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Return to Play Post Achilles Tendon Rupture: A Systematic Review and Meta-Analysis of Rate and Measures of Return to Play

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Abstract

Aim—This systematic review and meta-analysis sought to identify return to play (RTP) rates following Achilles tendon rupture and evaluate what measures are used to determine RTP.

Design—Systematic review and meta-analysis. Studies were assessed for risk of bias and grouped based on repeatability of their measure of RTP determination.

Data Sources—PubMed, CINAHL, Web of Science, and Scopus databases were searched to identify potentially relevant articles.

Eligibility criteria for selecting studies—Studies reporting return to play/sport/sport activity in acute, closed Achilles tendon rupture were included.

Results—A total of 108 studies encompassing 6,506 patients were included for review. Eighty-five studies included a measure for determining RTP. The rate of RTP in all studies was 80% (CI_{95%}: 75 – 85%). Studies with measures describing determination of RTP reported lower rates than studies without metrics described, with rates being significantly different between groups ($p < 0.001$).

Conclusions—Eighty percent of patients returned to play following Achilles tendon rupture, however, the return to play rates are dependent on the quality of the method used to measure RTP. To further understand RTP after Achilles tendon rupture, a standardised, reliable, and valid method is required.

Keywords

Achilles; return to sport; return to activity; outcome measure

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COMPETING INTERESTS

The authors have no competing interests.

BACKGROUND

A rupture of the Achilles tendon predominantly occurs in middle-aged males during sports activity[1–8], with increasing incidence rates of as much as 69 per 100,000[1,9]. The greatest increases in incidence occur in the 40–60 and over 60 age groups[1,10,11].

Most people with an Achilles tendon rupture are recreationally competitive or involved in social sport[12,13] at the time of injury and report a desire to return to same activity[14]. The resumption of sports and physical activity is also an essential factor for the maintenance of health and prevention of morbidities following injury[15]. Despite this goal, there are reports that only half of patients return to play one year after injury[14,16].

There have been a variety of proposed reasons that may contribute to why not all patients are able to return to play. Rupture of the Achilles tendon leads to muscle weakness[17] and decreased endurance[18], which persists to 10 years following injury[19–22]. Performance of higher-level activities, such as those required for return to play (RTP), also demonstrate large variations between individuals[17]. In a study by Olsson et al.[17], limb symmetry indexes between injured and non-injured sides ranged from 84–102% with standard deviations ranging from 15–26% during two jumping tasks. This variability may be due to any number of factors – gender, method of management, plyometric strength deficits, psychological components, and other physical changes indirectly related to injury and recovery course[4,23–25]. Patients may be physically able to return to sports activities[26], but the fear of re-rupture may cause an individual to avoid the sports activity during which injury occurred[14]. Patients may also develop additional musculoskeletal problems related to changes in gait biomechanics[27–29] such as knee injury or contra-lateral Achilles tendinopathy (25%) and rupture (6%)[30].

To appreciate the impact of Achilles tendon rupture on the ability for an individual to RTP, it is important to understand what the RTP rates are following injury and how RTP is currently evaluated. This will allow for standardised evaluation of RTP across studies, providing a solid basis for comparisons. Standardised evaluation can enable larger, combined cohorts more generalisable to the larger population, which will help inform treatment and rehabilitative guidelines.

The aim of this study was to perform a systematic review and meta-analysis of RTP rates following Achilles tendon rupture and evaluate what measures are used to evaluate RTP.

