Washington State Health Care Authority

Hip Surgery Procedures for Treatment of Femoroacetabular Impingement Syndrome – Update Report

Final Evidence Report Appendix

October 16, 2026

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Hip Surgery Procedures for Treatment of Femoroacetabular Impingement Syndrome – Update Report

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October 16, 2026

This technology assessment report is based on research conducted by a contracted technology assessment center, with updates as contracted by the Washington State Health Care Authority. This report is an independent assessment of the technology question(s) described based on accepted methodological principles. The findings and conclusions contained herein are those of the investigators and authors who are responsible for the content. These findings and conclusions may not necessarily represent the views of the HCA/Agency and thus, no statement in this report shall be construed as an official position or policy of the HCA/Agency.

The information in this assessment is intended to assist health care decision makers, clinicians, patients and policy makers in making sound evidence-based decisions that may improve the quality and cost-effectiveness of health care services. Information in this report is not a substitute for sound clinical judgment. Those making decisions regarding the provision of health care services should consider this report in a manner similar to any other medical reference, integrating the information with all other pertinent information to make decisions within the context of individual patient circumstances and resource availability.

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Appendix A. Search Strategies

Appendix Table A-1. Pubmed search strategy – KQs 1-3

#	Search Strategy (LIMITS)
1.	FEMOROACETABULAR IMPINGEMENT* OR FEMORACETABULAR IMPINGEMENT* OR "Femoracetabular Impingement"[Mesh] OR ((HIP OR ACETABUL* OR FEMUR OR FEMORAL) AND IMPINGMENT*) OR “femoral osteochondroplasty” OR “femoral osteoplasty”
2.	"Reoperation"[Mesh] OR "Femur Head Necrosis"[Mesh] OR "Arthroplasty, Replacement, Hip"[Mesh] OR REOPERATION REATTACHMENT OR AVN OR AVASCULAR NECROSIS OR TOTAL HIP OR TOTAL JOINT OR ARTHROPLASTY OR INFECTION* OR DEATH OR COMPLICATION* OR ADVERSE EVENT OR "Intraoperative Complications"[Mesh] OR SCIATIC* OR NERVE OR NEURO* OR FRACTURE* OR INTRAABDOM* OR CARDIAC ARREST OR THROMBO* OR EMBOL* OR INSTABILITY
3.	#1 AND #2 (LIMIT ENGLISH)

Appendix Table A-2. Pubmed search strategy – KQ 4

#	Search Strategy (LIMITS)
1.	FEMOROACETABULAR IMPINGEMENT* OR FEMORACETABULAR IMPINGEMENT* OR "Femoracetabular Impingement"[Mesh] OR ((HIP OR ACETABUL* OR FEMUR OR FEMORAL) AND IMPINGMENT*) OR “femoral osteochondroplasty” OR “femoral osteoplasty”
2.	COST OR "Cost-Benefit Analysis"[Mesh])
3.	#1 AND #2 (LIMIT ENGLISH)

Appendix Table A-3. Cochrane search strategy – KQs 1-3

#	Search code
1	femoroacetabular impingement*
2	MeSH descriptor: [Femoracetabular Impingement] explode all trees
3	hip
4	femur
5	acetabul*
6	femoral
7	#3 or #4 or #5 or #6
8	impingement*
9	#7 and #8
10	femoral osteochondroplasty
11	femoral osteoplasty
12	#1 or #2 or #9 or #10 or #11
13	MeSH descriptor: [Reoperation] explode all trees
14	MeSH descriptor: [Femur Head Necrosis] explode all trees
15	MeSH descriptor: [Arthroplasty, Replacement, Hip] explode all trees
16	reoperation reattachment
17	avn
18	avascular necrosis
19	total hip
20	total joint
21	arthroplasty
22	infection*
23	death
24	complication*
25	adverse event
26	MeSH descriptor: [Intraoperative Complications] explode all trees
27	sciatic*
28	nerve
29	neuro*
30	fracture*
31	intraabdom*
32	cardiac arrest
33	thrombo*
34	embol*
35	instability
36	#13 or #14 or #15 or #16 or #17 or #18 or #19 or #20 or #21 or #22 or #23 or #24 or #25 or #26 or #27 or #28 or #29 or #30 or #31 or #32 or #33 or #34 or #35
37	#12 and #36
38	"clinical trial protocol":pt
39	"conference proceeding":pt
40	"trial registry record":pt
41	#38 or #39 or #40
42	#37 not #41

Appendix Table A-4. Cochrane search strategy – KQ 4

#	Search code
1	femoroacetabular impingement*
2	MeSH descriptor: [Femoracetabular Impingement] explode all trees
3	hip
4	Femur
5	acetabul*
6	femoral
7	#3 or #4 or #5 or #6
8	impingement*
9	#7 and #8
10	femoral osteochondroplasty
11	femoral osteoplasty
12	#1 or #2 or #9 or #10 or #11
13	cost
14	MeSH descriptor: [Cost-Benefit Analysis] explode all trees
15	#13 or #14
16	#12 and #15
17	"clinical trial protocol":pt
18	"conference proceeding":pt
19	"trial registry record":pt
20	#17 or #18 or #19
21	#16 not #20

Appendix B. Excluded Articles

Appendix Table B-1. Studies excluded at full text review

Author, Year	Title	Reason for Exclusion
Addai, 2021	Addai D, Zarkos J, Pettit M, Sunil Kumar KH, Khanduja V. Outcomes following surgical management of femoroacetabular impingement: a systematic review and meta-analysis of different surgical techniques. Bone & joint research. 2021;10(9):574-90.	Ineligible Comparator
Agricola, 2024	Agricola R, van Buuren MMA, Kemp JL, Weinans H, Runhaar J, Bierma-Zeinstra SMA. Femoroacetabular impingement syndrome in middle-aged individuals is strongly associated with the development of hip osteoarthritis within 10-year follow-up: a prospective cohort study (CHECK). British journal of sports medicine. 2024;58(18):1061-7.	Ineligible Study Design
Ahern, 2023	Ahern S, O'Sullivan MD, Clesham K, Wade A, Meleady E, Green C. Clinical and radiological outcomes following surgical hip dislocation for paediatric hip pathologies, a prospective cohort study. The surgeon : journal of the Royal Colleges of Surgeons of Edinburgh and Ireland. 2023;21(3):198-202.	Ineligible Population
Akhtar, 2025	Akhtar M, Razick D, Dhaliwal A, Pasko K, Shelton T, Jimenez A, et al. Clinical outcomes of arthroscopic hip labral reconstruction versus repair in the primary setting: A systematic review and meta-analysis. Journal of ISAKOS : joint disorders & orthopaedic sports medicine. 2025;16:101058.	Ineligible Intervention
Akpinar, 2021	Akpinar B, Lin LJ, Bloom DA, Youm T. Hip Arthroscopy for Femoroacetabular Impingement: Minimal Clinically Important Difference Rates Decline From 1- to 5-Year Outcomes. Arthroscopy, sports medicine, and rehabilitation. 2021;3(2):e351-e8.	Ineligible Study Design
Almasri, 2022	Almasri M, Simunovic N, Heels-Ansdell D, Ayenil OR. Osteochondroplasty Benefits the Pragmatic Patient With Femoroacetabular Impingement: Analysis From the Embedded Prospective Cohort of the Femoroacetabular Impingement RandomiSed Controlled Trial (FIRST). Arthroscopy : the journal of arthroscopic & related surgery : official publication of the Arthroscopy Association of North America and the International Arthroscopy Association. 2022;38(3):818-30 e1.	Ineligible Study Design
Arashi, 2019	Arashi T, Murata Y, Utsunomiya H, Kanezaki S, Suzuki H, Sakai A, et al. Higher risk of cam regrowth in adolescents undergoing arthroscopic femoroacetabular impingement correction: a retrospective comparison of 33 adolescent and 74 adults. Acta orthopaedica. 2019;90(6):547-53.	Ineligible Outcomes
Bastos, 2021	Bastos RM, de Carvalho Júnior JG, da Silva SAM, Campos SF, Rosa MV, de Moraes Prianti B. Surgery is no more effective than conservative treatment for Femoroacetabular impingement syndrome: Systematic review and meta-analysis of randomized controlled trials. Clinical rehabilitation. 2021;35(3):332-41.	Systematic Review for Pearling
Bolarinwa, 2020	Bolarinwa SA, Aryee JN, Labaran LA, Werner BC, Browne JA. Does Arthroscopic Repair of Femoroacetabular Impingement Pathology Affect Clinical Outcomes after Ipsilateral Total Hip Arthroplasty? Hip & pelvis. 2020;32(1):35-41.	Ineligible Intervention

Author, Year	Title	Reason for Exclusion
Bonin, 2024	Bonin N, Manzini F, Viamont-Guerra MR. No Differences in Clinical Outcomes Between Hip Arthroscopy With Versus Without Capsular Closure in Patients With Cam- or Mixed-Type Femoroacetabular Impingement: A Randomized Controlled Trial. Arthroscopy : the journal of arthroscopic & related surgery : official publication of the Arthroscopy Association of North America and the International Arthroscopy Association. 2024;40(9):2388-96.	Ineligible Comparator
Bouchard, 2025	Bouchard MD, Hayes E, Skaik K, Vivekanantha P, Theodoropoulos J, Ayeni OR. The Impact of Hip Arthroscopy on Long-term Performance Trajectories in NHL Players: A Matched Cohort Study Using Advanced Analytics. Orthopaedic journal of sports medicine. 2025;13(12):23259671251384600.	Ineligible Comparator
Chona, 2020	Chona DV, Bonano JC, Ayeni OR, Safran MR. Definitions of Return to Sport After Hip Arthroscopy: Are We Speaking the Same Language and Are We Measuring the Right Outcome? Orthopaedic journal of sports medicine. 2020;8(9):2325967120952990.	Ineligible Outcomes
Cohen, 2022	Cohen D, Comeau-Gauthier M, Khan A, Kay J, Slawaska-Eng D, Simunovic N, et al. A higher proportion of patients may reach the MCID with capsular closure in patients undergoing arthroscopic surgery for femoroacetabular impingement: a systematic review and meta-analysis. Knee surgery, sports traumatology, arthroscopy : official journal of the ESSKA. 2022;30(7):2425-56.	Ineligible Study Design
Curley, 2023	Curley AJ, Nerys-Figueroa J, George T, Carbone AD, Parsa A, Domb BG. Patient-Reported Outcomes Improve at 2-Year Minimum Follow-Up After Hip Arthroscopy for Femoroacetabular Impingement Syndrome: A Systematic Review. Arthroscopy : the journal of arthroscopic & related surgery : official publication of the Arthroscopy Association of North America and the International Arthroscopy Association. 2023;39(2):476-87.	Ineligible Study Design
Dhillon, 2024	Dhillon J, Orozco E, Keeter C, Scillia AJ, Harris JD, Kraeutler MJ. Microfracture of Acetabular Chondral Lesions Is Not Superior to Other Cartilage Repair Techniques in Patients With Femoroacetabular Impingement Syndrome: A Systematic Review. Arthroscopy : the journal of arthroscopic & related surgery : official publication of the Arthroscopy Association of North America and the International Arthroscopy Association. 2024;40(2):602-11.	Ineligible Comparator
Dijkstra, 2022	Dijkstra HP, Mc Auliffe S, Ardern CL, Kemp JL, Mosler AB, Price A, et al. Oxford consensus on primary cam morphology and femoroacetabular impingement syndrome: part 2-research priorities on conditions affecting the young person's hip. British journal of sports medicine. 2022;57(6):342-58.	Ineligible Study Design
Dion, 2021	Dion MO, Simonyan D, Faure PA, Pelet S, May O, Bonin N, et al. Validation of the French version of the Self-Administered International Hip Outcome Tool-12 Questionnaire and determination of the Minimal Clinically Important Difference (MCID) in the French speaking population. Orthopaedics & traumatology, surgery & research : OTSR. 2021;107(8):103083.	Ineligible Study Design

Author, Year	Title	Reason for Exclusion
Domb, 2024	Domb BG, Prabhavalkar ON, Maldonado DR, Perez-Padilla PA. Long-Term Outcomes of Arthroscopic Labral Treatment of Femoroacetabular Impingement in Adolescents: A Nested Propensity-Matched Analysis. The Journal of bone and joint surgery American volume. 2024;106(12):1062-8.	Ineligible Comparator
Domb, 2025	Domb BG, Sikligar D, Keane J, McCarroll TR, Kahana-Rojkind AH, Quesada-Jimenez R. Ten-Year Outcomes of Hip Arthroscopy for the Treatment of FAI and Labral Tears in Patients with a Workers' Compensation Claim. The Journal of bone and joint surgery American volume. 2025;107(17):1940-8.	Ineligible Outcomes
Doran, 2022	Doran C, Pettit M, Singh Y, Sunil Kumar KH, Khanduja V. Does the Type of Sport Influence Morphology of the Hip? A Systematic Review. The American journal of sports medicine. 2022;50(6):1727-41.	Ineligible Study Design
Dornan, 2024	Dornan GJ, Ruzbarsky JJ, Comfort SM, Ernat JJ, Martin MD, Briggs KK, et al. Two-Year Outcomes of Primary Arthroscopic Surgery in Patients with Femoroacetabular Impingement: A Comparative Study of Labral Repair and Labral Reconstruction. The Journal of bone and joint surgery American volume. 2024;106(19):1757-66.	Ineligible Comparator
Dwyer, 2020	Dwyer T, Whelan D, Shah PS, Ajrawat P, Hoit G, Chahal J. Operative Versus Nonoperative Treatment of Femoroacetabular Impingement Syndrome: A Meta-analysis of Short-Term Outcomes. Arthroscopy : the journal of arthroscopic & related surgery : official publication of the Arthroscopy Association of North America and the International Arthroscopy Association. 2020;36(1):263-73.	Systematic Review for Pearling
Edelstein, 2019	Edelstein AI, Duncan ST, Akers S, Pashos G, Schoenecker PL, Clohisy JC. Complications associated with combined surgical hip dislocation and periacetabular osteotomy for complex hip deformities. Journal of hip preservation surgery. 2019;6(2):117-23.	Ineligible Study Design
Elma, 2026	Elma T, Büyüksayın O, Eren TK, Aslan NK, Aral F, Kanatlı U. Long-term outcomes after hip arthroscopy for femoroacetabular impingement PASS, MCID, return to sport, and revision rates at a minimum five-year follow-up. International orthopaedics. 2026.	Ineligible Study Design
Elwood, 2021	Elwood R, El-Hakeem O, Singh Y, Shoman H, Weiss O, Khanduja V. Outcomes and rate of return to play in elite athletes following arthroscopic surgery of the hip. International orthopaedics. 2021;45(10):2507-17.	Ineligible Study Design
Fahmy, 2026	Fahmy M, Abdelazeem AH, Shawky MA. Long-term outcomes of the modified Dunn procedure in moderate and severe slipped capital femoral epiphysis: a prospective case series with 7-year follow-up. Journal of orthopaedics and traumatology : official journal of the Italian Society of Orthopaedics and Traumatology. 2026;27(1):5.	Ineligible Population
Foldager, 2024	Foldager FN, Kierkegaard-Brøchner S, Kemp JL, van Tulder MW, Lund B, Mygind-Klavsen B, et al. First-line treatment for femoroacetabular impingement syndrome and hip-related quality of life: study protocol for a multicentre randomised controlled trial comparing a 6-month supervised strength exercise intervention to usual care (the Better Hip Trial). BMJ open. 2024;14(6):e078726.	Ineligible Comparator
Fukase, 2022	Fukase N, Murata Y, Pierpoint LA, Soares RW, Arner JW, Ruzbarsky JJ, et al. Outcomes and Survivorship at a Median of 8.9 Years Following Hip Arthroscopy in Adolescents with Femoroacetabular Impingement: A Matched Comparative Study with Adults. The Journal of bone and joint surgery American volume. 2022;104(10):902-9.	Ineligible Population (adult arm)

Author, Year	Title	Reason for Exclusion
Gatz, 2020	Gatz M, Driessen A, Eschweiler J, Tingart M, Migliorini F. Arthroscopic surgery versus physiotherapy for femoroacetabular impingement: a meta-analysis study. European journal of orthopaedic surgery & traumatology : orthopedie traumatologie. 2020;30(7):1151-62.	Systematic Review for Pearling
Go, 2021	Go CC, Kyin C, Chen JW, Domb BG, Maldonado DR. Cost-Effectiveness of Hip Arthroscopy for Treatment of Femoroacetabular Impingement Syndrome and Labral Tears: A Systematic Review. Orthopaedic journal of sports medicine. 2021;9(3):2325967120987538.	Systematic Review for Pearling
Hadjam, 2025	Hadjam T, Lacombe-Ossó J, Valentin E, Moussa MK, Lefèvre N, Hardy A. The Hip-RSI Score for Evaluating Psychological Readiness to Return to Sport After Surgical Repair of a Proximal Hamstring Avulsion. Orthopaedic journal of sports medicine. 2025;13(11):23259671251389118.	Ineligible Population
Hassan, 2023	Hassan MM. Editorial Commentary: Hip Arthroscopy for Femoroacetabular Impingement Syndrome in Adolescents Improves Outcomes: Don't Forget the Young Guns. Arthroscopy : the journal of arthroscopic & related surgery : official publication of the Arthroscopy Association of North America and the International Arthroscopy Association. 2023;39(5):1220-1.	Ineligible Publication Type
Huang, 2022	Huang HJ, Zhou X, Huang ZG, Dang HH, Xue SL, Zhang ZY, et al. Arthroscopic Treatment for Femoroacetabular Impingement Syndrome in Adolescents: A Systematic Review and Meta-Analysis. Clinical journal of sport medicine : official journal of the Canadian Academy of Sport Medicine. 2022;32(6):608-16.	Systematic Review for Pearling
Jan, 2023	Jan K, Fenn TW, Kaplan DJ, Nho SJ. Patients Maintain Clinically Significant Outcomes at 5-Year Follow-Up After Hip Arthroscopy for Femoroacetabular Impingement Syndrome: A Systematic Review. Arthroscopy : the journal of arthroscopic & related surgery : official publication of the Arthroscopy Association of North America and the International Arthroscopy Association. 2023;39(8):1869-81 e1.	Systematic Review for Pearling
Jimenez, 2022	Jimenez AE, Glein RM, Owens JS, Lee MS, Maldonado DR, Saks BR, et al. Predictors of Achieving the Patient Acceptable Symptomatic State at Minimum 5-Year Follow-up Following Primary Hip Arthroscopy in the Adolescent Athlete. Journal of pediatric orthopedics. 2022;42(3):e277-e84.	Ineligible Study Design
Johnson, 2024	Johnson AH, Levermore SB, Maley AD, Turcotte JJ, Petre BM. Effects of Preexisting Anxiety and Depression on Postoperative Outcomes in Patients Aged 30 Years and Younger Following Hip Arthroscopy for Femoroacetabular Impingement Syndrome. HSS journal : the musculoskeletal journal of Hospital for Special Surgery. 2024;20(2):214-21.	Ineligible Study Design
Kang, 2026	Kang L, Okolo M, Cleary EJ, Lu Y, Iyer S, Levy BA, et al. High Rates of Return to American Football After Primary Hip Arthroscopy for Femoroacetabular Impingement: A 2-Year Minimum Follow-up. Orthopaedic journal of sports medicine. 2026;14(1):23259671251397513.	Ineligible Study Design
Kim, 2020	Kim CH, Moon JK, Yoon JY, Lee S, Kim WJ, Kim HS, et al. Arthroscopy versus nonoperative treatment of symptomatic femoroacetabular impingement syndrome: A systematic review and meta-analysis. Medicine. 2020;99(49):e23247.	Systematic Review for Pearling

