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No difference in outcome between early versus delayed weight-bearing following microfracture surgery of the hip, knee or ankle: a systematic review of outcomes and complications

Darren de SA,[1] Patrick Thornley,[2] Gavinn Niroopan,[1] Moin Khan,[1] Colm McCarthy,[1] Nicole Simunovic,[3] John Adamich,[1] Sahab Jamshidi,[1] Forough Farrokhyar,[1,3] Devin Peterson,[1] Volker Musahl,[4] Olufemi R Ayeni[1]

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[1]Division of Orthopaedic Surgery, Department of Surgery, McMaster University Medical Centre, Hamilton, Ontario, Canada
[2]Michael G. DeGroote School of Medicine, McMaster University, Hamilton, Ontario, Canada
[3]Department of Clinical Epidemiology and Biostatistics, McMaster University, Hamilton, Ontario, Canada
[4]Department of Orthopaedic Surgery, UPMC Center for Sports Medicine, University of Pittsburgh, Pittsburgh, Pennsylvania, USA

Correspondence to
Dr Olufemi R Ayeni, Division of Orthopaedic Surgery, Department of Surgery, McMaster University Medical Center, 1200 Main St W, Room 4E15, Hamilton, Ontario, Canada L8N 3Z5; ayenif@mcmaster.ca

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ABSTRACT

Importance Injuries to hyaline cartilage have poor healing potential. Microfracture is often used to treat these lesions; yet, significant variation exists in postoperative rehabilitation protocols.

Objective To systematically examine the evidence on the effects of postoperative weight-bearing status after microfracture surgery. We aimed to ascertain the surgical outcomes and complications associated with patients undergoing microfracture surgery for chondral lesions of the hip, knee or ankle assessing for any difference in outcome between early versus delayed weight-bearing postoperatively.

Evidence review A literature search was performed through five databases (CINHAL, MEDLINE, EMBASE, PubMed and Web of Science) identifying studies addressing weight-bearing following microfracture surgery published between 1990 and March 2015. 2 reviewers conducted a full-text review of eligible studies and the references of these included studies. Inclusion criteria included studies conducted on human subjects who underwent microfracture with a described postoperative weight-bearing protocol; had outcomes data reported and were published in English. Exclusion criteria included review articles, non-surgical studies, technique papers and non-English language studies. The Grades of Recommendation, Assessment, Development and Evaluation (GRADE) criteria were used to evaluate the quality of the evidence among all included studies and data were abstracted and separated by joint—hip, knee and ankle. Descriptive statistics are presented.

Findings We identified and included 46 studies (5 hip studies, 22 knee studies and 19 ankle studies) of very low methodological quality. No included hip studies examined early weight-bearing or any functional protocol assessment. With respect to knee microfracture studies, only 20 of a total of 900 patients followed an early weight-bearing protocol. Given the discrepancy between early and delayed weight-bearing sample sizes available, comparative analyses of outcome scores and complications/reoperations were not pursued. With respect to ankle microfracture studies, there were no differences in functional scores and the rate of complications or reoperations between early and delayed weight-bearing groups.

Conclusions and relevance There is insufficient evidence to draw any meaningful conclusions with respect to differences in functional scores between early versus delayed weight-bearing following microfracture surgery for the treatment of chondral lesions in the hip, knee and ankle.

What is already known

- Most untreated cartilage lesions, partial or full thickness in nature, progress to osteoarthritis and cause significant morbidity without surgical intervention.
- Microfracture surgery is a popular technique of choice for chondral lesion repair; however, it is not known if early versus delayed postoperative weight-bearing protocols impact outcomes and complication rates.

What are the new findings

- There is insufficient evidence to draw any meaningful conclusions with respect to differences in functional scores between early versus delayed weight-bearing (EWB vs DWB) following microfracture surgery for the treatment of chondral lesions in the hip, knee and ankle.
- Included hip microfracture studies only report a DWB protocol.
- With respect to microfracture of the knee, only 20 total patients have been reported to follow an EWB protocol, and therefore comparison to DWB protocol was not possible.
- There were similar sample sizes for patients with EWB (395 patients) and DWB (455 patients) protocols for ankle studies. CIs for combined outcome scores of EWB patient protocols and DWB patient protocols overlapped for Ankle Activity Score, American Orthopaedic Foot and Ankle Society and Visual Analogue Scale (VAS) pain scores.