METHODS

Search strategy

Potentially relevant articles were identified via a search of PubMed, CINAHL, Web of Science, and Scopus databases. Search terms included two strings linked by an AND modifier. The first search string included (Achilles tendon AND injur*) OR (Achilles tendon AND rupture). The second string was designated as (Recovery of function OR performance outcome* OR athletic performance* OR treatment outcome*). The terms tendinopathy and review were linked with NOT modifiers. Results were filtered to English language, human

studies, and adults. Databases were searched on March 1, 2016 with no restriction of timeframe. Results of the database search were exported to a reference management database for review. Preliminary searches included terms such as “return to play” and “return to sport,” however, these searches yielded less studies, and studies known to the authors as reporting RTP following Achilles tendon rupture were missing. Therefore, the more general, inclusive terminology was utilised. Articles were identified through electronic database searching; no hand searching, citation tracking, or reference scanning was performed. The initial search and search strategy was performed by a reference librarian with input from the authors.

Selection criteria

To be included, articles needed to describe patients with closed, acute Achilles tendon rupture and be of randomised control trial, cohort study, or case series study design. Due to the demographics of typical patients with Achilles tendon rupture, inclusion was limited to adults (at least age 18). Finally, an outcome measure regarding return to activity, sport, or play needed to be included within the abstract or body of the article. Articles were excluded based on the following criteria: case studies, chronic/delayed treatment (>4 weeks), open rupture/tendon laceration, inclusion of only patients with Achilles tendon re-rupture, non-English articles, non-human studies, bilateral ruptures. Studies including cohorts of both included and excluded populations (for example, a study comparing outcomes in a cohort of acute Achilles tendon rupture versus chronic Achilles tendon rupture) were included, but only data meeting inclusion for the review were included in the data analysis (i.e. acute Achilles tendon rupture).

To ensure that each study met the inclusion criteria, studies were reviewed first by title. Title review primarily excluded articles not relating to Achilles tendon rupture, basic science studies not relevant to the purpose of this study, or studies pertaining to chronic rupture. Articles were then reviewed by abstract, followed by a full text review to ensure that the study included RTP outcomes either in the abstract or full text. All articles were reviewed by title and abstract by two independent reviewers to determine if the study met selection criteria. If consensus was unable to be reached, a third reviewer was consulted. For full text review, two independent reviewers each independently reviewed 25% of studies. Reviewers were consistently able to agree on inclusion of studies, and, therefore, the remaining studies were divided between the two reviewers due to the volume of studies identified and time constraints. If there were any studies that did not clearly meet selection criteria, this study was brought to the attention of the second reviewer to ensure consensus in the studies included in the review. If consensus was unable to be reached, a third reviewer was consulted.

Risk of bias

All articles included for full text review were scored for risk of bias using the scoring system described by Arden et al.[31]. This scoring system comprises six criteria, and the number of criteria fulfilled have been determined for each study. To fulfill all six criteria, the study must include selection criteria for patient inclusion/exclusion, report patient demographic data, report results of a representative population, report patients’ pre-injury level, compare

patients' post-intervention/post-injury sports level to their pre-injury level, and be of prospective study design. Studies were rated for risk of bias by two reviewers.

Data extraction and synthesis

Data were extracted from each included study by two reviewers. The following data were extracted: number of patients, patient demographics (age, sex), study design, percentage of patients returning to sport, measures of performance utilized, time frame to return to sport (with measure of variance), and time of evaluation of RTP. In studies that reported RTP percentages at multiple time points, data from the final study time point were used in our analysis. In retrospective studies where a mean follow-up time was reported, this value was used for time of evaluation of RTP. Studies that included measures of sport/activity performance but did not report a return to play percentage were included in the demographics analysis, but were not included in the RTP rate meta-analysis.

When there is no definition of measurement method, the risk of bias is considered very high, therefore, we also assessed the RTP-rated methodology of each study. Studies were classified into one of two groups. Group 1 included studies in which the measure could be implied based on how return to activity/sport was reported or the measure of RTP was clearly described in the study's methods (e.g. studies that specified patients had returned to play at the same level as prior to injury or provided exact wording of interview/survey questions to patients or subscales of questionnaires specific to return to sport). Group 2 studies included those that reported a return to play percentage or timeframe in the results, but the measure to determine RTP was not described and unable to be inferred based on the phrasing of the results (e.g. studies that included a statement in the results such as, "X% of patients returned to sport"). Two reviewers grouped studies into methodology classifications. Initially, two reviewers independently reviewed a subset of articles to check agreement. Then, remaining articles were divided between reviewers and reviewed by a single reviewer. If grouping classification was unclear, the second reviewer was requested to provide a classification rating. If consensus was not achieved, a third reviewer was consulted.

