

Defining Return to Sport

A Systematic Review

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Background: Return to sport (RTS) commonly serves as a measure for assessment of clinical outcomes in orthopaedic sports medicine surgery. Unfortunately, while RTS is commonly utilized in research for this purpose, currently there is no widely accepted or standardized definition for when an athlete has officially returned to his or her sport.

Purpose: To conduct a systematic review to evaluate and report the differences in specific definitions of RTS utilized in the orthopaedic surgery literature.

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

Methods: A systematic review was performed using PubMed, EMBASE, and Cochrane Trials databases per PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines. Search terms consisted of variations of “RTS” combined with variations of “orthopedic surgery” and “define” to capture as many relevant articles as possible. The definition of RTS was recorded and analyzed.

Results: A total of 718 articles were identified in the initial search, 29 of which met eligibility criteria, providing a clear definition of RTS. Of the 29 studies included, 20 (69.0%) defined RTS as an athlete competing in a game or other competitive play. Three (10.3%) defined this as the athlete competing in a game or other competitive play but with an explicitly stated competition-level modifier of the athlete returning to his or her preinjury level of competition. Two articles (6.9%) included returning to training or practice, and the remaining 4 articles (13.8%) used terminology other than the standard RTS.

Conclusion: There is variability in the definition of RTS used in orthopaedic sports medicine literature. Most studies refer to the athlete competing in a game or other competitive play. Other variants include returning to practice/training and explicitly defined competition levels and objectives. Future studies should aim to standardize the definition of RTS to facilitate more precise assessment of outcome after sports medicine surgery. Using terminology that describes components of the recovery and rehabilitation process, such as “return to participation” and “return to performance,” in addition to RTS will allow us to more clearly understand the athlete’s recovery and associated level of competition or performance.

Keywords: athletic training; medical aspect of sports; physical therapy/rehabilitation; return to play; return to sport

A desire to return to sport (RTS) participation after orthopaedic surgery is a powerful motivating factor and, often-times, the primary measure of success from the athlete’s standpoint. Therefore, RTS, also referred to as return to play (RTP), has become an often-cited surrogate for clinical outcomes in orthopaedic sports medicine surgery. Unfortunately, while it is commonly utilized in research for this purpose, currently there is no standardized or widely accepted definition for when an athlete has officially returned to his or her sport. This lack of standardization can result in inaccurate comparisons, difficulty managing patient expectations, and patient disappointment.

Many potential variables exist in reporting RTS, including the type of activity to which the athlete returns (regular

season or preseason game vs practice), the volume (1 game vs a season), the level of competition (high school, college, professional), and type of sport (throwing, contact, noncontact). Because of the variations in reporting, many authors have called for a more standardized approach to reporting RTS.^{1,25} For instance, a 2018 meta-analysis of RTS after surgical treatment of femoroacetabular impingement (FAI) syndrome found an overall RTS at any level of 91% but an RTS at the same level of competition of 74%.²⁴ Additionally, Wörner et al³⁴ reported an 89% RTS after hip arthroscopy for FAI when patients were asked in a general way (return to participation in some sort of sport or exercise) but reported only a 28% RTS in the same preinjury sport at a lower competition level and a 21% RTS in the same sport at the same or higher competition level. These studies demonstrate the disparity that can occur between reported RTS levels when the definition for RTS is not clearly established.

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Most RTS outcomes are reported as binary (returned to sport or did not), while an athlete's postinjury clinical course is more complex and best viewed as a spectrum of recovery.¹ In a 2016 consensus statement on RTS, Ardern et al¹ proposed a model that defines 3 elements of RTS: return to participation, RTS, and return to performance.¹ Combining these elements in the reporting of RTS will result in a more complete picture of an athlete's recovery. The purpose of this study was to conduct a systematic review to evaluate and report the differences in specific definitions of RTS utilized in the orthopaedic surgery literature. We hypothesized that there would be substantial variability in the reported definitions of RTS.

METHODS

Study Design

A systematic search was performed using PubMed, EMBASE, and Cochrane Trials databases and according to PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines (April 2020) to identify and collect articles defining RTS/RTP.

