***Journal of Sport Rehabilitation*, 2020, 29, 231-237**
https://doi.org/10.1123/jsr.2019-0038

Human Kinetics
SYSTEMATIC REVIEW

Lack of Consensus on Return-to-Sport Criteria Following Lateral Ankle Sprain: A Systematic Review of Expert Opinions

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Context: Lateral ankle sprains (LAS) have one of the highest recurrence rates of all musculoskeletal injuries. An emphasis on rapid return to sport (RTS) following LAS likely increases reinjury risk. Unfortunately, no set of objective RTS criteria exist for LAS, forcing practitioners to rely on their own opinion of when a patient is ready to RTS. ***Purpose:*** To determine if there was consensus among published expert opinions that could help inform an initial set of RTS criteria for LAS that could be investigated in future research. ***Evidence Acquisition:*** PubMed, CINHL, and SPORTDiscus databases were searched from inception until October 2018 using a combination of keywords. Studies were included if they listed specific RTS criteria for LAS. No assessment of methodological quality was conducted because all included papers were expert opinion papers (level 5 evidence). Extracted data included the recommended domains (eg, range of motion, balance, sport-specific movement, etc) to be assessed, specific assessments for each listed domain, and thresholds (eg, 80% of the uninjured limb) to be used to determine RTS. Consensus and partial agreement were defined, a priori, as ≥75% and 50% to 75% agreement, respectively. ***Evidence Synthesis:*** Eight domains were identified within 11 included studies. Consensus was reached regarding the need to assess sport-specific movement (n = 9, 90.9%). Partial agreement was reached for the need to assess static balance (n = 7, 63.6%). The domains of pain and swelling, patient reported outcomes, range of motion, and strength were also partially agreed on (n = 6, 54.5%). No agreement was reached on specific assessments of cutoff thresholds. ***Conclusions:*** Given consensus and partial agreement results, RTS decisions following LAS should be based on sport-specific movement, static balance, patient reported outcomes, range of motion, and strength. Future research needs to determine assessments and cutoff thresholds within these domains to minimize recurrent LAS risk.

Keywords: sport-specific movement, balance, range of motion, pain, patient reported outcomes

Lateral ankle sprains (LAS) are the most common injuries in sport[1–4] and the military[5,6] and are extremely common among the general public.[7] In 2010, LAS resulted in excess of $1.1 billion in health care charges from emergency departments in the United States alone.[7] Despite this volume and cost of LAS, these injuries are erroneously considered as innocuous. However, the recurrence rate of LAS is one of the highest of all musculoskeletal injuries.[1,8–11] Prospective evidence also indicates that at least 40% of individuals who sustain a first time ankle sprain develop residual symptoms, often defined as chronic ankle instability (CAI).[12] The condition of CAI is associated with a variety of perceptual, sensorimotor, and structural deficiencies and alterations[13–15] that are hypothesized to contribute to an increased risk of reinjury and to the development of ankle posttraumatic osteoarthritis.[16] Effective intervention strategies for acute LAS exist[17] but many individuals who sustain a LAS, regardless of population (eg, sport, general public), fail to seek medical care[18] or complete recommended rehabilitation.[19] This clinical phenomenon is likely because LAS are perceived as an innocuous injury but failure to complete supervised rehabilitation likely increases the risk of reinjury and facilitates development of long-term residual symptoms.

Within sporting populations, LAS patients often receive care but an emphasis on rapid return to sport (RTS) exists. For example, among intercollegiate athletes seen by a health care provider for LAS, 44.4% RTS in less than 24 hours (ie, a nontime loss injury).[20] Similarly, among interscholastic athletes seen by a health care provider, the average RTS time was 3 days for a new LAS and less than 24 hours for recurrent sprains.[21] Further, the average number of treatment sessions for time-loss LAS among interscholastic athletes was 10 days.[22] These treatment timelines and volumes are lower than the treatment durations and volumes shown to be effective for LAS.[17]

Such rapid timelines to RTS likely fail to provide adequate healing time. These rapid timelines are also likely inadequate to fully address the impairments associated with LAS.[13–15] Thus, rapid RTS could serve as a possible mechanism for the increased injury risk and long-term sequelae within sporting populations. Recent evidence supports this hypothesis as a mix of interscholastic and intercollegiate LAS patients had increased ligamentous laxity, limitations in self-reported function, limited dorsiflexion range of motion, and impaired dynamic postural control on their involved limb, relative to their uninvolved limb, when they were cleared to RTS. The RTS clearance occurred on average 12.7 ± 10.0 days following the LAS.[23] Given the rapid RTS timelines and residual deficits still present, sporting LAS patients appear to be cleared for RTS too soon. RTS decisions for LAS, and musculoskeletal injuries more broadly, are derived from anecdotal evidence and practitioner experience. RTS decisions can also be influenced by stakeholders (eg, patients, parents, and coaches) pushing RTS expediency. Thus, unique practitioner experiences and job setting environments facilitate inconsistent RTS decisions for LAS. The development of evidence-based criteria that could guide the RTS decision-making process for LAS would help providers quell external pressures and reduce risk of recurrent injury.