Statistical analysis

Means and standard deviations were calculated for demographic data. Pooled proportion of RTP rate, 95% confidence intervals, and I^2 index (a measure of heterogeneity)[32] were calculated for the total group and for the two RTP methodology sub-group classifications using StatsDirect Statistical Software (StatsDirect Ltd, England). A one-way analysis of variance (ANOVA) test was used to determine whether there were differences in RTP rates between the two RTP methodology sub-groups. Pearson correlations were conducted to identify relationships between RTP rate with the year of study and time of RTP evaluation. ANOVA and correlations were done using SPSS version 23 (IBM SPSS Statistics for Windows, Armonk, NY: IBM Corp). Weighted mean (weighted by number of patients) and standard deviation was calculated for time to RTP means across all studies reporting a time to RTP mean with measure of variance.

RESULTS

Search results and description of studies

The database searches yielded 552 articles. Three hundred twenty-two articles were excluded based on title. Of the 230 articles reviewed by abstract, 199 articles were included for full text review. Of those, a total of 108 articles met the inclusion criteria (Figure 1, Table 1).

Of the 108 studies, 71 reported selection criteria, 106 reported patient demographic data, 24 reported patient pre-injury level of play, 82 compared post-intervention/post-injury sports outcome to pre-injury level, and 57 were prospective in design. The mode qualitative assessment score of all included articles was 4 criteria fulfilled. There was no difference in mode of criteria fulfilled on qualitative assessment between methodology sub-groups.

Patients were a Mean (SD) of 41.4 (6.8) years of age, and 79.6% of patients were male. Six studies did not report patient sex[38,61,75,85,102,126] and five studies did not report patient age[45,62,73,75,80]. Eighty-five of the studies reported RTP measure (RTP methodology sub-group 1) and 23 were classified as lacking RTP measure (methodology sub-group 2). There were 6,506 patients included in all studies – 5,535 in sub-group 1 and 971 in sub-group 2.

Rate of RTP

The pooled rate of RTP (based on 98 studies) was 80% (CI_{95%}: 75 – 85%, I²=95.8%) (Figure 2). Three studies[81,95,121] did not report a return to play percentage but reported RTP timeframes. These studies were included in the analysis for subject demographics and timeframe to RTP. In methodology sub-group 1 studies, the RTP rate was 77% (CI_{95%}: 70–83%) (Figure 2). In methodology sub-group 2 studies, the rate of return to play was 91% (CI_{95%}: 84–96%) (Figure 3). Lower return to play rates were significantly lower in sub-group 1 versus sub-group 2 studies ($p < 0.001$). There was no relationship between RTP rate and year of study publication (Pearson $r = -0.030$, $p = 0.765$).

Relationship between RTP and time of evaluation

The time of evaluation of RTP varied between 5 and 145.2 months (mean = 23.8 months SD = 22.9 months). There was no relationship between time of evaluation and RTP rate (Pearson $r = -0.026$, $p = 0.803$).

Time to RTP

The mean (SD) time to RTP (based on 37 studies) with a measure of variance was 6.0 (1.8) months (Figure 4).

DISCUSSION

The results of this systematic review indicate that 80% of patients with Achilles tendon rupture will RTP, however, determination of the rate of RTP is subject to bias and dependent on the measure used to evaluate RTP. In the process of identifying how different studies

evaluated RTP, we found that numerous studies report a rate of RTP without including how this rate was measured. While the rate of RTP for studies describing RTP measures fell 3% below the rate for all included studies, the rate of RTP for studies without described RTP measures (and higher risk of bias) was 11% higher than the rate for all included studies.