Search Strategy

The search strategy aimed to capture articles that defined RTS and involved athletes who had undergone orthopaedic surgery. The search terms consisted of the following phrases and their synonyms: "return to sport" ("return to play," "RTS," "RTP," "Return to Sporting Activities," "Return to Sporting Activity," "Resumption of Sporting Activity," and "Resumption of Sporting Activities"), "orthopedic procedures" ("orthopedic procedure," "orthopedic surgery," "orthopedic surgeries," "post op*," "surger*," "surgical," "reconstruction," "arthroscop*," and "orthopedic") and "define" ("defines," "definition," "defined," and "defining"). Synonyms were linked using the Boolean command "OR," and the three phrases were combined using the Boolean command "AND". A variety of word combinations were used, "/exp" term "explosions" were used in Embase, and Medical Subject Headings terms were used in PubMed when appropriate in order to capture as many definitions as possible. Because of the large volume of articles involving RTS combined with orthopaedic surgery, the term "define" was included to capture articles that defined RTS in the abstract. Accordingly, while this search strategy resulted in a manageable number of full texts to review, it also likely missed numerous articles, which may have defined RTS in the body of the text but not in the abstract.

Eligibility Criteria

This review included articles written in English with abstracts that provided a definition of RTS or referred to a definition being given in the full text of the paper. Inclusion criteria aimed to capture articles studying athletes who had undergone orthopaedic surgery for a sport-related injury. To capture as many relevant articles as possible, the search was not limited to a specific injury or sport. Articles that solely used medical or rehabilitation guidelines/criteria (eg, strength or range of motion testing, pain scale) to determine when an athlete was cleared to RTS were excluded, as these did not provide a definition of when an athlete actually returned to his or her sport. Concussion studies, case reports, systematic reviews, narratives, commentaries, editorials, cadaveric studies, animal studies, and published abstracts that did not have a full-text article were excluded.

Data Extraction

The systematic review was conducted per PRISMA guidelines, as noted, and interreviewer agreement of the studies to be included was determined as follows: 2 authors (J.D. and J.M.A.) independently performed the search, removed duplicates, and screened titles and abstracts for relevance and a clear definition of RTS. Three authors (J.D., J.M.A., and M.J.M.) then screened the remaining full-text articles against the eligibility criteria. Any relevant studies referenced by the remaining articles were also identified and screened against the eligibility criteria. Interreviewer disagreement about an article's eligibility for inclusion was resolved by a majority ruling among the 3 reviewers.

RESULTS

Search Results

As shown in the PRISMA flow diagram (Figure 1), a total of 718 articles were originally identified across the 3 databases (238 from PubMed, 461 from EMBASE, and 19 from Cochrane Trials). Of these, 228 duplicates were excluded, leaving 490 articles. After screening titles and then abstracts for relevance, 455 articles were excluded, leaving 35 articles. Of these, 7 were excluded based on the eligibility criteria, and 1 article that was referenced by an included article was identified as being relevant and meeting eligibility criteria. This resulted in a total of 29 articles, which are summarized in Appendix Table A1. Given that this study did not analyze any of the data or conclusions from

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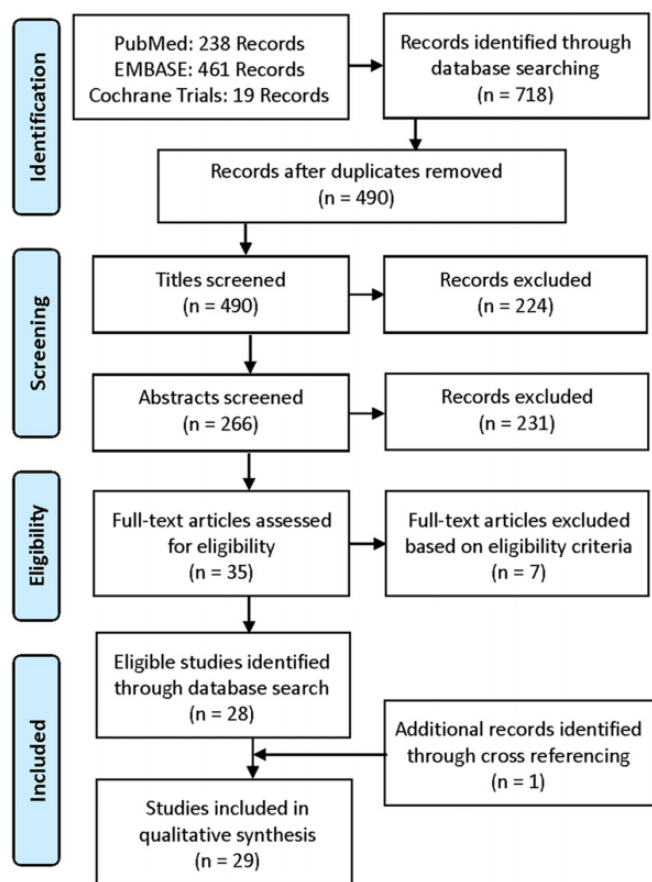