Author, Year	Title	Reason for Exclusion
Kingery, 2024	Kingery MT, Akpinar B, Rynecki ND, Campbell HT, Lin LJ, Youm T. Intermediate-Term Outcomes of Hip Arthroscopy for Femoroacetabular Impingement Syndrome in Patients With Global Versus Isolated Lateral Acetabular Overcoverage. The American journal of sports medicine. 2024;52(1):45-53.	Ineligible Study Design
Kucharik, 2022	Kucharik MP, Abraham PF, Nazal MR, Varady NH, Eberlin CT, Meek WM, et al. Arthroscopic Acetabular Labral Repair Versus Labral Debridement: Long-term Survivorship and Functional Outcomes. Orthopaedic journal of sports medicine. 2022;10(7):23259671221109012.	Ineligible Study Design
Lameire, 2025	Lameire DL, Pathak A, Hu SY, Kero Yuen YT, Whelan DB, Dwyer T, et al. The Impact of Hip Arthroscopy on the Progression of Hip Osteoarthritis in Patients With Femoroacetabular Impingement Syndrome: A Systematic Review and Meta-analysis. Orthopaedic journal of sports medicine. 2025;13(4):23259671251326116.	Systematic Review for Pearling
Lamo-Espinosa, 2025	Lamo-Espinosa JM, Mariscal G, Gómez-Álvarez J, San-Julián M. Efficacy and safety of arthroscopy in femoroacetabular impingement syndrome: a systematic review and meta-analysis of randomized clinical trials. Scientific reports. 2025;15(1):7775.	Systematic Review for Pearling
Lee, 2023	Lee SM, Kim JS, Moon NH, Woo SH, Park C, Shin WC. Recovery After Hip Arthroscopy in Patients With Combined Femoroacetabular Impingement and Labral Tears Compared With Isolated Pathology. Orthopaedic journal of sports medicine. 2023;11(6):23259671231167908.	Ineligible Study Design
Lim, 2020	Lim C, Cho TJ, Shin CH, Choi IH, Yoo WJ. Functional Outcomes of Hip Arthroscopy for Pediatric and Adolescent Hip Disorders. Clinics in orthopedic surgery. 2020;12(1):94-9.	Ineligible Population
Malempati, 2021	Malempati M, Terle PM, Dhillon J, Kraeutler MJ. Residual Structural Disease and New Labral Tears Are the Most Common Indications for Revision Hip Arthroscopy: A Systematic Review. Arthroscopy : the journal of arthroscopic & related surgery : official publication of the Arthroscopy Association of North America and the International Arthroscopy Association. 2025;41(12):5437-52 e2.	Systematic Review for Pearling
Mayer, 2021	In Young Adults with Femoroacetabular Impingement, Osteochondroplasty and Hip Joint Lavage, Each with or without Labral Repair, Did Not Differ for Pain at 1 Year; Osteochondroplasty Reduced Reoperations at 2 Years	Ineligible Study Design
Mok, 2021	Mok TN, He QY, Teng Q, Sin TH, Wang HJ, Zha ZG, et al. Arthroscopic Hip Surgery versus Conservative Therapy on Femoroacetabular Impingement Syndrome: A Meta-Analysis of RCTs. Orthopaedic surgery. 2021;13(6):1755-64.	Systematic Review for Pearling
Nasseri, 2025	Nasseri A, Diamond LE, Pizzolato C, Savage TN, Grant T, Besier T, et al. Effects of Arthroscopic Surgery and Non-Surgical Therapy on Hip Contact Forces in Femoroacetabular Impingement Syndrome. Medicine and science in sports and exercise. 2025;57(5):1008-18.	Ineligible Study Design
Nelson, 2024	Nelson CT, Reiter CR, Harris M, Edge C, Satalich J, O'Neill C, et al. Femoral rotational osteotomy for femoroacetabular impingement: A systematic review. Journal of orthopaedics. 2024;50:139-48.	Systematic Review for Pearling

Author, Year	Title	Reason for Exclusion
Ohlin, 2019	Öhlin A, Karlsson L, Senorski EH, Jónasson P, Ahldén M, Baranto A, et al. Quality Assessment of Prospective Cohort Studies Evaluating Arthroscopic Treatment for Femoroacetabular Impingement Syndrome: A Systematic Review. Orthopaedic journal of sports medicine. 2019;7(5):2325967119838533.	Systematic Review for Pearling
Park, 2024	Park JW, Hwang JM, Yoo JJ. Arthroscopic Treatment of Femoroacetabular Impingement Syndrome: An Updated Review. Clinics in orthopedic surgery. 2024;16(4):517-25.	Ineligible Study Design
Parry, 2025	Parry D, Dhillon J, Embree G, Kraeutler MJ. Hip Arthroscopy for Femoroacetabular Impingement Syndrome Reduces the Risk for Developing Hip Osteoarthritis: A Systematic Review. Arthroscopy, sports medicine, and rehabilitation. 2025;7(5):101256.	Systematic Review for Pearling
Ramadonov, 2025	Ramadanov N, Lettner J, Voss M, Hable R, Prill R, Dimitrov D, et al. Conservative treatment versus hip arthroscopy in patients with femoroacetabular impingement : a multilevel meta-analysis of randomized controlled trials. Bone & joint open. 2025;6(4):480-98.	Systematic Review for Pearling
Richard, 2020	Richard HM, Cerza SP, De La Rocha A, Podeszwa DA. Preoperative mental health status is a significant predictor of postoperative outcomes in adolescents treated with hip preservation surgery. Journal of children's orthopaedics. 2020;14(4):259-65.	Ineligible Study Design
Savoye-Laurens, 2023	Savoye-Laurens T, Verdier N, Wettstein M, Baulot E, Gédouin JE, Martz P. Labral tears in hip dysplasia and femoroacetabular impingement: A systematic review. Orthopaedics & traumatology, surgery & research : OTSR. 2023;109(4):103539.	Systematic Review for Pearling
Schwabe, 2020	Schwabe MT, Clohisy JC, Cheng AL, Pascual-Garrido C, Harris-Hayes M, Hunt DM, et al. Short-term Clinical Outcomes of Hip Arthroscopy Versus Physical Therapy in Patients With Femoroacetabular Impingement: A Systematic Review and Meta-analysis of Randomized Controlled Trials. Orthopaedic journal of sports medicine. 2020;8(11):2325967120968490.	Systematic Review for Pearling
Serbin, 2023	Serbin PA, Youngman TR, Johnson BL, Wilson PL, Sucato D, Podeszwa D, et al. Radiographic Predictors of Reoperation in Adolescents Undergoing Hip Preservation Surgery for Femoroacetabular Impingement. The American journal of sports medicine. 2023;51(3):687-93.	Ineligible Comparator
Snaebjörnsson, 2022	Snaebjörnsson T, Anari SS, Lindman I, Desai N, Stålman A, Ayeni OR, et al. Most Elite Athletes Who Underwent Hip Arthroscopy for Femoroacetabular Impingement Syndrome Did Not Return to the Same Level of Sport, but the Majority Were Satisfied With the Outcome of Surgery. Arthroscopy, sports medicine, and rehabilitation. 2022;4(3):e899-e906.	Ineligible Study Design
Sogbein, 2019	Sogbein OA, Shah A, Kay J, Memon M, Simunovic N, Belzile EL, et al. Predictors of Outcomes After Hip Arthroscopic Surgery for Femoroacetabular Impingement: A Systematic Review. Orthopaedic journal of sports medicine. 2019;7(6):2325967119848982.	Ineligible Study Design
Su, 2024	Su T, Huang X, Yang L, Chen GX. Acetabular Labral Repair and Selective Labral Debridement Show No Significant Difference in Clinical Outcomes at a Minimum 2-Year Follow-Up. Arthroscopy : the journal of arthroscopic & related surgery : official publication of the Arthroscopy Association of North America and the International Arthroscopy Association. 2024;40(2):330-40.	Ineligible Comparator

Author, Year	Title	Reason for Exclusion
Tiao, 2024	Tiao J, Ranson W, Ren R, Wang KC, Rosenberg AM, Herrera M, et al. Assessment of Risk Factors and Rate of Conversion to Total Hip Arthroplasty Within 2 Years After Hip Arthroscopy Utilizing a Large Database of Commercially Insured Patients in the United States. Orthopaedic journal of sports medicine. 2024;12(2):23259671231217494.	Ineligible Comparator
Trivedi, 2019	Trivedi NN, Sivasundaram L, Su CA, Knapik D, Nho SJ, Mather RC, 3rd, et al. Indications and Outcomes of Arthroscopic Labral Reconstruction of the Hip: A Systematic Review. Arthroscopy : the journal of arthroscopic & related surgery : official publication of the Arthroscopy Association of North America and the International Arthroscopy Association. 2019;35(7):2175-86.	Ineligible Population
Vakharia, 2025	Vakharia AM, Fortier LM, Paliobeis A, Hallwachs A, Brown M, Salata M. A Nationwide Analysis Shows Anxiety Disorders Are Associated With Higher Rates of Pneumonia, Pulmonary Embolism, Deep Vein Thrombosis, and Acute Renal Failure After Hip Arthroscopy for Femoral Acetabular Impingement Syndrome: A Matched-Control Analysis. Arthroscopy : the journal of arthroscopic & related surgery : official publication of the Arthroscopy Association of North America and the International Arthroscopy Association. 2025;41(9):3579-85.	Ineligible Study Design
Vera, 2025	Vera AM, McQuivey KS, Murphy SN, Brinkman JC, Economopoulos KJ. Evaluating the Impact of Capsular Closure on Clinical Outcomes, Revision Rates, and Return to Sports in Adolescent Females Undergoing Hip Arthroscopy for Femoroacetabular Impingement. Orthopaedic journal of sports medicine. 2025;13(3):23259671241295755.	Ineligible Study Design
Watanabe, 2020	Watanabe N, Murakami S, Uchida S, Tateishi S, Ohara H, Yamamoto Y, et al. Validity of the Japanese Orthopaedic Association Hip Disease Evaluation Questionnaire (JHEQ) for Japanese patients with labral tear. Journal of hip preservation surgery. 2020;7(3):466-73.	Ineligible Study Design
Yang, 2025	Yang S, Wang H, Wang L, Tian X, Chen G. Comparative efficacy of hip arthroscopy versus structured non-surgical treatment for femoroacetabular impingement syndrome: a mid-term retrospective cohort study. European journal of medical research. 2025;31(1):108.	Ineligible Outcomes
Youngman, 2023	Youngman TR, Johnson BL, Morris WZ, Montanez B, Serbin PA, Wagner KJ, 3rd, et al. Soft Tissue Cam Impingement in Adolescents: MRI Reveals Impingement Lesions Underappreciated on Radiographs. The American journal of sports medicine. 2023;51(14):3749-55.	Ineligible Outcomes

Appendix C. Risk of Bias, Strength of Evidence, QHES, and AMSTAR-2

Each included comparative study is rated against pre-set criteria that resulted in a Risk of Bias (ROB) assessment and presented in a table. Assessment of RCTs followed appropriate criteria based on methods described in *the Cochrane Handbook for Systematic Reviews of Interventions*[4] and guidance from the Agency for Healthcare Research and Quality (AHRQ) *Methods Guide for Effectiveness and Comparative Effectiveness Reviews*.[1] In keeping with the AHRQ methods, each study was given a final rating of "good", "fair", or "poor" quality as described below in Table C-1. Discrepancies in ratings between reviewers were resolved through discussion and consensus. Where blinding is not possible, studies will automatically be rated as "fair" given the potential for biased assessment of outcomes. The final quality assessments are provided in Appendix D.

Table C-2 provides an example of the format used to assess ROB for comparative studies of testing/therapy. Additional criteria for non-randomized studies includes consideration of how patients are selected and appropriate control for confounding. Table C-3 provides an example for non-randomized studies of interventions. Table C-4 provides an example for evaluating administrative database studies. A "No" indicates that the criterion was not met; an "Unclear" indicates that the criterion could not be determined with the information provided or was not reported by the author. Risk of bias assessments were not conducted for case series; all were considered High risk of bias.

Appendix Table C-1. Definition of the risk of bias categories for individual studies of testing

Rating	Description and Criteria
Good	• Least risk of bias; study results generally considered valid • Employ valid methods for selection, inclusion, and allocation of patients to testing; report similar baseline characteristics in different test groups; clearly describe attrition and have low attrition; use appropriate means for preventing bias (e.g., blinding of patients, care providers, and outcomes assessors); and use appropriate analytic methods (e.g., intention-to-treat analysis)
Fair	• Study is susceptible to some bias but not enough to necessarily invalidate results • May not meet all criteria for good quality, but no flaw is likely to cause major bias; the study may be missing information making it difficult to assess limitations and potential problems • This category is broad; studies with this rating will vary in strengths and weaknesses; some fair-quality studies are likely to be valid, while others may be only possibly valid
Poor	• Significant flaws that imply biases of various kinds that may invalidate results; the study contains "fatal flaws" in design, analysis, or reporting; large amounts of missing information; discrepancies in reporting or serious problems with intervention delivery • Study results are at least as likely to reflect flaws in the study design or execution as the true difference between the compared interventions • Considered to be less reliable than higher quality studies when synthesizing the evidence, particularly if discrepancies between studies are present

Appendix Table C-2: Template for Assessment of ROB for Individual Randomized Controlled Trials

Methodological Principle	Author 1, 2023	Author 2 2024	Author 3, 2021
Random sequence generation			
Concealed allocation			
Groups comparable at baseline*			
Outcome assessors independent or blinded			
Care providers blinded			
Patients blinded			
Reporting of attrition			
Complete follow-up of ≥80%			
<10% difference in follow-up between groups			
Intention to treat			
Outcomes prespecified			
Risk of Bias			

Unclear indicates that the study had insufficient detail to determine whether criteria were met

* Groups must be comparable on a robust set of baseline characteristics or present evidence that controlling of confounding presented was performed.

Appendix Table C-3: Template for Assessment of ROB for Individual Non-Randomized Studies of Interventions

Methodological Principle	Author 1, 2024	Author 2, 2019	Author 3, 2020
Did the study attempt to enroll a random sample or consecutive patients meeting inclusion criteria (inception cohort) from same underlying population?			
Were the groups comparable at baseline on key prognostic factors?			
Did the article report attrition?			
Overall loss to follow up acceptable? (≤20%) Differential loss to follow up acceptable? (≤10%)			
Were the outcomes investigated prespecified and defined?			
Did the study clearly describe and use accurate methods for ascertaining outcomes, exposures, and potential confounders?			
Were outcome assessors and/or data analysts blinded to treatment?			
Did the study perform appropriate statistical analyses on potential confounders or otherwise control for confounding (e.g. restriction, stratification, matching)?			
Was the duration of follow-up reasonable for investigated events?			
Risk of Bias			

NA = not applicable (due to being a case series)
Unclear indicates that the study had insufficient detail to determine whether criteria were met

Assessment of Economic Studies

Full formal economic analyses evaluate both costs and clinical outcomes of two or more alternative interventions. The four primary types are cost minimization analysis (CMA), cost-utility analysis (CUA), cost-effectiveness analysis (CEA), and cost-benefit analyses (CBA). Each employs different methodologies, potentially complicating critical appraisal, but some common criteria can be assessed across studies.

No standard, universally accepted method of critical appraisal of economic analyses is currently in use. A number of checklists [Canadian, BMJ, AMA] are available to facilitate critique of such studies. The Quality of Health Economic Studies (QHES) instrument developed by Ofman, et al. embodies the primary components relevant for critical appraisal of economic studies.[5] It also incorporates a weighted scoring process which was used as one factor to assess included economic studies. This tool has not yet undergone extensive evaluation for broader use but provides a valuable starting point for critique. Table C-4 below provides a template of the instrument.

In addition to assessment of criteria in the QHES, other factors are important in critical appraisal of studies from an epidemiologic perspective to assist in evaluation of generalizability and potential sources of study bias.

