

Clinical Outcomes of Discoid versus Standard Meniscus Tear Procedures: A systematic review

Yi (David) Diao¹ BMSc, Prushoth Vivekanantha¹ BMSc, Dan Cohen² MD, Yuichi Hoshino³ MD, Kanto Nagai³ MD PHD, Darren de SA² MBA(c) MD FRCSC

¹ Michael DeGroote School of Medicine, McMaster University, Hamilton, ON, Canada ² Division of Orthopaedic Surgery, Department of Surgery, McMaster University Medical Centre, Hamilton, ON, Canada.

³ Department of Orthopaedic Surgery, Kobe University Graduate School of Medicine, Kobe, Japan

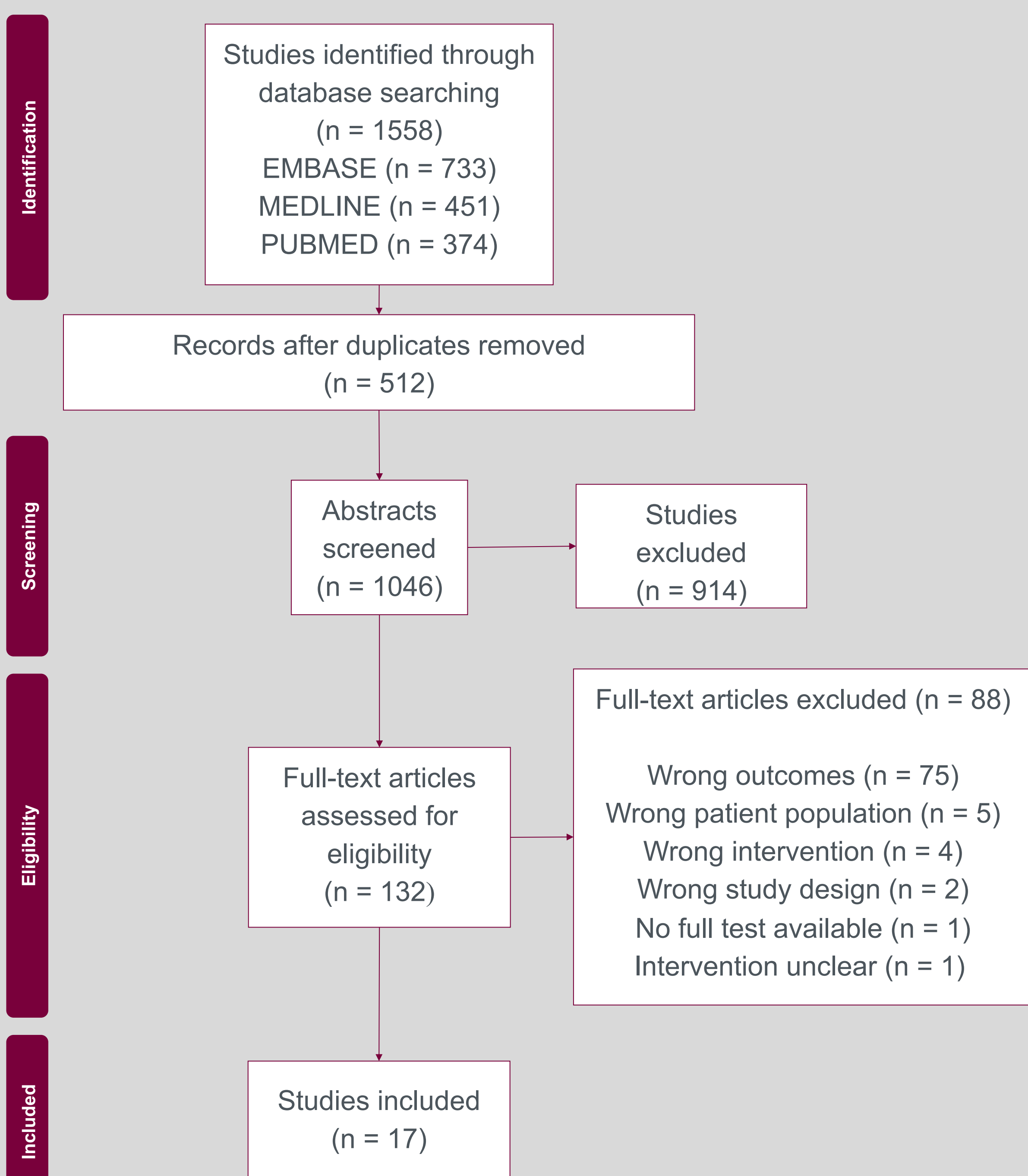
Background

- The discoid meniscus is a congenital deformity of the meniscus shape, consisting of a meniscus that has a larger diameter, central hypertrophy, and loss of the typical “C”-shaped structure [1]. Typically, these patients are asymptomatic [2], however discoid menisci have disorganized collagen, a lack of vascularization, and mucinous degeneration, which increase the risk of tear in the absence of trauma [3].
- A recent systematic review showed that there was no additional benefit to saucerization with repair compared with saucerization alone in discoid menisci [4]. This is contrasting with literature that shows that non-discoid menisci have improved postoperative outcomes after meniscus repair versus meniscectomy.
- There is a lack of literature comparing outcomes of patients undergoing meniscus surgery for discoid compared to non-discoid menisci.

Objectives

- This review aims to compare postoperative clinical outcomes of discoid meniscus tear procedures such as saucerization and saucerization with stabilization to those of non-discoid meniscus tears such as meniscectomy or repair in skeletally mature patients with no concomitant injuries.

Methods



- Three databases MEDLINE, PubMed and EMBASE were searched from inception to July 3rd, 2022 for literature describing patient reported outcome measures after meniscus surgery in discoid or non-discoid meniscus tears.
- Broad search terms such as “discoid”, “saucerization”, “meniscectomy”, and “repair” were used
- Inclusion criteria were English, non-cadaveric, human studies that reported on clinical outcomes from saucerization and/or meniscectomy and/or repair procedures. Exclusion criteria were reviews, abstracts, case reports, V level of evidence, care reports, concomitant injuries (eg.ACL).