Figure 1. PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) flow diagram.

the articles, we did not believe it was necessary to determine and report on the quality of the included studies.

Types of Publications and Their Contents

The articles included in this systematic review evaluated athletes in professional hockey (2 articles^{23,28}), professional football (9 articles⁸), professional baseball (4 articles^{9,12-14}), professional basketball (2 articles^{4,15}), professional soccer (1 article³⁰), across >1 professional sport (3 articles^{7,16,19}), collegiate football (1 article³²), baseball athletes across several levels of competition (1 article⁶), high school athletes across several sports (1 article³), and overhead-throwing athletes of many ages (1 article²²). Some articles focused on injuries across multiple age groups and sports (4 articles^{11,21,26,27}). The surgeries reported in the studies included arthroscopic labral repair in FAI (hip arthroscopy) (11 articles¹¹), anterior cruciate ligament reconstruction (3 articles^{3,8,19}), Achilles tendon repair (2 articles^{30,35}), hindfoot arthroscopy (1 article²⁷), arthroscopic treatment of internal impingement of the shoulder (1 article²²), ligament reconstruction of the Lisfranc joint (1 article²¹),

[§]References 2, 8, 10, 17, 18, 20, 29, 31, 35.

^{||}References 4, 7, 9, 11, 12, 15, 16, 20, 23, 26, 28.

TABLE 1

Definitions of RTS and RTP in the 29 Included Studies^a

Definition	Studies
Playing in at least 1 game of the athletes' respective sport or the first game played after surgery	12 studies ^{4,8,12-17,28-31}
The first regular season game played after surgery	3 studies ^{10,18,19}
The first preseason or regular season game played after surgery	3 studies ^{2,9,20}
The first regular or postseason game played after surgery	2 studies ^{7,35}
Specification of competition level	3 studies ^{6,11,26}
Return to training or practice	2 studies ^{23,32}
Articles that did not use RTS or RTP	4 studies ^{3,21,22,27}

^aRTP, return to play; RTS, return to sport.

clavicle open reduction and internal fixation (1 article¹⁷), forearm open reduction and internal fixation (1 article²⁹), thumb ulnar collateral ligament repair (3 articles^{14,31,32}), Tommy John surgery (ulnar collateral ligament reconstruction) (1 article¹³), repair of acute superficial deltoid complex avulsion during ankle fracture fixation (1 article¹⁰), hook of hamate excision (1 article⁶), partial lateral meniscectomy (1 article²), and operative Jones fracture treatment (1 article¹⁸). In addition, 25 of the 29 included studies[¶] (86.2%) reported data on time to RTS, 7 studies^{||} (24.1%) reported on patient-reported outcomes, and 15 studies^{4,7-9,12-17,19,28-31} (51.7%) utilized sport-specific metrics in the data and evaluation of RTS.

Definition of RTS/RTP

Of the 29 articles that met inclusion criteria, 14 articles^{8,11-17,23,26,28-31} (48.3%) used the terminology “return to sport,” 11 articles[#] (37.9%) used “return to play,” 1 article³ (3.4%) used “return to competitive play,” 1 article²¹ (3.4%) used “return to athletic activity,” 1 article²⁷ (3.4%) used “return to sporting activities,” and 1 article²² (3.4%) used “favorable return to sport outcome (RTS +).” The most common definitions of RTS and RTP are summarized in Table 1. The less commonly used terminologies are individually described below, and all are listed in Appendix Table A1.

Twelve articles (41.4%), 6 by Jack et al,¹²⁻¹⁷ 4 by Sochacki et al,²⁸⁻³¹ 1 by Begly et al,⁴ and 1 by Cinque et al,⁸ defined RTS as playing in at least 1 game of the athletes' respective sport or the first game played after surgery. All of these articles used the terminology “RTS” and explicitly stated this definition except Begly et al,⁴ who used “RTP” and defined RTP as competing in a professional basketball game of equal competition level after surgery.