Such factors include:

- Are the interventions applied to similar populations (e.g., with respect to age, gender, medical conditions, etc.)? To what extent are the populations for each intervention comparable and are differences considered or accounted for? To what extent are population characteristics consistent with “real world” applications of the comparators?
- Are the sample sizes adequate so as to provide a reasonable representation of individuals to whom the technology would be applied?
- What types of studies form the basis for the data used in the analyses? Data (e.g., complication rates) from randomized controlled trials or well-conducted, methodologically rigorous cohort studies for data collection are generally of highest quality compared with case series or studies with historical cohorts.
- Were the interventions applied in a comparable manner (e.g., similar protocols, follow-up procedures, evaluation of outcomes, etc.)?
- How were the data and/or patients selected or sampled (e.g., a random selection of claims for the intervention from a given year/source or all claims)? What specific inclusion/exclusion criteria or processes were used?

Were the outcomes and consequences of the interventions being compared comparable for each? (e.g., were all of the relevant consequences/complications for each intervention considered or do they primarily reflect those for one intervention?

Appendix Table C-4. Template for Assessment of Quality of Health Economic Studies Criteria

Question	Possible Points*	Criteria For Credit*
1. Was the study **objective** presented in a clear, specific, and measurable manner?	7	Authors must fully describe the objective; is it measurable?
2. Were the **perspective** of the analysis (societal, third-party payer, etc.) and reasons for its selection stated?	4	Authors must state perspective, provide rationale AND have done the correct analysis corresponding to the perspective
3. Were **variable estimates** used in the analysis from the best available source (i.e., randomized controlled trial - best, expert opinion - worst)?	8	No credit if most of estimates are not from the best sources available
4. If estimates came from a **subgroup analysis**, were the groups prespecified at the beginning of the study?	1	-
5. Was **uncertainty** handled by (1) statistical analysis to address random events, (2) sensitivity analysis to cover a range of assumptions?	9	NO credit if they do not give details regarding type of sensitivity analysis, methods (e.g. what assumptions or factors were varied/why), AND the results (what factors are influential, what is the range of ICERs, etc.)
6. Was **incremental analysis** performed between alternatives for resources and costs?	6	-
7. Was the methodology for **data abstraction** (including the value of health states and other benefits) stated?	5	No credit if sources of model inputs and process of choosing model inputs not specified
8. Did the **analytic horizon allow time** for all relevant and important outcomes? Were benefits and costs that went beyond 1 year discounted (3% to 5%) and justification given for the discount rate?	7	No credit if time horizon is too short to allow for important outcomes
9. Was the **measurement of costs** appropriate and the methodology for the estimation of quantities and unit costs clearly described?	8	No credit if sources of cost data or methods of estimating costs not clearly described
10. Were the primary **outcome measure(s**) for the economic evaluation clearly stated and did they include the major short-term, long-term and negative outcomes included?	6	NO credit if major important outcomes are not included or if time horizon did not allow for important outcomes to be measured
11. Were the health outcomes **measures/scales valid** and reliable? If previously tested valid and reliable measures were not available, was justification given for the measures/scales used?	7	No credit if sources of outcome data or not clearly described or if outcome data is not appropriate for the study population/outcome of interest (i.e. using utility weights from QOL measures that aren't validated or apply to a different population)
12. Were the **economic model** (including structure), study methods and analysis, and the components of the numerator and denominator displayed in a clear, transparent manner?	8	Must provide explicit detail for methods and should be able to trace/identify specific components, how they were derived, etc.
13. Were the choice of economic model, main **assumptions, and limitations** of the study stated and justified?	7	NO credit if insufficient detail of model, assumptions AND limitations are provided (No credit if they do not provide justifications/rationale)

Question	Possible Points*	Criteria For Credit*
14. Did the author(s) explicitly discuss direction and magnitude of potential **biases?**	6	NO credit if no discussion of direction and magnitude of biases
15. Were the **conclusions/recommendations** of the study justified and based on the study results?	8	NO credit if conclusions/recommendations are stronger than warranted based on findings
16. Was there a statement disclosing the **source of funding** for the study?	3	-
Total	100	-

ICER = Incremental Cost-Effectiveness Ratio; QOL = quality of life.
* Study must fit criteria in order to receive full points. Partial credit is not given. If criteria is not met, then the question receives no points.

Application of AMSTAR 2 to systematic reviews

Table C-6 shows our criteria for RoB assessment based on the AMSTAR-2 tool. AMSTAR-2 is the revised and updated version of AMSTAR published in 2007 used for critical appraisal of systematic reviews (Shea, 2017).[8] It is not intended to provide an overall score, as high scores may hide weaknesses in critical domains. In light of this, we used a modified AMSTAR tool as determined by Dettori et al (2020).[3] Table C-7 (adapted from Dettori 2020) describes how overall scores were determined considering critical domains.[2] Bold items in table 1 were considered as critical items. The original AMSTAR-2 guidance suggests grading each item as no or yes, with items 2, 4, 7, 8, and 9 allowing for a 'partial yes'. We considered a 'yes' or 'partial yes' as yes.

Appendix Table C-5. Criteria for Assessing Systematic Reviews Based on AMSTAR-2.

Item	Criteria
1: Did the research questions and inclusion criteria for the review include the components of PICO?	• **Yes** if all components of PICO are described somewhere in the report. • **No** if any components of PICO are missing.
2: Did the report of the review contain an explicit statement that the review methods were established prior to the conduct of the review and did the report justify any significant deviations from the protocol?	• **Yes** if the protocol or review methods were established prior to review. • **No** if no protocol or discussion/description of methods decided prior to review.
3: Did the review authors explain their selection of the study designs for inclusion in the review?	• **Yes** if study design inclusion is justified or discussed. No penalty for restricting study designs. • **No** if no discussion of justification for inclusion.
4: Did the review authors use a comprehensive literature search strategy?	• **Yes** if 2 or more electronic databases were searched and key words are available in report or appendices. No penalty for language restrictions. • **No** if less than 2 electronic databases were searched or key words are unavailable.

Item	Criteria
5: Did the review authors perform study selection in duplicate?	• **Yes** if selection at title/abstract and full text reviews were performed by 2 authors with consensus upon disagreement or single author selecting with a second checking agreement on sample and a kappa reported of ≥0.80. • **No** if no second author involved or no kappa reported.
6: Did the review authors perform data extraction in duplicate?	• **Yes** if abstraction was performed by 2 authors with consensus upon disagreement or single author abstracting with a second checking agreement on sample and a kappa of reported of ≥0.80. • **No** if no second author involved or no kappa reported.
7: Did the review authors provide a list of excluded studies and justify the exclusions?	• **Yes** if a list of potentially relevant studies is reported in appendix or discussed in text with citations with justification for exclusion. List of references must be provided. • **No** if no list of references provided or not potentially relevant but excluded studies are discussed.
8: Did the review authors describe the included studies in adequate detail?	• **Yes** if study characteristics are reported in sufficient detail to determine whether the studies met PICO criteria and provides framework to judge heterogeneity. • **No** if study characteristics are not reported or table 1 does not include age, sex, (and #'s).
9: Did the review authors use a satisfying technique for assessing the RoB in individual studies that were included in the review?	**RCTS** • **Yes** if important domains similar to Cochrane. **Cohort studies** • **Yes** if it addresses all of the following: confounding, selection bias, measurement bias, and selective reporting of outcomes (Newcastle okay if all 8 questions included). **Case series** (study of incidence, no direct comparison) • **Yes** if selection bias, measurement bias, and selective reporting of outcomes met (Newcastle okay IF questions #1, 2, 3, 4, 6, 7, and 8 addressed). **For all studies** • **No** if there is obvious evidence that the authors misapplied an acceptable technique.
10: Did the review authors report on the sources of funding for the studies included in the review?	• **Yes** if authors report funding of individual studies. • **No** if authors do not report funding.
11: If meta-analysis was performed did the review authors use appropriate methods for statistical combination of results?	• **Yes** if all the following are present • Meta-analysis justified (e.g., studies comparable, direct comparison). • Explanation of fixed or random effects (must do more than merely report without explanation). • Pooled results reported separately for RCTs and cohort studies. • Assessment of heterogeneity (must address I^2). • **No** if one or more of the above are not present. • If no meta-analysis was done mark as **NM (No meta-analysis)**

Item	Criteria
12: If meta-analysis was performed, did the review authors assess the potential impact of RoB in individual studies on the results of the meta-analysis or other evidence synthesis?	• **Yes** if results are stratified by RoB or if the review only included the lowest RoB studies in the analysis. • **No** if results are not stratified by RoB and review includes a range of RoB outcomes in the analysis. No credit if RoB method from item #9 is not acceptable. • If no meta-analysis was done mark as **NM (No meta-analysis**)
13: Did the review authors account for RoB in individual studies when interpreting or discussing the results of the review?	• **Yes** if there is a discussion of the impact of RoB in the interpretation of results and/or accounting for differences between studies. • **No** if there is no discussion of the impact of RoB in the interpretation of results and/or accounting for differences between studies. No credit if method from #9 is not acceptable.
14: Did the review authors provide a satisfactory explanation for, and discussion of, any heterogeneity observed in the results of the review?	• **Yes** if I^2 demonstrates no heterogeneity (<50%) or authors explored reasons for heterogeneity if I^2 is ≥50%. • **No** if I^2 demonstrates heterogeneity (>50%) and authors do not explore reasons for heterogeneity.
15: If they performed quantitative synthesis did the review authors carry out an adequate investigation of publication bias (small study bias) and discuss its likely impact on the results of the review?	• **Yes** if there is an attempt to identify publication bias. Must also show awareness of likely impact of publication bias on results. Credit given if they acknowledge publication bias could be a problem but not enough data given or if they have fewer than 10 studies and show no evidence of publication bias. • **No** if there is no attempt to identify or discuss publication bias. • If no meta-analysis was done mark **as NM (No meta-analysis)**
16: Did the review authors report any potential sources of conflict of interest, including any funding they received for conducting the review?	• **Yes** if authors report no competing interests or how they managed potential conflicts of interest. • **No** if there is no discussion or reporting of potential conflicts of interest.

PICO = population, intervention, comparison, outcome; RoB = risk of bias.

Appendix Table C-6. Rating Overall Confidence in the Results of the Review (Dettori, 2020).

High**:** No or 1 noncritical weakness	The systematic review provides an accurate and comprehensive summary of the results of the available studies that address the question of interest.
Moderate**:** More than 1 noncritical weakness*	The systematic review has more than 1 weakness but no critical flaws. It may provide an accurate summary of the results of the available studies that were included in the review.
Low**:** One critical flaw with or without noncritical weaknesses	The review has a critical flaw and may not provide an accurate and comprehensive summary of the available studies that address the question of interest.
Critically low**:** More than 1 critical flaw with or without noncritical weaknesses	The review has more than 1 critical flaw and should not be relied on to provide an accurate and comprehensive summary of the available studies.

* Multiple noncritical weaknesses may diminish confidence in the review, and it may be appropriate to move the overall appraisal down from moderate to low confidence.

Determination of Overall Strength (Quality) of Evidence

Following the assessment of the quality of each individual study included in the report, an *overall* "strength of evidence" or "quality of evidence" for all critical and important *primary* health outcomes and harms based on methods used by GRADE (Grading of Recommendation Assessment, Development and Evaluation) and the Agency for Healthcare Research and Quality (AHRQ) will be reported.[1]

The overall strength of evidence is based on assessment of the following required domains: risk of bias, consistency, directness, and precision. The overall Strength of Evidence (SoE) ranges from high for a body of evidence if new studies are unlikely to change the effect estimates to low if estimates from the currently available body of evidence is very likely to change as new data become available or insufficient if evidence is unavailable or does not permit a conclusion. To evaluate differential efficacy and safety (heterogeneity of effect, interaction), we will focus on RCTs as they have the least potential for bias and confounding thus potentially allowing for causal inference. Further, only RCTs that formally test for interaction between subgroups will be reported. SOE for these studies is based on consideration of the overall study risk of bias (study quality) as well as whether subgroup variables and analyses were specified a priori, the hypothesized impact of a subgroup on the outcome/effect and sample size as evaluation of interaction requires greater sample size are based on recommendations from Oxman and Guyatt[6] and the Instrument to assess the Credibility of Effect Modification (ICEMAN) criteria.[7] The overall strength of evidence reflects our confidence in the effects estimated in the included studies and how likely new studies are to change the estimates. If only poor-quality studies are available for an outcome, SOE will be graded as insufficient.

The strength of evidence for the overall body of evidence for all *critical health outcomes* was assessed by one researcher following the principles for adapting GRADE (Grades of Recommendation Assessment, Development and Evaluation) as outlined by the Agency for Healthcare Research and Quality (AHRQ). The strength of evidence was based on the highest quality evidence available for a given *primary* outcome. In determining the strength of body of evidence regarding a given *primary* outcome, the following domains were considered:

- **Risk of bias:** the extent to which the included studies have protection against bias.
- **Consistency:** the degree to which the included studies report results are similar in terms of range and variability.
- **Directness:** describes whether the evidence is directly related to patient health outcomes.
- **Precision:** describes the level of certainty surrounding the effect estimates.
- **Publication bias:** is considered when there is concern of selective publishing.

All AHRQ "required" and "additional" domains (risk of bias, consistency, directness, precision, and if possible, publication bias) were assessed. Bodies of evidence consisting of RCTs were initially considered as High strength of evidence (SoE), while those that comprised nonrandomized studies began as Low strength of evidence. The strength of evidence could be downgraded based on the limitations described above. There could also be situations where the *nonrandomized* studies could be upgraded, including the presence of plausible unmeasured confounding and bias that would decrease an observed effect or increase an effect if none was observed, presence of a dose-response relationship, and large magnitude of effect (strength of association) *if no downgrades for domains above*. Publication and reporting bias are difficult to assess. Publication bias is particularly difficult to assess with fewer than 10 RCTs (AHRQ

methods guide). When publication bias was unknown in all studies and this domain is often eliminated from the strength of evidence tables for our reports. The final strength of evidence for each **primary** outcome was assigned an overall grade of high, moderate, low, or insufficient, which are defined as follows:

High— Very confident that effect size estimates lie close to the true effect for this outcome; there are few or no deficiencies in the body of evidence; we believe the findings are stable.

Moderate— Moderately confident that effect size estimates lie close to the true effect for this outcome; some deficiencies in the body of evidence; we believe the findings are probably stable but some doubt remains.

Low— Limited confidence that effect size estimates lie close to the true effect for this outcome; important or numerous deficiencies in the body of evidence; we believe that additional evidence is needed before concluding that findings are stable or that the estimate is close to the true effect.

Insufficient— We have no evidence, are unable to estimate an effect or have no confidence in the effect estimate for this outcome; OR no available evidence or the body of evidence has unacceptable deficiencies precluding judgment.

Similar methods for determining the overall quality (strength) of evidence related to economic studies have not been reported, thus the overall strength of evidence for outcomes reported in Key Question 4 was not assessed.

Appendix Table C-7. Example Methodology Outline for Determining Overall Strength of Evidence (SoE)

All AHRQ "required" and "additional" domains* are assessed. Only those that influence the baseline grade are listed in table below.
Baseline strength: HIGH = RCTs. LOW = observational, cohort studies, administrative data studies.
DOWNGRADE: Risk of bias for the individual article evaluations (1 or 2); Inconsistency** of results (1 or 2); Indirectness of evidence (1 or 2); Imprecision of effect estimates (1 or 2); Sub-group analyses not stated *a priori* and no test for interaction (2)
UPGRADE (non-randomized studies): Large magnitude of effect (1 or 2); Dose response gradient (1) done for observational studies ***if no downgrade for domains above***

Outcome	Strength of Evidence	Conclusions & Comments	Baseline SOE	DOWNGRADE	UPGRADE
Outcome	**HIGH**	Summary of findings	**HIGH** RCTs	**NO** consistent, direct, and precise estimates	**NO**
Outcome	**MODERATE**	Summary of findings	**LOW** Cohort studies	**NO** consistent, direct, and precise estimates; high quality (moderately low ROB)	**YES** Large effect

Outcome	**LOW**	Summary of findings	**HIGH** RCTs	**YES (2)** Inconsistent Indirect	**NO**

*Required domains: risk of bias, consistency, directness, precision. Plausible confounding that would decrease observed effect is accounted for in our baseline risk of bias assessment through individual article evaluation. Additional domains: dose-response, strength of association, publication bias.
**Single study = "consistency unknown", may or may not be downgraded

Appendix Table C-8. Definitions for Magnitude of Effects, Based on Mean Between-Group Differences

Outcome	Slight/Small	Moderate	Large/Substantial
QoL	5–10 points on SF-36	10–20 points on SF-36	>20 points on SF-36
	0.1 points on EQ-5D	>0.1 to <0.2 points on EQ-5D	>0.2points on EQ-5D
Symptoms	1.2 to 1.4 RR/HR	1.5 to 1.9 RR/HR	≥2.0 RR/HR
	0.83 to 0.68 RR/HR	0.67 to 0.51 RR/HR	≤0.5 RR/HR

EQ-5D = EuroQol 5 dimensions questionnaire; HR = hazard ratio; QoL = quality of life; RR = risk ratio; SF-36 = Short Form 36 questionnaire.