INTRODUCTION

Chondral injuries remain a considerable challenge due to the decreased vasculature in the extracellular

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matrix and consequent limited intrinsic regeneration capacity of articular cartilage.[1–3] Although full-thickness lesions involving the subchondral bone possess some healing potential—given their association with marrow release differentiating into fibrocartilage—partial-thickness tears have a lower propensity for healing.[4–6] Regardless, it is known that most untreated cartilage lesions, partial or full thickness in nature, progress to osteoarthritis and cause significant morbidity.[4–10]

Equine and primate studies have shown the process of cartilage repair. Four weeks postoperatively, a fibrin clot is present without fibrocartilage and by 6 weeks, a thin layer of tissue covers the base of the lesion.[11 12] Eight weeks postoperatively, fibrocartilage can be detected and by 12 weeks, the lesion is filled with fibrocartilage and the quality of the cartilaginous tissue improves significantly.[11 12] However, it never approaches the integrity of native hyaline cartilage.[4]

Controversy exists over the best method to preserve the fibrin super clot after microfracture procedures in humans. There are significant variations in postoperative rehabilitation protocols, especially pertaining to weight-bearing status postoperatively. Dzioba[13] published a non-weight-bearing protocol for 8 weeks postoperatively following knee microfracture surgery. Levy *et al*[14] published a postoperative rehabilitation protocol with early weight-bearing (EWB) less than 1 week postoperatively, and a return to sports at an average of 11 weeks after knee microfracture. Popular practice, however, has incorporated a minimum of 6 weeks non-weight-bearing.[2 8–10 15 16] We hypothesise that there is limited evidence on the effects of weight-bearing after microfracture surgery and assume the null hypothesis—that is, postoperative weight-bearing status is not a significant factor affecting patient outcomes. Accordingly, this systematic review aims to ascertain the surgical outcomes associated with EWB versus delayed weight-bearing (DWB) following microfracture surgery for chondral lesions in the hip, ankle or knee.

MATERIALS AND METHODS

Search strategy

Two reviewers (GN and CM) searched the literature retrieved from five databases (CINHAL, MEDLINE, EMBASE, PubMed and Web of Science) for studies involving EWB and DWB after microfracture surgery published between 1990 and March 2015. For this study, EWB was defined as progression to full weight-bearing up to 5 weeks and 6 days postoperative and DWB was defined as progression to full weight-bearing at or after the 6-week postoperative period. This 6-week time point was based on the aforementioned equine and primate studies, at which point the fibrin clot should be covered by a thin layer of tissue. The search was conducted on 15 July 2015 and combined the following terms: *microfracture*, *weight-bearing*, *rehabilitation*, *post-operative care* and *cartilage*. The research question and individual study inclusion and exclusion criteria, determined a priori, were used to include studies that: (1) were of all levels of evidence; (2) involved surgical treatment for cartilage repair; (3) were conducted on human subjects; (4) reported outcomes (and/or complications) data; (5) reported the time from when patients resumed weight-bearing during their postoperative period and (6) studies published in English. Exclusion criteria were: (1) non-surgical studies, or those where microfracture was not an intervention; (2) patients with osteoarthritis, rheumatoid arthritis, etc; (3) cadaveric or technical studies and (4) review articles/book chapters (see online supplementary appendix 1).

Study screening

The titles, abstracts and full text of all retrieved studies were screened independently and in duplicate by two reviewers (GN and CM). Throughout this process, if at any point one reviewer believed an article should proceed to full review, it was included to ensure thoroughness. Any disagreements at the full-text stage were discussed between the two reviewers, and a third reviewer (DdSA) resolved any conflicts. The references of those studies satisfying all inclusion criteria were additionally screened to capture any studies that may have evaded the initial search strategy or screening process.

