**Supplementary tables**

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| **Supplementary table 1:** Prevention and risk factor search. Search terms in the columns were combined with “OR”, and, subsequently, the columns were combined with “AND”. | | |
| Meniscal injury | Risk factor and prevention | Prognosis |
| Menisci tibial[MeSH]  Menisc\*[TIAB] | Risk factors[MeSH]  Risk factors[TIAB]  Predict\*[TIAB]  Primary Prevention [MeSH]  Prevention[TIAB] | Prognosis[MeSH]  Prognosis[TIAB] |

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| **Supplementary table 2:** Diagnosis search. Search terms in the columns were combined with “OR”, and, subsequently, the columns were combined with “AND”. | | |
| Meniscal injury | Test | Diagnostic accuracy |
| Menisci, Tibial [MeSH]  exp Knee Joint [MeSH]  exp Knee Injuries [MeSH]  menisc\*[TIAB]  semilunar cartilage\*[TIAB]  knee\*[TIAB] AND (pain\*[TIAB] or tenderness[TIAB] OR injur\*[TIAB] OR trauma\*[TIAB] OR swelling OR swollen[TIAB])  joint line\* AND (pain\*[TIAB] OR tenderness[TIAB]). | Physical Examination [MeSH]  Clinical examination\*[TIAB]  clinical diagnos\*[TIAB]  physical examination\*[TIAB] physical diagnos\*[TIAB]  test\*[TIAB] mcmurray\*[TIAB]  apley\*[TIAB]  thessaly\*[TIAB] | "Sensitivity and Specificity"[MeSH]  Sensitivity[TIAB]  specificity[TIAB]  ((pre-test[TIAB]OR pretest[TIAB]) AND probability[TIAB])  post-test probality[TIAB]  predictive value\*[TIAB]  likelihood ratio\*[TIAB] |

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| **Supplementary table 3:** Exercise as treatment search. Search terms in the columns were combined with “OR”, and, subsequently, the columns were combined with “AND”. | | |
| Meniscal injury | Exercise | Publication type |
| Menisci, Tibial[MeSH]  Knee Joint[MeSH]  Knee Injuries[MeSH]  menisc\*[TIAB]  semilunar cartilage\*[TIAB]  knee\*[TIAB]  AND  (pain\*[TIAB] OR tenderness[TIAB] OR injur\*[TIAB] OR trauma\*[TIAB] OR  swelling OR s  wollen[TIAB])  joint line\*  AND  (pain\*[TIAB] OR tenderness[TIAB]). | Exercise[MeSH]  Exercise movement techniques[MeSH]  Exercise therapy[MeSH] Physical Fitness[MeSH] Recovery of Function [MeSH]  Weight Lifting[MeSH] Resistance Training [MeSH]  Sports[TIAB]  physical therapy[TIAB] physiotherapy[TIAB] rehabilitation[TIAB]  recovery of function[TIAB]  exercise\*[TIAB]  kinesiotherap\*[TIAB]  fitness[TIAB]  weightlifting[TIAB]  jump\*[TIAB]  workout[TIAB]  sport\*[TIAB]  run\*[TIAB]  walk\*[TIAB]  cycling[TIAB]  bicycling[TIAB]  bicycle\*[TIAB]  (isometric\*[TIAB] OR isokinetic\*[TIAB] OR aerobic\*[TIAB] OR endurance[TIAB] OR weight\*[TIAB] OR resistance[TIAB] OR resistive[TIAB] OR strength\*[TIAB] OR muscle\*[TIAB])  AND  (train\*[TIAB] OR exercise\*[TIAB] OR therap\*[TIAB] OR rehab\*[TIAB] OR program\*[TIAB])) | Randomized controlled trial[Publications type]  Controlled clinical trial [Publications type]  Randomized[TIAB]  Placebo[TIAB]  Randomly[TIAB]  Trial[TIAB] |

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| **Supplementary table 4:** Passive physiotherapy treatments search. Search terms in the columns were combined with “OR”, and, subsequently, the columns were combined with “AND”. | | |
| Meniscal injury | Passive treatment | Publication type |
| Menisci tibial[MeSH] Meniscus Tibial, Knee [MeSH]  Degenerative Meniscal Tear[TIAB]  Knee Meniscus[TIAB]  Meniscal Injuries[TIAB]  Meniscal Tears[TIAB] | Ultrasonic waves[MeSH]  Ultrasound[TIAB]  Ultra Sound[TIAB]  Ultrasonic[TIAB]  Low-Level Light Therapy [MeSH]  Laser Therapy[MeSH]  Laser Therapy[TIAB]  High Energy Shock Waves [MeSH]  Shock Wave[TIAB]  Shockwave[TIAB] | Randomized controlled trial[Publications type]  Controlled clinical trial [Publications type]  Randomized[TIAB]  Placebo[TIAB]  Randomly[TIAB]  Trial[TIAB] |