Appendix D. Study Quality: Risk of Bias, QHES, and AMSTAR-2 Evaluation

Appendix Table D-1. Risk of Bias Ratings for Included RCTs

Criteria	Griffin, 2018, Griffin, 2022[1,2]	Mansell, 2018[3]	Palmer 2019, Palmer, 2025[4]	Martin 2021, Martin, 2024[5,6]	Hunter, 2021, Murphy, 2023 [7,8]	Ayeni, 2021, Kay, 2022[9,10]
Random sequence generation	Yes	Yes	Yes	Yes	Yes	Yes
Concealed allocation	Yes	Yes	Yes	Unclear	Yes	Yes
Groups comparable at baseline*	Yes	Yes	Yes	No	No	No
Outcome assessors independent or blinded	No	No	No	No	No	Yes
Care providers blinded	No	No	No	No	No	Yes
Patients blinded	No – PROM Yes – CROM	No – PROM Yes – CROM	No – PROM Yes – CROM	No – PROM	No – PROM Yes – CROM	Yes
Reporting of attrition	Yes	Yes	Yes	Yes	Yes	Yes
Complete follow-up of ≥80%	Yes	No	Yes at 8 months; no at 38 months	Yes	Yes	No
<10% difference in follow-up between groups	Yes	No	Yes	Yes	Yes	Yes
Intention to treat	Yes	Yes	Yes	Yes	Yes	Yes
Outcomes prespecified	Yes	Yes	Yes	Yes	Yes	Yes
Overall RoB	**Moderate**	**Moderate**	**Moderate**	**Moderate**	**Moderate**	**Moderate**

CROM = clinician reported outcome measure; PROM = patient reported outcome measure

Appendix Table D-2. Risk of Bias Ratings for Included NRSIs

Criteria	Pennock, 2018[11]
Did the study attempt to enroll a random sample or consecutive patients meeting inclusion criteria (inception cohort) from same underlying population?	Yes
Were the groups comparable at baseline on key prognostic factors?	No
Did the article report attrition?	Yes
Overall loss to follow up acceptable? (≤20%) Differential loss to follow up acceptable? (≤10%)	Yes
Were the outcomes investigated prespecified and defined?	Yes
Did the study clearly describe and use accurate methods for ascertaining outcomes, exposures, and potential confounders?	Yes
Were outcome assessors and/or data analysts blinded to treatment?	Unclear
Did the study perform appropriate statistical analyses on potential confounders or otherwise control for confounding (e.g. restriction, stratification, matching)?	Yes
Was the duration of follow-up reasonable for investigated events?	Yes
Overall Risk of bias	**High**

Appendix Table D-3. QHES Ratings for Economic Studies

QHES Question (points possible)	Griffin 2018[1]	Mather 2018[12]	Shearer 2012[13]	Yan, 2024[14]
1. Was the study objective presented in a clear, specific, and measurable manner? (7 points)	7	7	7	7
2. Were the perspective of the analysis (societal, third-party payer, etc.) and reasons for its selection stated? (4 points)	4	4	4	4
3. Were variable estimates used in the analysis from the best available source (i.e. randomized controlled trial - best, expert opinion - worst)? (8 points)	8	0	0	0
4. If estimates came from a subgroup analysis, were the groups prespecified at the beginning of the study? (1 point)	1	1	0	1
5. Was uncertainty handled by (1) statistical analysis to address random events, (2) sensitivity analysis to cover a range of assumptions? (9 points)	9	9	9	9
6. Was incremental analysis performed between alternatives for resources and costs? (6 points)	6	6	6	6
7. Was the methodology for data abstraction (including the value of health states and other benefits) stated? (5 points)	5	0	5	5
8. Did the analytic horizon allow time for all relevant and important outcomes? Were benefits and costs that went beyond 1 year discounted (3% to 5%) and justification given for the discount rate? (7 points)	0	7	7	7
9. Was the measurement of costs appropriate and the methodology for the estimation of quantities and unit costs clearly described? (8 points)	8	8	0	0
10. Were the primary outcome measure(s) for the economic evaluation clearly stated and did they include the major short-term, long-term and negative outcomes included? (6 points)	0	6	6	6
11. Were the health outcomes measures/scales valid and reliable? If previously tested valid and reliable measures were not available, was justification given for the measures/scales used? (7 points)	7	0	0	7
12. Were the economic model (including structure), study methods and analysis, and the components of the numerator and denominator displayed in a clear, transparent manner? (8 points)	0	8	0	8
13. Were the choice of economic model, main assumptions, and limitations of the study stated and justified? (7 points)	7	0	7	7
14. Did the author(s) explicitly discuss direction and magnitude of potential biases? (6 points)	6	0	6	0
15. Were the conclusions/recommendations of the study justified and based on the study results? (8 points)	8	8	8	8
16. Was there a statement disclosing the source of funding for the study? (3 points)	3	3	0	3
Total score:	**79**	**67**	**65**	**78**

Appendix Table D-4. AMSTAR-2 Ratings for Included Systematic Reviews*

Criteria	Rathore, 2025[15]	De Sa, 2015[16]
PICO	Yes	Yes
Protocol†	Yes	Unclear
Design inclusion	Yes	Yes
Search†	Yes	Yes
Duplicate selection	Yes	Yes
Duplicate extraction	Yes	Yes
Excluded studies list†	No	No
Study description	Yes	Yes
RoB†	Yes	No
Funding	Yes	Yes
Meta-analysis†	Yes	No
RoB considered in results	Yes	No
RoB in discussion†	No	No
Heterogeneity discussed	Yes	Yes
Publication bias†	Yes	No
COI	Yes	Yes
Overall AMSTAR-2	**Critically low**	**Critically low**

* In adolescents.

† If not present, considered as a critical flaw.

Appendix E. Additional Demographic and Outcome Data of Included Studies

See document "Appendix E. Data abstraction of included studies" for full data abstraction

See document "Appendix E. Risk of bias of included studies" for full risk of bias assessments

Appendix Table E-1. Diagnostic Criteria Across RCTs

Trial (Author, Year)	Symptoms	Clinical Signs	Dx Imaging	Dx Injection	Failed PT/CC
UK FASHIoN (Griffin 2018, Griffin 2022)[1,2]	Yes; hip pain, mean duration 37 vs. 40 months (between groups)	No	Yes (radiograph); cam (alpha angle >55°) or pincer (center-edge angle >40° or positive crossover sign) morphology	No	No
Mansell, 2018[3]	Yes; hip/groin pain, pain with active flexion, duration >2 years	Yes; Positive FADIR	Yes (radiograph, CT, MRI); ≥2mm joint space positive crossover sign (pincer) or alpha angle >50° (cam)	Yes	Yes; 6 weeks
FAIT Trial (Palmer 2019, Palmer 2025)[4,17]	Yes	Yes; NR	Yes (radiograph, MRI)	No	No
Martin Trial (Martin 2021, Martin 2024)[5,6]	Yes; Catching, popping, clicking, groin pain when sitting and standing from seated, episodic pain, >3 months	Yes; Positive FADIR, positive FABER	Yes (MRI); labral tear	No	Yes; ≥3 months
Australian FASHIoN Trial (Hunter 2021, Murphy 2023)[7,8]	Yes; Hip pain	No	Yes (radiograph); cam (alpha angle >55°) or pincer (LCEA >40°, positive cross-over sign, other)	No	No
FIRST Trial (Ayeni 2021, Kay 2022)[9,10]	Yes; Pain	No	Yes (radiograph, MRI); Cam or mixed-type impingement	Yes	Yes; ≥6 months

CT = computed tomography, Dx = diagnosis; LCEA = lateral center edge angle, FABER = flexion abduction and external rotation, FADIR = flexion adduction and internal rotation, mm = millimeter, MRI = magnetic resonance imaging, NR = not reported; PT = physiotherapy

Appendix Table E-2: Inclusion and Exclusion Criteria for Included RCTs

Study, Year	Griffin, 2018 (UK FASHIoN Trial)[1]	Mansell, 2018[3]	Palmer, 2019 (FAIT Trial)[17]	Martin, 2024 (Martin Trial)[6]	Hunter, 2021 (Australian FASHIoN Trial)[7]	FIRST Investigators (FIRST Trial)[9]
Comparison (N)	Arthroscopy (n=171) vs. PT (n=177)	Arthroscopy (n=40) vs. PT (n=40)	Arthroscopy (n=112) vs. PT (n=110)	Surgery + PT (n=52) vs. PT (n=45)	Arthroscopic Surgery + CC (n=49) vs. PT (n=50)	Arthroscopic Surgery (n=110) vs. Lavage (n=110)
Inclusion Criteria	-	-	-	-	-	-
Age	≥16 years old	18-60 years old	18-60 years old	≥40 years old	≥16 years old	15-80 years old
Pain	Hip pain	Anterior hip or groin reproduced with passive or active flexion	Symptomatic FAI	Groin pain when sitting and standing from seated position, episodic pain (neither required but checked for)	Hip pain	Hip pain >6 months
Type of FAI	Cam, pincer, or mixed	NR	Cam, pincer, or mixed	Cam or pincer	Cam, pincer, or mixed	Cam or mixed
Failed Conservative Treatment	NR	6 weeks, includes NSAID, profile, patient education, and exercise handouts	NR	≥3 months	NR	Yes, includes NSAIDs and rest
Failed PT	NR	NR	NR	NR	NR	Yes, includes core conditioning of hip, back and abdomen

Study, Year	Griffin, 2018 (UK FASHIoN Trial)[1]	Mansell, 2018[3]	Palmer, 2019 (FAIT Trial)[17]	Martin, 2024 (Martin Trial)[6]	Hunter, 2021 (Australian FASHIoN Trial)[7]	FIRST Investigators (FIRST Trial)[9]
Positive Impingement	NR	Positive FADIR test	Confirmed clinically, not further described	History consistent with symptomatic labral tear (one or more of catching, clicking, popping, groin pain when sitting and standing from seated position, episodic pain), positive FADIR or FABER test	NR	NR
Positive Imaging Sign	Cam: Alpha angle >55° Pincer: LCEA >40° or a positive crossover sign	Positive crossover sign or alpha angle >50°	Confirmed via imaging, qualitative methodology used instead of specific thresholds	MRI evidence of acetabular labral tear, not further described	Cam: Alpha angle >55° Pincer: LCEA >40° or a positive crossover sign	Cam or mixed signs confirmed via MRI or MRA
Intra-articular Injection	NR	Yes, subjective pain relief	NR	NR	NR	Yes, temporary pain relief
Other	NR	NR	NR	NR	NR	NR
Exclusion Criteria	-	-	-	-	-	-
Pre-existing OA	Yes, Tonnis grade 1 or higher or <2mm joint space on AP radiograph	Yes, <2mm joint space on imaging	Yes, Kellgren-Lawrence grade ≥2	Yes, Tonnis grade 3	Yes, Tonnis grade 1 or higher or <2mm joint space on AP radiograph	Yes, Tonnis grade ≥2
Hip Dysplasia	NR	NR	Yes, LCEA <20°	Yes, LCEA <20°	NR	Yes, LCEA <20°

Study, Year	Griffin, 2018 (UK FASHIoN Trial)[1]	Mansell, 2018[3]	Palmer, 2019 (FAIT Trial)[17]	Martin, 2024 (Martin Trial)[6]	Hunter, 2021 (Australian FASHIoN Trial)[7]	FIRST Investigators (FIRST Trial)[9]
Previous Surgery to Hip	Yes, shape-changing	Yes	Yes	Yes	Yes, shape-changing	Yes, either hip
Previous PT	NR	Within last 6 months	Within last 12 months to symptomatic hip	NR	NR	NR

Study, Year	Griffin, 2018 (UK FASHIoN Trial)[1]	Mansell, 2018[3]	Palmer, 2019 (FAIT Trial)[17]	Martin, 2024 (Martin Trial)[6]	Hunter, 2021 (Australian FASHIoN Trial)[7]	FIRST Investigators (FIRST Trial)[9]
Other	History of hip pathology such as Perthes' disease, slipped upper femoral epiphysis, or avascular necrosis, or previous hip injury such as acetabular fracture, hip dislocation, or femoral neck fracture	Concurrent systemic disease (cancer, rheumatoid arthritis or systemic arthralgia/arthritis), pending litigation/workmen's compensation, moving or relocating within the following 6 months, clearing the lumbar spine reproduces the patient's hip symptoms, pregnancy	NR	Suspected septic arthritis, osteonecrosis, hemarthrosis, fractures of femoral head/neck, fractures of acetabulum, IT band syndrome, greater trochanteric pain syndrome, sacroiliac joint pain, piriformis syndrome, or radicular symptoms; Unexpected pathology at arthoscopy time (pigmented villonodular synovitis, avascular necrosis)	History of hip pathology such as Perthes' disease, slipped upper femoral epiphysis, or avascular necrosis, or previous hip injury such as acetabular fracture, hip dislocation, or femoral neck fracture	Previous inclusion in a study involving FAI, presence of other hip syndromes, previous trauma to hip, severe acetabular deformities (acetabular protrusion, coxa profunda, circumferential labral ossification); immunosuppressant use; chronic pain syndromes, significant comorbidities affecting activities of daily living, history of pediatric hip disease (Legg-Calve-Perthes; slipped capital femoral epiphysis), ongoing litigation or compensation claims secondary to hip problems, any other reason given to exclude based on surgeon's judgement

CC = conservative care; LCEA = lateral center-edge angle; FAI = femoroacetabular impingement; FABER = flexion, abduction, and external rotation; FADIR = flexion, adduction, and internal rotation; mm = millimeter; MRA = magnetic resonance angiography; MRI = magnetic resonance imaging; NR = not reported; NSAID = non-steroid anti-inflammatory drug; OA = osteoarthritis; PT = physical therapy; UK = United Kingdom

Appendix Table E-3. Treatment details for FIRST trial (arthroscopy vs. lavage)

FIRST Trial (Ayeni, 2021)[9] N=220	Arthroscopy n=110	Lavage n=110
Femoral and Acetabular Osteochondroplasty	100%	0%
Labral Repair	79 (73%)	50 (47%)
Labral Debridement	Yes, % NR	Yes, % NR
Labral Resection	20 (19%)	20 (19%)
Labral Injection	59 (55%)	54 (51%)
Any Labral Tear	92 (85%)	91 (86%)
Complete Labral Tear	----	----
Partial Labral Tear	----	----
Partial Capsulotomy	87 (81%)	77 (73%)
Complete Capsulotomy	20 (19%)	21 (20%)
Capsular Closure	33 (31%)	14 (13%)
Operation time (mins.), median (IQR)	90 (60-115)	52 (35-70)
Number of post-surgery PT-sessions, median (range)	1/week for 1 month, then 2/week for 1 month, then 3/week for 1 month	1/week for 1 month, then 2/week for 1 month, then 3/week for 1 month
High fidelity of surgery	NR	NR

IQR = interquartile range, NR = not reported, PT = physical therapy

Appendix Table E-4. Treatment details for RCTs: Arthroscopy

Trial (Author, year) Total N	UK FASHION trial (Griffin 2018)[1] N=348	FAIT trial (Palmer 2019)[17] N=222	Mansell 2018[3] N=80	Martin Trial (Martin 2021, Martin 2024)[5,6] N=110[‡‡]	Australian FASHIoN Trial (Hunter, 2021)[7] N=99
Sample Size (Arthroscopy)	n=171 randomized; 142[*] treated	n=99	n=40 randomized; 65 treated	n=46, 43 treated	n=49, 47 treated
Femoral Osteochondroplasty	-----	66 (67%)	-----	-----	-----
Femoroplasty[†]	105 (74%)	-----	Yes, % NR	Yes, % NR	-----
Acetabular Osteochondroplasty	-----	5 (5%)	-----	-----	-----
Acetabuloplasty[‡]	8 (6%)	-----	Yes, % NR	-----	-----
Femoral and Acetabular Osteochondroplasty	-----	19 (19%)	-----	-----	Yes, % NR
Femoral and Acetabular Osteoplasty[§]	26 (18%)	-----	-----	-----	Yes, % NR
Chondral Microfracture	21 (15%)	9 (9%)	-----	Yes, % NR	-----
Chondroplasty	29 (20%)	-----	-----	-----	-----
Chondral Debridement	10 (7%)	-----	-----	-----	-----
Labral Procedure Only	-----	9 (9%)[**]	-----	-----	-----
Labral Repair	35 (25%)	70 (71%)	Yes, % NR	Yes, % NR	Yes, % NR
Labral Debridement	57 (40%)	25 (25%)	Yes, % NR	-----	-----
Labral Resection	5 (4%)	-----	-----	-----	-----
Labral Thermal Shrinkage	29 (20%)	-----	-----	-----	-----
No Labral Procedure	-----	4 (4%)	-----	-----	-----
Any Labral Tear	Yes, % NR	Yes, % NR	Yes, % NR	100%	Yes, % NR
Complete Labral Tear	-----	-----	-----	-----	-----
Partial Labral Tear	-----	-----	-----	-----	-----
Partial Capsulotomy	-----	-----	-----	100%	-----
Complete Capsulotomy	-----	-----	-----	-----	-----

Trial (Author, year) Total N	UK FASHION trial (Griffin 2018)[1] N=348	FAIT trial (Palmer 2019)[17] N=222	Mansell 2018[3] N=80	Martin Trial (Martin 2021, Martin 2024)[5,6] N=110‡‡	Australian FASHIoN Trial (Hunter, 2021)[7] N=99
Capsular Closure	-----	-----	-----	-----	-----
Operation time (mins.), median (range)	-----	55, IQR 45-80 (22-160)	NR††	-----	-----
Number of post-surgery PT-sessions, median (range)	Received PT, details NR	4, IQR 2.5-6 (1-14)	Yes, % NR	Minimum 1/week, 24 weeks	PT was recommended but not required, details NR
High fidelity of surgery	Satisfactory: 86.8% (105/121) Inadequate: 13.2% (16/121) due to: • Inadequate bony resection [proximal femur: 5.8% (7/121) • Acetabular rim: 1.7% (2/121) • Sharp transition from femoral head to neck: 4.1% (5/121) • No reshaping due to degenerative hip: 1.7% (2/121)	NR	NR	NR	Satisfactory: 72.3% (34/47) Inadequate: 14.9% (7/47) due to: • Head not spherical: 2.1% (1/47) • No bony resection: 10.6% (5/47) • Degenerative hip: 2.1% (1/47) Missing: 12.8% (6/47)

IQR = interquartile range, NR = not reported, PT = physical therapy
* 144 patients (of 171) received their surgery within 12 months of randomization. Operation notes were available for review in 142 patients.
† cam only resection
‡ pincer only resection
§ combined cam and pincer resection
** 3 individuals had a higher degree of osteoarthritis than expected and 6 had no signs of impingement once procedure was performed and thus only received labral treatment.
††Typical surgery time is approximately 2 h in duration; surgery time may fluctuate up to 60 min depending on the complexity of the surgery
‡‡Treatment may also include intermittent traction, joint lavage, bone marrow aspirate injection, and electrocautery

