Systematic Review

Arthroscopic Debridement of Mild and Moderate Knee Osteoarthritis Results in Clinical Improvement at Short-Term Follow-Up: A Systematic Review

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Purpose: To report the clinical outcomes of arthroscopic debridement for the treatment of Kellgren-Lawrence (KL) grade I and II (mild) and III (moderate) knee osteoarthritis (OA) at a minimum 1-year follow-up. **Methods:** A systematic review of primary literature was performed in concordance with Preferred Reporting Items for Systematic Reviews and Meta-analyses guidelines using the Medline, Embase, and Cochrane databases for studies regarding arthroscopic debridement/chondroplasty for management of knee OA at a minimum 1-year follow-up. Studies were included if they included KL grades I to III or dichotomized clinical outcomes by KL grade. The primary outcome was patient-reported outcome measures (PROMs) at the final follow-up. Bias was assessed using the Methodological Index for Non-Randomized Studies (MINORS) score. **Results:** Eight studies including a total of 773 patients met inclusion criteria (range of patients in each study, 31-214). Mean age of patients ranged from 35.5 to 64 years, with most studies having a mean patient age of 55 to 65 years. Mean follow-up ranged from 1.5 to 10 years. Seven of the 8 (87.5%) studies reported good to excellent PROMs at a minimum 1- to 4-year follow-up after arthroscopic debridement. Improvements in PROMs were superior in patients with less severe knee OA (KL I-II) in comparison to KL III in most studies. Conversion to arthroplasty ranged from 7.6% to 50% in KL III patients compared with 0% to 4.5% in KL I-II patients after arthroscopic debridement. Two of the 3 studies with at least a 4-year clinical follow-up reported that clinical improvements diminished with time (improvements no longer significant in total Western Ontario and McMaster Universities Osteoarthritis Index score). The lone randomized controlled trial was the only investigation that did not find a benefit of arthroscopic debridement over quality nonoperative care. MINORS scores ranged from 6 to 10 (mean, 8.0) for the 5 nonrandomized studies without controls. **Conclusions:** Arthroscopic debridement for the management of mild to moderate knee OA is effective at short-term follow-up in patients who have exhausted conservative care. There is limited evidence demonstrating the durability of improvement following arthroscopic debridement after 2 years. **Level of Evidence:** Level IV, systematic review of Level I to IV studies.

Knee osteoarthritis (OA) is common, affecting over 19% of American adults ≥45 years of age, and is a leading cause of pain and disability.[1-3] Knee OA is a broad diagnosis encompassing patients with minimal joint space narrowing and possible osteophyte formation to complete joint space loss and deformity.[4] The grade of OA is important as knees differ from a structural, mechanical, and synovial environment based on the degree of OA, which can inform what management options may be beneficial.[5] Management of knee OA is multidisciplinary and consists broadly of diet and exercise, physical therapy (PT), oral and topical medications, braces, intra-articular injections, and surgery.[6-11] When conservative measures fail to adequately control symptoms, surgical intervention is considered.

For patients with Kellgren-Lawrence (KL) grade IV OA, complete joint space loss with osteophyte formation and sclerosis, total knee arthroplasty (TKA) is indicated when conservative measures do not provide pain relief.[4] Patients with symptomatic KL grade I, II, or III OA—namely, mild to moderate diffuse unicompartmental or multicompartmental disease—pose a clinical challenge regarding nonarthroplasty surgical options and outcomes. These patients are a distinct

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population from those with focal chondral defects for which cartilage reparative or restorative procedures may be indicated as they do not have severe enough structural changes to recommend arthroplasty. In addition, prior work has shown mildly arthritic patients respond poorly to TKA.[12] Unlike those with focal chondral defects with maintenance of joint space and where defect size and depth are often used to make determinations for specific repair techniques, those with early to mid-level arthritic changes such as those with KL I to III have more diffuse changes over multiple surfaces in the knee leading to radiographic changes of joint space narrowing and are otherwise not candidates for current cartilage repair options. Part of the challenge with this latter population is that surgical options remain limited and arthroscopic debridement and chondroplasty are often considered. Unlike the literature reporting the results of arthroscopic debridement for localized cartilage defects in the otherwise healthy knee where defect size may determine the success and duration of a treatment response, the literature that investigates arthroscopic debridement of the mild to moderately arthritic knee rarely quantifies the extent of involvement other than the radiographic changes documented preoperatively. In one of the few studies that includes mild to moderately arthritic patients and documents the size of involvement, Anderson et al.[13] reported significant improvement in patient-reported outcome measures (PROMs) following arthroscopic debridement in a 53-patient series, 14 of whom had KL grade I to II OA with a mean area of involvement of 3.3 cm^2. Thus, unlike the management of focal chondral defects where defect size and location help dictate appropriate treatment options, the size of the involved area in the setting of arthritis is not as integral a part of surgical decision-making to pursue debridement of loose or catching chondral flaps.[14,15] Patients may or may not improve with arthroscopic debridement, and if they do not, there is a paucity of options outside of TKA if conservative treatments such as injections do not provide symptom relief.[6,7,10,11] Several potential treatment options are being explored both in the United States and abroad but are not available or widely used at this time.[16,17]

To date, the literature is conflicting with substantial heterogeneity between study populations regarding how patients with symptomatic, diffuse areas of arthritic change in the knee consistent with KL grade I, II, or III OA improve following arthroscopic debridement (including chondroplasty, loose body removal, lavage, synovectomy, and/or partial meniscectomy).[6,10,18] The purpose of this systematic review is to report the clinical outcomes of arthroscopic debridement for the treatment of KL grade I and II (mild) and III (moderate) knee OA at a minimum 1-year follow-up. The authors hypothesized that in the short term, knee arthroscopy and debridement would lead to improvement in pain and PROMs but that these improvements would diminish in studies with longer-term follow-up.

