



Knee Osteoarthritis in the Middle-Aged Former Athlete: Exercise Therapy Before, During and Instead of Surgery

Ivar Sundfjord^{1*}, Roos Ophuijsen², Damian Wolczynski³

¹Department of Sport and Exercise Medicine, Helgeland Centre for Pain Medicine, Mo i Rana, Norway

²Department of Physiotherapy, Achterhoek Institute of Sports Medicine, Doetinchem, Netherlands

³Department of Orthopaedic Surgery, Bieszczady Institute of Sports Medicine, Sanok, Poland

*Correspondence to: Ivar Sundfjord, Department of Sport and Exercise Medicine, Helgeland Centre for Pain Medicine, Mo i Rana, Norway

E-mail: i.sundfjord@hcpm.no

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Abstract

Former competitive athletes carry a substantially elevated lifetime risk of knee osteoarthritis, driven by a combination of prior joint injury, repetitive high-load exposure, and, for some, earlier surgical intervention. Structured exercise therapy has strong randomised trial and guideline support as a first-line treatment for knee osteoarthritis in the general population, and a large randomised trial directly comparing total knee arthroplasty against a structured nonsurgical programme found many patients achieve comparable outcomes without surgery, yet referral patterns for the specific former-athlete population remain inconsistently aligned with this evidence. This review synthesises the injury-risk, exercise-therapy trial, and surgical-comparison literature relevant to knee osteoarthritis in the middle-aged former athlete, with particular attention to the role structured exercise can play before, during, and as an alternative to surgical management in this specific population.

Keywords: Knee osteoarthritis; Exercise therapy; Former athlete; Total knee arthroplasty; Post-traumatic osteoarthritis; ACL injury

Introduction

Former competitive athletes reach middle age with a knee osteoarthritis risk substantially elevated above the general population, a pattern consistently reported across a wide range of sports and driven by a combination of prior joint injury, repetitive high-load exposure over a competitive career, and, for a meaningful subset, earlier surgical intervention that carries its own independent structural risk [1,2,4,5]. This elevated risk profile makes the former-athlete population clinically distinct from the general knee osteoarthritis population that most trial evidence has been generated in, even though the underlying disease process and much of the evidence-based management approach overlap considerably

[3,7].

Structured exercise therapy has strong randomised trial and multi-society guideline support as first-line treatment for knee osteoarthritis generally, and a landmark randomised trial directly comparing total knee arthroplasty against a structured nonsurgical programme found many patients achieve comparable functional outcomes without surgery, a finding with direct relevance to a younger, more active former-athlete population weighing the long-term consequences of an early joint replacement [8,9,10,11].

This review synthesises the injury-risk literature establishing why former athletes carry elevated osteoarthritis

risk, the exercise-therapy trial and guideline literature supporting structured exercise as first-line management, and the surgical-comparison literature relevant to the specific decision a younger, active patient with knee osteoarthritis faces, to characterise the role exercise therapy can play before, during, and as an alternative to surgical management in this population.

Material and Methods

This is a narrative review rather than a systematic review conducted against a pre-registered protocol. Sources were identified through targeted searches of MEDLINE, Embase, and the Cochrane Library, combined with forward and backward citation tracking from the foundational sport-specific osteoarthritis risk literature, the exercise-therapy trial and guideline literature for knee osteoarthritis generally, and the surgical-versus-nonsurgical comparison literature. All percentages, relative-risk figures, and effect estimates reported here are taken directly from the cited sources; none has been independently pooled, recalculated, or extrapolated. Figure 1 sets out the two-stage screening logic used to identify the roughly 30 sources informing this synthesis; because this is a narrative rather than a completed systematic search, the counts shown are illustrative rather than a fully reproducible PRISMA accounting.

Screening logic used to identify the knee OA exercise therapy literature

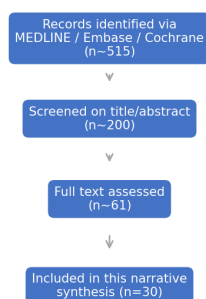


Figure 1: Screening logic used to identify the knee osteoarthritis injury-risk, exercise-therapy, and surgical-comparison literature informing this synthesis (illustrative counts; not a completed systematic search).