Appendix Table E-5. Treatment details for RCTs: physical therapy

Trial (Author, year) Total N	UK FASHION trial (Griffin 2018)[1] N=348	FAIT trial (Palmer 2019)[17] N=222	Mansell 2018[3] N=80	Martin Trial (Martin 2021, Martin 2024)[5,6] N=110	Australian FASHIoN Trial (Hunter, 2021)[7] N=99
Sample Size (PT)	n=177 randomized; 168 treated*	n=96	n=40 randomized, 39 treated	n=44, 40 treated	n=50, 50 treated
Individualized	Yes	Yes	Yes	Yes	Yes
Supervised	Yes	Yes	Yes	Yes	Yes
Home-therapy component	Yes	NR	Yes	Yes	Yes
Therapy components	(1) Assessment of pain, function, and range of hip motion; (2) Patient education; (3) Progressive exercise (4) Help with pain relief when pain prevents performance of the exercise program§	(1) Muscle strengthening to improved core stability and movement control; (2) Encouraged to avoid impingement positions (extremes of hip flexion, abduction, internal rotation)	(1) Joint mobilizations (2) Mobilization with motion (3) Therapeutic exercise (4) Soft tissue mobility (5) Stretching (6) Motor control exercises (7) Hip mobilization (8) Other treatment interventions implemented at the discretion of the physical therapist	(1) Manual therapy (2) Postural re-education (3) Home exercise program (4) Hydrotherapy (5) Progressive hip strength training (6) functional strengthening (7) Hip ROM movements (8) Core control program (9) Biking/elliptical (10) Proprioception/balance exercises (11) Flexibility movements (12) Pain control (TENS, kinesiotaping, ice, cold pack)	(1) Assessment of pain, function, and range of hip motion (2) Progressive exercise (3) Patient education (4) Advice on pain relief
Number of sessions attended	≥6: 64% (n=100) Range, 6-10	Median 6 (IQR 4-8); Range, 1-8	12 sessions	≥1 in-person visit per week, 24 weeks total	Minimum 6, Maximum 10

Trial (Author, year) Total N	UK FASHION trial (Griffin 2018)[1] N=348	FAIT trial (Palmer 2019)[17] N=222	Mansell 2018[3] N=80	Martin Trial (Martin 2021, Martin 2024)[5,6] N=110	Australian FASHIoN Trial (Hunter, 2021)[7] N=99
Duration of first session (mins.)	NR	Median 60 (IQR 60-60); Range, 30-95	45	NR	NR
Duration of follow-up sessions (mins.)	Mean 30 (SD 11)†	Median 30 (IQR 30-30); Range, 20-60	45	NR	NR
Fidelity/adherence	70% (n=107) received PT to a high fidelity; reasons for low fidelity were: • <6 therapy sessions, 22% (n=34) • No progression of exercise, 7% (n=11) Non-compliance with exercise program, 1% (n=2)	NR	NR	NR	Satisfactory: 82.0% (41/50) Inadequate: 12.0% (6/50) due to: • <6 contacts w/ physiotherapist: 6.0% (3/50) • Treatment period >6 months: 4.0% (2/50) • Non-protocol treatment (ultrasound): 2.0% (1/50) Missing: 6.0% (3/50)

IQR = Interquartile range; NR = not reported; PT = physical therapy, ROM = range of motion, TENS = transcutaneous electrical nerve stimulation

* 14 of 168 received most or all of the personalized hip therapy sessions and then went on to receive hip arthroscopy per their request. 9 patients received no treatment.

† With the first assessment and treatment session usually lasting longer.

Appendix Table E-6. Function, Pain, and Quality of Life in Pediatric Populations Undergoing Operative Treatment for FAIS.

Outcome	Study	N	Mean Age	Mean F/U(Years)	Athletes	Mean Baseline (SD)	Mean Follow-up (SD)	% meeting MCID
mHHS	Barastegui, 2023[18*]	14	15	3.2	NR	48.53 (17.9)	97.07 (2.9)	NR
	Beck, 2021[19*]	85	18	5	76.2%	58.9 (13.3)	85.1 (15.9)	80%
	Byrd 2016a[20]	108	15.9	2.5	96%	68.3 (12.7)	94.3 (6.7)	NR
	Byrd 2016b[21*]	104	16	3.2	100%	69 (NR)	94 (NR)	NR
	Chandrasakeran, 2017[22*]	90	16	2.6	NR	64.5 (10.5)	89.6 (10.5)	NR
	Cvetanovich 2018[23*]	37	17	≥2 years	81%	58.1 (14.2)	82.1 (9.3)	84%
	Degen 2017[24]	32	16	3	NR	63.8 (14)	86 (14.1)	NR
	Fabricant 2012[25]	21	17.6	≥1 year	100%	67 (NR)	88 (NR)	NR
	Fukase, 2022[26*]	157	17	8.9	NR	58.3 (11.1)	93.7 (17.8)	85%
	Guindani, 2017[27†]	51	14	3	NR	73 (20)	92 (6.3)	NR
	Larson 2019[28]	28	15.9	3.3	100%	66.8 (NR)	94.5 (NR)	81.1%
	Litrenta, 2019[29]	43	16.1	2	NR	65.1 (16.7)	91.9 (8)	NR
	Litrenta, 2020[30*]	81	15.9	2	100%	64.6 (15.9)	88.1 (12.3)	84%
	Maldonado, 2022[31*†]	10	19	2	NR	63.9 (17.8)	88.3 (16)	70%
	Maldonado, 2023[32*]	249	16	2.2	NR	56.7 (21.4)	77.1 (26)	71.7%
	Morris, 2024[33*†]	27	16	1	NR	57 (16.7)	84.7 (19.7)	74.1%
	Newman, 2016[34*]	84	16	3.5	NR	57.5 (16)	55.3 (15)	NR
	Novais 2016[35†]	17	15.5	1.8	100%	52.8 (10.5)	92 (10.5)	NR
	Nwachukwu, 2017[36*]	47	16	1	NR	61.6 (15.3)	90 (10.5)	85%
	Philippon, 2008[37]	16	15	1.4	100%	55 (9.3)	90 (7.5)	NR
	Philippon, 2012[38]	55	15	3	100%	57 (20.81)	91 (11.35)	NR
	Ruzbarsky, 2023[39*]	123	16.4	≥2	NR	59 (15)	90 (13)	84.6%
	Saks, 2022[40*]	50	19.5	3	100%	66.1 (13.1)	87.8 (14.5)	76.6%
	Schaefer, 2026[41]	19	17	9.8	100%	68.5 (33.2)	90.5 (11.5)	100%
	Serbin, 2023[42*†]	55	16	2	85.7%	64.3 (16)	90 (12.8)	NR
	Sink 2013[43†]	44	16	2.25	NR	57.7 (19.2)	85.8 (17.37)	NR
	Tran 2013[44*]	34	15.7	≥1	94%	77.39 (18.68)	94.15 (11.99)	NR

Outcome	Study	N	Mean Age	Mean F/U(Years)	Athletes	Mean Baseline (SD)	Mean Follow-up (SD)	% meeting MCID
HOS-Sport	Barastegui, 2023[18*]	14	15	3.2	NR	48.5 (17.9)	94.9 (3.2)	NR
	Beck, 2021[19*]	85	18	5	76.2%	47.3 (20.9)	83.8 (19.6)	81.3%
	Chandrasakeran, 2017[22*]	90	16	2.6	NR	46.6 (21.5)	92.1 (10)	NR
	Cvetanovich 2018[23*]	37	17	≥2 years	81%	45.9 (21.8)	86.9 (16.3)	97%
	Degen 2017[24]	32	16	3	NR	52.2 (21.9)	85.7 (15.7)	NR
	Fabricant 2012[25]	20	17.6	≥1 year	100%	49 (NR)	82 (NR)	NR
	Fukase, 2022[26*†]	157	17	8.9	NR	46 (28.2)	91.3 (14.8)	88%
	Litrenta 2019[29]	43	16.1	2	NR	48.5 (25)	85.3 (16.3)	NR
	Litrenta, 2020[30*]	81	15.9	2	100%	45.1 (23.4)	82.5 (19.2)	NR
	Maldonado, 2022[31*†]	10	19	2	NR	39.1 (24.3)	71 (29)	60%
	Maldonado, 2023[32*]	249	16	2.2	NR	48.1 (21.4)	82.6 (23)	68.1%
	Newman, 2016[34*]	84	16	3.5	NR	46.3 (23)	79.9 (21)	NR
	Nwachukwu, 2017[36*]	47	16	1	NR	55.2 (21.5)	91 (13.3)	85%
	Philippon, 2008[37]	16	15	1.4	100%	33 (19.5)	89 (10.5)	NR
	Philippon 2012[38]	55	15	3	100%	38 (22.25)	82 (18)	NR
	Ruzbarsky, 2023[39*]	123	16.4	≥2	NR	50 (21)	87 (20)	73.1%
	Saks, 2022[40*]	50	19.5	3	100%	44.5 (22.1)	78.9 (23)	76.1%
	Schaefer, 2026[41]	19	17	9.8	100%	NR	91.1 (12.1)	100%
HOS-ADL	Barastegui, 2023[18*]	14	15	3.2	NR	76.3 (10.9)	97.7 (1.5)	NR
	Beck, 2021[19*]	85	18	5	76.2%	68.9 (18.3)	90.5 (13.3)	70.3%
	Chandrasakeran, 2017[22*]	90	16	2.6	NR	66.1 (20.1)	92.1 (10.3)	NR
	Cvetanovich 2018[23*]	37	17	≥2 years	81%	66.3 (18.4)	92.2 (10.1)	81%
	Degen 2017[24]	33	16	3	NR	74.5 (18.1)	93.1 (8.4)	NR
	Fabricant 2012[25]	21	17.6	≥1 year	100%	77 (NR)	88 (NR)	NR
	Fukase, 2022[26*†]	157	17	8.9	NR	68.7 (20)	96 (7.4)	83%
	Newman, 2016[34*]	84	16	3.5	NR	65.9 (17)	87.4 (15)	NR
	Nwachukwu, 2017[36*]	47	16	1	NR	72.3 (19.1)	95.7 (5.6)	79%

Outcome	Study	N	Mean Age	Mean F/U(Years)	Athletes	Mean Baseline (SD)	Mean Follow-up (SD)	% meeting MCID
	Philippon, 2008[37]	16	15	1.4	100%	58 (9.5)	94 (6.5)	NR
	Ruzbarsky, 2023[39*]	123	16.4	≥2	NR	68 (16)	94 (9)	80.8%
	Schaefer, 2026[41]	19	17	9.8	100%	73.9 (25.9)	94.5 (7.1)	100%
NAHS	Chandrasakaran, 2017[22*]	90	16	2.6	NR	65.3 (16.2)	89.9 (13.4)	NR
	Guindani 2017[27†]	51	14	3	NR	73 (13)	86 (16)	NR
	Litrenta, 2019[29]	43	16.1	2	NR	69.3 (19.1)	91.9 (8.7)	NR
	Litrenta, 2020[30*]	81	15.9	2	100%	66.8 (17.9)	89.8 (11.4)	NR
	Maldonado, 2022[31*†]	10	19	2	NR	59.8 (17.3)	84.7 (13.6)	60%
	Maldonado, 2023[32*]	249	16	2.2	NR	65.3 (16.4)	89 (14.9)	83%
	Saks, 2022[40*]	50	19.5	3	100%	65.4 (17.1)	89.2 (12.3)	NR
	Tran 2013[44*]	34	15.7	≥1	94%	76.3 (16.8)	93.2 (13.3)	NR
iHOT-12	Beck, 2021[19 *]	85	18	5	76.2%	37.5 (17.2)	74.3 (26.6)	75%
	Litrenta, 2020[30]	81	15.9	2	100%	NR	80.7 (20.6)	NR
	McConkey, 2019[45]	24	16	2	100%	49 (19.7)	67 (17.9)	NR
	Maldonado, 2023[32*]	249	16	2.2	NR	47.9 (22.9)	83.6 (20.6)	79.5%
	Saks, 2022[40]	50	19.5	3	100%	79.2 (23.4)	80.2 (23.1)	NR
IHOT-33	Degen, 2017[24]	25	16	3	NR	43.1 (16.3)	73.6 (20.8)	NR
	Nwuchukwu, 2017[36]	47	16	1	NR	40.6 (15.3)	84.6 (16.2)	94%
HOOS Symptoms	Serbin, 2023[42†]	17	15.5	1.8	85.7%	35 (18.8)	80 (13.8)	NR
	Novais, 2016[35†]	55	16	2	100%	62.6 (21.7)	85.7 (17.9)	NR
HOOS Pain	Serbin, 2023[42†]	17	15.5	1.8	85.7%	37.5 (20)	92.5 (9.3)	NR
	Novais, 2016[35†]	55	16	2	100%	54.8 (18.8)	87.4 (17.7)	NR
HOOS ADL	Serbin, 2023[42†]	17	15.5	1.8	85.7%	47.1 (19)	97.1 (8.8)	NR
	Novais, 2016[35†]	55	16	2	100%	63.4 (20)	90.5 (14.3)	NR
HOOS Sport	Serbin, 2023[42†]	17	15.5	1.8	85.7%	18.8 (22)	87.5 (18.8)	NR
	Novais, 2016[35†]	55	16	2	100%	43.9 (24.4)	82 (21.6)	NR
HOOS QoL	Serbin, 2023[42†]	17	16	2	85.7%	39.7 (19.1)	81.8 (15.8)	NR
	Novais, 2016[35†]	55	15.5	1.8	100%	18.8 (18.8)	75 (20.3)	NR

Outcome	Study	N	Mean Age	Mean F/U(Years)	Athletes	Mean Baseline (SD)	Mean Follow-up (SD)	% meeting MCID
VAS Pain	Beck, 2021[19 *]	85	18	5	76.2%	6.8 (1.9)	2.4 (2.9)	NR
	Chandrasakeran, 2017[22*]	90	16	2.6	NR	6.1 (2.2)	2.2 (2)	NR
	Larson 2019[28]	28	15.9	3.3	100%	5.9 (NR)	1.2 (NR)	NR
	Litrenta 2019[29]	43	16.1	4.2	NR	5.3 (2.6)	1.2 (1.5)	NR
	Litrenta, 2020[30*]	81	15.9	2	100%	5.5 (2.6)	1.6 (1.9)	NR
	Maldonado, 2022[31*†]	10	19	2	NR	5.9 (2.4)	2.7 (2.4)	80%
	Maldonado, 2023[32*]	249	16	3	NR	5.5 (2.3)	1.6 (2.0)	NR
	Saks, 2022[40*]	50	19.5	3	100%	5.8 (2.3)	1.8 (2.1)	NR
	Schaefer, 2026[41] (at rest)	19	17	9.8	100%	4.9 (2)	1.3 (1.9)	NR
SF-12 PCS	Guindani, 2017[27†]	51	14	3	NR	47 (3)	50 (1.6)	NR
	Newman, 2016[34]	84	16	3.5	NR	39 (9)	51.8 (8)	NR
	Ruzbarsky, 2023[39]	123	16.4	≥2	NR	41.8 (8.8)	55.1 (5.7)	NR
	Sink 2013[43†]	44	16	2.25	NR	42.4 (9.5)	50.5 (8.5)	NR
SF-12 MCS	Ruzbarsky, 2023[39]	123	16.4	≥2	NR	54.4 (8.9)	53.2 (7.7)	NR
	Sink 2013[43†]	44	16	2.25	NR	51.9 (7.7)	53.9 (10.5)	NR

ADL = activities of daily living; HOOS = Hip Disability Osteoarthritis and Outcomes Score; HOS = Hip outcome score; iHOT = international Hip Outcomes Tool; MCS = mental component score; mHHS = modified Hip Harris Score; MCID = minimal clinically important difference; NAHS = Non-arthritic Hip Score; NR = not reported; PCS = physical component score; QoL = quality of life; SD = standard deviation; VAS = visual analogue scale

* Reported in Rathore 2025

† Studies that reported on interventions other than arthroscopy included open surgery (Guindani, 2017; Novais, 2016; Sink, 2013), arthroscopic hip labral reconstruction (Maldonado, 2022), and combined arthroscopic and/or open surgery (Morris, 2024; Serbin, 2023).

Appendix F. Additional Information from Economic Studies

Appendix Table F-1. Summary of Included Full Economic Studies.