- Clinical outcome data on Lysholm, Tegner, IKDC, revision rate, and complications were recorded, with MINORS and Detsky scores used to perform quality assessment.

Results

- A total of 44 studies comprising 3795 patients were included in this review with a mean age of 39.7 years (range: 9.0-64.4). The mean loss to follow up in each study was 10.3% (range: 0-57.3%) and the mean follow-up time was 49.4 months (range: 3-234). The average percentage of female participants in each study was 24.8% (range: 9.5-95.5).

Lysholm Scores						
Author	Discoid		Non-discoid meniscectomy		Non-discoid meniscus repair	
	Mean Lysholm Score (n)	Author	Mean Lysholm Score (n)	Author	Mean Lysholm Score (n)	Author
Bae (2012) [3]	91 (52)	Al-Dadah (2021) [1]	53.2 (34)	Kim (2019) [18]	80.9 (21)	Kim (2019) [18]
Bin (2002) [11]	93.6 (31)	Sihvonen (2020) [38]	83.7 (70)	Chung (2020) [8]	77.1 (37)	Chung (2020) [8]
Hashimoto (2020) [13]	97.3 (95)	Yoon (2022) [42]	65.6 (24)	Atsumi (2020) [2]	98 (13)	Atsumi (2020) [2]
Li (2020) [26]	88.2 (9)	Kim (2019) [18]	75.9 (24)	Choi (2010) [7]	94.7 (14)	Choi (2010) [7]
Lins (2021) [28]	78.6 (25)	Burks (1997) [5]	94 (146)	Furumatsu (2019) [11]	86.1 (38)	Furumatsu (2019) [11]
Lu (2007) [29]	89 (51)	Haviv (2015) [14]	78.9 (135)	Griffin (2015) [12]	89 (20)	Griffin (2015) [12]
Papadopoulos (2008) [30]	82.9 (9)	Kim (2013) [20]	85.8 (40)	Hiranaka (2020) [15]	85 (68)	Hiranaka (2020) [15]
Wasser (2011) [41]	88 (20)	Chung (2020) [8]	56.2 (18)	Kim (2011) [19]	92.9 (45)	Kim (2011) [19]
---	---	Kim (2011) [19]	81.6 (28)	Kimura (2004) [21]	98.1 (8)	Kimura (2004) [21]
---	---	---	---	Lee (2020) [24]	85.1 (22)	Lee (2020) [24]
---	---	---	---	Lee (2014) [25]	86.5 (50)	Lee (2014) [25]
---	---	---	---	Perdue (1996) [32]	83.4 (23)	Perdue (1996) [32]
---	---	---	---	Rodriguez-Roz (2020) [34]	89.3 (43)	Rodriguez-Roz (2020) [34]
---	---	---	---	Salle de Chou (2015) [36]	93 (34)	Salle de Chou (2015) [36]
---	---	---	---	Ulku (2020) [39]	88.2 (41)	Ulku (2020) [39]
---	---	---	---	Uzun (2018) [40]	90 (43)	Uzun (2018) [40]
---	---	---	---	Kim (2011) [19]	85.1 (30)	Kim (2011) [19]
Range:	78.6 - 97.3 (n = 292)	Range:	53.2 - 94.0 (n = 519)	Range:	77.1 - 98.1 (n = 550)	