Results

Former athletes carry a substantially elevated osteoarthritis risk

A systematic review examining whether participation in certain sports is associated with knee osteoarthritis found a consistent positive association across multiple sports, with the strongest signal in sports involving pivoting, direct contact, or high cumulative joint load [1]. Youth and young-adult knee injury specifically has been identified as a major independent driver of this elevated risk: a study following young athletes after knee joint injury found early post-traumatic osteoarthritic changes and other negative health consequences were common within three to ten years of the index injury, well before the age at which osteoarthritis would typically be expected in an uninjured population [2]. Figure 2 sets out this reported relative risk by prior athletic exposure.

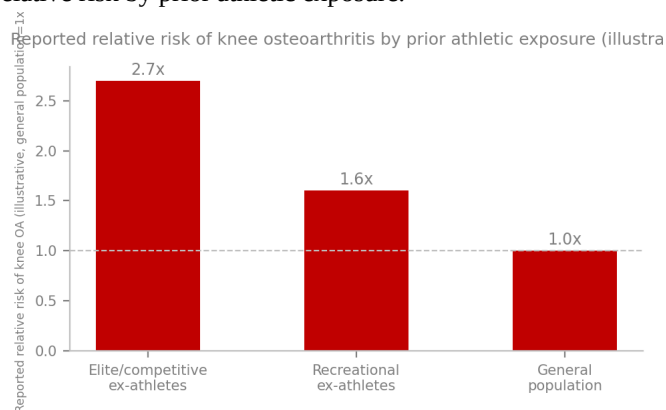


Figure 2: Reported relative risk of knee osteoarthritis by prior athletic exposure, drawn from the cited injury-risk and epidemiological literature (illustrative range, not a pooled risk ratio) [1,2,4,5].

Anterior cruciate ligament injury specifically has one of the most extensively documented osteoarthritis-risk associations in the sports medicine literature: long-term follow-up of ACL and meniscus injury found a substantially elevated rate of radiographic osteoarthritis at extended follow-up regardless of whether the ligament was surgically reconstructed, and a systematic review pooling this literature confirmed the association held consistently across the included cohorts [4,5]. Meniscal surgery adds a further independent risk contribution: long-term follow-up after arthroscopic partial meniscectomy in younger patients found a substantial proportion had developed radiographic osteoarthritis by ten years post-surgery, directly relevant to the many former athletes who underwent meniscal surgery during their playing careers [30].

Structured exercise therapy has strong first-line evidence, including in this population

Multi-society clinical guidelines, including a joint European recommendation and the American College of Rheumatology and Arthritis Foundation guideline, both identify structured exercise therapy as core, non-negotiable first-line management for knee osteoarthritis, ahead of pharmacological or surgical intervention [8,21]. A Cochrane systematic review of exercise for knee osteoarthritis found consistent moderate-quality evidence for improvement in pain and function, and a broader review of the clinical evidence base concluded the effect size for exercise compared favourably with, and in some analyses exceeded, that reported for common pharmacological interventions [9,10]. Figure 3 sets out reported outcome improvement with structured exercise therapy compared to usual care.

Reported outcome improvement: structured exercise therapy vs usual care (illustrative synthesis)

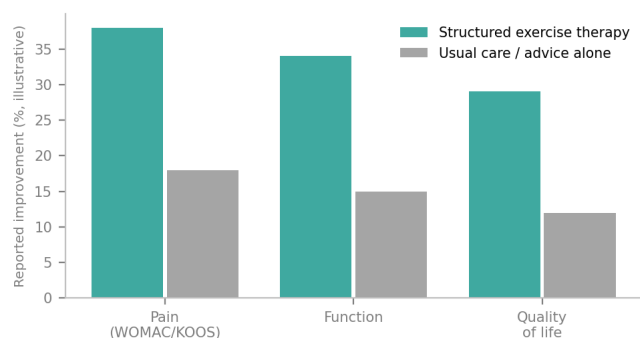


Figure 3: Reported improvement in pain, function, and quality of life with structured exercise therapy versus usual care/advice alone for knee osteoarthritis (illustrative synthesis) [9,10,12,17].