Such criteria should assess domains that are based on risk of reinjury (eg, range of motion, balance, etc); use techniques that are

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quantifiable and scalable (eg, the Star Excursion Balance Test); and gauge RTS readiness against specific measurable thresholds (eg, 80% of the uninvolved limb). Such RTS decision paradigms exist for lower-extremity musculoskeletal injuries[24,25] but such efforts have not been undertaken for LAS despite the high volume of index and recurrent LAS. However, there are numerous published expert opinion papers on RTS within the literature. Establishing agreement among such opinions could help to further clinical practice and research into this important area.

Objective

To determine if there was consensus among published expert opinions that could help inform an initial set of RTS criteria for LAS that could be investigated in future research. We hypothesized that minimal consensus would be reached regarding the domains (eg, postural control, range of motion, strength, etc) that should be assessed. We further hypothesized that little to no agreement would be noted on assessment techniques or thresholds that should be used to gauge athlete RTS readiness among the published expert opinion papers.

Evidence Acquisition

Search Strategy

To assess the published literature, we searched the PubMed, CINHL, and SPORTDiscus databases from the earliest available date until March 2019. Each search used the following combination of keywords: (1) return to sport OR return to play OR return to participation OR return to work OR return to duty and (2) ankle sprain OR lateral ankle sprain OR acute ankle sprain OR acute lateral ankle sprain. Reference lists of all retrieved full-text papers were manually searched for additional potentially eligible papers, but we failed to identify any additional articles for this systematic review.

Inclusion and Exclusion Criteria

Included opinion pieces/papers/articles for this systematic review were required to list RTS criteria for LAS. For this investigation, an a priori decision was made to accept both broad (eg, strength) and specific (eg, complete a single-limb balance test for 10 s) RTS criteria given the dearth of available information on the topic. The search was limited to English language, full-text, and original peer-reviewed journal articles. Two authors (C.M. and E.A.W.) independently assessed all full-text records to determine eligibility. Initial agreement between the raters was 92%. Differences among the raters were discussed until a consensus was reached.

Assessment of Methodological Quality

No assessment of methodological quality was conducted for this investigation. All included papers were expert opinion pieces (Evidence Level 5) with no methodology that could be assessed.

Data Extraction and Synthesis

To determine if consensus exists among the published expert opinions on LAS RTS criteria, 2 authors (C.M. and E.A.W.) independently reviewed the included papers and extracted the relevant data when possible. Extracted data included the background/credentials of the authorship team; a definition of RTS; domains (eg, range of motion, balance, sport-specific movement, etc) that recommended to be assessed; specific assessments for each listed domain; and specific thresholds (eg, 80% of the uninjured limb) to be used when determining if an athlete is ready for RTS. Domains were created qualitatively by the research team based on our review of the data extracted from the included papers. Expert consensus was defined, a priori, as ≥75% agreement. Partial agreement was defined, a priori, as 50% to 75% agreement. Lack of consistency/no consistency was defined, a priori as <50%.[26]

Evidence Synthesis

Study Selection

Figure 1 is a display of the flowchart summarizing the result of the systematic search, which identified a total of 194 records while an additional record was identified through another source. After removing duplicates (n = 91), having screened records by title, abstract, and ineligible articles, 11 papers were identified and included in this systematic review (Table 1).[27–37] All of the 11 identified papers focused on RTS with no identified papers making recommendations for report to work or return to duty.