Author, year	Yan, 2024[14]	Griffin 2018[1]	Mather 2018[12]	Shearer 2012[13]
Population	Mean age: 36 years Gender: 38% patients presenting with a documented period of failed non-operative management (≥6 months) with cam- or mixed-type FAIS diagnosed using radiography/MRI and obtained temprorary pain relief from a diagnostic intra-articular hip injection. One patient in each group crossed over, authors do not describe how or if this is incorporated into the model.	Mean Age: 35.3 years Gender: 39% female RCT based: 171 surgery; 177 PT Presenting hip pain w/ radiographic evidence of cam or pincer morphology no osteoarthritis Allowed crossover (7.3% to surgery). Authors do not describe how or if this is incorporated into the model.	Mean Age: 33 years Gender: 70% female Mean F/U: 15 months “noncontroversial indications for surgery” Tönnis grade 0 or 1 and no more than mild hip dysplasia (<20% angle) All patients underwent 6 weeks non-operative treatment prior to start No crossover	Mean Age: 36 years Gender: NR Weighted average of 5 reviewed surgical case series with “symptomatic FAIS” from 2008 to 2010 Patients assumed to progress to poor hip function at a rate of 3.3% per year (33% over 10 years) Assumed benefit of arthroscopy only lasted 3 years No crossover
Intervention	Osteochondroplasty (with or without labral repair)	Hip arthroscopy	Hip arthroscopy	Hip arthroscopy
Comparator	Arthroscopic lavage (with or without labral repair)	Personalized Hip Therapy (12-24 weeks) best conservative care	Non-operative: oral NSAIDs, activity modification, physical therapy and corticosteroid injection	Observation followed by THA if progresses to end stage arthritis
Country	Canada	UK	USA	USA
Funding	Government	Government	Industry	Funding unclear Reports no conflicting interest

Author, year	Yan, 2024[14]	Griffin 2018[1]	Mather 2018[12]	Shearer 2012[13]
Study design	CUA	CUA	CUA	CUA
Perspective	Canadian public payer	Societal (UK National Health Service)	Societal	Hospital or payer (unclear)Direct procedural cost only
Time horizon	Lifetime	1 year	10 year model; data from case series and patient surveys collected over 1 year	Lifetime model using small number (N= 10) of "recent cases" for cost estimates
Analytic model	Markov cohort state-transition model 8 state model	Micro-costing/sampling direct costs	Markov decision tree 5 state model	Markov decision tree 8 state model
Effectiveness outcome	QALY	QALY	QALY	QALY
Effectiveness outcome components	EQ-5D-3L (for reoperation) Progression to THA Disutility: Reoperation 0.05 THA 0.1	EQ5D-3l EQ5d-5L SF-12	Utility: (Unvalidated methods) FAIS 0.75 Post-surgical complications 0.5 primary THA 0.9 Post-arthroscopy 0.94 Disutility: Arthroscopy -0.05 Arthroplasty -0.10 Revision arthroplasty -0.12	Modified Harris Hip Score that included both pain and function scores. Used linear extrapolation to generate utility values. (Unvalidated) Utility: FAIS 0.75 Primary THA 0.9 Poor hip function 0.5 Fair hip function 0.75 Good hip function 0.94. Disutility: Arthroscopy -0.05 Arthroplasty -0.10 Revision arthroplasty -0.12 Arthroscopy complication rate 1.5%
Source for effectiveness data	RCT, published literature, and clinical experts	RCT	Relied heavily on expert opinion; published case series Published literature	Published case series

Author, year	Yan, 2024[14]	Griffin 2018[1]	Mather 2018[12]	Shearer 2012[13]
Costing year	2023	2016	2015	2010
Currency	CAD	Reported in Pounds converted to USD using $1 =£0.745*	USD	USD
Discounting	1.5%	None (short time horizon)	3%	3%
Components of cost data	Surgery Osteochondroplasty: $4,129 Lavage: $2,597 Reoperation: $5,045 THA: $9,681 Medication cost No operation: $72.56 Reoperation: $91.13 Progression to THA: $91.13 THA failed: $735.95	Resource use and Delivery of intervention Health services for F/U Lost productivity and societal impact	Arthroscopy: $14,363 Revision, Post-op Non-Operative: $1,669 annual Lost productivity: modeled	Arthroscopy: $11,850 THA: $24,200
Cost sources	RCT All costs were validated by clinical experts	RCT Micro-costing for surgery Personal Social Services Research Unit for PT Follow up care costs from NHS	PearlDiver Inc. (Insurance claim records) Expert panel consulted; survey of patients from surgery practices Survey results from National Health Interview Survey	A review of 10 procedures Cost-to-charge ratio to evaluate payments received.
Sensitivity analysis	One-way probabilistic	one-way sensitivity analysis (pre-specified and post hoc)	One, two and three-way, probabilistic	One, two-way, probabilistic
QHES	78	79	67	65
Cost / QALY of intervention	$7,792.5/QALY	$5,023/QALY	$23,120/8.52 = $2,7134/QALY	NR
Cost / QALY of comparator	$8,748.4/QALY	$2,055/QALY	$18,828/6.48 = $2,906/QALY	NR

Author, year	Yan, 2024[14]	Griffin 2018[1]	Mather 2018[12]	Shearer 2012[13]
ICER	osteochondroplasty (with or without labral repair) dominates lavage (with or without labral repair)	PT Dominates Arthroscopy Surgery is an additional: $3,184/-0.02 QALY	Arthroscopy Dominates Nonoperative care	$21,700/QALY
One-way SA	Osteochondroplasty (with or without labral repair) remained the dominant strategy, with the exception of 2 scenario: 1. When using a log-normal common-shape model for extrapolation, 2. A shorter time horizon (10 years).	Unadjusted model slightly favored surgery in QALY's generated With WTP = $67,114 there was a 0.08 probability that surgery was cost-effective Adjusting for sex, study site, impingement type, healthcare service surgery was significantly more expensive.	All variables robust with WTP of $100,000. Time horizon, cost of surgery and post-surgery productivity most sensitive variables. Costs are equal when procedure reaches $76,826 Looking at only direct costs yields an ICER or $2,751 Must change nonoperative rate of success to >90% AND reduce rate of recurrence of symptoms to <5% to make it dominant	Varying the durations of benefit to 13 months the ICER <$50,000/QALY Increasing cost of arthroscopy to $27,300 the ICER = $50,000/QALY With arthritis: ICER = 79,500/QALY ICER robust for wide range of cost and outcome of THA
Other SA	NR	In all post hoc sensitivity analyses PT dominated surgery while reasonably varying costs and assumptions behind utility measures	Probabilistic Monte Carlo simulations suggest arthroscopy CE in 99% of trials	Probabilistic Monte Carlo simulations suggest ICER <$50,000 in 85% of trials <$100,000 in 97%
Author's Conclusion	Over a lifetime time horizon, osteochondroplasty (with or without labral repair) is a cost-effective treatment strategy for young adults with FAIS.	Personalized hip therapy was more cost-effective than arthroscopy at 12 months. Cross over to surgery increases costs of PT group and makes surgery increasingly cost-effective	Arthroscopy greatly reduces the economic cost of FAI while contributing to improved quality of life. Acknowledges the importance of 6 to 12 weeks of nonoperative treatment before surgery.	Although data are limited, the model suggests that arthroscopy in FAI patients without OA may have a favorable ICER vs. other interventions; Uncertainty remains regarding the QoL, duration of benefits and effect on subsequent THA.

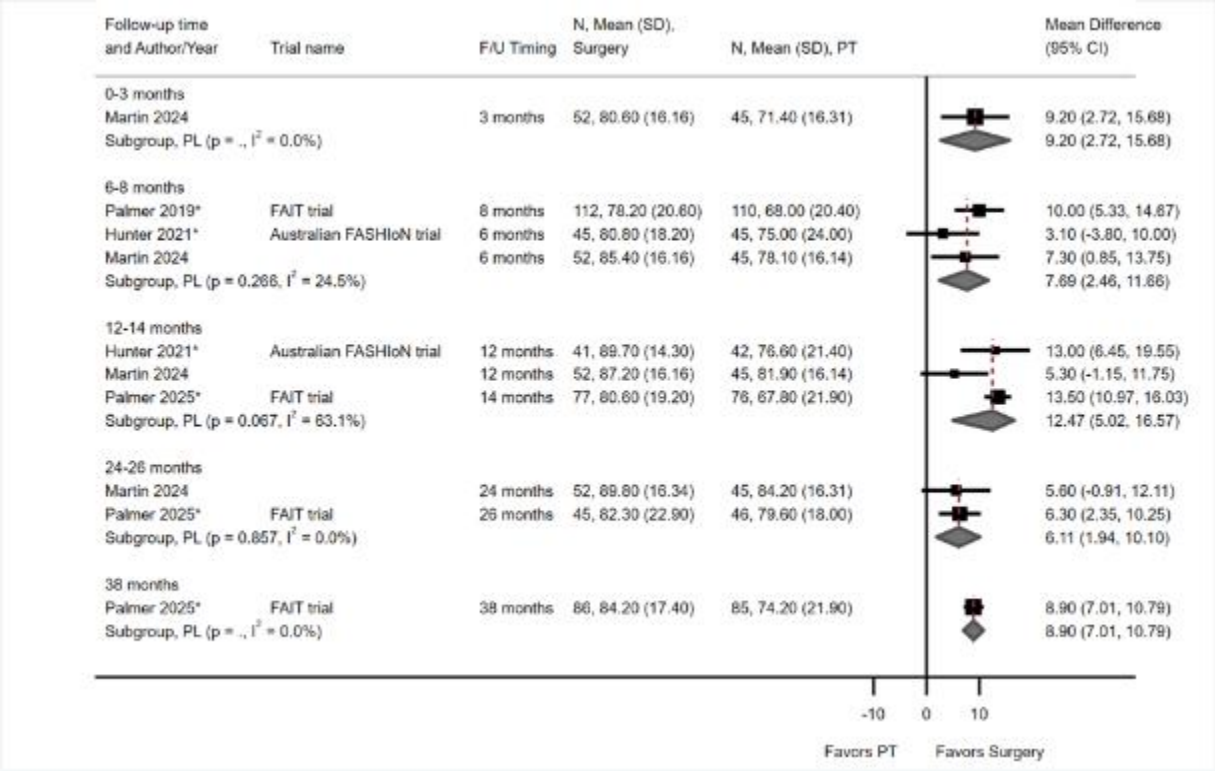
Author, year	Yan, 2024[14]	Griffin 2018[1]	Mather 2018[12]	Shearer 2012[13]
Limitations	Lifetime extrapolation beyond the 2-year FIRST trial, creating structural uncertainty. Long-term THA progression and model inputs informed by literature/expert opinion Canadian payer perspective; limited generalizability outside Canada Post-THA utilities derived from published literature rather than RCT data	UK based, applicability to US unclear Lack of clarity regarding handling of cross over Short term prevented from fully investigating long term risk - development of osteoarthritis, need for future surgeries, recurrent pain or recurrent labral tear	Sourcing of data for clinical benefits, transition probabilities, and abstraction poorly documented – relied heavily on expert opinion Direct patient data came from survey of 2 surgeons' practices – high likelihood of selection bias No data for non-op patients other than what was recalled by patients regarding their pre-op status Patient selection from high-volume hip arthroscopists Potential conflict of interest Unvalidated utility methods	Case series as primary source of clinical data; Uncertainty with input parameters such as the rate of progression of arthritis; rate of OA progression in treated and untreated FAI described as unknown Unvalidated utility methods Only considered direct costs; perspective is not clearly stated Relied on a single hospital cost with small sample of patients

CAD = Canadian dollar; CUA = cost utility analysis; FAIS = femoroacetabular impingement syndrome; F/U = follow-up; ICER = incremental cost-effectiveness ratio; NR = not reported; NSAIDS = non-steroidal anti-inflammatory drugs; OA = osteoarthritis; PT = physical therapy; QALY = quality adjusted life years; QoL = quality of life; RCT = randomized controlled trial; THA = total hip arthroplasty; UK = United Kingdom; USA = United States of America; USD = US dollars; WTP = willingness-to-pay threshold.

* Conversion rate based on Treasury Reporting Rates Of Exchange as of June 30, 2016

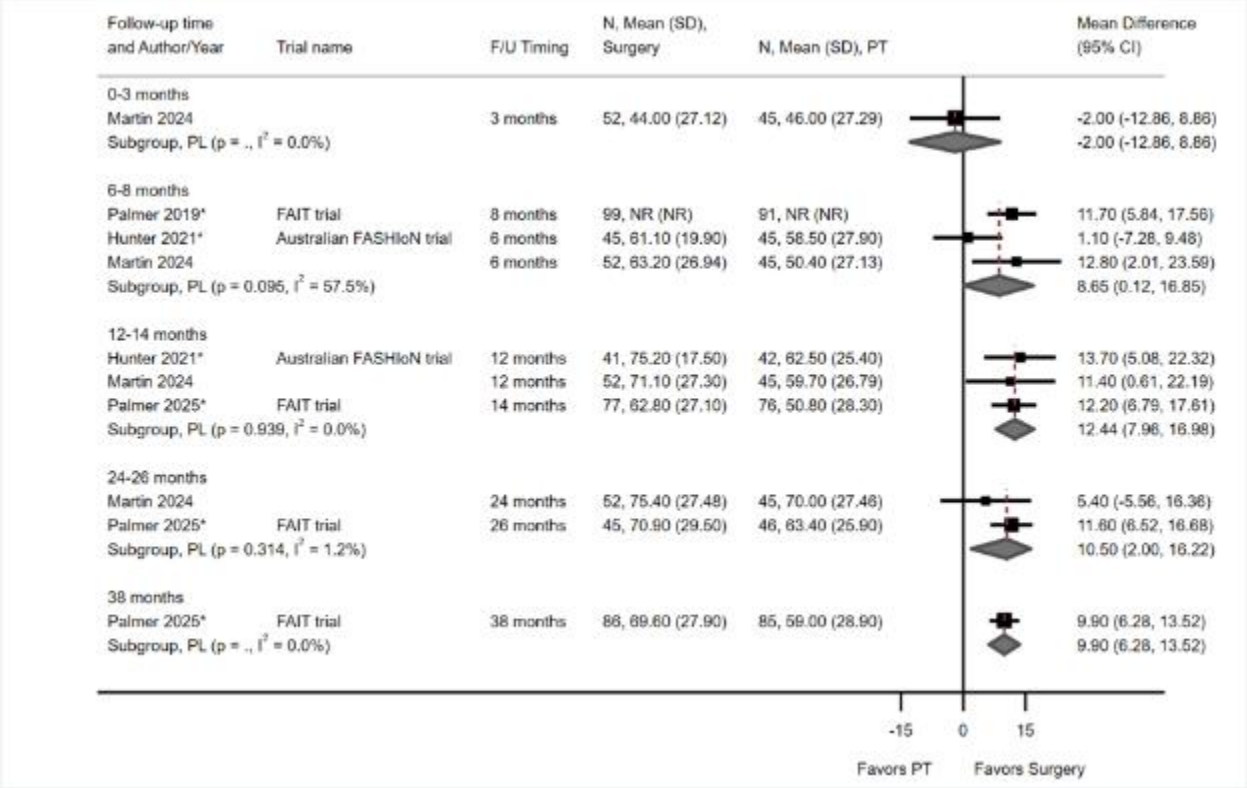
Appendix G. Additional Forest Plots

Appendix Figure G-1. HOS-ADL and HOOS-ADL Scores Following Hip Arthroscopy versus Physical Therapy in Adults with FAIS (excluding Mansell et al.).



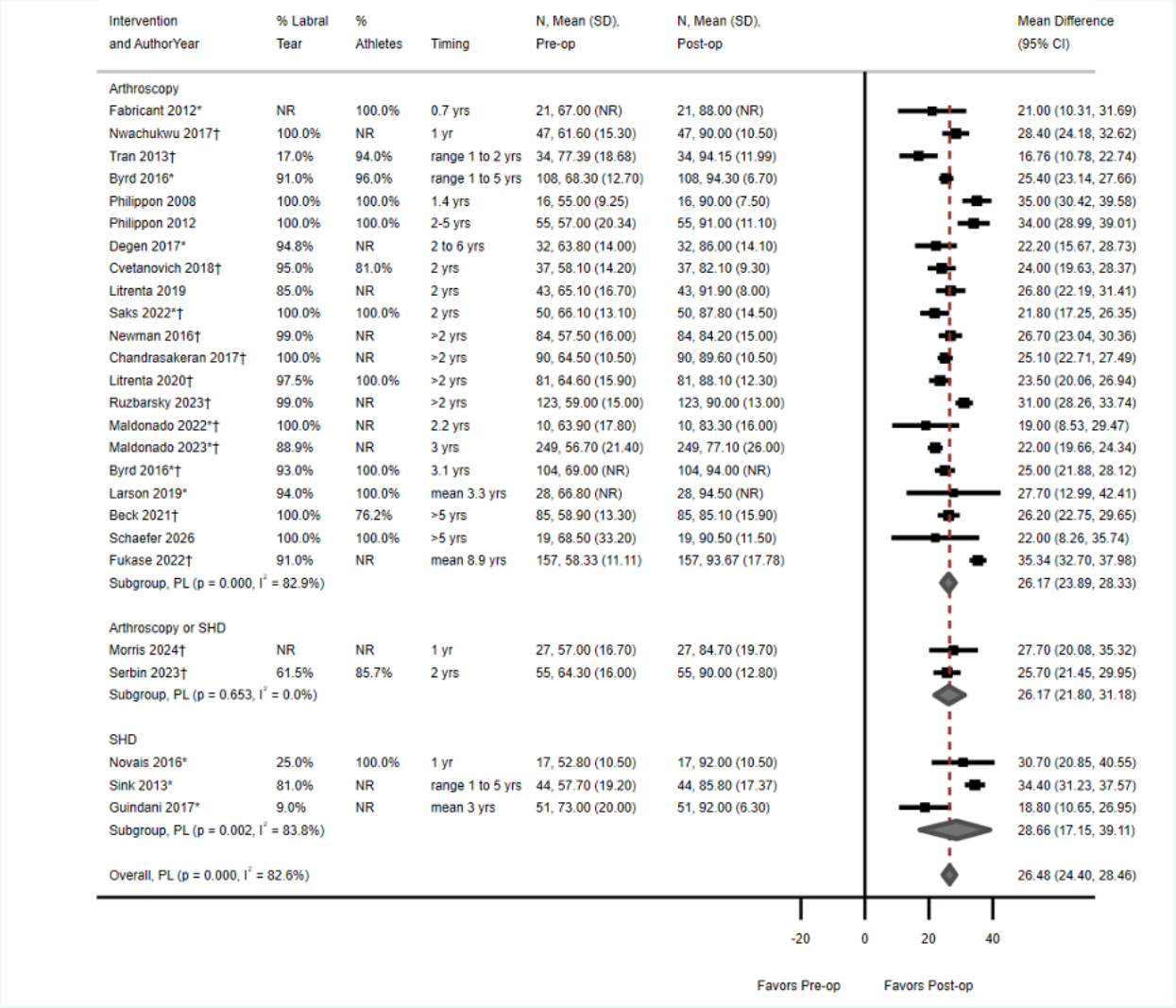
CI = confidence interval; F/U = follow-up; HOOS-ADL: Hip Disability and Osteoarthritis Outcome Score activities of daily living subscale; HOS ADL = Hip Outcome Score activities of daily living subscale; PL = profile likelihood; PT = physical therapy; SD = standard deviation.
NOTE: All trials used the HOS-ADL measure except for Hunter 2021 which used the HOOS-ADL.
* Adjusted MD as reported by authors. Palmer 2019/2025 is adjusted for gender, age at randomization and the baseline value, using mixed-effects model. Hunter 2021 is based on regression model including adjustment for baseline.