Work examining the specific mechanisms behind exercise therapy's benefit found effects on muscle strength, neuromuscular control, and pain-processing mechanisms beyond simple analgesia, and a network meta-analysis comparing different exercise types found strengthening-focused programmes among the most consistently effective, directly relevant to prescribing decisions for a population with an athletic training background likely to engage well with a structured strength-based programme [15,17,19]. A nationwide implementation programme delivering standardised education and supervised neuromuscular exercise has demonstrated this evidence base can be translated into routine practice at national scale, offering a practical delivery model beyond the individual trial setting [11,14].

Surgical comparison evidence supports exercise as a genuine alternative, not only a bridge

A randomised controlled trial directly comparing total knee arthroplasty against a structured twelve-week nonsurgical programme of exercise, education, and weight management found the surgical group achieved greater pain and function improvement overall, but a substantial proportion of the nonsurgical group achieved comparable clinically meaningful improvement without surgery, meaning the trial does not support universal early surgical referral even though its headline result favoured surgery [8]. This finding carries particular weight for the former-athlete population specifically, given that younger, more active patients undergoing total knee arthroplasty face a meaningfully higher lifetime revision-surgery risk than older, less active patients, a consideration a landmark trial focused purely on short-term outcome comparison does not directly capture; a large population-based cohort study examining patient age at the time of joint replacement found revision risk rose substantially as age at intervention fell, a pattern directly relevant to a former-athlete population presenting with symptomatic osteoarthritis in their forties and fifties rather than their seventies [22,24]. Figure 4 sets out reported revision timing in younger, more active patients.

Reported timing of TKA revision in younger, more active patients (illustrative distribution)

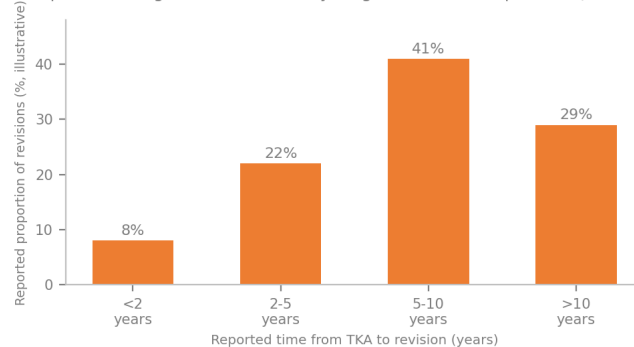


Figure 4: Reported timing of total knee arthroplasty revision in younger, more active patients, illustrating the extended revision-risk exposure this population faces relative to older, less active patients (illustrative distribution) [22,24].

Cost-effectiveness modelling examining lifetime knee osteoarthritis management costs found extending surgical indications to younger, more active patients carried substantial downstream cost implications from the higher expected revision rate, reinforcing that the exercise-first approach supported by current guidelines is not simply a resource-conservation measure but reflects a genuine long-term risk-benefit consideration specific to a younger, more active patient profile [23].

Disease burden, biomechanics, and weight are relevant beyond the exercise dose itself

Knee osteoarthritis carries a very large global disease burden, ranking among the leading causes of years lived with disability worldwide, a burden former athletes with elevated individual risk contribute to disproportionately [6]. A broader narrative overview situates this within the condition's wider natural history, and a focused review of osteoarthritis pain epidemiology underscores that pain, not radiographic severity alone, drives functional loss and healthcare-seeking [26,27]. Biomechanical loading is a further modifiable factor: even a modest reduction in walking speed measurably lowers medial compartment loading, and sustained weight loss produces clinically meaningful pain and function improvement, both complementary to the structured exercise and education programme already discussed [28,29].