Data abstraction

Two reviewers (GN and CM) for knee studies and two reviewers (PT and SJ) for ankle and hip studies, working independently and in duplicate, abstracted all relevant study data from the studies meeting all inclusion criteria, and recorded this in Microsoft Excel (2013). Demographic information included author, year of publication, sample size, study design, level of evidence and patient demographics (ie, sex, age, affected joint, etc). Data were separated and grouped by the joint examined (hip, knee and ankle). Abstracted data were then stratified and grouped by joint and into early or delayed postoperative weight-bearing status to analyse outcome of weight-bearing status effects on microfracture surgery outcomes.

Statistical analysis

A κ was calculated for each stage of article screening in order to evaluate inter-reviewer agreement.[17] Agreement was categorised a priori as follows: $\kappa>0.61$ to indicate substantial agreement, $0.21<\kappa<0.60$ to indicate moderate agreement, and $\kappa<0.20$ to indicate slight agreement.[17] Descriptive statistics, such as means, ranges and measures of variance (eg, SDs, 95% CIs), where appropriate, are presented.

GRADE quality assessment and summary of findings

The Grades of Recommendation, Assessment, Development and Evaluation (GRADE) Working Group has developed a system for grading the quality of evidence that has been adopted by over 70 major health research organisations.[18] Data from randomised controlled trials (RCTs) are considered high-quality evidence, but can be rated down according to risk of bias, imprecision, inconsistency, indirectness or publication bias.[19] Data from moderate-quality trials can be rated higher according to large effect, dose–response, or if all plausible biases would not undermine the conclusions. Two independent assessors graded the quality of the evidence and resolved discrepancies by consensus, with a κ calculated to evaluate inter-reviewer agreement.[17]

RESULTS

Systematic search

From the initial 2415 studies found from our electronic database search, 129 were selected for full-text screening. A total of 46 studies (5 hip, 22 knee and 19 ankle) were included here (figure 1). These studies were published between the years 2003 and 2014. Additional screening of the references used in the 46 included studies yielded no further eligible studies for inclusion. A meta-analysis was not performed, as the data in each of the 46 studies were not reported in a consistent manner and there were no direct prospectively collected comparison data between multiple studies. There was variability between studies regarding surgical technique and reporting of outcomes, among other

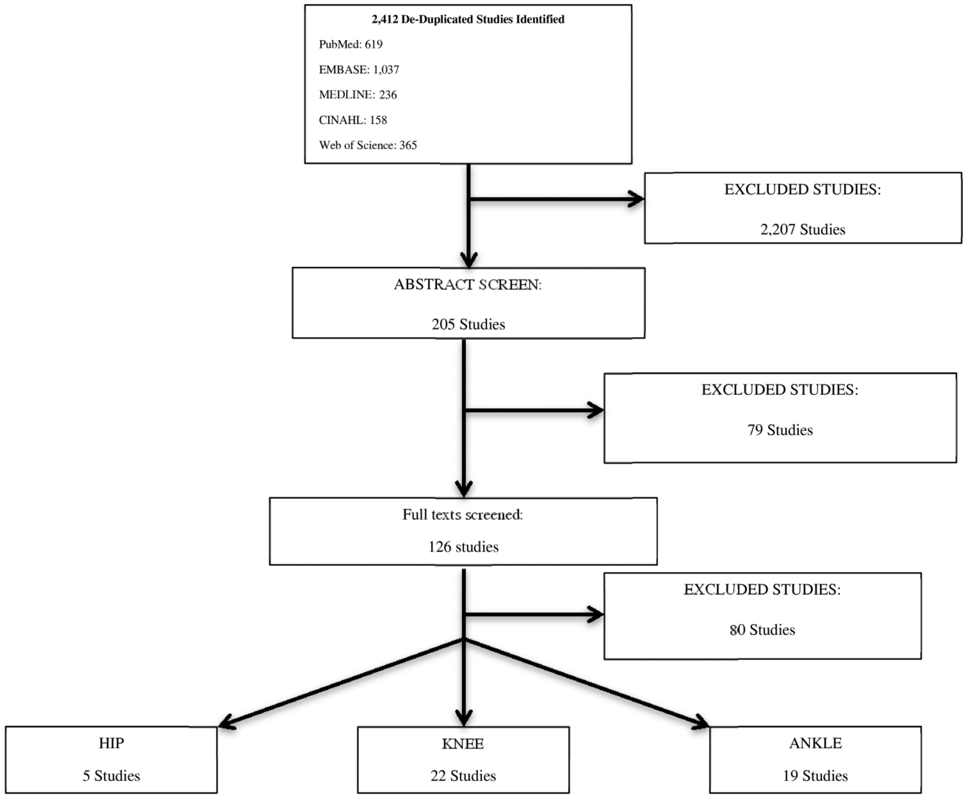

Figure 1 Systematic search of the literature addressing weight-bearing status postmicrofracture.