In general, while there is good consensus that RTP is a goal in this population, the literature regarding the resumption of sports activity to pre-injury levels following Achilles tendon rupture is limited. Return to play is reported as an outcome in a minority (19.7%) of studies on recovery of function following Achilles tendon rupture and a smaller number, 15.4% out of 552 articles, report RTP with indication of what measure was used to gauge RTP. For the individual patient, RTP is often a primary goal and is an important component of success of treatment following Achilles tendon rupture. This points to the need for better, standardised measures for gauging RTP that encompass the multiple aspects that comprise an individual's ability to RTP.

Measures to assess RTP range from patient interview to the use of sports participation scores to objective sports performance indicators[41,120]. The measures used to assess return to play performance address multiple aspects of play, including volume/frequency of play, type of sport/sport demands, level of play, and play performance. Considering these aspects will be important in developing comprehensive measures that seek to capture RTP as a multi-faceted concern.

Rate of RTP

There were large variations on return to play rates and timeframes among the included studies. While the results indicate that 80% of subjects were able to return to play, studies reported as few as 18.6% and as large as 100% return to play rates. In studies of patients with ACL reconstruction, increasing stringency of RTP definition results in lower percentages of athletes who RTP[31,148]. Therefore, the more conservative estimate of 77% provided by the methodology sub-group 1 studies in our review might be a more accurate (although likely still optimistic) estimate of true RTP rates.

There was no relationship between time of evaluation of RTP and RTP rate. This suggests that, while there was variability in time of evaluation, the majority of studies were of long enough duration to capture RTP outcomes.

Time to RTP

The average time to RTP was 6.0 months, but this also varied with study means/medians as low as 2.95 months and as high as 10.4 months. This estimate seems to coincide with timing of functional capacity recovery post-rupture, which has been reported to recover rapidly 3 and 12 months[69,83,116,149,150], followed by slowed rates of change between 1 and 2 years post-rupture[17]. Prior studies evaluating the return of functional capacity following Achilles tendon rupture have reported large variations between individuals[151,152]. Some of the variation seen in this analysis may be due to those individual variations. Additionally, differences in study design and definition of RTP may contribute to the variance in reported time of RTP. In the future, consistency and standardisation of RTP evaluation will assist in

establishing RTP timeframes that allow for improved comparison of multiple cohorts across studies.

Other functional and performance measures

There are a variety of functional and performance measures that have been used in the study of patients with Achilles tendon rupture. These measures present challenges when measuring RTP, however. On the one hand, there are a variety of validated, reliable questionnaires that assess different aspects of RTP that have been developed for use in non-Achilles tendon rupture populations. For instance, the Physical Activity Scale[90] includes measures of activity intensity and duration. The Halasi score[147], an adaptation of the Tegner score[48], captures factors such as type and level of sport activity. The Foot and Ankle Outcome Score[59] and Foot and Ankle Ability Measure[33] both have a sport-specific scale, which captures perceived difficulty with sport-related maneuvers. While these scores capture certain components of the whole RTP picture, the difficulty with using these scores is that they were not developed specifically for use in this unique population and many have not been validated in the Achilles tendon rupture population. They may or may not capture the unique needs of this specific population. On the other hand, there are Achilles tendon rupture specific questionnaires that capture some aspects of performance but may not comprehensively capture RTP. For example, the Achilles tendon Total Rupture Score[40] is a valid, reliable, reproducible and responsive questionnaire for use in individuals following Achilles tendon rupture. While this questionnaire addresses multiple concerns reported by patients with Achilles tendon rupture, it only asks three questions regarding running, jumping, and physical labor capacity, which may not adequately address the RTP question.