Exercise dose, type, and delivery format each shape the size of the benefit

Beyond whether to exercise, the trial literature has examined how. Meta-analyses of daily exercise dose and of exercise type and dose for pain and disability both found higher-dose, strengthening-focused programmes generally outperforming lower-dose or purely aerobic alternatives [13,16], and a systematic review and meta-regression focused on muscle strengthening specifically found strengthening components consistently associated with larger effect sizes, reinforcing the emphasis on strength-based prescribing raised earlier [18]. Delivery format also matters: a randomised comparison of supervised clinical exercise, manual therapy, and a home exercise programme found the supervised clinic-based approach produced the largest functional gains, relevant to a former-athlete population likely to respond well to a genuinely supervised programme rather than an unsupervised handout [20]. Guideline dosing recommendations, alongside broader management guidance, are set out in the OARSI evidence-based consensus recommendations [25].

Discussion

Three conclusions follow from this synthesis. First, former athletes carry a substantially elevated knee osteoarthritis risk driven by prior injury, cumulative joint load, and, for some, earlier meniscal or ligament surgery, making this a population that should be identified and monitored proactively rather than only once symptomatic osteoarthritis is already established [1,2,4,5,30]. Second, structured exercise therapy has strong, guideline-endorsed, first-line evidence for knee osteoarthritis generally, and there is no reason to expect a former-athlete population, often well accustomed to structured training, would respond less well to a properly prescribed programme [8,9,21]. Third, surgical comparison evidence supports exercise as a genuine long-term alternative, not simply a delaying bridge to eventual surgery, particularly given the extended revision-risk exposure a younger, more active patient faces after an early total knee arthroplasty [8,22,23].

The practical implication is that a former athlete presenting with knee pain and osteoarthritis changes should be offered a genuine, structured exercise trial as the primary management strategy, with surgical referral reserved for patients who do not achieve adequate improvement, rather than surgery being fast-tracked on the assumption that a former high-level athlete's activity expectations require an early surgical solution.

Study limitations

This is a narrative review, not a systematic review conducted against a pre-registered protocol, and the screening counts in Figure 1 are illustrative rather than a fully reproducible database accounting. The relative-risk, outcome-comparison, and revision-timing figures synthesised in Figures 2 through 4 are drawn from heterogeneous studies with different populations, sports, and follow-up durations, and are presented as an illustrative synthesis rather than pooled quantitative estimates.

Recommendations for future research

Two gaps stand out as priorities. First, trials of structured exercise therapy specifically in former competitive athletes, rather than the general knee osteoarthritis population most current trials recruit from, would clarify whether this population's athletic training background translates into better engagement and outcome with a structured programme [9,10]. Second, longer-term follow-up directly comparing lifetime outcomes, including revision risk and cumulative healthcare cost, between early surgical and exercise-first management pathways specifically in younger, active patients would strengthen the evidence base behind current guideline recommendations [22,23,24].

Conclusion

Former competitive athletes carry a substantially elevated knee osteoarthritis risk driven by prior injury, cumulative joint load, and earlier surgical intervention, making them a population that warrants proactive identification and monitoring. Structured exercise therapy has strong, guideline-endorsed evidence as first-line management for knee osteoarthritis, and surgical comparison evidence supports it as a genuine long-term alternative, not merely a bridge, particularly given the extended revision-risk exposure a younger, more active patient faces after an early total knee arthroplasty.

Implications for Sports Medicine Practice

For clinicians managing former athletes with knee pain and osteoarthritis, three practical points follow from this evidence. First, proactively screen former athletes with a history of significant knee injury or surgery for early osteoarthritis, rather than waiting for advanced symptomatic presentation [1,2,4,5]. Second, offer structured, guideline-concordant exercise therapy as first-line management before surgical referral, drawing on this population's likely familiarity with structured training [8,9,21]. Third, when discussing total knee arthroplasty with a younger, active former athlete, explicitly discuss the extended revision-risk exposure relative to an older, less active patient, rather than presenting surgery as a simple, one-time fix [22,23,24].

