Definitions of Return to Sport After Hip Arthroscopy

Are We Speaking the Same Language and Are We Measuring the Right Outcome?

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Background: Return to sport is a commonly studied outcome of hip arthroscopy that is relevant to both patients and providers. There exists substantial variability in criteria used to define successful return to sport.

Purpose: To review and evaluate the definitions used in the literature so as to establish a single standard to enable comparison of outcomes in future studies.

Study Design: Systematic review; Level of evidence, 4.

Methods: The PubMed, MEDLINE, and Embase databases were searched from inception to June 1, 2019, for studies relating to hip arthroscopy and return to sport. Articles included were those that met the following criteria: (1) contained 2 or more patients, (2) studied patients 18 years of age and older, (3) reported postoperative outcomes after hip arthroscopy, (4) clearly defined return to play, and (5) were written in English. Excluded articles (1) reported outcomes for nonoperative or open treatments, (2) did not clearly define return to play, or (3) were review articles, meta-analyses, or survey-based studies. Return-to-play definitions and additional metrics of postoperative performance and outcome were recorded.

Results: A total of 185 articles were identified, and 28 articles were included in the final review, of which 18 involved elite athletes and 10 involved recreational athletes. Of articles studying elite athletes, 6 (33%) defined return to play as participation in regular or postseason competition, 3 (17%) extended the criteria to the preseason, and 2 (11%) used participation in sport-related activities and training. The remaining 7 (39%) reported rates of return to the preoperative level of competition but did not specify preseason versus regular season. All 10 articles evaluating recreational athletes defined return to play based on patient-reported outcomes. Four (40%) did so qualitatively, while 6 (60%) did so quantitatively.

Conclusion: There exists significant variability in criteria used to define successful return to sport after hip arthroscopy, and these criteria differ among elite and recreational athletes. For elite athletes, return to the preoperative level of competition is most commonly used, but there exists no consensus on what type of competition—regular season, preseason, or training—is most appropriate. For recreational athletes, patient-reported data are most commonly employed, although there are clear differences between authors on the ways in which these are being used as well.

Keywords: hip; femoroacetabular impingement; hip arthroscopy; athletic training; return to play; return to sport

Hip arthroscopy for all patients represents a technique with significant potential to treat a variety of conditions through minimally invasive approaches.[11,12,17,22,28,29,33] For athletes, decreasing the extent of soft tissue dissection contributes to the ability to return to activity after a relatively brief duration and potentially lessened morbidity. Recent meta-analyses have reported rates of return as high as 93%.[20,22,28] This benefit, combined with recent advances that have expanded the applications of hip arthroscopy, has led to a surge in its use.[13,22,29]

From 2005 to 2010, the number of hip arthroscopies performed by American Board of Orthopaedic Surgery Part II examinees increased by more than 6-fold.[22,28] Concurrently, hip arthroscopy began to attract substantial research interest, as it experienced a 5-fold increase in the number of publications on the topic over the same interval.[22]

While newly validated tools have been developed to assess patient-reported outcomes in patients with nonarthritic hip pain and hip preservation surgeries

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(International Hip Outcome Tool and Copenhagen Hip and Groin Outcome Score), return to play has been a commonly used metric when evaluating outcomes after many different procedures and injuries in athletes. A number of studies have focused on postoperative performance outcomes in athletes.[20,22,31] While many of those have demonstrated high rates of return to play, there appears to be no consensus as to its definition—whether to include practices, preseason games, and so on.[20,31] This, in turn, limits the ability of providers to inform the postoperative expectations of athletes as they weigh their options and determine whether hip arthroscopy is the optimal treatment. The aim of the present study was therefore to review and critically evaluate the various definitions of return to sport used in the literature, with the goal of establishing a single standard to enable comparison of outcomes in future studies.

METHODS

The PubMed, MEDLINE, and Embase databases were searched from inception to June 1, 2019, for studies relating to hip arthroscopy and return to sport using the terms "hip arthroscopy," "arthroscopic hip," "return to play," "return to sport," and "return to sports" (see the Appendix for the detailed search strategy). Titles, abstracts, and articles were evaluated independently by 2 reviewers (D.V.C., J.C.B.) on the basis of predefined inclusion and exclusion criteria. Consensus on disagreements was reached through discussion among reviewers.