Ultimately, while there are numerous questionnaires that measure various aspects of RTP, there are none that comprehensively address the needs of this specific population. Given the importance of RTP for these individuals and the need to standardise measures to evaluate RTP, it would be beneficial for a consistent set of currently available tests and measures to be defined or for a measure to be developed that emphasises volume as well as type of sport with consideration of Achilles tendon loading, and touches on sport performance.

Suggestions for clinical practice and research

From a study design and reporting standpoint, there are ways to improve measure of RTP using the tools currently available. While a majority of studies compare post-injury to pre-injury rates, this was done via patient interview or unvalidated questionnaire in the majority of studies and only 22.2% of studies report a measure for pre-injury performance. Pre-injury rates are often obtained at time of follow-up and rely on accurate patient recollection of activity participation status. Prospective data regarding sport performance is ideal, but not always available. It may be beneficial to have patients rate sport performance early post-injury as opposed to a follow-up several weeks to months post injury. Another thing to consider is improving the frequency of reporting sport-specific subscales of already validated questionnaires. The AOFAS[35], FAOS[59,153,154] and Thermann[43] scores include sports and activity sub-scales but these subscales are infrequently reported. Finally, though all terms implying sports participation of activity were included in this systematic

review, it was noted that a number of different terms were used in the literature. Activity, level, standard, performance, and intensity were all used, however, these may mean different things to patients and responses may vary accordingly. Variations in terminology further complicate search strategy when attempting to find relevant literature. Based on a consensus statement from 2002, the use of return to play is recommended to improve consistency in phrasing[155].

Study strengths and limitations

This systematic review assessed studies based on two separate set of criteria. The criteria developed by Arden et al.[31] was utilised to evaluate study risk of bias. We also developed a second set of criteria to evaluate study methodology with regard to measuring RTP based on reproducibility. The combination of both methods of assessing study risk of bias and methodology allowed us to distinguish between quality in reporting between groups of studies.

There are some limitations to our review. Included studies covered a range of research questions with a variety of set time points for follow-up and various types of treatments. Studies incorporated data from varied populations (recreational as well as professional athletes), which could impact the RTP rate and timeframe. Broad study inclusion is beneficial for understanding RTP in the larger, varied population of individuals with Achilles tendon rupture. Similarly, while many terms were included in this literature search to capture the large number of different terms currently used to describe return to play, this allows for improved generalisability to this population of individuals. Exclusion criteria did eliminate studies of portions of the population of patients with Achilles tendon rupture (Achilles tendon laceration, delayed treatment), so the findings of this study may not be generalisable to these populations. Unpublished and non-English language studies were not included in this study, which introduces the possibility of publication and language bias.

CONCLUSION

Four out of five patients returned to sport after Achilles tendon rupture, at an average of 6 months following injury. Studies with well-defined RTP measures demonstrated lower RTP rates compared to studies that only reported the RTP rate with no description of how the rate was determined.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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What are the new findings

- About 80% of people are able to RTP following Achilles tendon rupture
- Measures that are better described and more reproducible are associated with lower RTP rates
- Measures evaluating RTP are variable and inconsistently reported

How might it impact on clinical practice in the near future

- Provide evidence-based RTP rate estimates for patient education
- Improve consistency in use and reporting of RTP measures
- Inform the future development of comprehensive evaluative tools to measure RTP

Figure 1.
Decision tree for inclusion/exclusion of studies.

Figure 2.

Rate of Return to Play (RTP) in Group 1 studies reporting percent RTP. Error bars indicate 95% confidence intervals, square markers indicate proportion of patients able to return to play reported in each study. The diamond marker and vertical line indicate the proportion of patients able to return to play in all Group 1 studies combined.

Figure 3.

Rate of Return to Play (RTP) in Group 2 studies reporting percent RTP. Error bars indicate 95% confidence intervals, square markers indicate proportion of patients able to return to play reported in each study. The diamond marker and vertical line indicate the proportion of patients able to return to play in all Group 2 studies combined.

Figure 4.