variables. The reviewers had excellent agreement during the title, abstract and full-text screening stages with κ values (and 95% CI) of 0.89 (0.86 to 0.91), 0.83 (0.76 to 0.91) and 0.86 (0.81 to 0.92), respectively.

GRADE of included evidence

Two independent reviewers assessed the 46 included studies for the GRADE of evidence included and achieved perfect consensus agreement on their assessments with a κ value of 1.00. Both reviewers rated down the quality of evidence from the four RCTs from 'high' to 'very low' quality based on (1) unclear risk of bias, (2) imprecision due to few outcome events and (3) inconsistency due to residual unexplained heterogeneity (tables 1–3). According to the GRADE approach, very low-quality evidence indicates that we have very little confidence in the effect estimate and the true effect is most likely substantially different from the estimate of effect.[19] Across the 46 included studies, very low quality of evidence was demonstrated. Among all studies analysed, there were no studies found to be of high-quality evidence. There were 11 included RCTs in the assessment for knee studies, of which only nine were found to be of medium-quality evidence. Of the four analysed RCTs of ankle studies, only two were of medium-quality evidence.

HIP

Study demographics

This review identified five studies (1 retrospective comparative study, 1 case control and 3 case series) addressing weight-

Table 1 Study characteristics for microfracture studies of the hip

Study	Year	Study design	Level of evidence	Country	Sample size	Male (%)	Age (year)	Follow-up (months)	Follow-up (%)	Number of patients completing study	Surgeon expertise (as reported in the study manuscript)	GRADE
Karthikeyan *et al*[20]	2012	Case series	IV	UK	20	80	37.2 (SD: NR; range 17–54)	17 (SD 11; range 5–47)	100	20	NR	4
McDonald *et al*[21]	2014	Case–control series	III	USA	17	100	31 (SD: NR; range 23–37)	NR	100	17	Expert	4
McDonald *et al*[22]	2013	Retrospective comparative study	III	USA	39	100	30.3 (SD/ range: NR)	36 (NR)	100	39	Expert	4
Philippon *et al*[23]	2008	Therapeutic case series	IV	USA	9	56	37.3 (SD: NR; range 21–47)	20 (range 10–36)	100	9	NR	4
Singh and O'Donnell[24]	2010	Therapeutic case series	IV	Australia	6	100	22 (SD: NR; range 16–29)	22 (range 6–60)	100	2	Expert	4

GRADE, Grades of Recommendation, Assessment, Development and Evaluation; NR, not reported.