Articles included were those that met the following criteria: (1) contained 2 or more patients, (2) studied patients 18 years of age and older, (3) reported postoperative outcomes after hip arthroscopy, (4) clearly defined return to play, and (5) were written in English. Articles were excluded if they (1) contained fewer than 2 patients, (2) studied patients under the age of 18 years, (3) reported outcomes for nonoperative or open treatments, (4) did not clearly define return to play, (5) were review articles, meta-analyses, or survey-based studies, or (6) were not written in English. For studies reporting on identical cohorts at multiple time points, only the most recent publication was included.

The PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) statement was used to guide reporting from those studies that met the above criteria. The Methodological Index for Non-Randomized Studies (MINORS) instrument was used to quantify the quality of the included studies.[32] For noncomparative studies, scores less than 9 were considered poor quality; 9 to 12, fair quality; and greater than 12, good quality. For comparative studies, scores less than 14 were considered poor quality; 14 to 18, fair quality; and greater than 18, good quality. Kappa statistics were calculated for each stage of screening to quantify interreviewer agreement. Kappa values were categorized as 0.81 to 0.99, excellent agreement; 0.61 to 0.80, substantial agreement; 0.41 to 0.60, moderate agreement; 0.21 to 0.40, fair agreement; and 0.20 or less, slight agreement.

The same 2 reviewers collected data regarding definitions of return to play as the primary outcome of interest from the included publications. Additional outcome metrics reported, mean follow-up periods, sample sizes, sport(s), and level(s) of the athletes were also recorded. Elite athletes were defined as those who competed on either intercollegiate varsity, professional, or national teams, or for whom the sport was a primary occupation or source of income. Recreational athletes included all others who self-reported involvement in sport or activity at a level not meeting the above criteria.

RESULTS

After removal of duplicate search results, 185 publications were identified for potential inclusion. After review of titles and abstracts, 94 full-text manuscripts were screened, and 28 articles were identified that satisfied all inclusion and exclusion criteria. The results of the review process are displayed in Figure 1. Kappa statistics for interreviewer agreement were 0.86 and 0.94 for the abstract and manuscript stages, respectively, indicating excellent agreement at both stages.

Pertinent aspects of the included studies are summarized in Table 1. All studies represented level 3 or 4 evidence, and dates of publication ranged from 2003 to 2019. Eighteen articles presented data on elite athletes, while 10 reported on nonelite athletes. The sports represented included baseball (n = 4; 14%), hockey, soccer (n = 3 for each; 11%), football (n = 2; 7%), golf, basketball, cycling, high-intensity interval training, and squatting (n = 1 for each; 4%). The remaining 11 articles (39%) studied athletes from multiple sports. The mean follow-up time was 2.8 years, and the mean sample size was 68.4 patients. The age range of the included patients was 18 to 62 years.

MINORS scores for comparative studies averaged 17.5 out of a possible 24, while for noncomparative studies they averaged 9.5 out of a possible 16. Based on these