Methods

A systematic review was performed according to the Preferred Reporting Items for Systematic Reviews and Meta-analyses targeting literature regarding arthroscopic debridement for management of knee OA.[19] A comprehensive search was performed on January 10, 2024, across PubMed, Embase, and Cochrane databases using the following search terms: "(knee osteoarthritis OR knee arthritis) AND (arthroscopic OR arthroscopy OR debridement OR chondroplasty OR lavage OR loose body removal OR synovectomy OR meniscectomy OR meniscus OR meniscal) AND (Kellgren-Lawrence OR Kellgren Lawrence OR KL OR K-L)."

Inclusion criteria included Level I to IV studies documenting the use of arthroscopic debridement for the treatment of mild to moderate knee OA (defined as KL grades I-III). Of note, multicompartment OA patients were eligible for inclusion as long as they had KL grades I to III. Arthroscopic debridement was defined by the authors as chondroplasty with or without the addition of lavage, synovectomy, and/or partial meniscectomy. Studies including KL grade IV OA were included as long as those patients consisted of <10% of total patients for each study or the KL grade I to III patient outcomes could be distinguished from the KL grade IV patients within a study. For consistency of the target patient population, studies had to clearly describe the KL grade of all included patients for their study to be included in this review. Furthermore, studies focusing mainly on arthroscopic partial meniscectomy in the setting of knee OA were excluded. Articles were excluded if cartilage damage was described as focal (defined as <2 cm by the authors) or a product of osteochondritis dissecans. Inclusion and exclusion criteria are defined in Table 1.

After the removal of duplicate studies, a review of the studies' abstracts was conducted by 2 authors (A.C.W. and A.A.Y.). Discrepancies between the 2 were resolved by the senior author (B.J.C.). Following the initial screening, articles were subjected to a full-text review. Any arising disagreements were again settled by the senior author. The final set of articles in this review presents the outcomes of patients with mild to moderate knee OA treated with arthroscopic debridement.

Outcome Measures and Data Extraction

The primary outcome of interest was an improvement in PROMs at a minimum 1-year follow-up, understanding that the literature on this topic is likely heterogeneous in their primary outcomes and PROMs. A Microsoft Excel (Version 16.63) spreadsheet was created to store all extracted data from included studies.

Table 1. Inclusion and Exclusion Criteria for This Review

Inclusion Criteria	Exclusion Criteria
Knee osteoarthritis (Kellgren-Lawrence grades I, II, or III)	Kellgren-Lawrence grades 0 and IV
Arthroscopic debridement or chondroplasty was performed	Focal chondral defects (lesions described as "focal," <2 cm^2) or osteochondritis dissecans lesions
Patient age 18 to 75 y	Cartilage restorative procedures including autologous chondrocyte implantation, osteochondral allograft transplantation, and marrow stimulation
Minimum 1-year clinical follow-up including clear description of patient-reported outcome measures and complete patient information	Concomitant ligament incompetence, functionally meniscectomized, meniscal root tears, or meniscus tears indicated for repair
Written in English	Mechanical axis varus or valgus malignment ≥6°
Indexed in Medline, Cochrane, or Embase	Review articles
Minimum 20 patients in the study	Case reports, editorials, poster, or abstract only
	Animal or basic science study

If a study included patients with Kellgren-Lawrence grade I to III osteoarthritis in addition to less or more severe grades, the study was included if the clinical outcomes of the patients with grades I to III, with a focus on grades II to III, could be definitively separated from more or less severe cases in the article.

Studies were included if any of the following procedures were performed in conjunction with an arthroscopic debridement/chondroplasty: lavage, partial meniscectomy for degenerative tears, debridement, synovectomy, and/or loose body removal.

Extracted data included study title, year, journal of publication, study design, level of evidence, and inclusion and exclusion criteria so a clear representation of study heterogeneity could be reported; patient number if a control group was present; mean age; mean body mass index (BMI); mean follow-up; KL grades; what procedure(s) exactly were performed; PROMs preoperatively and postoperatively at all reported time points; reoperations; and complications. If clinical outcomes could be broken down by KL grade of OA, that was performed to add granularity regarding which patients may or may not benefit from arthroscopic debridement for OA.

Risk of Bias

Bias analysis for the 1 included randomized controlled trial[10] was evaluated by 2 independent authors (A.C.W. and A.A.Y.) using the Cochrane Collaboration's Bias Tool.[20] The same 2 reviewers utilized the Methodological Index for Non-Randomized Studies (MINORS) score on the 7 included nonrandomized studies to evaluate bias.[21] This tool uses a numeric scale composed of 12 questions. For noncomparative studies, the ideal score is 16, and for a comparative study, the ideal score is 24.

Results

Eight studies including a total of 773 patients met inclusion criteria (range of patients in each study, 31-214) (Fig 1).[10,22-28] One study was a Level I randomized controlled trial[10]; 1 was a prognostic, Level II study[22]; 4 were Level III evidence with comparative groups[24-26,28]; and the remaining 2 studies were Level IV case series.[23,27] The year of publication ranged from 2003 to 2022. Inclusion and exclusion criteria varied between studies and can be found in Table 2.

Patient Demographics and Surgical Details

The mean age of patients ranged from 35.5 years in the Jackson and Dieterichs[23] study for KL grade I patients to 64 years in the investigation by Hutt and colleagues,[27] with most studies having a mean patient age of 55 to 65 years of age. Mean BMI ranged from 23.9 to 31.8, with 2 studies not reporting mean BMI.[23,27] Each study described debridement of articular cartilage, with most patients also undergoing a concomitant procedure including partial meniscectomy, loose body removal, synovectomy, removal of osteophytes, or plica excision. Mean follow-up ranged from 18 to 120 months (Table 3).