Table 2 Study characteristics for microfracture studies of the knee

Study	Year	Study design	Level of evidence	Country	Sample size	Male (%)	Age (year)	Follow-up (months)	Follow-up (%)	Number of patients completing study	Surgeon expertise (as reported in the study manuscript)	GRADE
Asik *et al*[25]	2008	Case series	IV	Turkey	90	48	34.5 (Range 20–58)	62 (Range 24–108)	NR	NR	NR	1
Basad *et al*[26]	2010	RCT	II	Germany	20	85	37.5 (Range 18–50)	24 (Range 3–24)	75	15	Expert	3
Chung *et al*[27]	2014	RCT	II	South Korea	19	17	44.3 (SD 10.7)	24 (SD 24)	63	12	NR	3
Crawford *et al*[28]	2012	RCT	II	USA	9	67	39 (SD 10)	24 (SD 24)3	100	9	NR	3
Gobbi *et al*[29]	2014	Case series	IV	Italy	67	70.40	31.4 (SD 1.8)	181.23 (Range 120–240)	91	61	Expert	1
Gudas *et al*[30]	2012	RCT	I	Lithuania	29	59	24.3 (SD 6.8)	125 (Range 108–132)	97	28	NR	3
Knutsen *et al*[31]	2004	RCT	I	Norway/UK	40	60	31.1 (Range 18–45)	24 (NR)	96	38	NR	3
Kon *et al*[32]	2011	Prospective cohort	II	Italy	20	100	26.5 (SD 4.5)	89 (SD 25; Range 48–132)	NR	NR	Expert	1
Kon *et al*[33]	2009	Prospective cohort	II	Italy	40	68	30.6 (NR)	60 (NR)	100	40	NR	1
Krych *et al*[34]	2012	Retrospective cohort	III	USA	48	66	32.5 (Range 15–46)	53 (NR)	79	38	Expert	1
Lim *et al*[35]	2012	Prospective cohort	II	South Korea	30	58	32.9 (Range 22–42)	80 (Range 42–126)	83	25	Expert	3
Marder *et al*[36]	2005	Case–control	III	USA	50	56	39.7 (Range 16–66)	50 (Range 24–108)	86	43	Expert	1
Mithoefer *et al*[37]	2006	Case series	IV	USA	32	84	38 (SD 2)	41 (Range 24–54)	NR	NR	Expert	1
Mithoefer *et al*[38]	2005	Case series	IV	USA	48	77	41 (SD 12)	41 (SD7)	100	48	Expert	1
Petri *et al*[39]	2013	Case series	IV	Germany	10	60	41.7 (SD 13.2)	36 (NR)	100	10	NR	1
Saris *et al*[40]	2014	RCT	I	Multicenter	72	67	32.9 (SD 8.8)	24 (NR)	93	67	NR	2
Saris *et al*[41]	2008	RCT	I	Multicenter	61	67	33.9 (SD 8.6)	18 (NR)	84	51	NR	3
Stanish *et al*[42]	2013	RCT	I	Canada, Spain, South Korea	39	64	37.2 (SD 10.6)	12 (NR)	95	37	NR	2
Steadman *et al*[7]	2003	Case series	IV	USA	25	100	29 (Range 22–36)	54 (Range 24–168)	100	25	NR	1
Ulstein *et al*[43]	2014	RCT	II	Norway	11	55	37.1 (SD 8)	188 (Range 59–137)	100	11	NR	3
Van Assche *et al*[44]	2010	RCT	II	Belgium/the Netherlands	61	67	34 (SD 8)	24 (NR)	43	26	'Extensive training'	3
Vanlauwe *et al*[45]	2011	RCT	I	Multicenter Europe	61	67	32 (Range 18–45)	60 (NR)	NR	NR	NR	3

GRADE: 1=very-low-quality evidence; 2=low-quality evidence; 3=medium-quality evidence; 4=high-quality evidence.
GRADE, Grades of Recommendation, Assessment, Development and Evaluation; NR, not reported; RCT, randomised controlled trial.