Time to Return to Play (RTP). Forest plot of time to return to play in months. Error bars indicate range as that was the most commonly reported measure of variance. Six studies reported a range without a mean and appear with only bars indicating reported range. The vertical line indicates the group mean for all studies reporting mean with measure of variance for time to return to play. Group 1 studies are indicated with squares for means, Group 2 studies are indicated with circles for means. Studies are ordered by RTP methodology group, then by number of patients with studies larger number of patients higher on the y-axis.

Table 1

Description of Included Studies

First Author	Number Subjects	Risk of Bias (no. of items fulfilled)	RTP Methodology Group	Percent RTP	RTP Definition	Other functional and performance measures
Ahmad[2]	30	3	1	Not reported		FAAM - Sports Subscale[33]
Aktas[34]	40	5	1	87	Return to preinjury level of sport	AOFAS[35–37]
Aktas[38]	30	5	1	86.9	Return to preinjury level of sport	AOFAS
Al-Mouazzen[39]	30	4	1	Not reported	Return to preinjury level of activity	ATRS[40]
Amin[41]	18	5	1	61	Return to professional (NBA) sport	NBA Player Efficiency Rating (PER); min played per game; games played; [PER includes: points, rebounds, assists, steals, blocks, turnovers, field goals attempted and made, free throws attempted and made]
Amlang[42]	39	4	1	51	Return to preinjury level of sport	AOFAS
Ateschrang[3]	104	4	1	64.4	Return to preinjury level of sport	Thermann Score[43]
Barford[44]	56	6	1	18.6	Return to preinjury level of sport	ATRS
Bassi[45]	11	2	2	100	Return to sport, level not specified	
Bevoni[5]	66	4	2	98.5	Return to preinjury level of sport	AOFAS, Leppilähti[46]
Bostick[18]	84	4	2	84	Return to sport, level not specified	
Boyden[47]	10	2	2	80	Return to preinjury activity without restriction	Boyden Scale[47]
Carmont[16]	26	5	1	61	Return to preinjury level of sport	Tegner Score[48]
Ceccarelli[49]	24	5	1	91.7	Return to preinjury level of sport	AOFAS
Chandrakant[50]	52	3	1	90	Return to desired level of activity	AOFAS
Chen[51]	76	4	1	100	Return to preinjury level of activity	
Chiu[52]	19	5	1	94.7	Return to preinjury level of sport	Tegner Score, AOFAS
Coutts[53]	25	3	1	80	Return to preinjury level of sport	
Cretnik[54]	237	6	1	72.2	Return to preinjury level of activity	AOFAS
Cretnik[7]	116	4	1	96	Return to preinjury level of activity	AOFAS
Cretnik[55]	13	4	2	100	Return to preinjury activity, level unspecified	AOFAS
De Carli[56]	20	4	1	70.5	Return to preinjury level of sport	