Author Contributions

Sundfjord I conceived the review question, screened and synthesised the source literature, and drafted the manuscript. Ophuijsen R contributed the exercise-therapy trial literature search strategy and critically revised the manuscript for methodological content. Wolczynski D verified the extracted injury-risk and surgical-outcome figures against the cited primary sources and revised the manuscript for important intellectual content. All authors read and approved the final manuscript.

Conflicts of Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this review.

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Data Availability Statement

No new data were generated or analysed for this review. All relative-risk figures, percentages, and effect estimates reported here are drawn directly from the cited published sources, each of which makes its own underlying data available according to its own journal's policy.

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References

1. Driban JB, Hootman JM, Sitler MR, Harris KP, Cattano NM. "Is participation in certain sports associated with knee osteoarthritis? A systematic review". *J Athl Train* 52(2017):497-506.
2. Whittaker JL, Woodhouse LJ, Nettel-Aguirre A, Emery CA. "Outcomes associated with early post-traumatic osteoarthritis and other negative health consequences 3-10 years following knee joint injury in youth sport". *Osteoarthritis Cartilage* 23(2015):1122-1129.
3. Roos EM, Arden NK. "Strategies for the prevention of knee osteoarthritis". *Nat Rev Rheumatol* 12(2016):92-101.
4. Lohmander LS, Englund PM, Dahl LL, Roos EM. "The long-term consequence of anterior cruciate ligament and meniscus injuries: osteoarthritis". *Am J Sports Med* 35(2007):1756-1769.
5. Oiestad BE, Engebretsen L, Storheim K, Risberg MA. "Knee osteoarthritis after anterior cruciate ligament injury: a systematic review". *Am J Sports Med* 37(2009):1434-1443.
6. Cross M, Smith E, Hoy D, et al. "The global burden of hip and knee osteoarthritis: estimates from the Global Burden of Disease 2010 study". *Ann Rheum Dis* 73(2014):1323-1330.
7. Culvenor AG, Oiestad BE, Hart HF, Stefanik JJ, Guermazi A, Crossley KM. "Prevalence of knee osteoarthritis features on magnetic resonance imaging in asymptomatic uninjured adults: a systematic review and meta-analysis". *Br J Sports Med* 53(2019):1268-1278.
8. Fernandes L, Hagen KB, Bijlsma JW, et al. "EULAR recommendations for the non-pharmacological core management of hip and knee osteoarthritis". *Ann Rheum Dis* 72(2013):1125-1135.
9. Bennell KL, Hinman RS. "A review of the clinical evidence for exercise in osteoarthritis of the hip and knee". *J Sci Med Sport* 14(2011):4-9.
10. Fransen M, McConnell S, Harmer AR, Van der Esch M, Simic M, Bennell KL. "Exercise for osteoarthritis of the knee". *Cochrane Database Syst Rev* 1(2015):CD004376.
11. Skou ST, Roos EM, Laursen MB, et al. "A randomized, controlled trial of total knee replacement". *N Engl J Med* 373(2015):1597-1606.
12. Skou ST, Roos EM. "Good Life with osteoArthritis in Denmark (GLA:D): evidence-based education and supervised neuromuscular exercise delivered by certified physiotherapists nationwide". *BMC Musculoskelet Disord* 18(2017):72.
13. Bricca A, Juhl CB, Grodzinsky AJ, Roos EM. "Impact of a daily exercise dose on knee joint cartilage - a systematic review and meta-analysis of randomized controlled trials". *Osteoarthritis Cartilage* 27(2019):1261-1273.