Table 3 Study characteristics for microfracture studies of the ankle

Study	Year	Study design	Level of evidence	Country	Sample size	Male (%)	Age (year)	Follow-up (months)	Follow-up (%)	Number of patients completing study	Surgeon expertise (as reported in the study manuscript)	GRADE
Backus *et al*[46]	2012	Retrospective	III	USA	62	50.0	32.5 (Range 13–66)	Range 6–12	53	33	Expert	1
Becher *et al*[47]	2010	Case series	IV	Germany	45	56.0	40 (SD 14)	70 (SD 24)	87	39	Expert	1
Becher and Thermann[48]	2005	Prospective case series	IV	Germany	30	57.0	41 (Range 20–74)	24 (Range 22–27)	97	29	Expert	1
Chuckpaiwong *et al*[49]	2008	Prognostic case study	IV	USA	105	70.0	40.5 (SD 10.6)	31.6 (SD 12.1)	100	105	NR	1
Cuttica *et al*[50]	2012	Retrospective case series	IV	USA	13	68.0	32.9 (SD 11.8)	156 (SD 11.8)	85	11	NR	1
Doral *et al*[51]	2012	RCT	I	Turkey	57 (41 With injection; 16 no injection)	51.0	40.5 (SD 13)	24	86	49 (unsure losses to each group)	NR	3
Gobbi *et al*[52]	2006	RCT	I	Italy	9/10	63.0	24 (Range 17–28)	53 (Range 24–119)	100	9 patients (10 joints)	Expert	2
Guney *et al*[53]	2015	RCT	III	Turkey	16	43.0	42.8 (SD 14.7)	16.2 (Range 12–24)	100	16	NR	2
Guo *et al*[54]	2010	Retrospective case series	IV	China	48	83.0	31.8 (SD 10.2)	23.9 (Range 12–59)	90	43	NR	1
Jung *et al*[55]	2011	Case series	IV	South Korea	22	73.0	40 (Range 20–64)	Median 32 (range 18–63)	NR	NR	Expert	1
Kuni *et al*[56]	2012	Retrospective case series	IV	Germany	22	55.0	Median 31 (range 13–68)	24 (NR)	100	22	Expert	1
Lee DH *et al*[57]	2012	RCT	II	South Korea	40 DWB; 41 EWB	79.0	36 (Range 18–59)	DWB 38 (range 24–76); EWB 37 (range 24–74)	NR	NR	NR	3
Lee *et al*[58]	2010	Case series	IV	South Korea	35	77.0	35 (Range 17–50)	33 (NR)	NR	NR	Expert	1
Lee *et al*[59]	2009	Case series	IV	South Korea	19/20	75.0	38 (Range 19–51)	12 (NR)	100	19 patients (20 joints)	Expert	1
Li *et al*[60]	2014	Retrospective case series	IV	China	58	64.0	38.84 (NR)	35 (SD 7.3)	100	58	NR	1
Park and Lee[61]	2015	Prospective comparative study	II	South Korea	58 Ch 46 OC	81 Ch 54 OC	22.5 OC (95% CI 19.5 to 25.4); 41.5 Ch (95% CI 38.9 to 44.1)	38.3 OC (95% CI 35.4 to 41.2); 37.6 Ch (95% CI 34.7 to 40.5)	100	104	Expert	1
Sallakh[62]	2012	Case series	IV	Egypt	24/25	76.0	38 (Range 18–60)	32 (Range 22–44)	100	24 patients (25 joints)	Expert	1
Saxena and Eakin[63]	2007	Case series	IV	USA	26	71.0	36.2 (SD 6.5)	32 (Range 24–55)	100	26	Expert	1
van Bergen *et al*[64]	2013	Case series	IV	The Netherlands	50	60.0	32 (SD 10)	144 (Range 96–240)	88	44	Expert	1

GRADE: 1=very-low-quality evidence; 2=low-quality evidence; 3=medium-quality evidence; 4=high-quality evidence.
Ch, chondral; DWB, delayed weight-bearing; EWB, early weight-bearing; GRADE, Grades of Recommendation, Assessment, Development and Evaluation; NR, not reported; OC, osteochondral; RCT, randomised controlled trial.

bearing after microfracture in the hip.[20–24] A total of 91 patients were examined in these five studies. Mean patient age was 31.6 years (range 16–54 years), and a mean of 87.2% (range 56–100%) of study participants were male. All studies reported follow-up, with an average follow-up period of 23.8 months (range 17–36 months) (table 1).

Study data

Across the five included studies, the majority of single cartilage lesions in the hip joint were typically acetabular-sided and of a mean size of 179.6 mm^2 (range 119–300 mm^2) (see online supplementary appendix 2A).[20–24] None of the hip studies reported an EWB protocol or functional outcome measure assessments. In addition, these studies seldom reported complications and/or reoperations. Therefore, no meaningful data from the hip literature exists (see online supplementary appendix 2B).

Knee

Study demographics

This review identified 22 studies (13 RCTs, 3 prospective and 2 retrospective cohort studies, 1 matched-pair study and 3 case series) addressing weight-bearing after microfracture in the knee.[25–45] A total of 900 patients, with a mean age of 33.4 years (range 16–66 years), were examined. A mean of 64.3% (range 17–100%) of study participants were male. Among the included studies, there was a mean of 83% of study participants completing the full study follow-up (range 43–100%) to a mean follow-up period of 59.2 months (range 3–240 months) (table 2).