Revision Rates						
Author	Discoid		Non-discoid meniscectomy		Non-discoid meniscus repair	
	Revision Rate (n)	Author	Revision Rate (n)	Author	Revision Rate (n)	Author
Hashimoto (2020) [13]	3.2% (95)	Chatain (2003) [6]	8.3% (471)	Shieh (2016) [37]	18.0% (129)	Shieh (2016) [37]
Lins (2021) [28]	44.0% (21)	Chung (2020) [8]	56.0% (18)	Bogunovic (2014) [4]	19.0% (26)	Bogunovic (2014) [4]
Patel (2019) [31]	9.0% (239)	Krych (2016) [22]	51.8% (26)	Lind (2013) [27]	28.0% (26)	Lind (2013) [27]
Shieh (2016) [37]	15.0% (46)	Roos (2018) [35]	9.1% (22)	Salle de Chou (2015) [36]	5.9% (34)	Salle de Chou (2015) [36]
---	---	Shieh (2016) [37]	7.0% (149)	Labbe (2021) [23]	0.7% (20)	Labbe (2021) [23]
---	---	Sihvonen (2020) [38]	10.3% (70)	---	---	---
Range:	3.2% - 44% (n = 401)	Range:	7.0% - 56.0% (n = 756)	Range:	0.7% - 28.0% (n = 235)	

International Knee Documentation Committee (IKDC) Scores						
Author	Discoid		Non-discoid meniscectomy		Non-discoid meniscus repair	
	Mean IKDC Score (n)	Author	Mean IKDC Score (n)	Author	Mean IKDC Score (n)	Author
Lins (2021) [28]	77.4 (25)	Al-Dadah (2021) [1]	53.2 (34)	Kim (2019) [18]	75.2 (21)	Kim (2019) [18]
Perkins (2021) [33]	96.0 (32)	Chung (2020) [8]	44.4 (18)	Chung (2020) [8]	63.7 (37)	Chung (2020) [8]
Papadopoulos (2008) [30]	82.0 (9)	Dammerer (2019) [9]	46.9 (21)	Bogunovic (2014) [4]	87.6 (26)	Bogunovic (2014) [4]
---	---	Filardo (2016) [10]	85.7 (45)	Furumatsu (2019) [11]	63.7 (38)	Furumatsu (2019) [11]
---	---	Kim (2011) [19]	74.1 (28)	Griffin (2015) [12]	76 (20)	Griffin (2015) [12]
---	---	Kim (2013) [20]	84.8 (40)	Hiranaka (2020) [15]	63.1 (68)	Hiranaka (2020) [15]
---	---	Kim (2019) [18]	71.5 (24)	Lee (2020) [24]	77.4 (22)	Lee (2020) [24]
---	---	Krych (2018) [22]	67.8 (26)	Lee (2014) [25]	78.1 (50)	Lee (2014) [25]
---	---	Yoon (2022) [42]	53.2 (24)	Salle de Chou (2015) [36]	87.3 (34)	Salle de Chou (2015) [36]
---	---	---	---	Uzun (2018) [40]	92.6 (43)	Uzun (2018) [40]
---	---	---	---	Kim (2011) [19]	77.2 (30)	Kim (2011) [19]
---	---	---	---	Kaminski (2019) [16]	94.0 (20)	Kaminski (2019) [16]
---	---	---	---	Kaminski (2018) [17]	84.8 (17)	Kaminski (2018) [17]
Range:	77.4 - 96.0 (n = 66)	Range:	46.9 - 85.7 (n = 260)	Range:	63.1 - 94.0 (n = 426)	