Clinical Outcomes

The most common primary outcome reported was normalized total Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC) scores (0-96, with higher scores indicating more severe symptoms) in 3 studies[24,25,28] and the study by Kirkley et al.[10] using a different version of the WOMAC (0-2,400, with higher scores indicating more severe symptoms).[29] The PROMs presented by the 4 other included studies varied widely, including the Knee Society Score (KSS),[22] Visual Analog Pain Scale,[26,28] Hospital for Special Surgery Knee Rating Scale (HSS),[26] Oxford Knee Score (OKS),[27] and a self-assessment Likert scale of excellent, good, fair, and poor.[23]

Aaron and colleagues[22] performed a cross-sectional study of 110 patients with knee OA managed with arthroscopic debridement and subcategorized clinical outcomes by grade of OA. Their study included 58 (52%) KL II, 32 (29%) KL III, and 20 (18%) KL IV OA. KSS scores improved from 11.9 preoperatively to 30.8 postoperatively ($P < .001$), with a score ≥30 indicating treatment success. When dichotomized by KL grade of

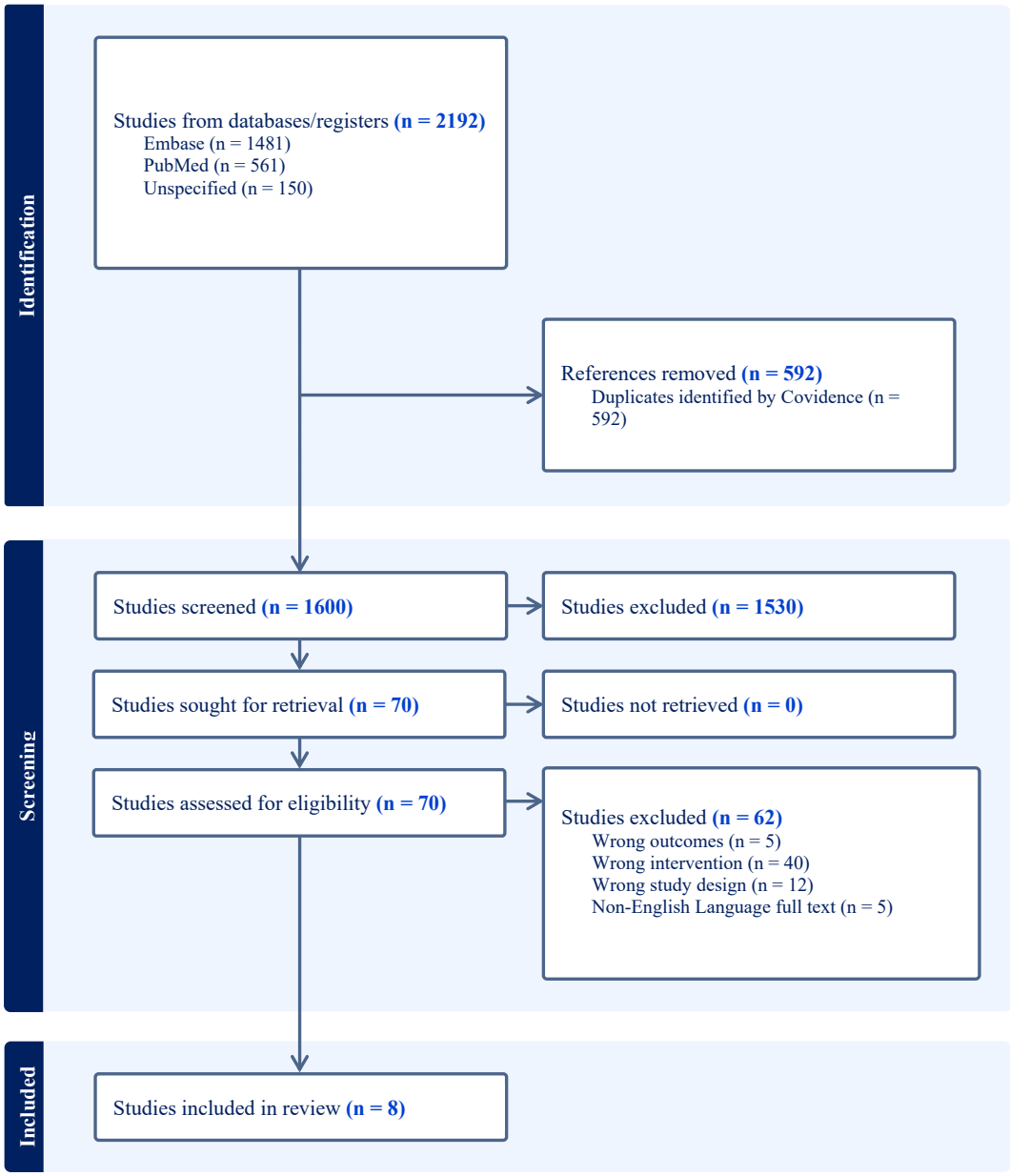

Fig 1. Preferred Reporting Items for Systematic Reviews and Meta-analyses flowchart of included and excluded studies.

OA, patients with KL II had 84% pain relief at 36 months of follow-up compared to 53% in those with KL III OA and 25% in those with KL IV OA. The authors also found a significant association between the severity of chondral wear in all 3 knee compartments and postoperative KSS scores, indicating arthroscopic debridement of more advanced disease carries a more guarded prognosis.[22] Hutt et al.[27] reported similar findings in a cohort of exclusively KL II (n = 31) and KL III (n = 12) knee OA. The authors noted significant improvements in OKS (median OKS preoperatively, 24; median postoperatively, 36.5) from preoperatively to a mean 1.5-year follow-up. They concluded that "while not universally effective, arthroscopic debridement for patients with knee OA and mechanical symptoms can result in significant improvements in pain and function."

