

Do lifestyle restrictions and precautions prevent dislocation after total hip arthroplasty? A systematic review and meta-analysis of the literature

Clinical Rehabilitation
2016, Vol. 30(4) 329–339
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DOI: 10.1177/0269215515579421
cre.sagepub.com


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Abstract

Objective: A systematic literature review and meta-analysis on the effectiveness of lifestyle restrictions and precautions to prevent dislocation after total hip arthroplasty.

Data sources: MEDLINE and the Cochrane Library were searched in February 2015, with additional hand searching of systematic reviews and reference lists.

Review methods: This review was conducted in accordance with the PRISMA statement for reporting systematic reviews and meta-analysis. PubMed and the Cochrane Library were searched from their start date through to February 2015. Randomized controlled trials and comparative case series in English, Dutch or German language were included. Only primary total hip arthroplasty procedures managed with different postoperative restrictions and precautions protocols were included. Primary outcome was the total hip arthroplasty dislocation rate, secondary outcomes were patient functioning, return to activities of daily living and patient satisfaction.

Results: A total of 119 eligible articles were identified, six were included: three randomized controlled trials, one retrospective matched cohort study, one retrospective and one prospective cohort study, describing 1122 procedures (restrictions group: $n = 528$; no restrictions group: $n = 594$). Both the standard posterior and anterolateral surgical approaches were included. There were eight dislocations (1.5%) in the restricted group, vs. six dislocations (1.0%) in the unrestricted group. Patients in the unrestricted group resumed activities significantly faster and were more satisfied with their pace of recovery.

Conclusion: A more liberal lifestyle restrictions and precautions protocol will not lead to worse dislocation rates after total hip arthroplasty, but will lead to earlier and better resumption of activities and higher patient satisfaction. These results appear to hold up for various surgical approaches.

Keywords

Total hip arthroplasty, dislocation rate, precautions, restrictions

Received: 29 September 2014; accepted: 7 March 2015

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Introduction

Peri and postoperative care for hip and knee arthroplasty is constantly evolving, and the introduction of fast-track surgery protocols¹⁻³ has reduced the traditional 'sick patient' role. In fast-track surgery, the patient is actively involved in working towards an optimized outcome.^{4,5} These developments challenge the role of restrictions and precautions after total hip arthroplasty, which patients have to adhere to in the first weeks and months after surgery. Traditionally, protocols describing these restrictions and precautions require patients to sleep supine (usually with an abduction pillow in place), to use walking aids for several weeks, only to sit on high chairs and not to sit cross-legged, not to bend forward or to flex their hip joint beyond 90°. Additionally, patients are usually not allowed to drive a car for several months after the surgery. The main rationale of these guidelines is to prevent dislocation of the newly placed hip prosthesis. Patients are more prone to hip dislocations postoperatively owing to soft tissue damage and reduced muscle strength.

It is debatable whether current lifestyle restrictions and precautions protocols, which are commonly used after total hip arthroplasty, can be considered as best-evidence in the management of these patients. In modern orthopaedic surgery, less invasive, tissue sparing techniques are introduced and patients are operated upon with shorter acting anaesthetics. Nowadays surgery duration is shorter and patients are being mobilized early after surgery. These factors possibly contribute to less loss of muscle strength after surgery, resulting in a more stable hip joint immediately postoperative. Postoperative joint stability is further enhanced by the use of larger diameter femoral head components. Patients are also better educated and managed with clinical pathways that include detailed protocols.^{6,7} However, the aspect of evidence-based application of precautions and restrictions after total hip arthroplasty has attracted less attention, with long-standing protocols routinely used in most hospitals. Our study aim was to systematically review the recent literature to answer the question: Is dislocation of the

hip prosthesis effectively prevented by using lifestyle restrictions and precautions after total hip arthroplasty surgery?

Methods

This review was conducted in accordance with the PRISMA statement for reporting systematic reviews and meta-analysis.⁸ Randomized controlled trials and comparative case series were included if they involved primary total hip arthroplasty procedures and reported on how patients were managed using two (or more) different postoperative restrictions and precautions protocols. The primary outcome was dislocation rate after total hip arthroplasty, and secondary outcomes were functioning, return to Activities of Daily Living (ADL), quality of life and patient satisfaction.

Case reports, studies without a control group and case series that did not report dislocation rates before and after changes in postoperative precautions protocols were excluded.