Three articles^{10,18,19} (10.3%) specified that RTS is defined as the first regular season game played after surgery. Two of these articles, Hsu et al¹⁰ and Lareau et al,¹⁸

[¶]References 2-4, 6-8, 10, 12-19, 21-23, 27-32, 35.

[#]References 2, 4, 6, 7, 9, 10, 18-20, 32, 35.

explicitly stated this definition of RTP. Mai et al¹⁹ defined RTP as successful return to the active roster for at least 1 regular season game after surgery. Three articles^{2,9,20} (10.3%) defined RTS as the first preseason or regular season game played after surgery. Menge et al²⁰ explicitly stated this definition of RTP in professional football players. Frangiamore et al⁹ defined RTP in Major League Baseball players as playing in a preseason or regular season major or minor league game after surgery. Aune et al² included the first preseason game in their definition of RTP in National Football League players, provided that the athlete played in a subsequent regular season game. Two articles (6.9%), Yang et al³⁵ and Christian et al,⁷ defined RTS as the first regular season or postseason game played after surgery. Three articles^{6,11,26} (10.3%) included a specification of competition level in their definition of RTS. Rosinsky et al²⁶ defined RTP as a patient's return to competitive participation in his or her sport at the same or higher level of competition than that of presurgery, regardless of time elapsed after surgery. Bursleson and Shin⁶ defined RTP in baseball players as reaching the athlete's preinjury level of competition and being able to perform full sports activities. Ishoi et al¹¹ defined RTS as the athlete being engaged in one's preinjury sport at preinjury level of competition at follow-up with a mean follow-up of 33.1 ± 16.3 months.

Two articles (6.9%), Philippon et al²³ and Werner et al,³² included returning to training in their definitions of RTS and RTP. Philippon et al defined RTS in professional hockey players as the player resuming skating for training or participation in the sport of ice hockey. Werner et al defined RTP in collegiate athletes as when both the senior author and athletic trainer released the patient to return to game play (when in season) or practice (when out of season).

Four studies^{3,21,22,27} (13.8%) used terminology other than the standard RTS or RTP and each study included a specification of competition level in their definition. Bauer et al³ defined "return to competitive play" in high school athletes as return to the same sport that was played preinjury within 1 year of surgery and specified that the sport had to be organized—that is, collegiate, interscholastic, "travel" or club teams, organized intramural sports, or tournaments. Smyth et al²⁷ defined "return to sporting activities" as being calculated as the time period from the date of surgery until the patient was able to participate at one's previous level of competition. Miyamoto et al²¹ defined "return to athletic activity" as return to near preinjury performance level, although the authors did not state how this was determined. Peduzzi et al²² distinguished between RTS + and RTS – in overhead-throwing athletes, defining a "favorable RTS outcome (RTS +)" as returning to the previous sport at a same or higher level of competition and defining "RTS –" as returning to the previous sport at a lower level of competition, a switch to another sport, or an inability to engage in any sport. The article analyzed the level of competition by determining whether the athletes competed recreationally, in regional competitions, in national competitions, or in international competitions both pre- and postoperatively.²²

DISCUSSION

Although a majority of the studies included in our analysis defined RTS as competing in a game or competitive play after surgery, significant variability exists among the definitions in the literature. Future studies should seek to standardize the definition and use more specific terminology to better describe the recovery and rehabilitation of the athlete. While we are not aware of any other studies that have analyzed the definitions of RTS used in the literature, the inconsistency of RTS definitions has been discussed in several studies and editorial commentaries, some with concern about patient satisfaction and safety as a result of the ill-defined parameter.^{5,25,33}

Of the 25 studies^{2,4,6-20,23,26,28-32,35} which used standard RTS or RTP terminology, 20 studies^{2,4,7-10,12-20,28-31,35} (69.0% overall) defined RTS as an athlete competing in a game or other competitive play, while 3 studies^{6,11,26} (10.3% overall) defined RTS as the athlete competing in a game or other competitive play but with an explicitly stated competition-level modifier of the athlete returning to one's preinjury level of competition. Philippon et al²³ and Werner et al³² alternatively defined RTS as the athlete returning to practice or training. The difference between returning to training versus competition is important to consider, and unfortunately, current definitions of RTS do not allow for this distinction.