Tegner Activity Scores						
Author	Discoid		Non-discoid meniscectomy		Non-discoid meniscus repair	
	Mean Tegner Score (n)	Author	Mean Tegner Score (n)	Author	Mean Tegner Score (n)	Author
Hashimoto (2020) [13]	6 (95)	Al-Dadah (2021) [1]	4.4 (34)	Atsumi (2020) [2]	6.8 (13)	Atsumi (2020) [2]
Lins (2021) [28]	7 (25)	Krych (2018) [22]	3.0 (26)	Choi (2010) [7]	5.7 (14)	Choi (2010) [7]
Perkins (2021) [33]	7.3 (32)	Yoon (2022) [42]	4.8 (24)	Furumatsu (2019) [11]	3.0 (38)	Furumatsu (2019) [11]
Wasser (2011) [41]	5.9 (20)	Filardo (2016) [10]	4.5 (45)	Lee (2014) [25]	4.8 (50)	Lee (2014) [25]
---	---	---	---	Lins (2021) [28]	4.5 (26)	Lins (2021) [28]
---	---	---	---	Perdue (1996) [32]	5 (23)	Perdue (1996) [32]
---	---	---	---	Rodriguez-Roz (2020) [34]	5.5 (43)	Rodriguez-Roz (2020) [34]
Range:	5.9 - 7.3 (n = 172)	Range:	3.0 - 4.8 (n = 129)	Range:	3.0 - 6.8 (n = 207)	

Discussion

- Discoid saucerization procedures with or without stabilization leads to similar Lysholm scores, IKDC scores and revision rates compared with non-discoid meniscectomy or repair procedures. Discoid patients appeared to have slightly higher Tegner activity scores compared with non-discoid patients; however, this is to be considered in the context of a younger population of discoid patients versus non-discoid patients due to limitations in the amount of available data.
- Information from this review can be used to inform patients with discoid menisci that they are likely to recover knee function equally as well as their morphologically normal counterparts.

Faculty Disclosures and Conflicts of Interest

**Yi (David) Diao¹ BMSc, Prushoth Vivekanantha¹ BMSc, Dan Cohen² MD, Yuichi Hoshino³ MD, Kanto Nagai³ MD
PHD, Darren de SA² MBA(c) MD FRCSC**

¹ Michael DeGroote School of Medicine, McMaster University, Hamilton, ON, Canada ² Division of Orthopaedic Surgery, Department of Surgery, McMaster University Medical Centre, Hamilton, ON, Canada.

³ Department of Orthopaedic Surgery, Kobe University Graduate School of Medicine, Kobe, Japan

No conflicts of interest to declare.

Supplementary Information

SUPPLEMENTARY DIGITAL MATERIAL

Table 1. Search Strategy

Search terms
1. Discoid saucerization
2. Discoid repair
3. Meniscectomy
4. Meniscal repair
5. 1 OR 2 OR 3 OR 4