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| **Supplementary table 5:** Overview of studies investigating risk factors for meniscal tears | | | | | |
| **Study** | **Study type** | **Study size (n)** | **Risk factor** | **Population** | **Risk of bias** |
| Arastu et al. 2015 | Observational cohort study | 116 ACL reconstructed participants | Time from ACL injury to reconstruction | Median age 18 years (range 12-57 years), 33% female. | - No confounder adjustment  - Large drop-out rate  - Unsure of assessment-blinding |
| Baker et al. 2002 | Case-control | 243 cases  460 controls | Overweight  Sports participation  Generalised joint hypermobility  Occupational activity | Mean case age 40.1 years (range 20-59 years) matched with controls. 19% of cases female. | - Cases are patients admitted in hospital for meniscal surgical treatment  - Possible selection bias: more patients with occupational activities involving kneeling etc. |
| Baker et al. 2003 | Cross sectional | 1404 participants | Sports participation  Occupational activity | Mean age 41.6 years (range 20-60 years), 100% male. | - Low response rate  -Possible recall bias |
| Bhattacharyya et al. 2003 | Cross sectional | 154 OA patients  49 Asymptomatic controls | Sex | OA patients: mean age 65 years and 89.4 kg, 100% male.  Controls: mean age 67 years and 77.1 kg, 100% male. | - Sub study from other cohort, drop-out rate not described.  - No confounder adjustment.  - Blinding not possible |
| Brambilla et al. 2015 | Retrospective cohort | 988 ACL reconstructed participants | Time from ACL injury to reconstruction | Median age 29.8 (IQR 20.9-40.6), 24% female. | - Assessors not blinded to time-from injury |
| Chen et al. 2015 | Cross sectional | 293 participants with total ACL rupture | Time from ACL injury to reconstruction | Mean age 28.6 years, 22% female. | - Blinding not described  - No confounder adjustment |
| Church & Keating 2005 | Retrospective cohort | 183 ACL reconstructed participants | Time from ACL injury to reconstruction | Mean age 27 years (range 16-40 years), 26% female. | - Meniscal injury may have proceeded ACL injury  - No confounder adjustment  - Blinding not described |
| Englund et al. 2008 | Cross sectional | 991 participants | Overweight  Sex  Age | Mean age 62.3 years and BMI 28.5, 57% female. | - Blinding not described |
| Friden et al. 1995 | Cross sectional | 59 sports active  30 down hill skiers | Trauma type | Younger than 40 years. | - Athletes performing competitive contact sports excluded  - Recruitment process not described in detail  - Assessor of meniscal injury not blinded to trauma type |
| Frobell et al. 2013 | Randomized controlled trial | 59 Early ACL reconstruction  30 Delayed ACL reconstruction | Time from ACL injury to reconstruction | Early group: 26.6 years (SD 5.1 years), 20% female.  Delayed group: 25.2 years (SD 4.5 years), 37% female. | - No obvious risk of bias |
| Hoessly et al. 2017 | Systematic review | Included 11 studies on meniscal changes from before to after running using MRI | Running | Healthy adults without prior major knee injury, malalignment and normal BMI. | - No quality assessment of included studies  - Single reviewer performed study selection and data extraction |
| Keading et al. 2005 | Observational cohort | 2 265 participants undergoing knee ligament surgery | Time from ACL injury to reconstruction | Mean age 26 years (SD 9.5 years), 38% female. | - Insufficient confounder adjustment (only adjusted for age)  - Blinding not described |
| Kluczynski et al. 2013 | Observational cohort | 541 ACL reconstructed participants | Time from ACL injury to reconstruction | Mean age 25.9 years (SD 11.3 years, range 7-62 years), 42% female. | - Blinding not described |
| Krutsch et al. 2015 | Cross sectional | 233 ACL reconstructed participants | Time from ACL injury to reconstruction | Mean age 30.5 years, 30% female. | - No confounder adjustment  - Blinding not described |
| Kuikka et al. 2008 | Register study | 128 584 conscripts | Overweight  Age | Men age 18-30 years, 100% male. | - Risk of selection bias  - Only men  - Short follow-up time |
| Mitchell et al. 2016 | Observational cohort | 1082 high-school athletes with meniscal tear | Trauma type | 32% female. | - Definition/  confirmation of meniscal injury not clearly described  - No confounder adjustment |
| Peat et al. 2014 | Register study | Not specified | Sex  Age | Population based. | - Diagnosis of meniscal injury based on diagnosis code alone |
| Rytter et al. 2009 | Cross sectional | 92 floor layers  49 graphic designers | Age  Occupational activity | Floor layers: Mean age 54.5, BMI 26.2.  Graphic designers: mean age 57.7, BMI 26.6. | - Large drop-out rate for MR  - Potential selection bias |
| Taunton et al. 2002 | Cross sectional | 2002 running injured participants | Sex  Age | Mean age 34 years, BMI 21.0, 54% female. | - Insufficient adjustment for other risk factors |
| Yüksel et al. 2006 | Cross sectional | 317 participants with total ACL rupture | Time from ACL injury to reconstruction | Mean age 28.1 years (SD 7.0, range 19-50 years). | - Insufficient confounder adjustment  - Possible selection bias |
| ACL=Anterior Cruciate Ligament, IQR=Inter quartile range, OA=Osteoarthritis, SD=Standard Deviation. | | | | | |