Electronic databases (MEDLINE and the Cochrane Library (Central Register of Controlled Trials)), were searched from their start through to February 2015, using the search string 'hip arthroplasty AND (restrictions OR precautions)' (see Appendix online). Systematic reviews were checked for not yet identified studies; reference lists of included studies were hand searched. English, Dutch and German language publications were included.

Two observers (WvdW, AK) independently screened all identified studies based on title and abstract for eligibility, in case of doubt consensus was reached by discussion. Next, the full text manuscripts of all studies included after this first step were again independently reviewed (WvdW, AK). Consensus in case of doubt was reached by discussing the full text manuscripts. Data was extracted by one observer (AK) who used a pre-set standardized data extraction form, including study year, study origin, number of patients and total hip arthroplasty procedures in the restriction group and in the non/less restriction group, description of restricted and unrestricted protocols, surgical approach, femoral component head diameter, length of stay in hospital, length of follow-up,

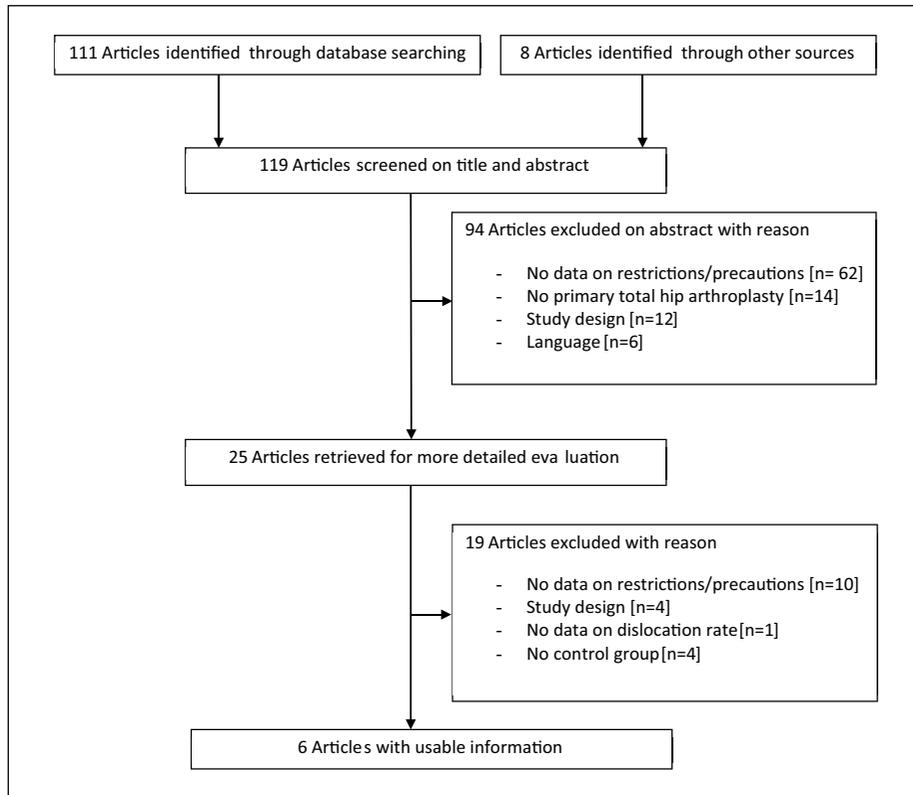


Figure 1. Study flow according to PRISMA statement.⁸

number of dislocations in each group, standardized clinical outcome measurements, patient satisfaction and resuming of activities. Corresponding authors were contacted if needed.

Study quality was discussed and results were pooled where possible, based on the heterogeneity of the included studies. Results from standardized clinical outcome measurements were presented using the three months follow-up data or nearest follow-up point available.

Results

Through electronic database searching, 111 articles were identified, and eight articles were found with hand searching. Of these, 94 were excluded. After reviewing 25 studies in full text, six articles were included for data extraction (Figure 1).