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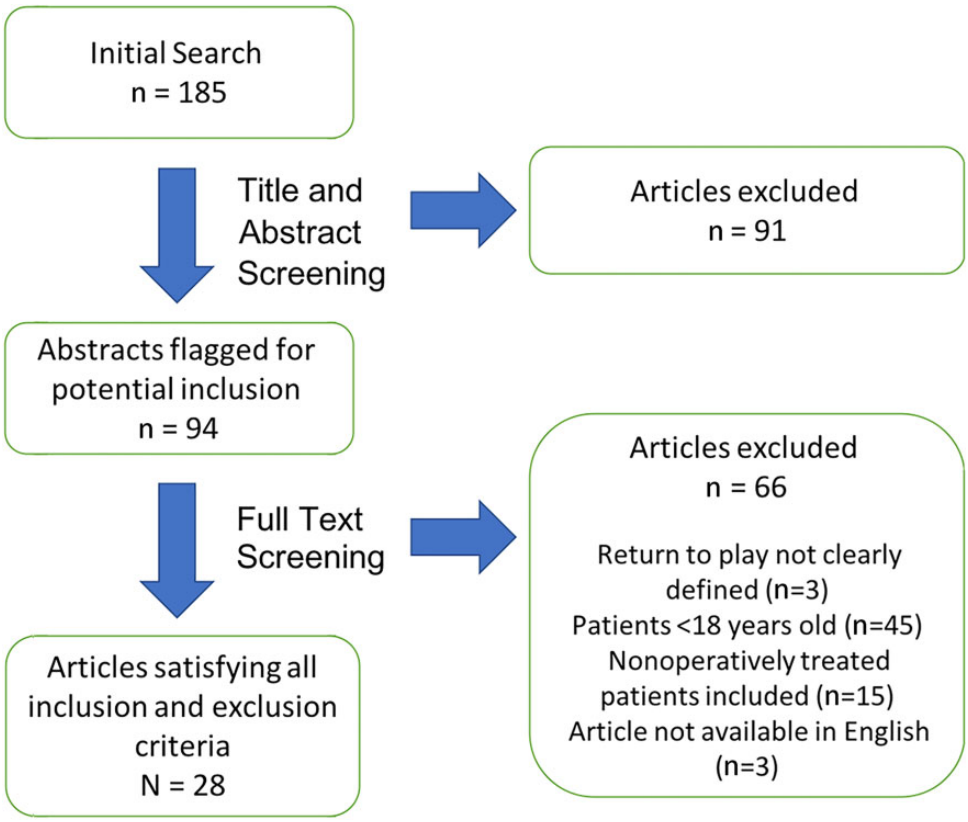

Figure 1. Search process results.

scores, the overall quality of studies included was considered fair.[32]

Of the 28 selected studies, 21 were performed at institutions within the United States. Of the remaining 7, 2 were from Italy; and 1 each was from the Netherlands, Sweden, Brazil, and Denmark; and 1 article was written by authors from multiple countries.

The breakdown of return-to-play definitions used in these articles is shown in Figure 2. For the 18 studies on elite athletes, 6 (33%) defined return to play as participation in 1 regular season or postseason game after surgery. Three (17%) extended the criteria to include preseason games, and 7 (39%) did not specify the type of competition. The remaining 2 (11%) reported return to sports-related activities and training. Among the 10 studies reporting on nonelite athletes, all used various forms of patient questionnaires to determine return to play. Six (60%) did so qualitatively, while the remaining 4 (40%) utilized a quantitative threshold to define return to play.

Of the articles published by authors outside of the United States, 6 of 7 involved nonelite athletes. Three used quantitative criteria based on questionnaires, and 3 used qualitative questionnaire data.

Numerous additional outcome measures were also reported in the studies and are displayed in Table 2. Sport-specific statistics or performance scores were presented in 61% of the studies on elite athletes. Additionally, 61% reported postoperative career length and/or number of games played, and 17% included patient-reported outcomes. Among studies on nonelite athletes, 90% utilized patient-reported outcomes and 30% reported results from sport-specific surveys.

DISCUSSION

Reviewing the existing literature on hip arthroscopy reveals differences in the criteria used to define postoperative return to play. This holds increased significance for athletic patients, whose patient-reported outcome measures may inadequately characterize their true recovery. In such cases, a "ceiling effect" may exist that results when athletes score high on their outcome measures but are unable to return to their sports. However, consistency in the measurement of return to play facilitates more reliable pooling of data and comparisons between publications.[20] It was therefore the aim of the present review to identify the various definitions of return to play after hip arthroscopy and enable future authors to make well-informed decisions regarding their uses of the term.

These results suggest that elite and nonelite athletes should be classified differently. Return to play for elite athletes has most commonly been measured by return to participation at their preoperative level of competition. Notably, this qualification does not consider athletes who return to a lower level of competition (eg, Major League

TABLE 1
Summary of Included Studies[a]