**Detailed results for individual risk factors**

*Overweight*

There was low quality evidence supporting that overweight increased the risk for meniscal tears based on three observational studies. Two observational studies reported overweight to be a risk factor for degenerative meniscal lesions. In a case-control study (243 cases, 19% women, mean age 40.1 years), Baker and co-workers20 found that a high Body Mass Index (BMI) was associated with degenerative meniscal lesions (OR 4.7, 95% CI 1.9-11.2). Furthermore, another study based on Magnetic resonance imaging (MRI) from 991 older individuals (57% women, mean age 62.3) found that women with degenerative meniscal lesions had higher BMI than women with no meniscal lesions (mean BMI 29.9 vs. 27.9, p<0.001) but this was not observed for men (BMI 28.7 vs. 28.6. p=0.83).7

One study reported young male Finnish army conscripts (age 18-30 years) in the heaviest quartile (kg) to have increased risk for both new (OR 2.6, 95% CI 1.4-5.0) and old (OR 1.8, 95% CI 1.0-12.2) meniscal tears.21

*Sex*

Based on four observational studies, there was low quality of evidence that male sex was associated with higher risk of degenerative meniscal lesions. Two studies found higher prevalence in males with a mean age above 60 years of age with and without symptoms of knee osteoarthritis.7 22 Similarly, a higher annual incidence of meniscal tears was found for men than women (98 vs. 60 per 100 000 person-years) in a population-based study23 and in a study on runners it was also found that meniscal tears where more prevalent in men than women (7.4% vs. 2.9%, p<0.001).24

*Age*

There was low quality evidence and conflicting results to whether age is a risk factor for meniscal tears. Englund et al.7 found a higher prevalence of meniscal tears with increased age in a population of older individuals with and without knee osteoarthritis (57% women, mean age 62.3 years). A study on the occupations of floor layers and graphic designers did not observe increasing prevalence of meniscal tears with increasing age.25 In a population-wide study using Swedish register data, the incidence of meniscal tears decreased after the age of 40 years in both men and women.23 In runners, age below 34 years was protective for meniscal injury for both men (OR 0.22, 95% CI 0.08-0.57) and women (OR 0.44, 95% CI 0.20-0.98) compared to those above 34 years of age.24 A Finnish study on army conscripts between 18 and 30 years of age found conscripts between 21-30 years to more frequently have an ‘old’ meniscal tears compared with those aged 18-19 years (OR 2.4, 95% CI 1.5-3.6).21

*Trauma type*

There was low quality evidence to support that trauma type increases the risk for meniscal tears. In sports active ACL injured individuals less than 40 years of age (contact sport and alpine skiing), one study found that a larger proportion had concomitant meniscal tears among those who sustained a weight bearing trauma compared to those who did not (59/72 vs. 9/28, p=0.001).26 An American study on high-school athletes reported that 56% of meniscal tears were contact injuries, 38% non-contact injuries and 4% overuse injuries.27 However, this distribution depended on the sport. That is, in soccer (one of the sports with most meniscal tears) about 60% of meniscal tears were contact injuries, whereas non-contact injuries were the most common cause of meniscal tears in lacrosse (boys=54% and girls=77%).27