The investigation by Lv and colleagues[26] of 98 patients with KL I to III OA reported significantly greater HSS scores at 24 months of follow-up compared with preoperative scores, with significant differences also found at 3 months, 6 months, 12 months, and 24 months postoperatively between patients who underwent arthroscopic debridement compared with activity modification and nonsteroidal anti-inflammatory medications favoring the surgical group ($P < .05$ for all time points). However, the clinical relevance of a 4- to 5-point difference in HSS score should be considered.

Table 2. Journal of Publication, Level of Evidence, Inclusion and Exclusion Criteria, and the Presence of a Control Group for the 8 Included Studies in This Systematic Review

Study	Journal	Level of Evidence	Inclusion Criteria	Exclusion Criteria	Control Group, Yes/No	Control Group Treatment
Jackson and Dieterichs (2003)[23]	*Arthroscopy*	IV	OA previously untreated KL grades II or III	Previous surgical procedure on the same knee KL grade I or IV Use of marrow stimulation during surgery	No	——
Aaron et al. (2006)[22]	*Journal of Bone and Joint Surgery*	II	18 to 70 years old KL grade II or higher OA of the tibiofemoral joint	Previous infection of the knee OA of the patellofemoral joint only Diagnosis other than OA (including cartilage defects without arthritis)	No	——
Kirkley et al. (2008)[10]	*New England Journal of Medicine*	I	18 years old or greater with idiopathic or secondary arthritis KL grades II to IV (grade IV in 1 compartment only)	Inflammatory or postinfection arthritis Previous arthroscopic treatment for knee OA More than 5° of varus or valgus deformity Previous major knee trauma KL grade IV OA in 2 compartments in persons over 60 years of age	Yes	Physical therapy for 1 hour a week for 12 consecutive weeks with an in-home program thereafter
Prakash et al. (2012)[28]	*Current Orthopaedic Practice*	III	45 years of age or greater Primary OA of the knee KL grade II or III	Trauma to the knee Any disease of the joint other than OA Current or former smokers	No	——
Steadman et al. (2013)[24]	*Arthroscopy*	III	Failed conservative treatment for OA KL grade III or IV Symptoms associated with OA (not only mechanical)	Traumatic chondral lesions Mild OA (KL grades 0-II) Incomplete radiographic studies	No	——
Hutt et al. (2015)[27]	*Knee Surgery, Sports Traumatology, Arthroscopy*	IV	Radiographic evidence of knee OA One or more mechanical symptoms, including locking, giving way, clicking, and sharp pain Failure of nonoperative treatment	Previously received intra-articular injection of steroid or visco-supplementary product KL grade IV	No	——
Su et al. (2018)[25]	*Arthroscopy*	III	18 years old or greater with knee OA KL grades II to IV Stoller grades 3 and 4 Meniscal damage not found on pretreatment MRI	Severe OA, stiffness, or pain and refused to undergo TKA when recommended Loose bodies or mild patellar plica	Yes	Physical therapy once a week for 5 weeks
Lv et al. (2021)[26]	*World Journal of Clinical Cases*	III	18 years old or greater with KL grades I to III No serious condition affecting the lower limb walking or treatment	Severe medical or psychiatric disease Acute knee injury or KL grade IV OA Inflammatory arthritis	Yes	Reduce activity of affected limb, weight loss, oral anti-inflammatories, hot compress on joint

KL, Kellgren-Lawrence; OA, osteoarthritis; MRI, magnetic resonance imaging; TKA, total knee arthroplasty.

Although the 4- to 5-point difference in HSS score was statistically significant, it is below the 5.41 minimal clinically reported difference reported in the arthroplasty literature.[30]

Su et al.[25] reported on a series of 214 patients who received arthroscopic debridement for KL grade II to IV OA in comparison to 168 who received conservative treatment, including oral medications, physiotherapy, and exercise. Their series included 44 patients with KL II OA (20.6%) and 118 (55.1%) with KL III OA. The authors reported that the total WOMAC score was significantly lower (improved) in the arthroscopy group compared with conservative care at 1 year and 2 years ($P < .01$), but this finding was no longer present at 3-, 4-, and 5-year postoperative time points.[25] Similarly, Prakash et al.[28] reported significant improvements in

Table 3. The Number of Patients in Each Study, Mean Age and Body Mass Index Broken Down by Kellgren-Lawrence Grade of Osteoarthritis (if Available), Description of Surgical Procedure(s) Performed, the Primary Outcome of the Study, and Mean Time to Follow-Up

Study	Total Patients	KL Grade	Mean Age, y	Mean BMI	Procedures Performed	Primary Outcome	Mean Follow-Up
Jackson and Dieterichs (2003)[23]	121		*	*	Debridement, removal of the articular fragment, loose body removal, meniscectomy, lavage	Self-assessment (excellent, good, fair, or poor)	4-6 years
		I	35.5	*			
		II	54	*			
		III	56	*			
		IV	64	*			
Aaron et al. (2006)[22]	110		61.7	31.8	Debridement with motorized chondrotome, loose flaps resected, crater edges smoothed, loose bodies removed, synovectomy, meniscectomy	Knee Society Score	34 months (24-74)
		I	*	*			
		II	*	*			
		III	*	*			
Kirkley et al. (2008)[10]	92		58.6	31.6	Scope at least 1 of the following: synovectomy, debridement, excision of degenerative tears of the meniscus, fragments of articular cartilage, or chondral flaps and osteophytes that prevented full extension	WOMAC score at 2 years	2 years
		I	*	*			
		II	*	*			
		III	*	*			
Prakash et al. (2012)[28]	31		53.68	25.49	Debridement, meniscectomy, loose body removal, osteophyte removal, synovectomy, removal of loose chondral flaps	WOMAC score at 2 years	2 years
		I	*	*			
		II	53.68	*			
		III	54.5	*			
Steadman et al. (2013)[24]	64		58	*	Debridement, loose flaps resected, synovectomy, loose body removal, meniscectomy, osteophyte removal, plica excision, pouch release	WOMAC score at 10 years	10 years
		I	*	*			
		II	*	*			
		III	*	*			
Hutt et al. (2015)[27]	43		64	*	Debridement, debridement of loose chondral flaps, meniscectomy, loose body removal	OKS, VAS, and failure	1.5 years
		I	*	*			
		II	*	*			
		III	*	*			
Su et al. (2018)[25]	214		56.4	25.7	Debridement (joint lavage), meniscectomy, chondral flaps, removal of osteophytes, synovectomy, or abrasion for patients with massive cartilaginous lesions	Conversion to TKA at 5 years and WOMAC score	5 years
		I	*	*			
		II	*	*			
		III	*	*			
Lv et al. (2021)[26]	98		59.26	24.6	Debridement, synovectomy, pouch release, rupture or injured menisci "treated with plastic," loose body removal	HSS and VAS at 2 years	24 months
		I	*	*			
		II	*	*			