Study data

Across the 22 studies, 82% (18/22) of the studies performed were on a single lesion in the knee joint, typically on the medial or lateral femoral condyle, with a mean size of 254 mm^2 (range 15–2000 mm^2) (see online supplementary appendix 3A).[25–45] Only 20 patients across all studies followed an EWB protocol, while 1000 patients followed a DWB protocol. These 20 individuals had Lysholm and Tegner scores (95% CI) of 44 (36.86 to 51.13) and 3.35 (2.29 to 4.41), respectively. The 288 and 307 patients following the DWB protocol and assessed with the Lysholm and Tegner scores, respectively, had values of 31.0 (26.84–33.35) and 1.48 (1.13–1.88). Other outcomes scores, such as the Knee injury and Osteoarthritis Outcome (KOOS): pain, activities of daily living (ADL), quality of life (QoL) and overall scores, as well as the International Knee Documentation Committee (IKDC) subjective scores, were used but were not reported on in patients following the EWB protocol; therefore, they are not applicable to our analyses (see online supplementary appendix 3B). There were no complications or reoperations reported across the 20 patients who followed the EWB protocol (see online supplementary appendix 3C). There were 141 complications and 34 reoperations reported in patients following the DWB protocol.

Ankle

Study demographics

This review identified 19 studies (4 RCTs, 7 retrospective cohort studies, 1 prospective (non-randomised) comparative study and 10 case series) addressing weight-bearing after microfracture in the ankle.[46–64] Overall, a total of 826 patients were examined, with a mean age of 36.4 years (range 13–68 years). The majority (66.1%) were male, and patients were followed up for an average of 40.6 months (range 6–240 months) (table 3).

Study data

Across the 19 studies, the lesions in the ankle joint were typically medial talus, and of a mean size of 68.3 mm^2 (range 6–417 mm^2)[46 49 52–54 59 61 62 64] (see online supplementary appendix 4A). There were a total of 455 patients in the DWB group and 395 patients in the EWB group with data contributing to analysis. For the Ankle Activity Score, early weight bearers scored 3.61 (3.30 to 3.96) vs 3.00 (2.65 to 3.35) (95% CI) for those who followed DWB protocols. The American Orthopaedic Foot and Ankle Society score demonstrated similar results, with scores of 21.72 (20.00 to 23.01) vs 22.22 (19.94 to 24.50) for early versus delayed weight bearers. Likewise, the Visual Analogue Scale (VAS) pain scored similarly between early and delayed weight bearers, with scores of −4.39 (−4.70–(−3.14)) and −4.49 (−5.03–(−3.94)), respectively (see online supplementary appendix 4B). There were 11 complications reported in the EWB and 13 complications reported in the DWB group (see online supplementary appendix 4C). Additionally, there were 23 reoperations in the EWB group and 16 reoperations in the DWB group.

DISCUSSION

There is insufficient evidence to draw any meaningful conclusions with respect to differences in functional scores between EWB versus DWB following microfracture surgery for the treatment of chondral lesions in the hip, knee and ankle. Of the included hip microfracture studies, each exclusively reports a DWB protocol for which data analysis/extraction was not possible for assessment of outcomes or complications/reoperations against EWB protocol outcomes. Of the included knee microfracture studies, a total of 20 patients followed an EWB protocol, with all other patient data representing results of DWB protocols. Given the discrepancy between EWB and DWB sample sizes available for knee microfracture studies, comparative analyses of outcome scores and complications/reoperations hold low utility. There were similar sample sizes for patients with EWB (395 patients) and DWB (455 patients) protocols. CIs for combined outcome scores of EWB patient protocols and DWB patient protocols overlapped for Ankle Activity Score, American Orthopaedic Foot and Ankle Society and VAS pain scores.

There were multiple strengths to this review. The literature search was extensive, covering five of the major databases. Articles were reviewed in duplicate during article screening and evaluation, and multiple reviewers performed data abstraction to minimise selection bias. In addition, eligibility criteria were sufficiently broad, allowing for inclusion of more eligible studies (multiple joints) and applicability of the results. Data were also abstracted for lesion location, size and number of lesions, as it has been shown previously that these factors have significant influence on outcomes, and are essential for deciding weight-bearing status.