*Sports participation*

There was low quality evidence to support that sports participation increases the risk for meniscal tears. Two studies examining the risk of meniscal tears in sports active people compared with non active controls both found that soccer was a risk factor for meniscal tears (OR 3.7-6.9).20 28 Conflicting results were found in the two studies regarding the risk of meniscal tears in rugby players and swimmers. Sports participation in ‘other sports’ was also associated with increased risk of meniscal tears (OR 1.5-2.1).19 28

Running was not a risk factor for meniscal tears20 28. However, with moderate quality evidence, a systematic review of studies investigating meniscal changes after long distance running assessed by MRI indicated immediate fleeting quantitative meniscal changes (i.e. signal intensity and volume) but changes were no longer present at follow-up (ranging from 1 hour to 3 months).29 No irreversible qualitative meniscal harmful effects (fluid/collagen content/orientation) were observed following running, though proteoglycan content assessed by T1ρ mapping was elevated up to 3 months. No clear conclusions on longer term consequences of running on structural meniscal changes assessed by MRI could be drawn due to the limited follow-up length of the included studies. Also, large heterogeneity of study design and participant characteristics between studies was observed.29

*Time from ACL injury to reconstruction*

Based on nine studies, low quality evidence supported that time from ACL injury to reconstruction increased the risk of medial meniscal tear. Six observational studies reported a higher incidence of concomitant medial meniscal tears in ACL injured patients with increasing time from injury to ACL reconstruction.30-35 However, two other studies reported no relationship between time from injury to ACL reconstruction on incidence of medial meniscal tears.36 37 The opposite pattern was observed for lateral meniscal tears, where seven observational studies30-34 36 37 did not find any relationship between time from injury to ACL reconstruction on lateral meniscal tears and one did.35 Finally, in the only published randomised study of ACL reconstruction vs. exercise there was no difference in number of meniscal tears at the 5-year follow-up between groups.38

*Generalised joint hypermobility*

There was low quality evidence to support generalised joint hypermobility, defined as Beighton score ≥ 2, as a risk factor for degenerative meniscal lesions (OR 3.6, 95% CI 1.1-12.1) based on one study, while this was not observed for traumatic meniscal tears.20

*Occupational activity*

Based on three studies there was low quality evidence that occupational activity increases the risk for meniscal tears. In two studies including individuals with a mean age around 40 years (range 20-59 years) it was reported that individuals doing kneeling or squatting for more than 1 hour per day as part of their occupation had an approximately 2.5 fold risk of meniscal tears.20 28 Similarly, it was reported that holding an occupation likely to include kneeling or squatting work was associated with increased risk of meniscal tears (OR 2.3, 95% CI 1.1-4.8).28 Nevertheless in a study comparing floor layers and graphical designers (mean age around 50 years), Rytter et al.25 found that frequent kneeling/squatting was associated with increased risk of medial meniscal tears (OR 2.3, 95% CI 1.1-5.0) but not lateral meniscal tears (OR 0.8, 95% CI 0.3-2.7). Work involving climbing more than 30 flights of stairs daily also appeared to be a risk factor for meniscal tears with ORs of 2.0 (95% CI 1.0-4.1)28 and 2.4 (95% CI 1.6-3.8)20 in individual studies. There was conflicting evidence for occupational lifting of 10 kg and 25 kg more than 10 times weekly as a risk factor for meniscal injury.20 28