BMI, body mass index; HSS, Hospital for Special Surgery Knee Rating Scale; KL, Kellgren-Lawrence; OKS, Oxford Knee Score; TKA, total knee arthroplasty; VAS, Visual Analog Pain Scale; WOMAC, Western Ontario and McMaster Universities Osteoarthritis Index.
*Signifies data not available.

total WOMAC score (in their study, a higher WOMAC score was indicative of improved outcome) in their series of 31 patients with KL II and III OA. Specifically, the mean improvement in WOMAC scores was ~35 points for patients with KL II OA and 32 points for patients with KL III OA after arthroscopic debridement. For patients with KL III OA, there was a 60% loss of improvement in WOMAC scores at 2 years.[28] The oldest included study, by Jackson and Dieterichs,[23] reported similar findings of more significant and durable improvement in clinical outcomes in patients with less severe disease. Specifically, at a minimum 4-year follow-up from arthroscopic debridement, patients with grade I disease had 100% excellent/good results reported by patients compared with 91% of grade II disease and 49% of those with grade III disease.

Steadman et al.[24] reported outcomes based on the degree of arthritis, including patients with more severe disease, specifically KL grade III and IV OA. The authors reported a 10-point lower WOMAC total score (improved outcome) at 10-year follow-up in patients with grade III OA (n = 38) compared with grade IV (n = 34). The authors also noted that 62% of patients were converted to TKA at a mean of 4.4 years (range, 1.0-9.6 years) after knee arthroscopy. Specifically, grade III OA patients had 70% and 53% survivorship free of TKA at 5 and 10 years, respectively.[24]

Table 4. Patient-Reported Outcome Measures at Preoperative (if Available) and Various Postoperative Time Points Further Broken Down by Kellgren-Lawrence Grade of Osteoarthritis, if Possible

Study	Outcomes Assessed	KL Grade	Preoperative Clinical Outcome Scores, Mean/SD	12 Months	18 Months	24 Months	36 Months	48 Months	60 Months	120 Months	Patient Satisfaction
Jackson and Dieterichs (2003)[23]	Patient Subjective self-evaluation at 4 years	I	*	*	*	*	*	8/8 (100%) excellent or good	*	*	*
		II	*	*	*	*	*	29/32 (90.6%) excellent or good, 3/32 (9.4%) poor	*	*	*
		III	*	*	*	*	*	19/39 (48.7%) excellent or good, 11/39 (28.2%) fair, 9/39 (23.1%) poor	*	*	*
Aaron et al. (2006)[22]	KSS pain domain success rate at 3 years	II	*	*	*	*	49/58 (84%)	*	*	*	*
		III	*	6/32 (19%)	*	*	17/32 (53%)	*	*	*	*
		IV	*	*	*	*	5/20 (25%)	*	*	*	*
Kirkley et al. (2008)[10]	WOMAC total score at 2 years	Mean of II-IV	1,187 ± 483	*	*	874 ± 624	*	*	*	*	*
Prakash et al. (2012)[28]	WOMAC score at 2 years	II	58.8	90	*	88	*	*	*	*	*
		III	45.31	67	*	58	*	*	*	*	*
Steadman et al. (2013)[24]	Lysholm score; Tegner activity score; WOMAC score; PSwOS at 10 years	III	50 (Lysholm)	*	*	*	*	*	*	75 (Lysholm); 3 (Tegner); 16 (WOMAC); 9/10 (PSwOS)	*
		IV	49 (Lysholm)	*	*	*	*	*	*	72 (Lysholm); 4 (Tegner); 26 (WOMAC); 8/10 (PSwOS)	*
Hutt et al. (2015)[27]	OKS score, VAS Pain score, and PSwOS at 1.5 years	Mean of I-III	24 (OKS); 7/10 (VAS Pain)	*	36.5 (OKS); 5/10 (VAS Pain); 6.2/10 (PSwOS)	*	*	*	*	*	*
Su et al. (2018)[25]	WOMAC score at 5 years	II	*	25.1 ± 10.9	*	27.6 ± 8.3	32.4 ± 13.1	31.0 ± 10.4	31.0 ± 12.9	*	*
		III	*	25.5 ± 10.6	*	27.3 ± 10.8	31.5 ± 12.8	33.9 ± 13.2	33.3 ± 4.3	*	*
		IV	*	27.3 ± 14.0	*	27.0 ± 10.8	32.9 ± 14.7	36.0 ± 13.1	40.4 ± 7.1	*	*
Lv et al. (2021)[26]	HSS score, VASW score, and VASR score at 2 years	Mean of I-III	78.65 ± 11.20 (HSS); 4.06 ± 1.55 (VASW); 1.22 ± 2.03 (VASR)	92.18 ± 5.90 (HSS); 0.94 ± 1.29 (VASW); 0.02 ± 0.14 (VASR)	*	92.08 ± 5.85 (HSS); 0.94 ± 1.26 (VASW); 0.02 ± 0.14 (VASR)	*	*	*	*	*

NOTE. Means and standard deviations were reported for continuous variable scores.