Study design and quality

We observed a large heterogeneity in the included studies regarding study design and outcomes, preventing pooling of data other than the number of procedures and observed dislocations. Of the six included studies, three were randomized controlled trials^{9–11} of which only one used blinding, in this case the surgeon.¹⁰ The three non-randomized studies were comparative cohorts,^{12–14} and consisted of one matched cohort¹² and two consecutive cohorts.^{13,14} Of these cohort studies, two were retrospective^{12,13} and one was prospective.¹⁴ Follow-up duration was either six weeks postoperative ($n=1$),¹⁴ six months ($n=1$),¹⁰ one year for three studies ($n=3$)^{9,11,12} or two years ($n=1$).¹³ All were single-centre studies with four studies originating from the US,^{9–12} one from Australia¹³ and one from Denmark.¹⁴ See Table 1 for study details.

Table 1. Study details.

Author, year	Design	Blinding	Indication	Age (years)	FU	THA restr/ unrestr (n)	Surg appr restr	Surg appr unrestr	Fem head diam
Barrett et al., 2013	RCT	No	Non-inflammatory degenerative joint disease	Restr 63.2 Unrestr 61.4	1 year	44/43	Posterior	Direct anterior	28, 32 or 36 mm
Duwelius et al., 2007	Matched cohorts	No	OA	Restr 59.1 Unrestr 57.4	1 years	43/43	MIS posterior	2-incision anterolat	Not reported
Khan et al., 2006	Retrospective Consecutive cohorts	No	OA/RA	Restr 69.3 Unrestr 68.9	2 year	100/100	Posterior	MIS posterior	28 mm
Mikkelsen et al., 2014	Retrospective Consecutive cohorts	No	OA	Restr 69.0 Unrestr 68.4	6 weeks	146/219	Posterior	Posterior	≤32 mm (4.2%) 36 mm (63.8%) ≥ 40 mm (32%)
Peak et al., 2005	Prospective RCT	Surgeon	OA/RA/AVN/Hip dyspl	Restr 58.6 Unrestr 57.3	0.5 years	152/151	Modified Hardinge anterolateral	Modified Hardinge anterolateral	22 to 36 mm
Ververeli et al., 2009	RCT	No	Unknown	Restr, female: 59.8 male: 57.4 Unrestr female: 60.8 male: 58.8	1 year	43/38	Modified Hardinge anterolateral	Modified Hardinge anterolateral	32, 36 or 40 mm

AVN: avascular necrosis; Fem head diam: femoral head diameter; FU: follow-up; Hip dyspl: hip dysplasia; OA: osteoarthritis; RA: rheumatoid arthritis; RCT: randomized controlled trial; restr: managed with restrictions; Surg appr: surgical approach; THA: total hip arthroplasties; unrestr: total hip arthroplasties managed without or with less restrictions; MIS: minimal invasive surgery.

Surgical approach and used components

The same surgical approach in both the restricted and unrestricted group was used in three studies: a modified Hardinge anterolateral approach in the two included randomized controlled trials^{9,10} and a standard posterior approach in the prospective, comparative cohort study by Mikkelsen et al.¹⁴ Three studies (one randomized controlled trial and two cohort studies) changed their surgical approach and consequently adapted their postoperative restrictions and precautions protocol.^{11–13}

Khan et al.¹³ used a standard posterior approach in the restricted group, and a modified, less invasive posterior approach for the unrestricted group, while Duwelius et al.¹² used a posterior mini-incision approach for the restricted group and an anterolateral 2-incision technique for the unrestricted group.¹² Barrett et al.¹¹ randomized patients to either the direct anterior approach without any restrictions or the posterior approach with lifestyle restrictions.

Four studies used only uncemented total hip arthroplasty components,^{9–12} of which the study by Ververeli et al.⁹ used a 32-mm femoral head on cross-linked polyethylene or a 36- or 40-mm metal-on-metal bearing. In the study by Peak et al.,¹⁰ a range of 22–32 mm femoral heads were used, depending on the acetabular component size in patients who received a polyethylene liner, with 36-mm femoral heads used for four patients who received a cup with a diameter of 60 mm. For patients who received a ceramic liner, the femoral head diameter ranged from 28 mm to 36 mm. Femoral head sizes ranged from 28 mm to 36 mm in the study by Barrett et al.¹¹ The study by Duwelius et al.¹² also inserted an uncemented total hip arthroplasty in all cases, but no data was provided on femoral head diameter. In the study by Khan et al.¹³ a hybrid fixation (uncemented acetabular component and a cemented femoral component) was used in the majority of procedures, always with a 28 mm femoral head diameter. Mikkelsen et al.¹⁴ used mostly uncemented total hip arthroplasty prostheses, with a 36 mm head diameter used in 63.8% ($n=213$) of all surgeries. The remaining patients received ≥ 40 mm (32%, $n=107$) or ≤ 32 mm (4.2%, $n=14$) femoral heads.