First Author	Number Subjects	Risk of Bias (no. of items fulfilled)	RTP Methodology Group	Percent RTP	RTP Definition	Other functional and performance measures
Demirel[57]	78	6	1	77.1	Return to preinjury level of sport	
Doral[58]	32	4	1	100	Return to preinjury level of activity	FAOS[59], ATRS
Eames[60]	32	2	1	63	Return to sport, level not specified	
Feldbrin[61]	14	3	1	100	Return to preinjury level of activity	AOFAS
Fernandez-Faure[62]	29	3	2	96.6	Return to preinjury level of sport	AOFAS
Fortis[63]	20	6	1	100	Return to preinjury level of activity	
Garabito[64]	49	4	1	89.8	Return to preinjury level of sport	AOFAS
Garrido[65]	18	3	2	72.2	Return to preinjury level of sport	AOFAS
Goren[66]	20	5	1	55	Return to preinjury level of activity	
Gorschewsky[67]	20	4	2	100	Return to original sport, level not specified	
Gorschewsky[68]	66	6	2	100	Return to original sport, level not specified	
Groetelaers[69]	55	4	1	39	Return to sport, level not specified	ARPS
Guillo[70]	23	4	1	80	Return to preinjury sport, level unspecified	ATRS, Boyden Scale
Halasi[71]	144	4	1	60.7	Return to preinjury level of sport	
Hohendorf[72]	42	3	1	88.6	Return to preinjury level of sport	Thermann Score
Hufner[73]	125	4	2	75.2	Return to preinjury level of sport	
Jaakkola[74]	55	3	2	90.9	Return to sport, level not specified	AOFAS
Jacob[75]	46	2	1	88.9	Return to preinjury sport, level unspecified for RTP percentage; return to preinjury level of activity for time to return to activity	
Jallageas[76]	31	6	1	77.5	Return to preinjury level of sport	AOFAS
Jennings[77]	30	2	1	63.6	Return to preinjury level of sport	Tegner
Josey[78]	39	3	1	66.7	Return to preinjury level of activity	AOFAS, Thermann Score
Jung[79]	30	3	2	90	Return to preinjury level of activity	
Kakiuchi[80]	22	4	1	45.5	Return to preinjury level of sport	
Karabinas[81]	34	2	2	Not reported	Return to preinjury level of activity, non-contact sport	AOFAS
Karkhanis[82]	107	3	2	77	Return to preinjury level of activity	ATRS
Keating[83]	80	5	1	66.9	Return to preinjury level of sport	
Keller[84]	100	4	1	80	Return to preinjury level of sport	

First Author	Number Subjects	Risk of Bias (no. of items fulfilled)	RTP Methodology Group	Percent RTP	RTP Definition	Other functional and performance measures
Klein[85]	34	3	2	100	Return to preinjury level of activity	VISA-A[86]
Knobe[87]	64	4	1	36.6	Return to sport, level not specified	
Kolodziej[88]	47	5	1	46	Return to preinjury level of sport	
Korkmaz[89]	47	4	1	Not reported		PAS[90]
Kraus[91]	36	5	1	53	Return to preinjury level of sport	
Labib[92]	44	4	1	65.71	Return to preinjury level of activity	
Lacoste[93]	75	5	1	63.6	Return to preinjury level of sport	ATRS, AOFAS
Lansdaal[94]	163	5	1	59.5	Return to preinjury level of sport	Leppilahti Score
Lee[95]	11	4	2	Not reported	Return to preinjury level of activity	
Leppilahti[46]	101	4	1	85.7	Return to preinjury level of activity	Boyden Scale
Macquet[96]	87	4	1	68.1	Return to preinjury level of sport	
Maffulli[97]	53	3	1	92.5	Return to preinjury level of activity	Modified VISA-A
Maffulli[98]	17	4	2	94	Return to sport, level not specified	ATRS
Maffulli[99]	27	6	2	50	Return to preinjury sport, level unspecified	ATRS
Majewski[100]	84	4	1	100	Return to preinjury level of sport	Hannover Achilles Tendon Score[101]
Majewski[102]	28	5	1	65.2	Return to preinjury level of sport	Hannover Achilles Tendon Score
Mandelbaum[103]	29	4	1	100	Return to sport, level not specified	
Maniscalco[104]	7	4	1	100	Return to sports or activity, level unspecified	Mandelbaum[103] & Pavanini[105] evaluation
Martinielli[106]	30	4	1	100	Return to preinjury level of sport	
McComis[107]	15	4	1	66	Return to preinjury level of activity	
Metz[108]	83	5	1	72.8	Return to preinjury level of sport	Leppilahti Score
Metz[26]	210	3	1	50	Return to preinjury sport, level unspecified	ATRS
Müller[109]	111	5	1	88	Return to sport, level not specified	
Möller[14]	112	6	1	54	Return to preinjury level of sport	Functional Index for the Lower leg and ankle (unpublished prior to use in this study)
Mortensen[110]	57	5	1	70	Return to preinjury level of sport	
Mortensen[111]	61	5	1	54.1	Return to preinjury level of sport	
Mortal[112]	71	6	1	28	Return to preinjury level of sport	