Author, Year	N	Definition of Return	Sport	Level of Athlete	Other Metrics	Country	MINORS	Follow-up, y
Begly, 2018[1]	18	Regular season	Basketball	Professional	Games played, seasons played, sport-specific stats	USA	18	4.0
Boykin, 2013[2]	21	Return to competition, type unspecified	Multiple	Elite	mHHS, HOS, SF-12, satisfaction, games started, games as substitute, sport-specific stats	USA	11	3.4
Byrd, 2015[3]	41	Baseball activities	Baseball	Intercollegiate or professional	mHHS	USA	12	3.8
Christian, 2019[4]	131	Regular season or postseason game	Multiple	Professional	Sport-specific stats, games played postop seasons 1-3, games started, career length	USA	10	2.7
Frangiamore, 2018[5]	44	Preseason or regular season	Baseball	Professional	Seasons played postop, games played postop, sport-specific stats	USA	10	3.6
Frank, 2018[7]	58	Qualitative questionnaire	Cycling	Recreational	mHHS, HOS-ADL, HOS-SS, VAS, pain, satisfaction	USA	12	2.6
Frank, 2019[6]	330	Qualitative questionnaire	Multiple	Self-reported	HOS-ADL, HOS-SS, mHHS, VAS	USA	19	2.6
Hammoud, 2012[8]	38	Return to competition, type unspecified	Multiple	Professional	None	USA	7	0.5
Ishøi, 2018[9]	189	Qualitative questionnaire	Multiple	Multiple	HAGOS	Denmark	9	2.8
Jack, 2019[10]	196	Any game	Multiple	Professional	Career length, games per season, sport-specific stats	USA	17	3.5
Jack, 2019[10]	50	Regular season	Baseball	Professional	Sport-specific stats, career length, innings pitched or plate appearances	USA	17	3.3
Locks, 2018[15]	24	Return to competition, type unspecified	Soccer	Professional	Sport-specific stats, appearances postop, career length postop	USA	10	4.3
Lubbe, 2018[16]	62	Regular season or postseason game	Hockey	Professional	Sport-specific stats, number of games per postop seasons 1-3	USA	10	2.1
McCarthy, 2003[17]	10	Return to competition, type unspecified	Multiple	Elite	Subjective outcome (specifics not reported)	USA	7	1.5
McDonald, 2013[19]	120	Return to competition, type unspecified	Multiple	Professional	Career length	USA	9	2.8
McDonald, 2014[18]	17	Return to competition, type unspecified	Hockey	Professional	Games played postoperatively, career length, sport-specific stats	USA	15	3.0
Menge, 2017[21]	51	Preseason or regular season	Football	Professional	None	USA	9	3.2
Newman, 2016[23]	20	Return to competition, type unspecified	Golf	Professional	Sport-specific stats	Multiple	7	5.7
Nwachukwu, 2018[24]	40	Regular season	Football	Professional	Sport-specific stats, mean annual salaries	USA	19	3.3
Philippon, 2010[25]	28	Sports activity	Hockey	Professional	mHHS, patient satisfaction, career length	USA	12	2.0
Polesello, 2015[26]	47	Qualitative questionnaire	Squatters	Recreational	mHHS	Brazil	6	2.9
Riff, 2018[27]	32	Qualitative questionnaire	HIIT	Recreational	mHHS, HOS-ADL, HOS-SS, VAS	USA	10	2.3
Sansone, 2015[30]	85	Quantitative questionnaire	Multiple	Multiple	HSAS, iHOT-12, HAGOS, EQ-5D	Sweden	11	1.0
Schallmo, 2018[31]	180	Regular season	Multiple	Professional	Sport-specific stats	USA	10	4.2
Tijssen, 2016[34]	37	Quantitative questionnaire	Multiple	Recreational	iHOT-33, VAS, GPE, sports questionnaires, hip functional performance tests	Netherlands	9	2.3
Tjong, 2016[35]	23	Qualitative questionnaire (interview)	Multiple	Multiple	mHHS, iHOT-12, HOS-SS, brief COPE, satisfaction	USA	8	2.0
Zini, 2014[37]	6	Quantitative questionnaire	Soccer	Recreational	HOOS, Oxford Hip Score, mHHS, VAS, SAL, ADL	Italy	9	1.0
Zini, 2018[36]	16	Quantitative questionnaire	Soccer	Multiple	HOOS, Oxford Hip Score, mHHS, VAS, SAL, ADL	Italy	10	2.0

[a]ADL, activities of daily living; COPE, Coping Orientation to Problems Experienced; EQ-5D, EuroQol 5-Dimensions; GPE, Global Perceived Effect scale; HAGOS, Copenhagen Hip and Groin Outcome Score; HIIT, high-intensity interval training; HOOS, Hip disability and Osteoarthritis Outcome Score; HOS, Hip Outcome Score; HOS-ADL, Hip Outcome Score–Activities of Daily Living; HOS-SS, Hip Outcome Score–Sport Specific; HSAS, Hip Sports Activity Scale; iHOT-12, 12-Item International Hip Outcome Tool; iHOT-33, 33-Item International Hip Outcome Tool; MINORS, Methodological Index for Non-Randomized Studies; mHHS, modified Hip Harris Score; SAL, sport activity level; SF-12, 12-Item Short Form Health Survey; VAS, visual analog scale.