Although many of the included studies discussed professional athletes, studies that discuss athletes in high school sports or amateur sports may give way to even greater variability if RTS is not defined explicitly. As mentioned, Bauer et al³ defined "return to competitive play" in high school athletes as return to the same sport that was played preinjury within 1 year of surgery and indicated the sport had to be organized (ie, collegiate, interscholastic, "travel" or club teams, organized intramural sports, or tournaments). Although Bauer et al offered a very strict definition of RTS relative to similar articles, the general requirement for the sport to be organized is an important consideration. Absent this criterion, an athlete may be determined to have returned to sport even if that athlete returns to noncompetitive and nonorganized sports in which the degree of intensity may be significantly decreased from the athlete's preinjury level of competition. That said, it is equally important to analyze RTS for recreational athletes in noncompetitive and nonorganized sports such as golf, skiing, and running. For reasons of health maintenance, socialization, and personal enjoyment, a patient may wish to return to his or her preinjury noncompetitive and nonorganized sport. Therefore, it is important for physicians to be able to share relevant data with these patients.

Finally, RTS in adolescent and high school sports may be biased because an athlete's age, graduation from high school/college, or both may lead to his or her cessation from playing sports. For example, while a professional athlete's RTP or retirement can be tracked, the same is not necessarily possible for a high school athlete who may not continue to play his or her sport after graduation.

In their study of professional basketball players, Begly et al⁴ defined RTP as competing in a game of "equal level"



Return to participation: The athlete may be participating in rehabilitation, training (modified or unrestricted), or in sport, but at a level lower than his or her RTS goal. The athlete is physically active, but not yet ‘ready’ (medically, physically and/or psychologically) to RTS. It is possible to train to perform, but this does not automatically mean RTS.

Return to sport (RTS): The athlete has returned to his or her defined sport but is not performing at his or her desired performance level. Some athletes may be satisfied with reaching this stage, and this can represent successful RTS for that individual.

Return to performance: The athlete has gradually returned to his or her defined sport and is performing at or above his or her preinjury level. For some athletes this stage may be characterized by personal best performance or expected personal growth as it relates to performance.

Figure 2. Return-to-sport continuum. Image adapted from Ardern et al¹ with permission from BMJ Publishing Group Limited.

after surgery. This is in contrast to Frangiamore et al,⁹ who defined RTP in Major League Baseball players as playing in a preseason or regular season major or minor league game after surgery. However, this would not qualify as competing in a game of “equal level.” These 2 definitions are further contrasted by Mai et al,¹⁹ who defined RTP as successful return to the active roster for at least 1 regular season game after surgery. Being on the active roster, however, does not give any indication of the athlete’s level of competition or frequency of play.

As mentioned in the eligibility criteria for this study, articles that solely used medical or rehabilitation guidelines/criteria (eg, strength or range of motion testing, pain scale) to determine when an athlete was cleared to RTS were excluded, as these did not provide a clear definition of when an athlete actually returned to his or her sport. This is significant because it is possible for an athlete to meet established criteria for being physically able to RTS but not actually RTS, which may be related to the athlete’s psychological response to injury and recovery.³⁶

Developing a more standardized definition of RTS would benefit sports medicine physicians, coaches, athletic trainers, researchers, and patients. Analysis of RTS on a spectrum, such as that presented by Ardern et al¹ in a 2016 consensus statement, may be advantageous compared with a binary definition, given that an athlete’s recovery is a complex process involving multiple stages and benchmarks.¹ Whereas the definition of RTS varied in the studies included in this systematic review, all definitions were binary (ie, an athlete was determined to either have returned to sport/play or not). Although Philippon et al²³ and Werner et al³² were unique in including return to training in their definitions of RTS, the definitions were still a yes or no question of whether the athlete had returned to sport/play. We endorse the use of a spectrum of RTS that more explicitly states the athlete’s recovery status, such as

that presented by Ardern et al (summarized in Figure 2). As the consensus statement states, “A clear definition of RTS is important, and researchers should consider using the RTS continuum as a basis for their definition.”¹

It may be difficult to determine an athlete’s return to performance as it is stated in Figure 2 because that is largely a subjective and personal determination by the athlete, particularly for noncompetitive and nonorganized sports. In addition, in reporting levels of RTS in a study according to the RTS continuum in Figure 2, the percentage of athletes returning to sport will certainly be much higher than will the percentage of athletes returning to performance. However, the continuum offers more specificity and more uniformity. Those 2 objectives provide for greater clarity and reliability of the metric of RTS.