References

1. Al-Dadah O, Shepstone L, Donell ST (2021) Patient reported outcome measures in meniscal tears and arthroscopic meniscectomy: The value of outcome score prediction. *Orthopaedics & Traumatology: Surgery & Research* 107(3):102803
2. Atsumi S, Hara K, Arai Y, Kamitani A, Nakagawa S, Inoue H, Kubo T (2020) Outcomes of arthroscopic repair using the all-inside inter-leaf vertical suture technique for horizontal meniscal tears sustained in sports. *Medicine* 99(41):e22609
3. Bae J-H, Lim H-C, Hwang D-H, Song J-K, Byun J-S, Nha K-W (2012) Incidence of Bilateral Discoid Lateral Meniscus in An Asian Population: An Arthroscopic Assessment of Contralateral Knees. *Arthroscopy: The Journal of Arthroscopic & Related Surgery* 28(7):936–941
4. Bogunovic L, Kruse LM, Haas AK, Huston LJ, Wright RW (2014) Outcome of All-Inside Second-Generation Meniscal Repair: Minimum Five-Year Follow-up. *The Journal of Bone and Joint Surgery* 96(15):1303–1307
5. Burks RT, Metcalf MH, Metcalf RW (1997) Fifteen-year follow-up of arthroscopic partial meniscectomy. *Arthroscopy: The Journal of Arthroscopic & Related Surgery* 13(6):673–679
6. Chatain F, Adeleine P, Chambat P, Neyret P (2003) A comparative study of medial versus lateral arthroscopic partial meniscectomy on stable knees: 10-year minimum follow-up. *Arthroscopy: The Journal of Arthroscopic & Related Surgery* 19(8):842–849
7. Choi N-H, Kim T-H, Son K-M, Victoroff BN (2010) Meniscal Repair for Radial Tears of the Midbody of the Lateral Meniscus. *Am J Sports Med* 38(12):2472–2476
8. Chung KS, Ha JK, Ra HJ, Yu WJ, Kim JG (2020) Root Repair Versus Partial Meniscectomy for Medial Meniscus Posterior Root Tears: Comparison of Long-term Survivorship and Clinical Outcomes at Minimum 10-Year Follow-up. *Am J Sports Med* 48(8):1937–1944
9. Dammerer D, Fischer F, Mayr R, Giesinger J, El Attal R, Liebensteiner MC (2019) Temporary postoperative treatment with compartment-unloading knee braces or wedge insoles does not improve clinical outcome after partial meniscectomy. *Knee Surg Sports Traumatol Arthrosc* 27(3):814–821
10. Filardo G, Di Matteo B, Tentoni F, Cavicchioli A, Di Martino A, Lo Presti M, Iacono F, Kon E, Marcacci M (2016) No Effects of Early Viscosupplementation After Arthroscopic Partial Meniscectomy: A Randomized Controlled Trial. *Am J Sports Med* 44(12):3119–3125
11. Furumatsu T, Okazaki Y, Kodama Y, Okazaki Y, Masuda S, Kamatsuki Y, Takihira S, Hiranaka T, Yamawaki T, Ozaki T (2019) Pullout repair using modified Mason-Allen suture induces better meniscal healing and superior clinical outcomes: A comparison between two surgical methods. *The Knee* 26(3):653–659
12. Griffin JW, Hadeed MM, Werner BC, Diduch DR, Carson EW, Miller MD (2015) Platelet-rich Plasma in Meniscal Repair: Does Augmentation Improve Surgical Outcomes? *Clinical Orthopaedics & Related Research* 473(5):1665–1672
13. Hashimoto Y, Nishino K, Reid JB, Yamasaki S, Takigami J, Tomihara T, Takahashi S, Shimada N, Nakamura H (2020) Factors Related to Postoperative Osteochondritis Dissecans of the Lateral Femoral Condyle After Meniscal Surgery in Juvenile Patients With a Discoid Lateral Meniscus. *Journal of Pediatric Orthopaedics* 40(9):e853–e859
14. Haviv Barak, Bronak Shlomo, Kosashvili Yona, Thein Rafael (2015) Gender Effect on the Outcome of Partial Medial Meniscectomy. *Orthopedics* 38(10):e925–e928