HSS, Hospital for Special Surgery Knee Rating Scale; KL, Kellgren-Lawrence; KSS, Knee Society Score; OKS, Oxford Knee Score; PSwOS, patient satisfaction with outcome score; VAS, Visual Analog Pain Scale; VASR, Visual Analog Pain Scale at rest; VASW, Visual Analog Pain Scale at walking; WOMAC, Western Ontario and McMaster Universities Osteoarthritis Index.

*Signifies data not available.

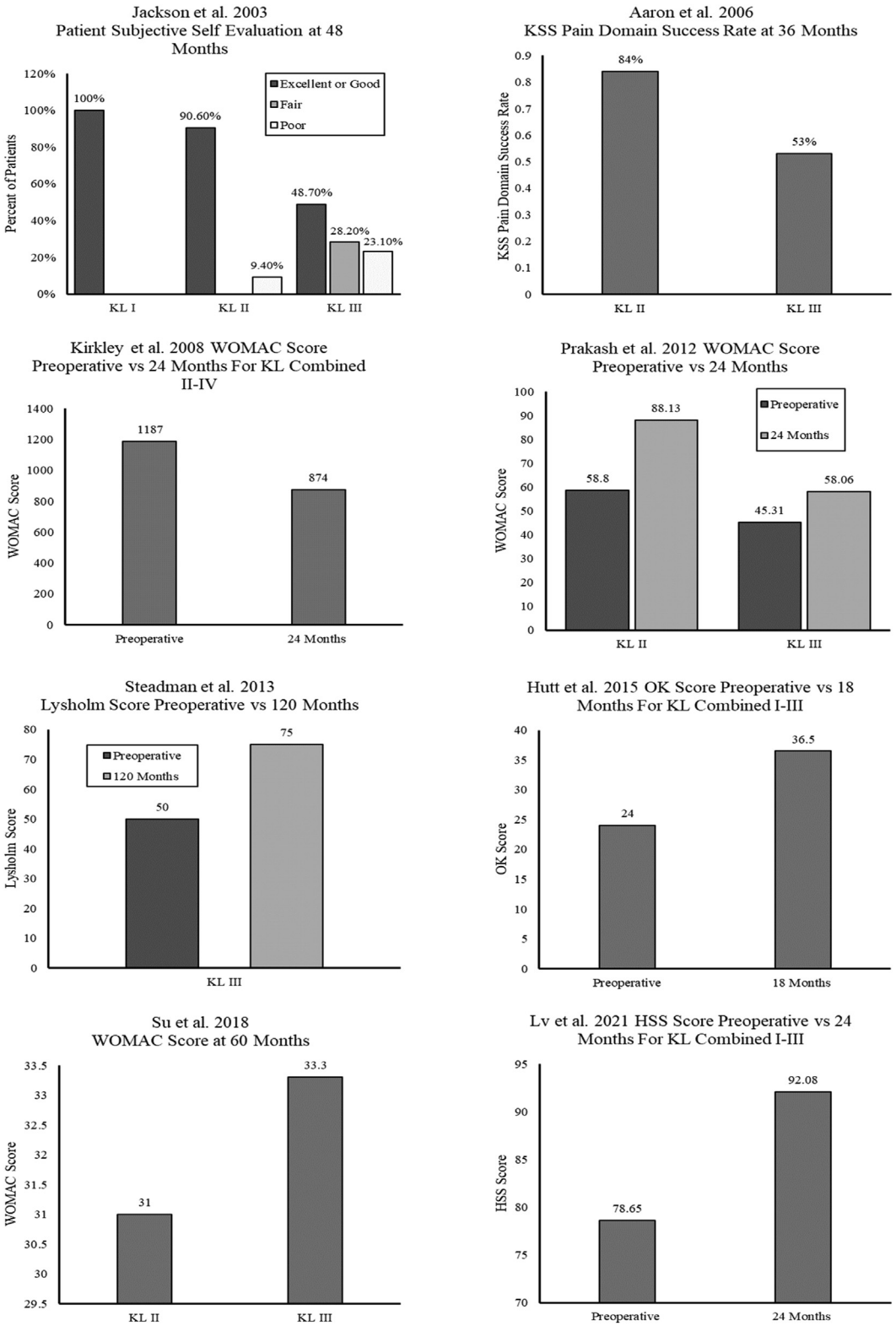

Fig 2. Patient-reported outcome measures at preoperative (if available) and postoperative time points subcategorized by KL grade of osteoarthritis and by individual study. Postoperative patient-reported outcome measures reported if available. Patient-reported outcome measures broken down by KL grade when available or reported as a mean. (HSS, Hospital for Special Surgery Knee Rating Scale; KL, Kellgren-Lawrence; KSS, Knee Society Score; OK, Oxford Knee; WOMAC, Western Ontario and McMaster Universities Osteoarthritis Index.)

Table 5. Reoperations, Complications, and Failures to Knee Arthroplasty in Each Study Subdivided by Kellgren-Lawrence Grade of Osteoarthritis, if Possible

Study	Kellgren-Lawrence Grade	Reoperations, n (%)	Complications, n (%)	Failures to Total Knee Arthroplasty, n (%)
Jackson and Dieterichs (2003)[23]	I	0/8 (0)	*	0/8 (0)
	II	3/32 (9.4)	*	0/32 (0)
	III	6/39 (15.4)	*	3/39 (7.7)
	IV	3/42 (6.7)	*	12/42 (29)
Aaron et al. (2006)[22]	II	*	*	3/58 (5)
	III	*	*	7/32 (22)
	IV	*	*	7/20 (35)
Kirkley et al. (2008)[10]		*	*	*
Prakash et al. (2012)[28]	Total	*	*	*
Steadman et al. (2013)[24]	III	*	*	19/38 (50) knees
	IV	*	*	24/31 (77) knees
Hutt et al. (2015)[27]	Total	*	*	7/43 (16)
Su et al. (2018)[25]	II	0/44 (0)	0/44 (0)	2/44 (4.5)
	III	0/118 (0)	0/118 (0)	9/118 (7.6)
	IV	0/52 (0)	0/52 (0)	21/52 (40.4)
Lv et al. (2021)[26]	Total	*	2/98 (2.04)	*
	I	*	*	*
	II	*	*	*
	III	*	*	*

*Signifies data not available.

