition of Degenerative Meniscus Lesions | Strongly Agree | Agree | Disagree | Strongly Disagree | Agreement |
|---|----------------|-------|----------|-------------------|-----------|
| Physiological and normal part of aging | 10 | 10 | | | 100% |
| Insidious onset | 6 | 14 | | | 100% |
| Mainly horizontal tears | 5 | 9 | 6 | | 70% |
| Often multiplanar tears | 6 | 14 | | | 100% |
| Mainly in zones 2 and 3 | 5 | 13 | 2 | | 90% |
| Location middle and posterior thirds | 12 | 8 | | | 100% |
| Nontraumatic | 7 | 12 | 1 | | 95% |

| Diagnosis of Degenerative Meniscus Lesions | Very Frequently | Frequently | Occasionally | Rarely | Very Rarely | Agreement |
|---|-----------------|------------|--------------|--------|-------------|-----------|
| History: gradual onset of activity-related pain | 9 | 7 | 4 | | | 80% |
| History: pain with prolonged sitting | 2 | 6 | 9 | 2 | 1 | 40% |
| History: pain with squatting and kneeling | 5 | 10 | 4 | | 1 | 75% |
| Joint line tenderness present | 9 | 8 | 3 | | | 85% |
| Joint line tenderness must be localized | 3 | 10 | 5 | 2 | | 65% |
| Joint effusion present | 1 | 4 | 13 | 2 | | 25% |
| Lack of flexion present | | 9 | 10 | 1 | | 45% |
| Lack of extension present | | | 4 | 14 | 2 | 80% |
| McMurray sign is positive | 2 | 5 | 10 | 3 | | 35% |
| Payr sign is positive | | 5 | 13 | 2 | | 35% |
| Localized pain, mechanical symptoms, short duration, normal radiographs: meniscus tear | 5 | 11 | 4 | | | 80% |
| In the presence of OA (Kellgren 3 + 4) clinical examination in particular localized tenderness not reliable | 9 | 6 | 5 | | | 75% |
| In the presence of OA (Kellgren 1 + 2) clinical examination in particular localized tenderness reliable | 6 | 11 | 3 | | | 85% |

| Imaging of Degenerative Meniscus Lesions | Strongly Agree | Agree | Disagree | Strongly Disagree | Agreement |
|--|----------------|-------|----------|-------------------|-----------|
| Radiographs needed | 12 | 8 | | | 100% |
| Should include at least a weightbearing coronal view | 15 | 4 | 1 | | 95% |
| Rosenberg views very helpful | 17 | 2 | 1 | | 95% |
| Long leg standing views should be ordered | 7 | 4 | 7 | 2 | 65% |
| MRI is needed | 5 | 7 | 8 | | 60% |
| MRI only needed if clinical examination positive and signs of radiographic OA | | 5 | 9 | 6 | 25% |
| MRI only needed if clinical examination positive and no signs of radiographic OA | 3 | 5 | 7 | 5 | 40% |

| Symptoms | Strongly Agree | Agree | Disagree | Strongly Disagree | Agreement |
|---|----------------|-------|----------|-------------------|-----------|
| All tears cause symptoms | | | 7 | 13 | 100% |
| Only if mechanical symptoms (locking, reduced ROM) | 1 | 11 | 8 | 1 | 60% |
| Present with displaced flap tears | 5 | 12 | 2 | 1 | 85% |
| Present with bucket-handle tears | 8 | 11 | 1 | | 95% |
| They are asymptomatic until a major tear occurs or there is extrusion | 3 | 5 | 7 | 5 | 40% |

| Treatment | Strongly Agree | Agree | Disagree | Strongly Disagree | Agreement |
|--|----------------|-------|----------|-------------------|-----------|
| Initial treatment should always be conservative | 10 | 8 | 2 | | 90% |
| Surgery is not indicated for at least 6 weeks whether there are mechanical symptoms or not | 5 | 8 | 7 | | 65% |

(continued)