First Author	Number Subjects	Risk of Bias (no. of items fulfilled)	RTP Methodology Group	Percent RTP	RTP Definition	Other functional and performance measures
Mukundan[113]	21	6	1	95.2	Return to preinjury level of sport	AOFAS, Leppilahti
Nestorson[114]	25	4	1	36	Return to preinjury level of activity	
Nilsson-Helander[115]	97	6	1	Not reported		PAS, ATRS
Olsson[116]	100	6	1	Not reported		PAS, ATRS, FAOS
Ort[117]	15	3	2	100	Return to unrestricted active duty military status	AOFAS
Ozsoy[118]	13	4	1	92	Return to preinjury activity, level unspecified	AOFAS
Pajala[119]	60	6	1	100	Return to preinjury level of activity	Leppilahti Score
Parekh[120]	31	5	1	64.3	Return to professional (NFL) sport	Power ratings per-season & game
Park[121]	14	2	2	Not reported	Return to sport, level not specified	
Rajasekar[122]	35	3	1	50	Return to preinjury level of activity	Tendo-Achilles injury questionnaire (developed by authors)
Rebecato[123]	59	4	1	98.4	Return to preinjury level of sport or activity	
Rettig[124]	89	3	1	100	Return to preinjury level of activity	
Richardson[125]	30	3	1	77	Return to preinjury level of sport	AOFAS
Sanchez[126]	12	4	1	58	Return to preinjury sport, level unspecified	Modification of the Cincinnati Function Scales[127]
Schepull[128]	10	3	1	40	Return to preinjury level of activity	Thermann Score
Silbemergal[129]	8	4	1	Not reported		ATRS, FAOS
Soldatis[130]	30	5	1	61	Return to preinjury level of activity	
Solveborn[131]	17	4	1	94	Return to preinjury level of sport	Arner-Lindholm rating scale[132]
Sorrenti[133]	52	4	2	100	Return to preinjury activity, level unspecified	
Speck[134]	20	4	1	100	Return to sport, level not specified	
Stein[135]	27	3	1	92	Return to sport, level not specified	
Strauss[136]	54	3	1	74	Return to preinjury level of activity	Boyden Score, AOFAS
Suchak[137]	98	6	2	65	Return to partial sport activity	
Talbot[138]	15	3	1	66.7	Return to preinjury level of sport	AOFAS
Tenenbaum[139]	29	4	1	90	Return to preinjury level of activity	AOFAS, Modified Boyden Score

First Author	Number Subjects	Risk of Bias (no. of items fulfilled)	RTP Methodology Group	Percent RTP	RTP Definition	Other functional and performance measures
Troop[140]	13	4	1	94	Return to preinjury level of sport	
Uchiyama[141]	100	5	1	100	Return to preinjury level of sport	
Valente[142]	35	4	2	100	Return to sport, level not specified	AOFAS
Wagnon[143]	57	6	1	40	Return to preinjury sport, level unspecified	
Wallace[144]	945	5	1	100	Return to preinjury level of sport	
Wallace[145]	140	5	1	37	Return to preinjury level of sport	
Young[146]	84	4	1	Not reported		Leppilahti Score, Halasi Score[147], Self-rated Achilles tendon score

Foot and Ankle Ability Measure (FAAM), American Orthopaedic Foot and Ankle Society Ankle-Hindfoot Score (AOFAHS), Foot and Ankle Outcome Score – Ankle and Hindfoot (FAOS), Physical Activity Scale (PAS), Achilles Tendon Total Rupture Score (ATRS), return to play (RTP), Achilles Rupture Performance Score (ARPS), National Football League (NFL), National Basketball Association (NBA).