Kirkley and colleagues[10] reported no significant difference in total WOMAC score in their randomized controlled trial of arthroscopic surgery versus PT and medical therapy alone at 2 years after treatment initiation. Their cohorts were composed predominately of patients with KL grade II and III OA (95% of patients in each treatment arm). The authors concluded that arthroscopic surgery for knee OA provides no benefit over quality PT and medical therapy.[10] Complete breakdown of PROMs reported by study and KL grade can be found in Table 4. The primary PROM outcome of interest for each study based on KL grade, if subcategorized, is displayed in Figure 2. A complete report of reoperations, complications, and conversion to TKA

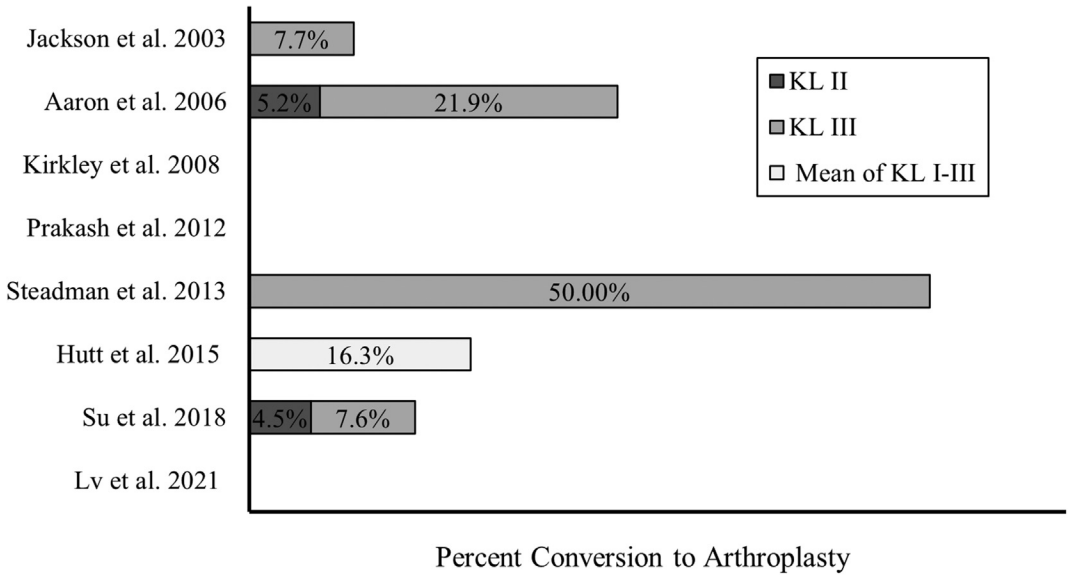

Fig 3. Conversion to arthroplasty following treatment failure further subcategorized by KL grade of osteoarthritis. Data reported unless unavailable in original study. Conversion to arthroplasty broken down by KL grade when available or reported as a mean. Percentage of patients converting to arthroplasty was at time of final follow-up for each study that differed. For the 5 studies reporting on conversion to arthroplasty, final mean follow-up time points are noted as follows: Jackson and Dieterichs,[23] 4 to 6 years; Aaron et al.,[22] 34 months; Steadman et al.,[24] 10 years; Hutt et al.,[27] 1.5 years; and Su et al.,[25] 5 years. (KL, Kellgren-Lawrence.)

Study	Random Sequence Generation	Allocation Concealment	Blinding of Participants and Personnel	Blinding of outcome assessment	Incomplete outcome data	Selective reporting	Other bias	Overall
Kirkley et al. 2008	+	+	+	+	+	?	+	+

Fig 4. Results of the Cochrane Collaboration Bias Tool for the single randomized controlled trial included. +, low risk; ?, unclear.

is detailed in Table 5. Conversion to TKA is noted based on KL grade in Figure 3.

The results of the combined scores by 2 reviewers for bias assessment of the randomized controlled trial by Kirkley et al.[10] and the 7 nonrandomized trials[22-28] can be found in Figures 4 and 5, respectively. MINORS scores ranged from 6 to 10 (mean, 8.0) for the 5 nonrandomized studies without a control group (ideal score 16).[22-24,27,28]

Discussion

The main findings of this systematic review demonstrate that most patients (7 of 8 included studies) report good to excellent PROM scores at a minimum 1- to 4-year follow-up after arthroscopic debridement for mild to moderate knee OA. Improvements in PROMs were more significant in patients with less severe knee OA (KL I-II). Similar findings were seen regarding the percentage of patients subsequently undergoing TKA

	A clearly stated aim	Inclusion of consecutive patients	Prospective collection of data	Endpoints appropriate to the aim of the study	Unbiased assessment of the study endpoint	Follow-up period appropriate to the aim of the study	Loss to follow up less than 5%	Prospective calculation of study size	An adequate control group	Contemporary groups	Baseline equivalence of groups	Adequate statistical analyses	Total
Jackson *et al.* 2003	1	2	1	2	0	2	2	0	NA	NA	NA	NA	10
Aaron *et al.* 2006	1	0	2	2	2	1	1	0	NA	NA	NA	NA	9
Prakash *et al.* 2012	2	0	1	1	0	2	0	0	NA	NA	NA	NA	6
Steadman *et al.* 2013	2	1	0	2	0	2	0	0	NA	NA	NA	NA	7
Hutt *et al.* 2015	2	0	2	1	0	1	0	2	NA	NA	NA	NA	8
Su *et al.* 2018	2	2	2	2	0	2	2	0	2	2	2	2	20
Lv *et al.* 2021	1	1	2	2	0	2	0	0	2	2	2	2	16