Table 4. Continued

| Treatment | Strongly Agree | Agree | Disagree | Strongly Disagree | Agreement | |
|---|----------------|-------|----------|-------------------|-----------|-----|
| If there are true mechanical symptoms (locking), surgery is the first line of treatment | 3 | 10 | 7 | | 65% | |
| If there are mechanical symptoms (catching), surgery is the first line of treatment | 2 | 5 | 13 | | 35% | |
| If there are mechanical symptoms (clicking, grinding), surgery is the first line of treatment | | 2 | 15 | 3 | 90% | |
| A steroid injection is a good option | 3 | 10 | 3 | 4 | 65% | |
| Steroids are only helpful in the presence of osteoarthritis | 2 | 1 | 12 | 5 | 85% | |
| Viscosupplementation is effective with meniscus lesions | 1 | 3 | 12 | 4 | 80% | |
| Viscosupplementation is only effective with OA | 2 | 10 | 7 | 1 | 60% | |
| PRP a good option with meniscus lesions | | 1 | 14 | 5 | 95% | |
| PRP is only a good option with osteoarthritis | 2 | 10 | 5 | 3 | 60% | |
| Persistent pain, effusion, failed conservative treatment (<3 months) should have surgery | 6 | 14 | | | 100% | |
| Surgery | Strongly Agree | Agree | Disagree | Strongly Disagree | Agreement | |
| A degenerative lesion will not benefit from repair | 10 | 5 | 5 | | 75% | |
| Repairable meniscal tears should be repaired | 3 | 15 | 1 | 1 | 90% | |
| Repairable meniscal tears should only be repaired in patients with a high activity level | | | 15 | 5 | 100% | |
| Posterior root tears should always be repaired | 1 | 9 | 9 | 1 | 50% | |
| Peripheral longitudinal tears should be repaired | 1 | 17 | 1 | 1 | 90% | |
| Horizontal tears deserve to be repaired | 5 | 3 | 11 | 1 | 40% | |
| Chondral Defects | Strongly Agree | Agree | Disagree | Strongly Disagree | Agreement | |
| Should be ignored | | 3 | 9 | 8 | 60% | |
| Microfracture is a good option | | | 1 | 15 | 4 | 95% |
| Limited chondroplasty is effective | | | 13 | 4 | 3 | 65% |
| Debridement of loose fragments is justified | | 3 | 14 | 2 | 1 | 85% |
| Light arthroscopic debridement is beneficial | | | 10 | 6 | 4 | 50% |
| No debridement is ever indicated for grade 3 and above | | 5 | 3 | 11 | 1 | 40% |

MRI, magnetic resonance imaging; OA, osteoarthritis; PRP, platelet-rich plasma; ROM, range of motion.

The responses for the first round indicated that a degenerative lesion is part of physiological aging and the main diagnostic tool is clinical examination. A weightbearing radiograph should be part of any workup. The majority agreed that all lesions should be treated nonoperatively unless there are clear mechanical symptoms. The mainstay of operative treatment should consist of arthroscopic partial meniscectomy (APM); chondral lesions should be debrided. There was no agreement on whether tears cause symptoms and what the expected outcomes

would be. There was also no agreement with regard to the strength of the current evidence and cost-effectiveness.

The responses for the additional questions for the second round showed mixed responses. For example, the reliability of joint line tenderness was assessed as reliable by a few members, whereas others believed that they were nonspecific. All panel members agreed that radiographs should be used as part of the workup. The role of injection therapy was not supported. Clear mechanical symptoms with locking were an indication

for surgery for 50% of the members, whereas others questioned the need for surgery. Similarly, 50% of the members favored repair if feasible.

In round 3, consensus of > 80% was reached for the following items: tears are a physiological and normal part of aging, insidious onset, mainly horizontal tears but often multiplanar, location mainly middle and posterior thirds, and nontraumatic. Joint line tenderness is present; the McMurray sign is positive. Radiographs are required and should include weightbearing view; the Rosenberg view is helpful. Not all tears are symptomatic, but there are symptoms with displaced and bucket-handle tears. Platelet-rich plasma (PRP) is not a good option. Patients with persistent pain, joint effusion, and failed conservative treatment should have surgery. Peripheral meniscus tears should be repaired. Outcome depends on the degree of osteoarthritis and the meniscus lesion. Functional outcome is variable, but there is improvement in pain. Patient selection is key; short-term and mechanical symptoms are favorable. For the other items consensus was not reached and the authors outside consensus were asked to re-rank or explain their responses (Table 3).

For round 4, 100% consensus was reached for the following items: physiological and normal part of aging; insidious onset; often multiplanar tears; location middle and posterior thirds; radiographs are needed; persistence of pain, effusion, and failed conservative treatment for >3 months indicates need for surgery; outcomes depend on the degree of osteoarthritis; with loss of joint space, outcome is variable and often poor; patient selection is key; flap tears do well with surgery; obese patients have poor outcomes; and patients younger than 50 years have better outcomes. There was 100% disagreement that all tears cause symptoms and that repairable meniscal tears should only be repaired in young patients with high activity (Table 4).

There was no agreement with regard to the current evidence. Forty percent strongly agreed, 30% agreed, 10% neither agreed nor disagreed, 15% disagreed, and 5% strongly disagreed that current studies suggesting conservative treatment is the preferred option are biased. However, 70% agreed that there may be bias, and when applying the criteria of Sumsion,³⁴ consensus was reached. General consensus was reached that surgical treatment is not cost-effective in the presence of diffuse osteoarthritis but needs to be compared with conservative treatment. However, 90% agreed that surgical treatment is more cost-effective than physical therapy (PT) and conservative treatment if it exceeds 3 months.