Of an additional 31 procedures, the femoral head diameter was unknown (Table 1).¹⁴

All included studies, except the studies by Mikkelsen et al.¹⁴ and Barrett et al.,¹¹ described which implant positioning was aimed for, although Barrett et al. analysed the component orientation in great detail. The one patient revised for recurrent dislocation in the study by Barrett et al.,¹¹ who was randomized to the posterior group with lifestyle restrictions, appeared to have acetabular malpositioning. In the study by Duwelius et al.,¹² there were four outliers in the 2-incision group ($>50^\circ$ inclination) and two in the mini-posterior group, but none of these dislocated. Khan et al.¹³ felt the cup was insufficiently anteverted in two dislocation cases. Ververeli et al.⁹ and Peak et al.¹⁰ did not report what implant positioning was achieved.

Lifestyle restrictions and precautions protocols

The studies reported by Mikkelsen et al.,¹⁴ Peak et al.¹⁰ and Ververeli et al.⁹ described their restrictions and precautions protocol in great detail; less extensive information was provided in the studies by Khan et al.¹³ and Duwelius et al.,¹² and the protocol used in the study by Barrett et al.¹¹ was retrieved after contacting the authors (see Table 2).

All included studies did not allow extreme hip flexion in the restricted group. Other common restrictions and precautions were avoidance of internal hip rotation and hip adduction. Patients were commonly advised to use an elevated chair and an abduction pillow to avoid hip adduction. There were three studies in which the patients in the unrestricted group had no precautions or restrictions at all,^{11–13} although for comfort one of these studies allowed patients a normal pillow between the legs while sleeping.¹² The remaining three studies applied a less restricted protocol rather than a fully unrestricted protocol,^{9,10,14} and the common restriction was that patients were not allowed to sit cross-legged.

Dislocation rates

Together these six studies report the results of 1084 patients (1122 total hip arthroplasties: 528 in the

Table 2. Protocols, dislocation rates and clinical outcomes.

Author, year	THA restr/ unrestr (n) ^a	Restrictions	Unrestricted protocol	Dislocations restr (n)	Dislocations unrestr (n)	Clinical outcome restr	Clinical outcome unrestr
Barrett et al., 2013	44/43	6 weeks no: hip flexion >90° or hip adduction beyond 0°	None ^b	1	0	HHS: 91.4 VAS: 1.4 6MWT (m): 428.3 LOS: 2.3 days ^a	HHS: 91.2 VAS: 1.3 6MWT (m): 428.4 LOS: 2.3 days ^a
Duwelius et al., 2007	43/43	Avoid extreme hip flexion and internal rotation; For comfort (first 6 weeks): normal pillow between legs while sleeping	None, but pillow between legs while sleeping for comfort (first 6 weeks)	0	0	HHS: 80 points ^c SF-36 pain: 80 points ^c SF-36 physical function: 75 points ^c Time to resume: -driving: 24 days -shopping: 26 days LOS: 1.9 days	HHS: 85 points ^c SF-36 pain: 65 points ^c SF-36 physical function: 85 points ^c Time to resume: -driving: 13 days ^a -shopping: 14 days ^a LOS: 1.3 days
Khan et al., 2006	100/100	Bed rest first 24 hours with wedge pillow, 6 weeks no hip flexion > 90°, use raised seats	None	4	0	Relative improvement WOMAC: 28.54 points Relative improvement SF-36 PCS: 12.31 points LOS: 8 days	Relative improvement WOMAC: 33.73 points ^a Relative improvement SF-36 PCS: 11.35 points LOS: 5 days ^a
Mikkelsen et al., 2014	146/219	6 weeks no: hip flexion >90°, internal rotation or hip adduction beyond neutral; Do use: abduction pillow, elevated toilet seat, bathing chair, shoehorn, ergonomic reacher, sock-aid	No combined full hip flexion, internal rotation and adduction	2	6	HOOS ADL: 83.3 points HOOS symptoms: 82.5 points HOOS pain: 85.7 points HOOS QOL: 70.8 points Return to work at 6 weeks: 53.7% ^a % patient (very) satisfied: 95.7% Median LOS: 1 day	HOOS ADL: 82.6 points HOOS symptoms: 80.8 points HOOS pain: 85.0 points HOOS QOL: 69.0 points Return to work at 6 weeks: 53.7% ^a % patient (very) satisfied: 96.0% Median LOS: 1 day