Appendix Figure G-2. HOS-Sport and HOOS-Sport Scores Following Hip Arthroscopy versus Physical Therapy in Adults with FAIS (excluding Mansell et al.).



CI = confidence interval; F/U = follow-up; HOOS-Sport: Hip Disability and Osteoarthritis Outcome Score sports subscale; HOS Sport = Hip Outcome Score sports subscale; PL = profile likelihood; PT = physical therapy; SD = standard deviation.
NOTE: All trials used the HOS-Sport measure except for Hunter 2021 which used the HOOS-Sport.
* Adjusted MD as reported by authors. Palmer 2019/2025 is adjusted for gender, age at randomization and the baseline value, using mixed-effects model. Hunter 2021 is based on regression model including adjustment for baseline.

Appendix Figure G-3. mHHS Change from Baseline Following Operative Treatment in Adolescents with FAIS (excluding Barastegui, 2023).



CI = confidence interval; NR = not reported; PL = profile likelihood; SD = standard deviation; SHD = surgical hip dislocation
* MDs and 95% CIs as reported in individual study.
† Study included within Rathore 2025.

Appendix H. Diagnostic Accuracy Analyses (from 2019 report)

Appendix Table H-1. Summary of Diagnostic Accuracy Evidence: SRs (from 2019 report)

Study details and conclusions	Diagnosis Tests (studies, N, referent)	Sensitivity % (95% CI)	Specificity % (95% CI)	Other Outcomes (95% CI)
SR: Clinical tests Reiman (2015) AMSTAR score: Low ROB MRA Surgery 9 studies of FAI/ALT in pooled analysis reported here; 2 were prospective; all high risk of bias based on QUADAS Conclusion: Due to poor study quality and biased sampling of patients with high disease probability, tests do not provide significant value in altering probability of disease. FADIR and Flex-IR are supported by data as valuable screening tests. However, data supporting them are from retrospective studies at high risk of bias. Little difference in pre vs. post-test probabilities.	FADIR (n=4, N=188, MRA)	94% (95% CI 90% to 97%)	9% (95% CI 2% to 23%)	Pretest=84%, posttest=83%; PPV 83% (95% CI 77% to 89%); LR+ 1.02 (95% CI 0.96 to 1.08); LR-, 0.45 (95% CI 0.19 to 1.09)
	FADIR (n=4, N=319, surgery)	99% (95% CI 98% to 100%)	5% (95% CI 1% to 18%)	Pretest and posttest=90%; PPV 90% (95% CI 89% to 90%); LR+ 1.04 (95% CI 0.97 to 1.1); LR-, 0.14 (95% CI 0.02 to 0.9)
	Flexion IR (n=2, N=27, surgery)	96% (95% CI 81% to 99%)	25% (95% CI 1% to 81%)	Pretest=87%, posttest=90%; PPV 90% (95% CI 73% to 98%); LR+ 1.28 (95% CI 0.72 to 2.27); LR-, 0.15 (95% CI 0.01 to 1.99)

Study details and conclusions	Diagnosis Tests (studies, N, referent)	Sensitivity % (95% CI)	Specificity % (95% CI)	Other Outcomes (95% CI)
SR: Radiograph or other Imaging (continued) Reiman (2017) AMSTAR score: Low ROB Surgery 25 imaging studies for FAI/ALT* FAI Only (4 studies); ALT (22 studies); only 4 prospective studies **Conclusions:** Populations had high pre-test probabilities (high prevalence). For ALT, + findings ↑ probability of tear a minimal to small degree for MRI, MRA, US, moderate degree for CT); negative findings ↓ probability of ALT to minimal degree with MRI, US, small to moderate degree for MRA and moderate for CTA. Generalizability limited by high pre-test prevalence, wide CIs and study selection	FAI diagnosis: Cross-table lateral Xray; 1 (N=84)	NR	NR	Pre-test FAI probability (4 studies): 74% (95%CI 51%-91%). + test ↑ probability of FAI dx 41% (from 46% to 87%); (-) test ↑ odds of not having FAI 35% (from 54% to 89%).
	FAI diagnosis: 1.5T MRA; 1 (N=41)	NR	NR	Pre-test FAI probability (4 studies): 74% (95% CI 51%-91%). + test, probability of true + ↑15% (from 83% to 98%); (-) test probability of true (-) ↑64% (from 17% to 81%).
	FAI diagnosis: 3.0 T MRA; 1 (N=36)	NR	NR	Pre-test FAI probability (4 studies): 74% (95% CI 51%-91%). + test, probability of true + ↑6% (from 72% to 78%); (-) test probability of true (-) ↑47% (from 28% to 75%).

Study details and conclusions	Diagnosis Tests (studies, N, referent)	Sensitivity % (95% CI)	Specificity % (95% CI)	Other Outcomes (95% CI)
SR: Radiograph or other Imaging (continued) Reiman (2017) AMSTAR score: Low ROB Surgery 25 imaging studies for FAI/ALT* FAI Only (4 studies); ALT (22 studies); only 4 prospective studies **Conclusions:** Populations had high pre-test probabilities (high prevalence). For ALT, + findings ↑ probability of tear a minimal to small degree for MRI, MRA, US, moderate degree for CT); negative findings ↓ probability of ALT to minimal degree with MRI, US, small to moderate degree for MRA and moderate for CTA. Generalizability limited by high pre-test prevalence, wide CIs and study selection	FAI diagnosis: 4D-CT; 1 (N=30)	NR	NR	Pre-test FAI probability (4 studies): 74% (95% CI 51%-91%). Anterior impingement: + test, probability of true + ↑8% (from 90% to 98%); (-) test probability of true (-) ↑56% (from 10% to 75%). Posterior impingement: + test, probability of true + ↑20 (from 70% to 98%); (-) test probability of true (-) ↑61% (from 30% to 91%).
	Pooled results; ALT diagnosis: 1.5T MRI; 4 (n=181)	71% (95% CI 62% to 78%)	60% (95% CI 35% to 82%)	ALT pooled pre-test probability: 81% (95% CI 72%, 91%). (+) test: Pre=90%, Post=95% (88% to 98%). (-) test: Pre=10%, Post=19% (10% to 31%). LR+/LR-: 1.18 (0.69-2.1) / 0.78 (0.43-1.4).
	Pooled results; ALT diagnosis: 3.0T MRI; 2 (n=133)	72% (95% CI 62% to 80%)	76% (95% CI 57% to 89%)	ALT pooled pre-test probability: 81% (95% CI 72%, 91%). (+) test: Pre=76%, Post=90% (81% to 95%). (-) test: Pre=24%, Post=46% (32% to 60%). LR+/LR-: 2.03 (0.91-4.5) / 0.51 (0.35-0.73).

Study details and conclusions	Diagnosis Tests (studies, N, referent)	Sensitivity % (95% CI)	Specificity % (95% CI)	Other Outcomes (95% CI)
SR: Radiograph or other Imaging (continued) Reiman (2017) AMSTAR score: Low ROB Surgery 25 imaging studies for FAI/ALT* FAI Only (4 studies); ALT (22 studies); only 4 prospective studies **Conclusions:** Populations had high pre-test probabilities (high prevalence). For ALT, + findings ↑ probability of tear a minimal to small degree for MRI, MRA, US, moderate degree for CT); negative findings ↓ probability of ALT to minimal degree with MRI, US, small to moderate degree for MRA and moderate for CTA. Generalizability limited by high pre-test prevalence, wide CIs and study selection	Pooled results; ALT diagnosis: 1.5T MRA; 12 (n=517)	88% (95% CI 85% to 92%)	59% (95% CI 50% to 68%)	ALT pooled pre-test probability: 81% (95% CI 72%, 91%). (+) test: Pre=76%, Post=88% (85% to 90%). (-) test: Pre=24%, Post=63% (54% to 71%). LR+/LR-: 1.91 (1.2-3.2) / 0.20 (0.11-0.35).
	Pooled results; ALT diagnosis: 3.0T MRA; 4 (n=185)	89% (95% CI 82% to 95%)	79% (95% CI 61% to 92%)	ALT pooled pre-test probability: 81% (95% CI 72%, 91%). (+) test: Pre=75%, Post=93% (85% to 97%). (-) test: Pre=75%, Post=93% (85% to 97%). LR+/LR-: 3.21 (1.5-6.9) / 0.15 (0.07-0.31).
	Pooled results; ALT diagnosis: CTA; 4 (n=125)	91% (95% CI 83% to 96%)	89% (95% CI 74% to 97%)	ALT pooled pre-test probability: 81% (95% CI 72%, 91%). (+) test: Pre=70%, Post=95% (87% to 98%). (-) test: Pre=30%, Post=81% (65% to 91%). LR+/LR-: 6.28 (2.78-14.21) / 0.11 (0.06-0.21).
	Pooled results; ALT diagnosis: US; 2 (n=50)	66% (95% CI 48% to 81%)	65% (95% CI 38% to 86%)	ALT pooled pre-test probability: 81% (95% CI 72%, 91%). (+) test: Pre=67%, Post=79% (60% to 92%). (-) test: Pre=23%, Post=48% (27% to 68%). LR+/LR-: 1.86 (0.94-3.7) / 0.56 (0.32-0.99).

Study details and conclusions	Diagnosis Tests (studies, N, referent)	Sensitivity % (95% CI)	Specificity % (95% CI)	Other Outcomes (95% CI)
SR: Radiograph or other Imaging Saied (2017) SR Search AMSTAR score: Moderate ROB Surgery 12 studies for meta-analyses; Most at high risk of bias related to subject inclusion; most retrospective Author conclusions: MRI, dMRA and iMRA are useful for diagnosis of labral and chondral pathology in FAI with superior accuracy for dMRA. Accuracy was lower for the detection of chondral lesions compared to that for labral lesions.	Chondral and labral lesions in FAI: Conventional MRI. Labral: 3 (n=90); chondral: 3 (n=90).	Labral 86% (95% CI 76% to 94%); Chondral 76% (95% CI 65% to 85%)	Labral 83% (95% CI 36% to 100%); Chondral 72% (95% CI 57% to 84%)	NR
	Chondral and labral lesions in FAI: Direct MRA. Labral: 8 (N=NR); chondral: 8 (N=NR).	Labral 91% (95% CI 88%, 94%); Chondral 75% (95% CI 69% to 80%)	Labral 58% (95% CI 48%, 68%); Chondral 87% (95% CI 79% to 92%)	NR
	Chondral and labral lesions in FAI: Indirect MRA. Labral: 2 (N=NR); chondral: 2 (N=NR).	Labral not calculable; Chondral 72% (95% CI 47% to 90%)	Labral not calculable; Chondral 92% (95% CI 62% to 100%)	NR

ALT = acetabular labral tear; AMSTAR=A Measurement Tool to Assess Systematic Reviews; CI=confidence interval; CTA=computed tomography arthrography; FADIR=flexion adduction and internal rotation impingement test; FAI=Femoroacetabular Impingement; IR=internal rotation; LR=Likelihood ratio; MRA=magnetic resonance arthrogram; MRI=magnetic resonance imaging; NR=not reported; PPV=positive predictive value; ROB=risk of bias; US=ultrasound; vs.= versus.
*For inclusions study patient must have suspected hip pain related to FAI/ALT, have had ≥1 imaging and/or intraarticular injection for diagnosis and QUADAS score of ≥10.

Appendix Table H-2. Summary of Diagnostic Accuracy Evidence: Individual Studies of History and Clinical Tests (from 2019 report)

Author (year) Design Quality Study details and conclusions	Diagnosis Tests	Sensitivity % (95% CI)	Specificity % (95% CI)	Other Outcomes (95% CI)
Tijssen (2017) Retrospective High Risk of Bias Surgery (arthroscopy) N= 77 (79 hips); Intra-articular pathology n=78; Patients with pre-op PT screening scheduled for arthroplasty Age 37 years (SD 10.9)l groin pain 87% Sports 82% Symptom duration 3.2 years 89% (70/79) hips had labral pathology Author conclusions: In clinical practice absence of groin as main location of pain combined with a negative FABER test or the combination of a negative AIT and a negative FABER test are suggested to rule out the diagnosis of symptomatic FAI and/or labral pathology.	FAI and/or labral tear; Patient history: Groin primary pain location	87% (95% CI 77% to 93%)	100% (95% CI 5% to 100%)	LR+/LR-: Infinity / 0.13 (95% CI 0.07 to 0.23)
	Patient history: Clicking	57% (95% CI 45% to 68%)	100% (95% CI 31% to 100%)	LR+/LR-: Infinity / 0.43 (95% CI 0.34 to 0.56)
	Patient history: Giving way	28% (95% CI 19% to 40%)	100% (95% CI 5% to 100%)	LR+/LR-: Infinity / 0.72 (95% CI 0.62 to 0.83)
	Patient history: Locking	26% (95% CI 17% to 37%)	100% (95% CI 5% to 100%)	LR+/LR-: Infinity / 0.74 (95% CI 0.65 to 0.85)
	Patient history: Perceived stiffness	40% (95% CI 29% to 52%)	0% (95% CI 0% to 95%)	LR+/LR-: 0.40 (95% CI 0.3 to 0.52) / Infinity
	Patient history: Perceived mobility restriction	22% (95% CI 14% to 33%)	100% (95% CI 5% to 100%)	LR+/LR-: Infinity / 0.78 (95% CI 0.7 to 0.88)
	Physical tests: AIT	91% (95% CI 82% to 96%)	0% (95% CI 0% to 95%)	LR+/LR-: 0.91 (95% CI 0.85 to 0.98) / Infinity
	Physical tests: FABER	81% (95% CI 70% to 88%)	0% (95% CI 0% to 95%)	LR+/LR-: 0.81 (95% CI 0.72 to 0.9) / Infinity
	Physical tests: RSLR	21% (95% CI 13% to 32%)	0% (95% CI 0% to 95%)	LR+/LR-: 0.21 (95% CI 0.14 to 0.33) / Infinity

Author (year) Design Quality Study details and conclusions	Diagnosis Tests	Sensitivity % (95% CI)	Specificity % (95% CI)	Other Outcomes (95% CI)
This was a small retrospective study in a highly selected population. Sensitivities were high for many physical tests, but confidence intervals were often wide. Sensitivities were also high for combined parameters. For both physical tests and combined parameters the specificity was 0% for most.	Physical tests: Scour*	5% (95% CI 3% to 65%)	Infinity	LR+/LR-: Infinity / Infinity
	Physical tests: Fitzgerald test*	72% (95% CI 61% to 82%)	33% (95% CI 2% to 87%)	LR+/LR-: 1.08 (95% CI 0.48 to 2.45) / 0.83 (95% CI 0.16 to 4.41)
	Combined parameters: Groin pain + AIT + FABER + Fitzgerald*	97% (95% CI 90% to 100%)	0% (95% CI 0% to 69%)	LR+/LR-: 0.97 (95% CI 0.94 to 1.01) / Infinity
	Combined parameters: Groin pain + AIT + FABER	97% (95% CI 90% to 100%)	0% (95% CI 0% to 95%)	LR+/LR-: 0.97 (95% CI 0.94 to 1.01) / Infinity
	Combined parameters: Groin pain + AIT + Fitzgerald*	95% (95% CI 86% to 98%)	0% (95% CI 0% to 69%)	LR+/LR-: 0.95 (95% CI 0.9 to 1.0) / Infinity
	Combined parameters: Groin pain + FABER + Fitzgerald*	97% (95% CI 90% to 100%)	0% (95% CI 0% to 69%)	LR+/LR-: 0.97 (95% CI 0.94 to 1.01) / Infinity
	Combined parameters: Groin pain + FABER	97% (95% CI 90% to 100%)	0% (95% CI 0% to 95%)	LR+/LR-: 0.97 (95% CI 0.94 to 1.01) / Infinity
	Combined parameters: Groin pain + Fitzgerald*	91% (95% CI 81% to 96%)	33% (95% CI 2% to 87%)	LR+/LR-: 1.36 (95% CI 0.61 to 3.04) / 0.28 (95% CI 0.04 to 2.07)
	Combined parameters: AIT + FABER + Fitzgerald*	97% (95% CI 90% to 100%)	0% (95% CI 0% to 69%)	LR+/LR-: 0.97 (95% CI 0.94 to 1.01) / Infinity
	Combined parameters: AIT + FABER	97% (95% CI 90% to 100%)	0% (95% CI 0% to 95%)	LR+/LR-: 0.97 (95% CI 0.94 to 1.01) / Infinity
	Combined parameters: AIT + Fitzgerald*	93% (95% CI 85% to 98%)	0% (95% CI 0% to 69%)	LR+/LR-: 0.93 (95% CI 0.88 to0.99) / Infinity

Author (year) Design Quality Study details and conclusions	Diagnosis Tests	Sensitivity % (95% CI)	Specificity % (95% CI)	Other Outcomes (95% CI)
	Combined parameters: FABER + Fitzgerald*	91% (95% CI 81% to 96%)	0% (95% CI 0% to 69%)	LR+/LR-: 0.91 (95% CI 0.85 to 0.98) / Infinity

AIT = Anterior Impingement test; ALT = Acetabular Labral Tear; ALT = acetabular labral tear; CI = confidence interval; FABER = flexion adduction external rotation test; FADDIR = flexion-adduction-internal rotation impingement test; FAI = femoroacetabular impingement; LR = Likelihood ratio; PT = physical therapy; RSLR = resisted straight leg test; SD = standard deviation.

* Test only applicable in labral pathology.