Discussion

The results of this Delphi panel consensus indicated a that degenerative meniscus lesion is a normal part of aging, is of insidious onset, is nontraumatic, and mainly

occurs in the middle and posterior thirds of the meniscus. Only 70% of the panel believed that the tear has a horizontal pattern but rather is multiplanar. These findings are in agreement with the 2016 ESSKA consensus with the exception of tear pattern.^{11,12} The ESSKA panel believed that horizontal cleavage tears are most common.¹¹ The ESSKA authors possibly were of the opinion that horizontal cleavage tears were similar to the typical horizontal cleavage patterns observed in younger athletes caused by micro-traumatic overuse lesions and histological mucoid degenerative tissue.¹² Metcalf et al³⁵ showed that degenerative tears generally have a complex tear pattern and are predominantly found in the posterior horn and midbody. Clearly there is no consensus about tear patterns, and further research is needed to establish the most common tear configuration in degenerative meniscus tears.

The panel agreed that weightbearing radiographs are required and serve to evaluate the degree of degenerative osteoarthritic changes. There was no agreement with regard to the need for magnetic resonance imaging (MRI) with positive clinical examination regardless of whether signs of radiographic osteoarthritis were present. This is surprising given that there was also no strong agreement on how clinical examination would help in diagnosing a meniscus lesion. A history of gradual onset of activity-related pain, joint line tenderness, lack of full extension, and localized joint tenderness in the absence of radiographic osteoarthritis reached just the 80% agreement threshold. Abram et al,³⁶ representing the British Association for Surgery of the Knee, proposed that a locked knee, locking, catching, and tender palpable meniscal tissue are strongly suggestive of a treatable meniscus lesion. The ESSKA group agreed that radiographs are a useful first-line tool, and MRI may be useful in selected patients with refractory symptoms or warning flags.¹² The British Association for Surgery of the Knee recommends MRI if treatable meniscal pathology is suspected.³⁶

There is limited evidence that degenerative meniscus tears cause symptoms, but unstable flap tears or displaced torn meniscus tissue most likely cause knee pain. The panel disagreed that all tears cause symptoms but agreed that displaced flap tears and bucket-handle tears cause symptoms. There is agreement that the initial treatment should always be conservative. However, 35% of the panel believed that surgery is indicated if there are true mechanical symptoms. Persistent pain, effusion, and failed conservative treatment after 3 months were an indication for surgery, and the entire panel agreed on this approach. This path is in agreement with the ESSKA consensus.¹² There was strong agreement that PRP or viscosupplementation is not helpful in the presence of degenerative meniscus lesions but could potentially assist with concomitant osteoarthritis. Filardo et al³⁷ and, earlier, Thein et al³⁸

reported **no benefit using hyaluronic acid** after partial meniscectomy. Although these authors have used viscosupplementation after surgery, they support the panel opinion that it is not helpful in the setting of meniscal lesions. PRP was used by Blanke et al³⁹ to treat grade 2 intrasubstance meniscal lesions, and the authors showed that symptoms significantly improved in 60% of patients. This is supported by Ishida et al,⁴⁰ who investigated PRP for meniscal tissue regeneration in an animal trial. Meniscal tissue defects treated with PRP showed significantly greater scores for the number of fibrochondrocytes and production of extracellular matrix. The authors concluded that PRP increases healing properties of avascular meniscus.⁴⁰ At this stage, the **use of PRP with meniscus lesions is not supported by evidence.**

There was considerable controversy regarding whether meniscal lesions should be repaired. The Likert questions were designed to detect these animosities. Although 75% of the panel was of the opinion that degenerative lesions would not benefit from surgical repairs, there was agreement that repairable lesions and **peripheral longitudinal** tears should be repaired. It seems that the current literature does not consider meniscal repair a good option for degenerative meniscus tears.^{11,12,41-43} Several authors have previously demonstrated that meniscal repair is superior to partial meniscectomy with regard to functional outcomes, return to sports, and cartilage protection.⁴⁴⁻⁴⁶ Therefore, it could be argued that repair should be considered if feasible.

The treatment of concomitant chondral defects is not clear. Kreuz et al⁴⁷ investigated outcomes in patients > **40 years old** and showed that the results of microfracturing are **age** dependent. Chondral pathology and medial meniscus lesions are often associated and require a sensible treatment approach.^{48,49} The panel agreed that **microfracturing is not a good option**, and consensus was reached for debridement of loose fragments; 60% believed chondral defects should be ignored and only 65% believed that limited chondroplasty is effective. Clearly, the lack of evidence does not allow a clinically meaningful treatment approach, and future studies should assess the value of treating chondral defects in the presence of degenerative meniscal tears.