Table 2. (Continued)

Author, year	THA restr/ unrestr (n) ^a	Restrictions	Unrestricted protocol	Dislocations restr (n)	Dislocations unrestr (n)	Clinical outcome restr	Clinical outcome unrestr
Peak et al., 2005	152/151	6 weeks no: hip flexion >90°, internal-external rotation >45°, hip adduction (crossing legs); Do use: pillows to maintain abduction, elevated toilet seat and chair. No side sleeping, car driving or be a car passenger	6 weeks no: hip flexion >90°, internal or external rotation >45°, avoid hip adduction (crossing legs)	1	0	Time to resume: -side-sleeping: 5.8 weeks -first-time passenger in automobile: 1.9 weeks -first-time driver in automobile: 6.8 weeks -work: 9.5 weeks ADL ability at 6 months (% of preoperative value): 96.5 % Satisfied with recovery pace: 74.3 Mean LOS: 3.5 days	Time to resume: -side-sleeping: 3.2 weeks ^a -first-time passenger in automobile: 1.5 weeks ^a -first-time driver in automobile: 4.9 weeks ^a -work: 6.5 weeks ^a ADL ability at 6 months (% of preoperative value): 106.4 ^a % Satisfied with recovery pace: 89.4 ^a Mean LOS: 3.5 days
Ververeli et al., 2009	43/38	First month: no hip flexion >90°, sitting cross-legged or car driving. Do use: high toilet, high chair, sleep supine with pillow between legs Month 2-3: no hip flexion >90° and no hip adduction >5°	No cross-legged or sitting	0	0	HHS and SF-12 score: no absolute score presented Days until: -walked with cane only: 16.4 -walked without cane: 39.0 until walked without limp: 67.3 -until drove: 30.1	HHS and SF-12 score: no absolute score presented Days until: -walked with cane only: 12.6 ^a -walked without cane: 26.6 ^a -until walked without limp: 49.9 ^a -until drove: 22.9 ^a

^a6MWT: 6-minute walk test; HOOS: Hip disability and Osteoarthritis Outcome Score; HHS: Harris hip score; LOS: length of stay; QOL: quality of life; restr: managed with restrictions; SF-12: Short Form-12; SF-36: Short Form-36; THA: total hip arthroplasties; unrestr: total hip arthroplasties managed without or with less restrictions; VAS: visual analogue scale; WOMAC: Western Ontario and McMaster Universities Osteoarthritis Index; PCS: physical component scale.

^bp < 0.05.

^cFrom correspondence with authors institution.

^dEstimated from graph.

group with restrictions and 594 in the group with no or less restrictions). In the pooled restriction group there were eight dislocations observed (1.5%), vs. six dislocations (1.0%) in the unrestricted group (Table 2). Main reasons for dislocations were: (1) transfers (from bed to chair or surgery table to bed); (2) falling; and (3) a variety of movements (i.e. putting on socks, kneeling), respectively 35% ($n=5$), 14% ($n=2$) and 14% ($n=2$). There were two studies with no dislocations in either the restricted and the unrestricted group,^{9,12} three studies only had dislocations in the restricted group but not in the unrestricted group,^{10,11,13} and one study had postoperative dislocations in both groups.¹⁴ The pooled dislocation rates in the studies that compared restricted vs. no restrictions at all was 2.7% ($n=4$) vs. 0%, respectively, while the dislocation rates in the studies comparing restricted vs. less restricted was 0.9% ($n=3$) vs. 1.5% ($n=6$), respectively. Pooled dislocation rates in the randomized controlled trial studies was 0.8% ($n=1$) for the restricted group and 0% for the unrestricted group, and for the comparative case series it was 2.1% ($n=6$) and 1.7% ($n=6$), respectively. The pooled dislocation rate in the study groups using a (mini) posterior surgical approach with restrictions was 2.1% ($n=6$), vs. 1.8% ($n=6$) with the same approach but without restrictions. As for the anterolateral groups, the pooled dislocation rate was 0.6% ($n=1$) in the restricted group and 0% in the unrestricted group.