Fig 5. Results of the Methodological Index for Non-Randomized Studies score bias grading for nonrandomized studies. Studies are scored as 0 (not reported) Red, 1 (reported but inadequate) Yellow, or 2 (reported and adequate) Green. The maximum score for non-comparative studies is 16, and for comparative studies is 24. (NA, Not applicable, non-comparative study.)

after arthroscopic debridement. In addition, patients with more severe preoperative OA (KL III) grade had higher conversion rates to TKA at final follow-up in 4 studies (TKA rates 7.6%-50% in KL III patients compared with 0%-4.5% in KL I-II).[22-25] While 7 of the 8 included studies reported efficacy of arthroscopic debridement for management of mild to moderate knee OA, 2 of the 3 studies with at least a 4-year clinical follow-up reported that clinical improvements diminished with time (improvements no longer significant for total WOMAC score). The highest-quality study, the randomized controlled trial by Kirkley et al.,[10] was the only investigation not to find the benefit of arthroscopic debridement over quality nonoperative care. The existing literature on this topic has a significant degree of bias, as evidenced by the MINORS scores ranging from 6 to 10 (mean, 8.0) for the 5 nonrandomized studies without a control group[22-24,27,28] and 3 investigations[22,23,25] not reporting preoperative PROMs, raising concern for what the true improvement postoperatively was.

Arthroscopic management of atraumatic, degenerative meniscus tears in the setting of knee OA has been studied extensively, with the most recent American Academy of Orthopaedic Surgeons (AAOS) Clinical Practice Guidelines (CPG) on Management of Osteoarthritis of the knee giving arthroscopic partial meniscectomy in the setting of mild to moderate OA who have failed nonoperative measures a moderate recommendation in favor.[6] In contrast, the AAOS CPG gives arthroscopic lavage/debridement a moderate rating against its use in the setting of knee OA.[6] Despite this, the results of the present study suggest that at a 1- to 10-year follow-up range, arthroscopic debridement does lead to quality PROMs for most patients, with Jackson and Dieterichs[23] (>90% patient self-reflection of doing "excellent") and Steadman et al.[24] (mean 25-point improvement in Lysholm score from the preoperative state) reporting sustained improvement at 5- and 10-year follow-up, respectively. It may be time to reconsider a moderate recommendation against arthroscopic debridement to clarify that for patients with mild knee OA who have failed conservative measures, debridement is a viable treatment strategy. Defining what constitutes a "successful" procedure bears consideration as well in terms of improvement in pain, function, and durability. Although 7 of the 8 studies in this review suggest arthroscopic debridement for KL I to III OA can lead to clinically meaningful improvements in PROMs and low rates of conversion to arthroplasty for KL I to II OA, evidence of durability of this intervention is inconsistent.[25,28]

Since the results of the included study by Kirkley et al.[10] were published in 2008, there has been a shift away from arthroscopic debridement for knee OA.[31,32] Authors have supported this further with cost-effectiveness analyses that demonstrate a <20% probability that the addition of arthroscopy is a cost-effective treatment for knee OA compared with nonoperative therapies only.[33] In the opinion of the authors, it may be that prior indications have been too broad regarding not only the severity of disease but also medical comorbidities, extent/duration of prior nonoperative care, and patient BMI. This review highlights the importance of careful indications for operative intervention in the setting of knee OA. Most patients in the included studies were in the healthy or overweight BMI ranges (18.5 to <25 and 25 to <30), had atraumatic onset of symptoms, and had no success with conservative measures. In addition, patients with lower-grade disease clearly respond more effectively. This may be the target population that is worth considering arthroscopic debridement for when conservative measures have been exhausted, but patients should be counseled on the conflicting reports of long-term relief. It can be difficult when the ever-growing menu of conservative care, including injection therapies, is no longer effective for patients with mild to moderate disease.[6,7,34] Arthroscopic debridement may be a viable short- or even medium-term solution for these patients, depending on the severity of their OA.

Limitations

There are several limitations of the present study. The results of this review demonstrate how heterogeneous the literature is regarding arthroscopic debridement for the management of symptomatic knee OA. Even in the setting of a systematic review controlling for many variables of included studies, the literature varies widely in which patient populations were included in each study and, importantly, in the quality and consistency of outcome reporting. This study is limited by the lower quality evidence of the included nonrandomized controlled trials based on the MINORS scores ranging from 6 to 10 (mean, 8.0; ideal, 16). As has been discussed at length, few studies on the topic of arthroscopic management of knee OA include a well-defined, discrete OA grade population but rather include a broad range of diseases and indications. The diversity of included patients may make the results more generalizable, but without clearly breaking outcomes down by severity of disease, it is challenging to clearly define what specific populations may benefit most from an arthroscopic debridement. There was a lack of consistency in what PROMs were reported, if preoperative PROMs were collected, and what postoperative time points clinical follow-up was recorded, making it challenging to directly compare studies. In addition, concomitant procedures performed at the time of debridement varied, including osteophyte excision, meniscectomy, plica excision, abrasion, and loose body removal. It is unknown how

any of these concomitant procedures may have affected outcomes.

Conclusions

Arthroscopic debridement for management of mild to moderate knee OA is effective at short-term follow-up in patients who have exhausted conservative care. There is limited evidence demonstrating the durability of improvement following arthroscopic debridement after 2 years.

Disclosures

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