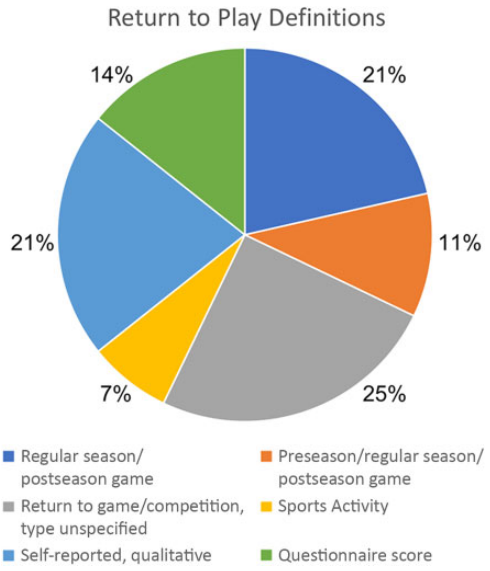

Figure 2. Return to play definitions from all studies (N = 28).

TABLE 2
Additional Outcome Metrics Reported[a]

	n (%)
Elite athletes (n = 18)	
Sport-specific statistics/performance scores	11 (61)
Postop games played/career length	11 (61)
Postop All-Star appearances	1 (6)
Annual mean salary	1 (6)
Patient outcome scores	3 (17)
Nonelite athletes (n = 10)	
Biomechanical measurements	1 (10)
Sport-specific survey	3 (30)
Patient outcome scores	9 (90)

[a]Outcome scores are based on 1 or more of the following: modified Hip Harris Score, Hip Outcome Score–Activities of Daily Living, Hip Outcome Score–Sport Specific, visual analog scale, 12-Item International Hip Outcome Tool, 33-Item International Hip Outcome Tool, Copenhagen Hip and Groin Outcome Score, and 12-Item Short Form Health Survey.

Baseball players who make it back to the sport but to the Minor League) as having successfully returned to play. Unfortunately for many athletes, this transition may represent the full extent of their postinjury comeback. Participation has generally referred to regular season or postseason competition, although less frequently this has included preseason as well. Rarely, return to sports-related activity or training has been used as an alternative. Notably, no studies included in this review measured return to play based on the achievement by athletes of sport-specific performance metrics equivalent to their preoperative level. For nonelite athletes, questionnaires have been the basis of measuring return to play. While some studies have employed quantitative criteria, others have made their assessments purely qualitatively. In either case, there is reporting bias inherent to this method of outcome measurement, but it is by necessity. Professional, collegiate, and international athletes typically have performance outcomes recorded in public databases, while there exist little comparable data on the performance of recreational athletes.[1,2,5,11,33]

Other potential differences must also be considered. The motivation to return to competition is likely to differ between patients whose financial livelihoods depend on performance and those participating for social, physical, and mental benefits alone. This is particularly relevant to professional athletes nearing the end of their contract or approaching negotiations.[14,17,20] Baseline conditioning and pain tolerance are likely to further confound comparisons between these groups.[14,17,20] Therefore, it is our recommendation that elite and nonelite athletes be considered separately in future work on return to play after hip arthroscopy.

When patients are athletes, informing their postoperative expectations on return to play is critical to the practice of orthopaedic surgery. Numerous publications have focused on this, but in hip arthroscopy, there has been no consensus definition established to date. For high-level athletes, the most commonly used definition was the ability to return to a single regular or postseason competition at the level of preinjury competition. Among the criteria documented in the current literature, this is likely the most appropriate, as preseason does not carry the same stakes for the participants. Although being physically able to perform in sport is a critical prerequisite for preseason participation and an important outcome, the level of competition is not subject to the same rigorous standards as regular-season competition. The same logic applies to return to practice or training, which has been considered return to play by a small subset of publications.