Limitations

There are several limitations to this study. First, a small group of authors wrote the majority of studies identified in the systematic review. We identify this as a limitation because one would assume that an author or institution would use the same definition across all of their studies, which could make the definitions in the literature appear very uniform even if every author or institution defined RTS differently. However, we identified at least 1 example of authors from the same institution using 2 different definitions in their respective studies.^{4,9,20,23} Thus, while an author may wish to use the same definition across all of his or her studies, it may not even be standardized at the level of the individual institution. In addition, we found that in the 20 studies (69.0%) that defined RTS as an athlete competing in a game or other competitive play, the authors represented 7 unique institutions, indicating a level of convergence on a common definition.

Second, there was undoubtedly a wide variety of injuries and treatment modalities, as well as type and competition level of sports in the studies analyzed in this review. Accordingly, there may have been opportunities to create or agree on unique definitions of RTS for specific subsets of athletes. However, given the inherent challenges posed by a lack of consistency in defining RTS, it was the intention of this review to evaluate and analyze a broad definition of RTS as it is used across the sports medicine literature.

Third, as a systematic review, only abstracts could be searched for the defined terms, as opposed to evaluating the full texts. There may have been other studies that defined RTS in the full text of the paper but not in the abstract. The word “define” was included in our search terms to limit the findings to those studies that specifically define RTS. It is possible that a definition could be provided, perhaps parenthetically, without using the word “define.” That said, we identified several studies in our search results that provided the definition parenthetically without the use of the word “define.” These studies most likely appeared in the search results because the word “define” was present in other sentences in the abstract. Fourth, many studies that use RTS as an outcome measure never define those terms likely because it is not seen as

needing a definition given its prominence in the literature and simplicity of terminology.

CONCLUSION

There is variability in the definition of RTS used in orthopaedic sports medicine literature. Most studies refer to the athlete competing in a game or other competitive play. Other variants include returning to practice/training and explicitly defined competition levels and objectives. Future studies should aim to standardize the definition of RTS to facilitate more precise assessment of outcome after sports medicine surgery. Using terminology that describes components of the recovery and rehabilitation process, such as “return to participation” and “return to performance,” in addition to RTS will allow us to more clearly understand the athlete’s recovery and associated level of competition or performance.

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APPENDIX

TABLE A1
Summary of Included Articles^a

Lead Author (Year)	Injury/Surgery	Sports/Athletes	LOE	Terminology Used and Definition
Jack (2017) ¹⁷	Clavicle ORIF	Pro football	3	RTS, defined as playing in 1 NFL game after surgery
Jack (2018) ¹⁴	Thumb UCL repair	Pro baseball	3	RTS, defined as playing in at least 1 MLB game after surgery
Jack (2018) ¹³	Tommy John surgery	Pro baseball	3	RTS, defined as playing in at least 1 MLB game after UCL reconstruction
Jack (2019) ¹²	Hip arthroscopy	Pro baseball	3	RTS, defined as playing in at least 1 MLB game after surgery
Jack (2019) ¹⁶	Hip arthroscopy for FAI	Pro football, basketball, baseball, and hockey	3	RTS, defined as playing in at least 1 game after surgery
Jack (2020) ¹⁵	Hip arthroscopy	Pro basketball	3	RTS, defined as playing in at least 1 game after surgery
Sochacki (2018) ²⁹	Forearm fracture ORIF	Pro football	3	RTS, defined as playing in a single NFL game after surgery
Sochacki (2019) ²⁸	Hip arthroscopy for FAI syndrome	Pro hockey	3	RTS, defined as playing in at least 1 NHL game after surgery
Sochacki (2019) ³¹	Thumb UCL surgery	Pro football	3	RTS, defined as playing in at least 1 NFL game after thumb UCL surgery
Sochacki (2019) ³⁰	Achilles tendon repair	Pro soccer	3	RTS, defined as playing in any MLS game after surgery
Begly (2018) ⁴	Hip arthroscopy	Pro basketball	3	RTP, defined as competing in a single professional game of equal level after surgery
Cinque (2017) ⁸	ACL reconstruction	Pro football linemen	3	RTS, defined as an athlete playing in at least 1 NFL game after ACL reconstruction
Hsu (2015) ¹⁰	Repair of acute superficial deltoid complex avulsion during ankle fracture fixation	Pro football	4	RTP, defined as the ability to successfully participate in at least 1 full regular season NFL game after surgery
Lareau (2016) ¹⁸	Operative Jones fracture treatment	Pro football	4	RTP, defined as the ability to play in a single regular season NFL game after surgery
Mai (2017) ¹⁹	ACL reconstruction	Pro football, basketball, hockey, and baseball	3	RTP, defined as a successful return to the active roster for at least 1 regular season game after ACL reconstruction
Menge (2017) ²⁰	Hip arthroscopy	Pro football	4	RTP, defined as competing in a preseason or regular season professional football game after surgery
Frangiamore (2018) ⁹	Hip arthroscopy	Pro baseball	4	RTP, defined as playing in a preseason or regular season major or minor league game after arthroscopy
Aune (2014) ²	Partial lateral meniscectomy	Pro football	4	RTP, defined as the first time a player played in a regular season NFL game after partial lateral meniscectomy; preseason game play was accepted as successful RTP, provided that the athlete played in a subsequent regular season game
Yang (2019) ³⁵	Primary Achilles tendon tear	Pro football	3	RTP, defined as playing in a regular season or postseason game after injury