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| **Supplementary table 6:** Summary of included studies of diagnostic tests for meniscal tears | | | | | | |
| **Author (year)** | **Clinical Test(s)** | **Reference test** | **Joint compartment** | **No of patients** | **Age** | **% female** |
| Dzoleva-Tolevska (2013) | McMurray’s test / Apley’s test | Arthroscopy | Medial / Lateral | 70 | - | - |
| Ercin (2012) | Combination of JLT, McMurray’s test, Apley’s test and other tests | Arthroscopy | Medial / Lateral | 30 | 38 (median) | 40% |
| Galli (2013) | JLT / McMurray’s test | Arthroscopy | Both | 56 | 29.7 | 30% |
| Goossens (2015) | McMurray’s test / Thessaly test (20 degrees) / Both | Arthroscopy | Medial / Lateral / Both | 593 | 49.4 | 42% |
| Gupta (2016) | JLT / McMurray’s test | Arthroscopy | Medial | 66 | 27.4 | 37% |
| Harrison (2009) | Thessaly test (20 degrees) | Arthroscopy | Both | 116 | 35.9 | 49% |
| Haviv (2015) | JLT | Arthroscopy | Medial / Lateral | 195 | 43.4 | 31% |
| Jaddue (2010) | JLT / McMurray’s test / Apley’s test | Arthroscopy | Medial | 50 | - | 8% |
| Karachalios  (2005) | JLT / McMurray’s test / Apley’s test / Thessaly test (5 + 20 degrees) | Arthroscopy | Medial / Lateral | 213 (patients) / 410 (total) | 29.4 | 26% |
| Konan (2009) | JLT / McMurray’s test / Thessaly test (5 + 20 degrees) | Arthroscopy | Medial / Lateral | 109 | 39 | 27% |
| Mohan (2007) | Combination of JLT and McMurray’s test | Arthroscopy | Medial / Lateral | 130 | 49 | 31% |
| Rinonapoli (2011) | McMurray’s test / Apley’s test | Arthroscopy | Medial / Lateral / Both | 102 | 27.8 | 26% |
| Rose (2006) | JLT | Arthroscopy | Medial / Lateral | 129 | 31.5 | 24% |
| Syal (2015) | JLT / McMurray’s test / Apley’s test | Arthroscopy | Medial / Lateral | 190 | 30.2 | 14% |
| Wadey (2007) | JLT | Arthroscopy | Both | 71 | - | 37% |
| JLT = Joint Line Tenderness | | | | | | |

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| **Supplementary table 7:** Summary of included studies of treatment of meniscal tears | | | | | | | | | |
|  | **Intervention**  **group (n)** | **Control**  **group (n)** | **Age** | **BMI** | **% female** | **VAS pain**  **(0-100mm)** | **Pain/function/strength outcome** | **Follow-up time primary outcome** | **Radio-graphic OA** |
| **Exercise Therapy** | |  |  |  |  |  |  |  |  |
| Herrlin (2007 & 2013) | APM, including limited debridement + supervised exercise (47) | Supervised exercise (49) | 55.0 | 27.5 | 40% | 41 | KOOS Pain / KOOS ADL | 6 months | Some |
| Gauffin (2014 & 2017) | APM + un-supervised exercise (75) | un-supervised exercise (75) | 54.0 | - | 27% | 63 | KOOS Pain / KOOS ADL | 12 months | Some |
| Katz (2013) | APM, including minimal debridement + physiotherapy (174) | Physiotherapy (177) | 58.4 | 30.0 | 57% | 53 | KOOS Pain / WOMAC Physical function | 6 months | Some |
| Kirkley (2008) | Debridement, and/or APM + physical and medical therapy (94) | Physical and medical therapy (94) | 59.6 | 30.9 | 63% | 45 | WOMAC Pain / WOMAC Physical function | 24 months | All |
| Kise (2016) & Stensrud (2014) | APM + home exercise (70) | Supervised exercise (70) | 49.6 | 26.2 | 39% | 34 | KOOS Pain /  KOOS ADL /  One-legged knee bends / peak torque in knee extension | 24 months | Some |
| Yim (2013) | APM, including limited debridement + home exercise (54) | Supervised exercise + home exercise (54) | 56.3 | 25.7 | 79% | 50 | VAS pain | 24 months | None |
| Østerås (2012) | APM (8) | Medical exercise therapy (9) | 49.7 | - | 76% | 36 | VAS pain at rest / Five RM in leg extension bench | 3 months | Some |
| **Passive Treatments** | |  |  |  |  |  |  |  |  |
| Malliaropoulos (2013) | Low-level laser therapy (32) | Placebo (32) | 42 | - | 69% | 74 | VAS pain / Lysholm score | 12 months | Some |
| ADL = Function in daily living, APM = arthroscopic partial meniscectomy, BMI = body mass index (kg/m2), KOOS = Knee Injury and Osteoarthritis Outcome Score, OA = osteoarthritis, RM = repetition maximum, SF-36 = The Short Form (36) Health Survey, VAS = Visual Analogue Scale, WOMAC = Western Ontario and McMaster Osteoarthritis Index | | | | | | | | | |