15. Hiranaka T, Furumatsu T, Miyazawa S, Okazaki Y, Okazaki Y, Takihira S, Kodama Y, Kamatsuki Y, Masuda S, Saito T, Ozaki T (2020) Comparison of the clinical outcomes of transtibial pull-out repair for medial meniscus posterior root tear: Two simple stitches versus modified Mason-Allen suture. *The Knee* 27(3):701–708
16. Kaminski R, Kulinski K, Kozar-Kaminska K, Wasko MK, Langner M, Pomianowski S (2019) Repair Augmentation of Unstable, Complete Vertical Meniscal Tears With Bone Marrow Venting Procedure: A Prospective, Randomized, Double-Blind, Parallel-Group, Placebo-Controlled Study. *Arthroscopy* 35(5):1500-1508.e1
17. Kaminski R, Kulinski K, Kozar-Kaminska K, Wielgus M, Langner M, Wasko MK, Kowalczewski J, Pomianowski S (2018) A Prospective, Randomized, Double-Blind, Parallel-Group, Placebo-Controlled Study Evaluating Meniscal Healing, Clinical Outcomes, and Safety in Patients Undergoing Meniscal Repair of Unstable, Complete Vertical Meniscal Tears (Bucket Handle) Augmented with Platelet-Rich Plasma. *BioMed Research International* 2018:1–9
18. Kim C-W, Lee C-R, Gwak H-C, Kim J-H, Park D-H, Kwon Y-U, Jung S-H (2019) Clinical and Radiologic Outcomes of Patients With Lax Healing After Medial Meniscal Root Repair: Comparison With Subtotal Meniscectomy. *Arthroscopy: The Journal of Arthroscopic & Related Surgery* 35(11):3079–3086
19. Kim J-H, Chung J-H, Lee D-H, Lee Y-S, Kim J-R, Ryu K-J (2011) Arthroscopic Suture Anchor Repair Versus Pullout Suture Repair in Posterior Root Tear of the Medial Meniscus: A Prospective Comparison Study. *Arthroscopy: The Journal of Arthroscopic & Related Surgery* 27(12):1644–1653
20. Kim J-R, Kim B-G, Kim J-W, Lee J-H, Kim J-H (2013) Traumatic and non-traumatic isolated horizontal meniscal tears of the knee in patients less than 40 years of age. *Eur J Orthop Surg Traumatol* 23(5):589–593
21. Kimura M, Shirakura K, Higuchi H, Kobayashi Y, Takagishi K (2004) Eight- to 14-Year Followup of Arthroscopic Meniscal Repair. *Clinical Orthopaedics & Related Research* 421:175–180
22. Krych AJ, Johnson NR, Mohan R, Dahm DL, Levy BA, Stuart MJ (2017) Partial meniscectomy provides no benefit for symptomatic degenerative medial meniscus posterior root tears. *Knee Surg Sports Traumatol Arthrosc* DOI: 10.1007/s00167-017-4454-5
23. Labbe MR, Elmallah RK, Albert BM, Malloch L, Jones LC, Replogle WH, Barrett GR (2019) An Analysis of Symptomatic Meniscal Re-Tear Incidence in Two Age Populations: Differences in Older versus Younger Adults. *J Knee Surg* 34(02):137–141
24. Lee DW, Jang HG, Lee YJ, Moon SG, Kim NR, Kim JG (2020) Effect of atelocollagen on the healing status after medial meniscal root repair using the modified Mason–Allen stitch. *Orthopaedics & Traumatology: Surgery & Research* 106(5):969–975
25. Lee DW, Kim MK, Jang HS, Ha JK, Kim JG (2014) Clinical and Radiologic Evaluation of Arthroscopic Medial Meniscus Root Tear Refixation: Comparison of the Modified Mason-Allen Stitch and Simple Stitches. *Arthroscopy: The Journal of Arthroscopic & Related Surgery* 30(11):1439–1446
26. Li Y, Wu Y, Zeng Y, Gu D Biomechanical differences before and after arthroscopic partial meniscectomy in patients with semilunar and discoid lateral meniscus injury.
27. Lind M, Nielsen T, Faunø P, Lund B, Christiansen SE (2013) Free Rehabilitation Is Safe After Isolated Meniscus Repair: A Prospective Randomized Trial Comparing Free with Restricted Rehabilitation Regimens. *Am J Sports Med* 41(12):2753–2758