Ultimately, however, focus should shift from participation to performance and, specifically, how this changes in response to injury and treatment. Comparisons of preoperative and postoperative sport-specific performance metrics can provide the most accurate insight regarding whether athletes are truly returning to their preinjury level, and should therefore be an area of emphasis for sports medicine physicians. While 61% of the publications included in the present study reported such performance parameters, few reported comparisons between preoperative and postoperative performance, and none utilized them as the primary criteria with which to define successful return to play. However, these are likely of top priority for elite athletes. It is therefore our recommendation that sport-specific statistics most relevant to quality of performance (eg, goals, assists, and tackles) should be the focus of future return-to-play studies. While using such parameters alone would compromise intersport comparisons, expressing them as proportions relative to preinjury performance would enable authors to pool athletes from multiple sports and make meaningful comparisons between them.

For nonelite athletes, performance is inherently more difficult to objectively assess given the lack of uniformity and record keeping typical of such athletic competition. For this subset of patients, quantitative thresholds for defining

return based on comparisons of preoperative and postoperative questionnaire scores would appear to be the most appropriate surrogate. Surveys geared toward specifically assessing return of athletic function, such as the Hip Outcome Score–Sport Specific subscale, likely represent the most appropriate options for this purpose. Such methodology was employed by only 40% of the studies of nonelite athletes in this review, but it is our recommendation that this become the accepted process going forward. Doing so will improve standardization and consequently enable more robust interstudy comparisons in an otherwise highly variable population.

While there are substantial data on return to play, there is a surprising lack of published information on what matters to athletes as patients. Future studies may address this void by surveying athletes—stratified by level of competition—and obtaining data on what matters to them with regard to postoperative outcomes. Additionally, surveying surgeons and comparing their results with those from athletes may provide insight into areas of potential improvement for delivering truly patient-centered care to this subset of orthopaedic patients.

The present study is not without limitations. As with any analysis of preexisting literature, there are likely to exist differences in patient populations, surgical techniques (as they are continuing to evolve), and postoperative protocols that affect the results of a review. Furthermore, both expertise and spectrum bias may limit the generalizability of these results, and many of the articles included in the final analysis were deemed to be of low or medium quality.[32] The effects of variability and bias were minimized by utilizing predefined inclusion and exclusion criteria, but nevertheless represent an inherent limitation of this study.

Despite its limitations, however, this study still contributes meaningfully to the existing literature by outlining the current uses of the term "return to play" after hip arthroscopy and providing a framework that may be utilized by future authors on the topic. Overall, there exists significant variability in the criteria used to define successful return to sport after hip arthroscopy, and these criteria differ among elite and recreational athletes.

CONCLUSION

Elite and nonelite athletes are generally evaluated by different outcomes in the existing literature. Postoperative level of participation has been the primary outcome used to define return to play after hip arthroscopy in elite athletes. While meaningful, this parameter alone inadequately characterizes the full impact of injury and treatment. Future researchers should strive to report comparisons of the preoperative and postoperative sport-specific performance metrics of their patients in order to better assess whether high-level athletes are truly returning to their preinjury levels of performance. Comparing quantitative preoperative and postoperative survey scores focused on athletic function can similarly facilitate more accurate assessment of return to sport in nonelite athletes.

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APPENDIX
Search Strategy

PubMed Strategy:

((hip arthroscopy) OR (arthroscopic hip)) AND ((return to play) OR (return to sport) OR (return to sports))

Retrieved: 182 results

Embase Strategy:

((‘hip’/exp OR hip) AND (‘arthroscopy’/exp OR arthroscopy) OR (arthroscopic AND (‘hip’/exp OR hip))) AND (return AND to AND (‘play’/exp OR play) OR (return AND to AND (‘sport’/exp OR sport)) OR (return AND to AND (‘sports’/exp OR sports))

Retrieved: 163 results

MEDLINE Strategy:

((‘hip’ OR ‘hip’/exp OR hip) AND (‘arthroscopy’ OR ‘arthroscopy’/exp OR arthroscopy) OR (arthroscopic AND (‘hip’ OR ‘hip’/exp OR hip))) AND (return AND to AND (‘play’ OR ‘play’/exp OR play) OR (return AND to AND (‘sport’ OR ‘sport’/exp OR sport)) OR (return AND to AND (‘sports’ OR ‘sports’/exp OR sports))

Retrieved: 153 results