The panel agreed that the outcomes after surgery depend on the **degree** of osteoarthritis, the character of the meniscus lesion, the degree of loss of joint space, the amount of malalignment, and obesity. Although there was agreement that the majority of patients obtain significant improvement, patient selection is key. Younger patients and patients with short-term symptoms generally have better outcomes. This is consistent with the findings of Sofu et al,⁵⁰ who showed that a body mass index of > 26 and chondral lesions of grade 3 and higher are major predictors of outcome.

Given the current controversy whether degenerative meniscus tears benefit from surgery, the panel was also asked whether they believed that the current evidence suggests superiority of either conservative treatment or arthroscopic partial meniscectomy. Fourteen panel members (70%) agreed that the current evidence should be viewed with caution. A recent systematic review strongly suggests that **high risk of bias**, weak to moderate study quality, small sample sizes, and diverse study characteristics do not allow any meaningful conclusions.²⁰

Finally, the agreement on cost-effectiveness of nonoperative and surgical interventions was investigated. The panel agreed that surgical treatment is not cost-effective in the presence of diffuse osteoarthritis. However, surgical treatment must be compared with the costs of nonoperative interventions and is most likely more cost effective than PT and continued failed nonoperative treatment for > 3 months. A recent study by Rongen et al⁵¹ could not demonstrate APM to be cost-effective and showed that the quality-adjusted life-years (QALYs) were 8.09 compared with 8.05 for no surgery. Interestingly, Katz and Losina⁵² critically reviewed the study and presented their findings in an editorial; although they agreed with the central finding that APM in all patients with symptomatic meniscal tears is unlikely to offer any benefit, the study compared apples and oranges. A cost-effectiveness analysis compared APM after an unsuccessful course on PT with PT alone.⁵² The authors demonstrated a cost-effectiveness ratio of \$13,450 (2016 USD) per QALY. With immediate surgery, APM regardless of prior PT outcome was compared with PT alone in this study; it had an incremental cost-effectiveness ratio of \$107,400 (2016 USD) per QALY.^{52,53}

It might be argued that the results of this study do not provide any new information, as prior studies, expert opinion, and consensus statements have already covered this topic extensively. However, this argument is difficult to fully support. Hohmann et al²⁰ completed a systematic review and strongly suggested that current published studies exhibited a high risk of bias, were of weak to moderate quality in the available studies, and had small sample sizes, and the diverse study characteristics do not allow any meaningful conclusions. They warned that the validity of the results and conclusions of **prior systematic reviews** and meta-analyses must be viewed with **extreme caution.**²⁰ Furthermore, the quality of the available published literature is not robust enough at this time to support allegations of superiority for either arthroscopic partial meniscectomy or physical therapy.²⁰

Evidence-based medicine, in particular randomized controlled trials, have inherent weaknesses.²⁵ They are often limited to the study population and are not generalizable to normal clinical practice, have the

potential for outcome measures not correlating with actual outcomes of interest, have the risk of inadequate sample size, and are resource intensive with regard to costs and time.^{25,54,55} The Delphi panel methodology provides a structured process to collate collective knowledge through a series of open-ended questionnaires with controlled feedback to reach consensus. One of the main advantages of the Delphi method is that a valid consensus can be confidently achieved even if evidence is lacking or uncertainty exists in a given field.⁵⁶⁻⁵⁸ The Delphi panel methodology synthesizes expert opinion in a high-quality and scientific manner and is an important and necessary approach to determine the answer to certain clinical questions.²⁵ The current study, therefore, provides further strong evidence and clearly helps to answer an important and controversial clinical question.

Limitations

This study has limitations. Delphi has been criticized to represent only the lowest common denominator.^{25,29} However, execution rather than the methodology of Delphi may be at fault: insufficient response rates for all rounds, the lack of feedback between rounds, and reporting of the method used to achieve consensus are common.^{25,29} Furthermore, consensus is agreement at a specific point in time and may change with new evidence or experience. Surgeons may also be strongly opinionated: "I always did so," "It works in my hands," etc. The term "mechanical symptoms" is not clearly defined, and panel members may have their own interpretation as to what this term means for them. Despite careful selection of panel members and following the Delphi methodology rigorously, the results of this consensus may not cover the opinion of the entire orthopaedic community but has aimed at the best possible synthesis at the time.

Conclusion

This consensus statement was in agreement that degenerative meniscus tears are a normal part of aging. Not all tears cause symptoms, and when symptomatic, they should initially be treated nonoperatively. Repairable tears should be repaired. The outcome of APM depends on the degree of osteoarthritis, the character of the meniscus lesion, the degree of loss of joint space, the amount of malalignment, and obesity. The majority of patients significantly improved, but younger patients and patients with short-term symptoms have better outcomes.

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