Microfracture surgery is popular as a first-line procedure for small cartilage lesions. It has a number of advantages, including being technically easy to perform, relatively inexpensive and a single-stage procedure. Microfracture also avoids the donor site morbidity, which is present with other techniques such as autologous chondrocyte implantation and autologous cartilage transplantation. The major limitation of microfracture, however, is not just the lack of its longevity, but that the formation of fibrocartilage possesses inferior biomechanical properties in comparison to hyaline cartilage.[5 6] In order to maximise the amount of fibrocartilage that is formed, it is essential for surgeons utilising microfracture techniques to optimise all aspects of patient treatment. Postoperative rehabilitation is an integral part of the treatment algorithm, and therefore furthering our understanding regarding patient outcomes with or without weight-bearing is critical. This review of the available literature failed to find any articles on EWB following microfracture of the hip. The included knee and ankle microfracture studies indicate that postoperative EWB or DWB results in similar outcomes, and that postoperative weight-bearing status is not a significant contributor to the proportion, nature or type of revision surgeries due to weight-bearing complications.

RCTs, though ideal as a study design, pose great difficulties in execution when attempting to ascertain the influence of postoperative weight-bearing status. For example, in addition to the expense of organising and running a large-scale study with a sufficient number of included patients, it would be essential to have agreement from expert surgeons regarding the need for such a study, given the lack of data available regarding current optimal management of these lesions. This is especially challenging as biological rationale exists for protecting healing cartilage following microfracture with protected weight-bearing. Additionally, fear of poor outcomes, possible litigation concerns and acceptance by patients will need to be overcome in order to carry out such a study with sufficient numbers.

Future research should first attempt to survey orthopaedic cartilage experts to achieve a consensus based on available evidence and clinical experience as to whether or not weight-bearing postoperatively should be limited (and, if so, for how long). Next, efforts must focus on the completion of higher methodological quality studies evaluating EWB versus DWB rehabilitation protocols following microfracture treatment of chondral lesions. Radiographic evaluation with MRI including cartilage mapping to explore fibrocartilage healing and incorporation could also be of value. A common criticism of microfracture is the controversy surrounding its lack of longevity. Since no apparent difference existed between EWB and DWB protocols, one must consider if further exploring this longevity is of clinical benefit. In this review, return to play was not consistently reported across all studies, and in fact most studies did not explicitly deal with an athlete population. Nevertheless, as this review suggests, postoperative weight-bearing may not be an influential factor for patient outcomes; future efforts should examine specific athletic populations, as it may be advantageous to encourage earlier participation in sports postoperatively to limit sport-specific performance losses.

Limitations

One major limitation of this systematic review was the variability in the studies with regard to their use of functional outcomes and variability of reporting functional outcomes limiting formal statistical analyses. Moreover, there was also a lack of diversity in the patient population, with the majority studied across all joints being male. Furthermore, there is a significant discrepancy with a very small number of patients in the EWB protocol group for knee microfracture surgery, which limits the ability to interpret any meaningful results between the EWB and DWB protocols given the sample size differences. Lastly, as outlined by the GRADE assessments, the overall quality of evidence in the included articles was low. It has not escaped notice that, in assessing the efficacy of the intended treatment, it is important to note that there was no documentation of compliance in either study. For example, there is no mention of a review of physiotherapy notes to document patient compliance with weight-bearing protocols. Therefore, information on compliance with the treatment protocol is limited. Prescription of non-weight-bearing treatments to patients imposes a number of constraints on patients. It is thus important to accurately identify the proportion of non-compliant patients, in order to comprehensively evaluate the effectiveness of this treatment.

CONCLUSION

This review demonstrated that for chondral lesions treated with microfracture surgery in the knee and ankle there are insufficient data to assess for any significant differences in functional scores, complications, or reasons for revision between those treated with EWB versus DWB. Given the lack of high-quality evidence and few applicable studies, there is a need for future well-designed multicentre RCTs to better elucidate if any true difference exists in outcomes following microfracture surgery of the hip, knee or ankle in patients prescribed early or delayed postoperative weight-bearing protocols.

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