(continued)

Table A1 (continued)

Lead Author (Year)	Injury/Surgery	Sports/Athletes	LOE	Terminology Used and Definition
Christian (2019) ⁷	Hip arthroscopy	Pro football, baseball, basketball, and hockey	3	RTP date, defined as the date of the first regular or postseason game played in the respective professional league after each arthroscopic hip procedure
Rosinsky (2019) ²⁶	Bilateral hip arthroscopy	High school, collegiate, and pro athletes across many sports	4	RTS, defined as a patient's return to competitive participation in his or her sport at the same level as or higher than that of presurgery, regardless of time elapsed after surgery
Burleson (2018) ⁶	Hook of hamate excision	High school, collegiate, and pro baseball	4	RTP, defined as reaching the athlete's preinjury level and being able to perform full sports activities
Ishoi (2018) ¹¹	Hip arthroscopy for FAI	18- to 30-y-old athletes across many sports	3	RTS, defined as the proportion of athletes who were engaged in their preinjury sport at preinjury level at follow-up
Philippon (2010) ²³	Arthroscopic labral repair and treatment of FAI	Pro hockey	4	RTS, defined as the player's resuming skating for training or participation in the sport of ice hockey
Werner (2014) ³²	Thumb ulnar collateral suture anchor repair	Collegiate football	4	RTP, defined as when both the senior author and athletic trainer released the patient to return to game play (when in season) or practice (when out of season)
Bauer (2019) ³	ACL reconstruction	High school athletes across many sports	3	Return to competitive play, defined as return to the same sport that was played preinjury within 1 y of surgery, and the sport had to be organized (ie, collegiate, interscholastic, "travel" or club teams, organized intramural sports, or tournaments)
Smyth (2013) ²⁷	Hindfoot arthroscopy	No specific sport or age group	4	Return to sporting activities, "calculated as the time period from the date of surgery until the patient was able to participate at one's previous level of activity"
Miyamoto (2015) ²¹	Ligament reconstruction using single bone tunnel technique for chronic symptomatic subtle injury of the Lisfranc joint	Rugby, football, and judo	4	Return to athletic activity, defined as return to near preinjury performance level
Peduzzi (2019) ²²	Arthroscopic treatment of internal impingement of the shoulder	Overhead athletes including handball, tennis, volleyball, and swimming	4	RTS +, defined as returning to the previous sport at the same or a higher level, or RTS -, defined as a return to the previous sport at a lower level, a switch to another sport, or an inability to engage in any sport

^aACL, anterior cruciate ligament; FAI, femoroacetabular impingement; LOE, level of evidence; MLB, Major League Baseball; MLS, Major League Soccer; NFL, National Football League; NHL, National Hockey League; ORIF, open reduction and internal fixation; pro, professional; RTP, return to play; RTS, return to sport; UCL, ulnar collateral ligament.