28. Lins LAB, Feroe AG, Yang B, Williams KA, Kocher SD, Sankarankutty S, Micheli LJ, Kocher MS (2021) Long-term Minimum 15-Year Follow-up After Lateral Discoid Meniscus Rim Preservation Surgery in Children and Adolescents. *Journal of Pediatric Orthopaedics* DOI: 10.1097/BPO.0000000000001903
29. Lu Y, Li Q, Hao J (2007) Torn discoid lateral meniscus treated with arthroscopic meniscectomy: observations in 62 knees: *Chinese Medical Journal* 120(3):211–215
30. Papadopoulos A, Karathanasis A, Kirkos JM, Kapetanios GA (2009) Epidemiologic, clinical and arthroscopic study of the discoid meniscus variant in Greek population. *Knee Surg Sports Traumatol Arthrosc* 17(6):600–606
31. Patel NM, Mundluru SN, Beck NA, Ganley TJ (2019) Which Factors Increase the Risk of Reoperation After Meniscal Surgery in Children? *Orthopaedic Journal of Sports Medicine* 7(5):2325967119842885
32. Perdue PS Jr, Hummer CD III, Colosimo AJ, Heidt RS Jr, Dormer SG (1996) Meniscal repair: Outcomes and clinical follow-up. *Arthroscopy* 12(6):694–698
33. Perkins CA, Busch MT, Christino MA, Willimon SC (2021) Saucerization and Repair of Discoid Lateral Menisci With Peripheral Rim Instability: Intermediate-term Outcomes in Children and Adolescents. *Journal of Pediatric Orthopaedics* 41(1):23–27
34. Rodríguez-Roiz JM, Sastre-Solsona S, Popescu D, Montañana-Burillo J, Combalia-Aleu A (2020) The relationship between ACL reconstruction and meniscal repair: quality of life, sports return, and meniscal failure rate—2- to 12-year follow-up. *J Orthop Surg Res* 15(1):361
35. Roos EM, Hare KB, Nielsen SM, Christensen R, Lohmander LS (2018) Better outcome from arthroscopic partial meniscectomy than skin incisions only? A sham-controlled randomised trial in patients aged 35–55 years with knee pain and an MRI-verified meniscal tear. *BMJ Open* 8(2):e019461
36. Sallé de Chou E, Pujol N, Rochcongar G, Cucurulo T, Potel J-F, Dalmay F, Ehkirch F-P, Laporte C, Le Henaff G, Seil R, Lutz C, Gunepin F-X, Sonnery-Cottet B (2015) Analysis of short and long-term results of horizontal meniscal tears in young adults. *Orthopaedics & Traumatology: Surgery & Research* 101(8):S317–S322
37. Shieh AK, Edmonds EW, Pennock AT (2016) Revision Meniscal Surgery in Children and Adolescents: Risk Factors and Mechanisms for Failure and Subsequent Management. *Am J Sports Med* 44(4):838–843
38. Sihvonen R, Paavola M, Malmivaara A, Itälä A, Joukainen A, Kalske J, Nurmi H, Kumm J, Sillanpää N, Kiekara T, Turkiewicz A, Toivonen P, Englund M, Taimela S, Järvinen TLN (2020) Arthroscopic partial meniscectomy for a degenerative meniscus tear: a 5 year follow-up of the placebo-surgery controlled FIDELITY (Finnish Degenerative Meniscus Lesion Study) trial. *Br J Sports Med* 54(22):1332–1339
39. Ulku TK, Kaya A, Kocaoglu B (2020) Suture configuration techniques have no effect on mid-term clinical outcomes of arthroscopic meniscus root repairs. *The Knee* 27(3):676–682
40. Uzun E, Misir A, Kizkapan TB, Ozcamdalli M, Akkurt S, Guney A (2018) Arthroscopic medial meniscal repair with or without concurrent anterior cruciate ligament reconstruction: A subgroup analysis. *The Knee* 25(1):109–117
41. Wasser L, Knörr J, Accadbled F, Abid A, Sales De Gauzy J (2011) Arthroscopic treatment of discoid meniscus in children: Clinical and MRI results. *Orthopaedics & Traumatology: Surgery & Research* 97(3):297–303
42. Yoon KH, Wan WS, Kim Y-S, Park J-Y (2022) The efficacy of intraarticular viscosupplementation after arthroscopic partial meniscectomy: a randomized controlled trial. *BMC Musculoskelet Disord* 23(1):32