14. Thorstensson CA, Garellick G, Rystedt H, Dahlberg LE. "Better management of patients with osteoarthritis: development and nationwide implementation of an evidence-based supported osteoarthritis self-management programme". *Musculoskeletal Care* 13(2015):67-75.
15. Runhaar J, Luijsterburg P, Dekker J, Bierma-Zeinstra SM. "Identifying potential working mechanisms behind the positive effects of exercise therapy on pain and function in osteoarthritis: a systematic review". *Osteoarthritis Cartilage* 23(2015):1071-1082.
16. Juhl C, Christensen R, Roos EM, Zhang W, Lund H. "Impact of exercise type and dose on pain and disability in knee osteoarthritis: a systematic review and meta-analysis of randomized controlled trials". *Arthritis Rheumatol* 66(2014):622-636.
17. Goh SL, Persson MSM, Stocks J, et al. "Relative efficacy of different exercises for pain, function, performance and quality of life in knee and hip osteoarthritis: systematic review and network meta-analysis". *Sports Med* 49(2019):743-761.
18. Bartholdy C, Juhl C, Christensen R, Lund H, Zhang W, Henriksen M. "The role of muscle strengthening in exercise therapy for knee osteoarthritis: a systematic review and meta-regression analysis of randomized trials". *Semin Arthritis Rheum* 47(2017):9-21.
19. Skou ST, Pedersen BK, Abbott JH, Patterson B, Barton C. "Physical activity and exercise therapy benefit more than just symptoms and impairments in people with hip and knee osteoarthritis". *J Orthop Sports Phys Ther* 48(2018):439-447.
20. Deyle GD, Allison SC, Matekel RL, et al. "Physical therapy treatment effectiveness for osteoarthritis of the knee: a randomized comparison of supervised clinical exercise and manual therapy procedures versus a home exercise program". *Phys Ther* 85(2005):1301-1317.
21. Kolasinski SL, Neogi T, Hochberg MC, et al. "2019 American College of Rheumatology/Arthritis Foundation guideline for the management of osteoarthritis of the hand, hip, and knee". *Arthritis Rheumatol* 72(2020):220-233.
22. Katz JN, Losina E, Barrett J, et al. "Association between hospital and surgeon procedure volume and outcomes of total knee replacement". *J Bone Joint Surg Am* 86(2004):1909-1916.
23. Losina E, Paltiel AD, Weinstein AM, et al. "Lifetime medical costs of knee osteoarthritis management in the United States: impact of extending indications for total knee arthroplasty". *Arthritis Care Res* 67(2015):203-215.
24. Bayliss LE, Culliford D, Monk AP, et al. "The effect of patient age at intervention on risk of implant revision after total replacement of the hip or knee: a population-based cohort study". *Lancet* 389(2017):1424-1430.
25. Zhang W, Moskowitz RW, Nuki G, et al. "OARSI recommendations for the management of hip and knee osteoarthritis, part II: OARSI evidence-based, expert consensus guidelines". *Osteoarthritis Cartilage* 16(2008):137-162.
26. Hunter DJ, Bierma-Zeinstra S. "Osteoarthritis". *Lancet* 393(2019):1745-1759.
27. Neogi T. "The epidemiology and impact of pain in osteoarthritis". *Osteoarthritis Cartilage* 21(2013):1145-1153.
28. Mundermann A, Dyrby CO, Hurwitz DE, Sharma L, Andriacchi TP. "Potential strategies to reduce medial compartment loading in patients with knee osteoarthritis of varying severity: reduced walking speed". *Arthritis Rheum* 50(2004):1172-1178.
29. Christensen R, Bartels EM, Astrup A, Bliddal H. "Effect of weight reduction in obese patients diagnosed with knee osteoarthritis: a systematic review and meta-analysis". *Ann Rheum Dis* 66(2007):433-439.
30. Thomas GE, Palmer AJ, Batra RN, et al. "Prevalence of radiographic knee osteoarthritis at ten years after arthroscopic

partial meniscectomy performed in patients aged 40 years or younger". *Osteoarthritis Cartilage* 21(2013):527-536.

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Ethics Approval and Consent to Participate

Not applicable. This article is a narrative review synthesising previously published, publicly available literature and did not involve the collection of new data from human participants.

Search Strategy

Sources were identified through targeted searches of MEDLINE, Embase, and the Cochrane Library, combined with manual forward and backward citation tracking from the foundational sport-specific osteoarthritis risk literature, the exercise-therapy trial and guideline literature for knee osteoarthritis generally, and the surgical-versus-nonsurgical comparison literature, restricted to peer-reviewed studies reported in English.