Clinical outcomes

Standardized clinical outcome scales used were the Harris Hip Score,^{9,11,12} the Hip Disability and Osteoarthritis Outcome Score,^{11,14} the Western Ontario and McMaster Universities Osteoarthritis Index,¹³ Short Form-36^{12,13} and Short Form-12.^{9,12} Barrett et al.¹¹ was the only one using a visual analogue scale for pain and the 6-minute walk test. The Harris Hip Score measures pain, function and hip range of motion and scores 0 to 100, with 100 being maximum (best) score. The Hip Disability and Osteoarthritis Outcome Score measures pain and symptoms, limitations in ADL and sports/leisure activities, and measures quality of life. Scores

range 0 to 100, with 100 being maximum (best) score. The Western Ontario and McMaster Universities Osteoarthritis Index measures pain, symptoms and physical functioning with different scoring options possible, resulting in different maximum scores. The Western Ontario and McMaster Universities Osteoarthritis Index was used in the study by Khan et al., but the scoring option used was not specified.¹³ The Short Form-36 measures perceived health and health-related quality of life, including physical and psychological items. The Short Form-36 score ranges from 0 to 100, with 100 being maximum (best) score. The Short Form-12 is a short version of the Short Form-36 using the same scoring system (100 being maximum (best) score).

Although clinical outcomes were generally better in the unrestricted groups, this only reached significance in the study by Khan et al.,¹³ who compared the Western Ontario and McMaster Universities Osteoarthritis Index score between the restricted and the unrestricted groups as a relative improvement from baseline, and in the study by Barrett et al.¹¹ In the latter study, patients in the unrestricted group had better visual analogue scale pain scores on the first postoperative day and had better Hip Disability and Osteoarthritis Outcome Score symptom scores at three months.¹¹

Time to resume activities (i.e. driving, walking without cane, etc.) was significantly better for the unrestricted group in four studies,⁹⁻¹² and length of stay was significantly shorter for the unrestricted group in two studies.^{11,13} Patient satisfaction was equal in the study by Mikkelsen et al.,¹⁴ but the percentage of patients who were satisfied with their recovery pace was significantly higher for the unrestricted group in the study by Peak et al. (Table 2).¹⁰

Discussion

Using a less restrictive protocol in the postoperative phase after total hip arthroplasty, or even a protocol without any restrictions and precautions, does not lead to worse dislocation rates and might even result in lower dislocation rates. More liberal protocols will lead to earlier and better resumption of

ADL, earlier return to work, a shorter length of stay and higher patient satisfaction. These results do appear to hold up for various surgical approaches, but more studies on this subject are needed to support these conclusions. After systematically reviewing the literature, we were only able to identify six studies that fulfilled our inclusion criteria, and three of the included studies used a non-randomized trial design.

Reasons for lower dislocation rates with a less or unrestricted protocol after total hip arthroplasty are unknown, but patients in the unrestricted groups resume activities faster, which could result in earlier recovery of soft tissue, including muscles around the hip joint, providing additional stability, thereby reducing the risk of dislocation. It is also suggested that patient selection and surgical technique are more important in the prevention of postoperative dislocation than restrictions and precautions protocols after total hip arthroplasty.⁹ In the studies included in our review, dislocation rates were indeed higher with the posterior approach than with the anterolateral approach used (1.8% vs. 0% in the group of patients managed without restrictions).

There are, however, many variables influencing the postoperative risk of dislocation after total hip arthroplasty. For example, Lübbecke et al. found a significant reduced risk for dislocation if patients attended a pre-operative educational session.⁶ The specific contribution of various factors, such as patient characteristics (age, BMI, gender, comorbidities), surgeon experience and used components (bearing type, femoral head size, dual mobility total hip arthroplasty, acetabular cup design) in relation to postoperative restrictions and precautions to prevent dislocation after total hip arthroplasty is unknown.

Another preventive factor for dislocation after total hip arthroplasty is a high procedure volume and we interpret our results applicable for high volume surgeons only, since the majority of the included studies appeared to have a considerable total hip arthroplasty volume.