Appendix Table H-3. Summary of Inter-rater Reliability Coefficients for Hip Tests Commonly Utilized in Diagnosing FAIS (from 2019 report)

Studies Included Author, year (ROB)	Examination	Overall raw agreement (95% CI)
Ratzlaff 2013 (moderately low) Population: N=12; mixed FAI and healthy hips Test condition: 2 rheumatologists and 7 physiotherapists with varying experience in musculoskeletal practice and examination of FAI.	Log roll test, pain	0.99 (0.96–1.00)
	FABER test, pain	0.84 (0.75–0.95)
	Hip IR, pain	0.84 (0.74–0.96)
	Posterior impingement test	0.81 (0.69–0.94)
	Flexion 120°/adduction/IR pain	0.78 (0.68–0.92)
	Anterior impingement test	0.76 (0.66–0.91)
	Flexion 90°/adduction/compression pain	0.70 (0.59–0.87)
	Flexion 120°/adduction/compression pain	0.69 (0.61–0.85)
	Flexion 90°/adduction/IR ROM	0.67 (0.60–0.83)
	Flexion 120°/adduction/IR ROM	0.58 (0.52–0.75)

95% CI = 95% confidence interval; FABER = flexion, abduction, and external rotation; IR = internal rotation; ER = external rotation; ROB = Risk of Bias; ROM = range of motion.

Appendix Table H-4. Summary of Inter-rater Reliability Coefficients for Imaging Commonly Described in Diagnosing FAIS (from 2019 report)

Studies Included Author, year (ROB)	Agreement measure	ICC (95% CI)*	Kappa (K)*†	ICC*	ICC (95% CI)*
Ayeni 2014 **(Moderately Low)** Population: N=51; consecutive symptomatic patients with unilateral hip pain and broad spectrum of FAI pathologies Test condition: 3 orthopedic surgeons, 3 radiologists; films read independently on 2 occasions 4 weeks apart; assessments based on uniform definitions; unclear whether readers had knowledge of clinical tests Images: 51 masked AP and frog-leg lateral films were in standardized format **Malviya 2016** **(High)** Population: N=10 patients Test condition: 39 orthopedic surgeons with varying levels of experience were presented with history/clinical findings with X-ray films 10 patients' films presented for initial diagnosis, additional investigations (e.g. MRI, CT) presented to determine final diagnosis (Continued in next row)	**Findings c/w FAI or Diagnosis of FAI**	Surgeons T1: **0.72** (0.52, 0.84);T2: **0.70** (0.52, 0.82) Radiologists T1: 0.59 (0.35, 0.76); T2: **0.74** (0.59, 0.84) Consensus T1: 0.33 (–0.17, 0.62); T2: 0.15 (–0.50, 0.51)	**A: 0.67** **B: 0.62** C: 0.56 D: 0.59 All: 0.6	NR	NR
	Cam morphology	Surgeons T1:**0.74** (0.57, 0.84); T2: **0.62** (0.39, 0.77) Radiologists T1: 0.54 (0.27, 0.73); T2: **0.69** (0.50, 0.81) Consensus T1: **0.78** (0.61, 0.87); T2: **0.74** (0.54, 0.85)	NR	NR	NR
	Pistol-grip morphology	Surgeons T1: **0.78** (0.63, 0.87); T2: **0.81** (0.70, 0.89) Radiologists T1: 0.60 (0.35, 0.76); T2: **0.75** (0.60, 0.85) Consensus T1: 0.27 (–0.28, 0.58); T2: 0.35 (–0.14, 0.63)	NR	NR	NR
	Pincer lesion	Surgeons T1: 0.42 (0.11, 0.64); T2: 0.28 (–0.15, 0.56) Radiologists T1: 0.39 (0.00, 0.65); T2: 0.20 (–0.31, 0.53) Consensus T1: 0.30 (–0.23, 0.60); T2: –0.10 (–0.92, 0.37)	NR	NR	NR
	Mixed FAI	Surgeons T1: **0.62** (0.38, 0.77); T2: 0.35 (–0.04, 0.61) Radiologists T1**: 0.62** (0.39, 0.77); T2: 0.34 (–0.06, 0.60) Consensus T1: **0.67** (0.42, 0.81); T2: 0.57 (0.25, 0.76)	NR	NR	NR

Studies Included Author, year (ROB)	Agreement measure	ICC (95% CI)*	Kappa (K)*†	ICC*	ICC (95% CI)*
(Continued from previous row) **Sutter 2012** **(Low)** Population: N=106; n=53 Cam FAI w/symptoms; n=53 asymptomatic volunteers Test condition: 2 musculoskeletal radiologists blinded to clinical data independently analyzed Images: MRI (enhanced in FAI patients, not in volunteers); focus on alpha angle from different planes **Hooper 2016** **(Moderately High)** Population: N=177 adolescents undergoing arthroscopy Test condition: 1 fellowship-trained musculoskeletal radiologist; 1 orthopedic surgery resident; 1 fourth-year medical student Images: Plain radiographs and MRI scans	**Type of FAI**	NR	A: 0.12 B: 0.23 C: 0.4 D: 0.29 All: 0.3	NR	NR
	Type of FAI after CT/MR	NR	A: 0.35 B: 0.21 C: 0.53 D: **0.75** All: 0.4	NR	NR
	Dysplasia	NR	A: 0.3 B: 0.42 C: 0.36 D: 0.45 All: 0.3	NR	NR
	Dysplasia after CT/MR	NR	A: 0.11 B: 0.48 C: 0.42 D: **0.65** All: 0.3	NR	NR
	Cross-over sign	Surgeons T1: 0.55 (0.29, 0.72); T2: 0.48 (0.17, 0.69) Radiologists T1: **0.67** (0.48, 0.80); T2: 0.18 (–0.31, 0.51) Consensus T1: 0.44 (0.01, 0.68); T2: 0.60 (0.30, 0.77)	A: **0.88** B: 0.59 C: 0.57 D: 0.43 All: 0.6	NR	NR
	Posterior wall sign	Surgeons T1: 0.49 (0.21, 0.69); T2: 0.14 (–0.37, 0.48) Radiologists T1: **0.69** (0.51, 0.81); T2: 0.16 (–0.33, 0.49) Consensus T1: 0.39 (–0.07, 0.65); T2: 0.34 (–0.16, 0.62)	A: 0.36 B: 0.28 C: 0.23 D: 0.17 All: 0.23	NR	NR

Studies Included Author, year (ROB)	Agreement measure	ICC (95% CI)*	Kappa (K)*†	ICC*	ICC (95% CI)*
	Ischial spine sign	Surgeons T1: **0.75** (0.60, 0.85); T2: **0.73** (0.56, 0.83) Radiologists T1: **0.65** (0.44, 0.79); T2: 0.59 (0.35, 0.76) Consensus T1: 0.40 (–0.06, 0.66); T2: **0.65** (0.39, 0.80)	A: 0.8 B: 0.45 C: 0.49 D: 0.52 All: 0.5	NR	NR
	α angle	Surgeons T1: **0.77** (0.58, 0.88); T2: **0.81** (0.69, 0.89) Radiologists T1: **0.73** (0.50, 0.86); T2: 0.62 (0.31, 0.80) Consensus T1: 0.55 (0.21, 0.74); T2: 0.47 (0.07, 0.70)	NR	NR	Radiographs: 0.56 (0.43, 0.67) MRI: **0.65** (0.56, 0.73)
	α angle; planes (MR) a. Anteroinferior b. Anterior c. Anterosuperior d. Superior **e.** Posterosuperior	NR	NR	FAI Patients **a. 0.68** **b. 0.817** c. 0.531 **d. 0.748** e. 0.560 Volunteers a. 0.370 **b. 0.625** **c. 0.741** d. 0.490 e. 0.235	NR
	Size of α angle	Surgeons T1: **0.66** (0.44, 0.80); T2: **0.69** (0.51, 0.82) Radiologists T1: 0.47 (0.07, 0.72); T2: 0.59 (0.30, 0.78) Consensus T1: **0.70** (0.48, 0.83); T2: **0.82** (0.61, 0.90)	NR	NR	NR

Studies Included Author, year (ROB)	Agreement measure	ICC (95% CI)*	Kappa (K)*†	ICC*	ICC (95% CI)*
	Central edge angle	NR	A: 0.54 B: 0.45 C: 0.44 D: 0.49 All: 0.44	NR	Radiographs: **0.73** (0.52, 0.84) MRI: **0.74** (0.67, 0.80)
	Offset ratio	Surgeons T1: **0.64** (0.40, 0.79); T2: **0.80** (0.67, 0.88) Radiologists T1: **0.69** (0.49, 0.82); T2: **0.69** (0.46, 0.83) Consensus T1: 0.31 (–0.22, 0.60); T2: 0.45 (0.04, 0.69)	NR	NR	NR
	Size of offset ratio	Surgeons T1: **0.69** (0.50, 0.82); T2: 0.50 (0.21, 0.70) Radiologists T1: 0.31 (–0.22, 0.63); T2: –0.04 (–0.74, 0.41) Consensus T1: 0.51 (0.14, 0.72); T2: **0.70** (0.47, 0.83)	NR	NR	NR
	Coxa profunda	Surgeons T1: **0.68** (0.48, 0.81); T2: **0.69** (0.51, 0.82) Radiologists T1: 0.39 (0.02, 0.63); T2: 0.26 (–0.18, 0.55) Consensus T1: **0.63** (0.35, 0.79); T2: 0.27 (–0.28, 0.59)	NR	NR	NR
	Acetabular protrusion	Surgeons T1: 0.26 (–0.14, 0.54); T2: 0.26 (–0.18, 0.55) Radiologists T1: 0.28 (–0.16, 0.57); T2:0.00 (–0.59, 0.40) Consensus T1: 0.55 (0.21, 0.74); T2: -0.06 (–0.86, 0.39)	NR	NR	NR

Studies Included Author, year (ROB)	Agreement measure	ICC (95% CI)*	Kappa (K)*†	ICC*	ICC (95% CI)*
	Fem head sphericity	NR	A: 0.34 B: 0.49 C: 0.4 D: 0.48 All: 0.4	NR	NR
	Rotation	NR	A: 0.12 B: 0.29 C: 0.59 D: **0.65** All: 0.41	NR	NR
	Tönnis angle	NR	A: 0.14 B: 0.2 C: 0.49 D: 0.39 All: 0.3	NR	Angle from Radiographs: 0.63 (0.43-0.70)
	Tönnis grade	NR	A: 0.27 B: 0.3 C: 0.49 D: 0.46 All: 0.4	NR	NR
	Best view	Surgeons T1: –0.10 (–0.72, 0.33); T2: 0.00 (–0.59, 0.40) Radiologists T1: 0.33 (–0.07, 0.60); T2: 0.57 (0.31, 0.74) Consensus T1: –0.29 (–1.26, 0.27); T2: 0.00 (–0.75, 0.43)	NR	NR	NR
	Film adequacy	NR	A: -0.02 B: 0.26 C: 0.23 D: 0.3 All: 0.2	NR	NR

AP = anteroposterior; CT = computed tomography; FAI = Femoroacetabular Impingement; ICC = intraclass correlation coefficient; MRI = magnetic resonance imaging; ROB = Risk of Bias.

* Boldface indicates kappa orICC≥0.61 suggesting at least good agreement or kappa of 0.61 to 0.80 indicating substantial agreement; values between 0.01-0.2 represents slight agreement; 0.21-0.40 fair; 0.41-0.60 moderate

† Group definitions: A= orthopedic trainees, n=5; B = hip surgeons with no/limited experience with hip preservation surgery, n= 9; C = hip surgeons with experience in hip preservation, n=22; D = high volume hip preservation surgeons, n=10.

Appendix Table H-5. Summary of Intra-rater Reliability Coefficients for Imaging Commonly Described in Diagnosing FAIS (from 2019 report)

Studies Included Author, year (ROB)	Agreement measure	ICC (95% CI)*	Kappa or ICC*
Ayeni 2014 (Moderately Low) Population: N=51 consecutive symptomatic patients with unilateral hip pain and broad spectrum of FAI pathologies Test condition: 3 orthopedic surgeons, 3 radiologists; films were standardized format, read independently, 2 occasions 4 weeks apart; assessments based on uniform definitions; unclear whether readers had knowledge of clinical tests Images: 51 masked AP and frog-leg lateral films were in standardized format **Ratzleff 2016 (Moderately Low)** Population: N=50; n=40 randomly selected from IMPACKT-HiP study and n = 10 with clinically, imaging, and arthroscopically confirmed FAI; 42% had hip pain in past 12 months Test condition: One 3rd year medical student trained by musculoskeletal radiologist; Clinical and demographic information blinded then 49 hips randomized, read by radiologist and student then were re-read by student 8 weeks later in new randomized order. Images: AP-Pelvis (weight-bearing), bilateral Dunn projections(supine)	**Overall diagnosis**	NR	**K=0.58, PABAK=0.76**
	Findings c/w FAI	Surgeons: 0.41 (-0.08, 0.67) Radiologists: 0.25 (-0.32, 0.75)	-
	Cam morphology	Surgeons: **0.86** (0.76, 0.92) Radiologists: **0.72** (0.50, 0.84)	-
	Pistol-grip morphology	Surgeons: 0.01 (-0.73, 0.44) Radiologists: **0.68** (0.44, 0.82)	-
	α angle >50.5°	Surgeons: 0.19 (-0.43, 0.54) Radiologists: 0.42 (-0.01, 0.67)	**>55° ICC=0.97,**
	Size of α angle	Surgeons: **0.84** (0.72, 0.91) Radiologists: **0.91 (0.84, 0.95)**	-
	Offset ratio <0.17	Surgeons: 0.40 (-0.06, 0.66) Radiologists: **0.71** (0.49, 0.83)	-
	Size of offset ratio	Surgeons: **0.82** (0.68, 0.90) Radiologists: -0.04 (-0.82, 0.41)	-
	Pincer lesion	Surgeons: **0.70** (0.48, 0.83) Radiologists: -0.13 (-0.98, 0.36)	-
	Cross-over sign	Surgeons: 0.29 (-0.25, 0.59) Radiologists: 0.26 (-0.30, 0.58)	K=0.58
	Posterior wall sign	Surgeons: 0.20 (-0.40, 0.54) Radiologists: 0.48 (0.08, 0.70)	-
	Ischial spine sign	Surgeons: 0.55 (0.20, 0.74) Radiologists: **0.80** (0.65, 0.89)	-

Studies Included Author, year (ROB)	Agreement measure	ICC (95% CI)*	Kappa or ICC*
	Coxa profunda	Surgeons: 0.02 (-0.72, 0.44) Radiologists: 0.52 (0.16, 0.73)	-
	Acetabular protrusion	Surgeons: 0.10 (-0.57, 0.49) Radiologists: -0.03 (-0.81, 0.41)	-
	Mixed FAI	Surgeons: 0.15 (-0.49, 0.52) Radiologists: 0.45 (0.04, 0.69)	-
	Best view	Surgeons: 0.00 (-0.75, 0.43) Radiologists: 0.20 (-0.40, 0.54)	-
	Central edge angle >40	NR	**ICC=0.87**

AP = anteroposterior; CI = confidence interval; FAI = femoroacetabular impingement; ICC = intraclass correlation coefficient; IMPAKT-HiP = Investigations of Mobility, Physical Activity and Knowledge Translation in Hip Pain; PABAK = prevalence and bias adjusted kappa; ROB = risk of bias

* Boldface indicates ICC≥0.61 suggesting at least good agreement or kappa of 0.61 to 0.80 indicating substantial agreement.

Appendix I. Ongoing and Unpublished Trials

Table I-1: Ongoing and Recent Unpublished Trials of Arthroscopic Treatment of FAI

Title	Interventions / Control	Study Design	N	Trial Number
The Purpose of This Pilot Study is to Determine Feasibility of a Randomized Controlled Trial Comparing Labral Repair Versus Reconstruction in Patients Over 40 Years of Age Undergoing Hip Arthroscopy for FAIS	Labral Repair / Labral Reconstruction	RCT (Pilot)	220	NCT07608237
Arthroscopic Treatment of Acetabular Labral Lesions: Intrarticular Injection of Bone Marrow vs Hip Arthroscopy Alone	Arthroscopy + Bone Marrow Aspirate Concentrate Injection / Arthroscopy Alone	RCT	80	NCT07422662
Intraoperative Bone Marrow Aspirate Concentrate Injections: Evaluating Outcomes in a Randomized Controlled Trial	Arthroscopy + Bone Marrow Aspirate Concentrate Injection / Arthroscopy Alone	RCT	80	NCT06750757
A 12 Months Prospective Study Comparing Functional Outcome Scores in Hip Arthroscopic Labral Repair Versus Debridement	Labral Repair / Labral Debridement	RCT	60	NCT06288867
Effect of PRP, PPP, & BMAC on Functional Outcomes Following Hip Arthroscopy for Acetabular Labral Pathologies (PRP; PPP; BMAC)	Arthroscopy + Bone Marrow Aspirate Concentrate, Platelet-Rich Plasma, and Platelet-Poor Plasma Injection / Arthroscopy Alone	RCT	160	NCT06003101
Arthroscopic Surgical Procedures vs Sham Surgery for Patients With Femoroacetabular Impingement and/or Labral Tears. (HIPARTI)	Arthroscopy / Sham	RCT	140	NCT02692807
Mobility, Strength, and Functional Outcomes Before Surgery, at 3 Months, and at 6 Months After Hip Arthroscopy for Femoroacetabular Impingement Syndrome	Arthroscopy / No Treatment (healthy controls)	Cohort	60	NCT07472400
An Evaluation of Hip Preservation Outcomes	Arthroscopy / Other Surgical Intervention	Cohort	10,000	NCT05746533

Title	Interventions / Control	Study Design	N	Trial Number
Use of BMAC With Hip Arthroscopy Treatment of FAI and Labral Tear	Arthroscopy + Bone Marrow Aspirate Concentrate Injection / Arthroscopy Alone	Cohort	400	NCT03909139
Effect of Lower Limb Rotation on Clinical Outcomes After Arthroscopic Management in Patients With Symptomatic Femoroacetabular Impingement Syndrome	Arthroscopy	Case Series	50	NCT06420180
Long Term Results After Hip Arthroscopy	Arthroscopy	Registry	451	NCT06327217

BMAC = bone marrow aspirate concentrate, FAIS = femoroacetabular impingement syndrome, PPP = platelet-poor plasma, PRP = platelet-rich plasma, RCT = randomized controlled trial

Appendix J. Appendix References

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