To prevent dislocation after total hip arthroplasty, orthopaedic surgeons aim the acetabular cup positioning to be around 45° of acetabular

inclination and 10° to 15° anteversion, as described by Lewinnek et al.¹⁵ The manner of reporting how well this was achieved prevented pooling of implant positioning results. There is, however, a large number of studies that already have established a firm relationship between implant position and dislocation rates.¹⁵⁻¹⁷

Furthermore, various surgical approaches have been developed to reduce soft tissue damage, thereby increasing speed of recovery and minimizing the risk of dislocation. Specifically, three of the included studies used different surgical approaches for the restricted and the unrestricted group, resulting in confounding of the reported dislocation rates. Although confounding by changing the surgical approach seems obvious, the anticipated faster and better recovery owing to using the anterior approach might be limited or non-existing. Poehling-Monaghan et al. found higher Harris Hip Scores with the direct anterior approach, but surprisingly better return to work and driving for the minimiposterior approach when both groups were managed without lifestyle restrictions.¹⁸ Reininga et al. found no differences in gait recovery after randomizing patients to either the anterior or posterior approach.¹⁹

Another consideration is that only three of the six included studies have no precautions or restrictions of any kind.¹¹⁻¹³ The other three studies managed their patients in the experimental group with less restrictive protocols rather than unrestricted protocols, which still include a variety of precautions and restrictions (mainly preventing hip flexion beyond 90° and sitting cross-legged).^{9,10,14} This has to be taken into account when one considers changing current clinical protocols on restrictions and precautions after total hip arthroplasty.

To our knowledge, there are no previous systematic reviews on the effectiveness of restrictions and precautions after total hip arthroplasty. Sharma et al.⁷ reviewed factors influencing early rehabilitation after total hip arthroplasty and concluded that although available studies justified no hip restrictions following an anterolateral approach, none had examined the question for a posterior approach. Several studies have shown an anterolateral approach to total hip arthroplasty having a lower

rate of dislocation than a posterior approach owing to its ease of access, superior visualization, and a predictable healing pattern.^{20–22} We were able to include four studies on restrictions and precautions after total hip arthroplasty that used the posterior approach,^{11–14} and dislocation rates in these studies were only minimally better in the restricted group than in the unrestricted group (2.1%, $n=6$ vs. 1.8%, $n=6$, respectively).

There is increasing evidence that the rate of dislocation in the posterior approach would be comparable with that with anterior approaches if augmented with an adequate soft tissue repair.^{23,24}

Postoperative protocols on restrictions and precautions do impose intrusive limitations and sometimes even discomfort for the patient in the first postoperative period. Clinicians are often asked by the patients how strict and how long they should adhere to these protocols, with a large individual variation observed in resuming normal day activities, such as driving a car, cycling, return to work or side-sleeping. Recently, Schmidt-Braekling et al.²⁵ reported that a shorter (four instead of six weeks) precaution protocol resulted in only eight dislocations after 797 total hip arthroplasty procedures (1%), but unfortunately a control group was lacking.²⁵

Besides the discomfort imposed upon the patients, economic aspects of restrictive protocols are to be considered. The lack of a need for additional equipment and devices was associated with a cost savings of approximately US\$655 per patient. This included the cost for an abduction pillow (\$12), an elevated toilet seat (\$65) and an elevated chair (\$15/day to rent), but not including costs of transportation or loss of wages while away from work.^{10,26}

There are several limitations to our study. Systematic reviews and meta-analysis have the inherent risk of publication bias. Furthermore, there was considerable heterogeneity in the included studies, preventing us from extensive quantitative pooling of results. A major issue is confounding of results by changing the surgical approach, as was done in three of the six included studies.^{11–13} Finally, the number of included studies is low.

Strengths of our study are that two reviewers independently reviewed all our identified manuscripts, and we reported our results in accordance

with the PRISMA statement for systematic reviews. Our search strategy was comprehensive, using electronic database searching, hand searching and contacting authors. We also searched for manuscripts written in languages other than English and we were able to report pooled results of >1000 total hip arthroplasty procedures. Also, the results of the three studies that changed surgical approach were comparable with the studies in which there was no change in surgical approach.

Clinical messages

- Surgeons and physiotherapists should not fear for an increased dislocation risk if they use a more liberal restrictions and precautions protocol after total hip arthroplasty. This is regardless of which surgical approach is used.
- Your patients will be more satisfied with their pace of recovery and will resume activities and return to work earlier, if they are managed with a more liberal restrictions and precautions protocol after total hip arthroplasty.

Conflict of interest

The authors declare that there is no conflict of interest.

Funding

This research received no specific grant from any funding agency in the public, commercial, or not-for-profit sectors.

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