Author Background and RTS Definition

Of the 11 papers included, 9 were from health care providers based in the United States.[27–30,32–36] Two papers were written by single authors,[31,34] whereas 8 papers were authored or coauthored by physicians.[27–33,36] Three papers were coauthors by physical/physio therapists,[30,32,37] 1 paper was authored by a nurse,[34] 1 paper was authored by doctors of podiatric medicine,[35] 1 paper was coauthored by a doctor of osteopathy,[29] and 1 paper was coauthored by athletic trainers.[32] Of the 11 papers included, only 2 were written by interdisciplinary teams.[30,32]

Only 4 papers included a definition of when RTS should occur.[27,29,31,35] Three of these definitions focused on safety (ie, when it is safe to participate in the desire sport).[29,31,35] Of these 3, one also specifically indicated that RTS should happen when recurrent injury will not occur and an athlete's performance is equal to their preinjury performance.[31] The fourth paper indicated that RTS should occur when the athlete's specific rehabilitation goals are met.[27]

RTS Criteria

Within the 11 included articles, 8 different domains were identified (Table 2). Consensus was reached regarding the need to assess sport-specific movement (n = 10, 90.9%).[27–33,35–37] Partial agreement was reached regarding the use of a hop test (n = 6, 54.5%),[28,29,31,32,35,36] but there was little consistency as to which hop test should be used. Only 2 papers provided a threshold (ie, the injured leg should perform at ≥80% of the uninjured leg) from which an objective decision could be made for RTS.[32,35] Partial agreement was also reached for the need to assess static balance (n = 7, 63.6%).[27,29,31,34–37] The use of a single-leg balance test (n = 4, 36.4%) was the most recommended.[29,34,36,37] While some objective thresholds were provided, no consistency was noted among the included papers.

A total of 6 studies (54.5%, partial agreement) recommended pain and swelling as a domain that should be tested during an

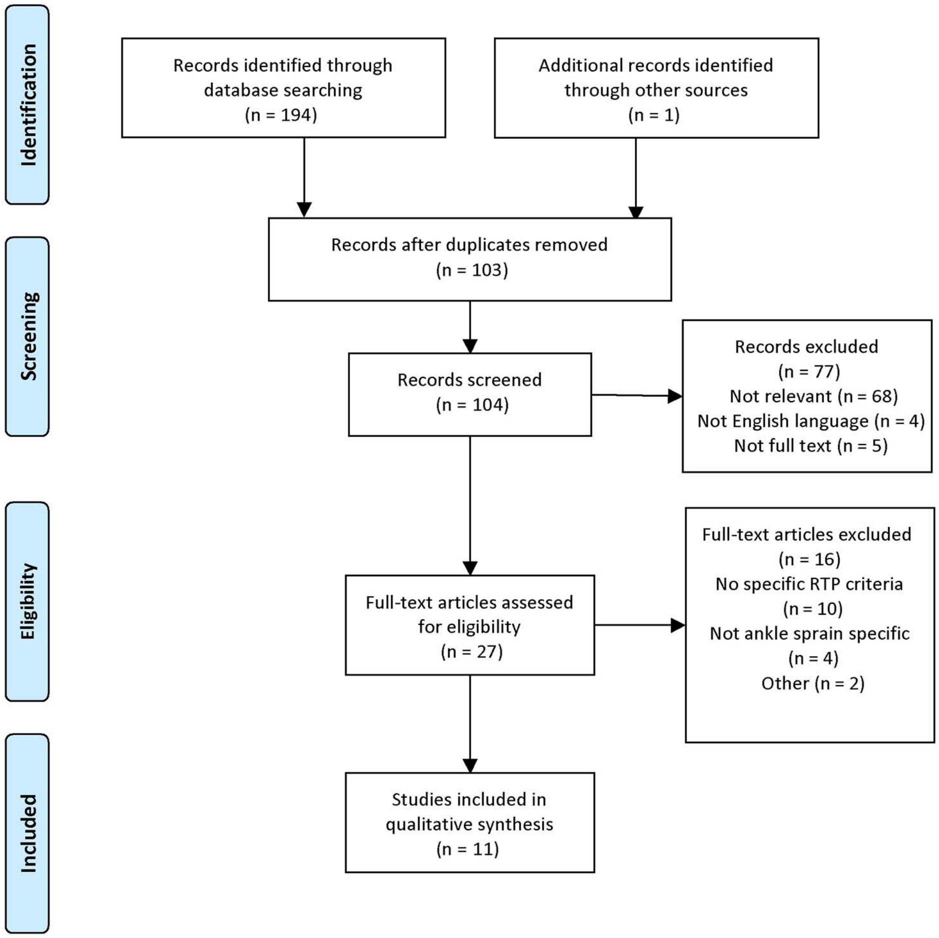

Figure 1 — PRISMA flowchart. RTP indicates return to play.

Table 1 Included Papers With Research Team Credentials

Authors	Year Published	Research team credentials
Anderson et al[27]	2010	Medical Doctor
Anderson et al[28]	2002	Medical Doctor
Canty and Nilan[29]	2015	Medical Doctor, Doctor of Osteopathy
Clanton et al[30]	2012	Medical Doctor, Physical Therapist
English[31]	2013	Medical Doctor
Kaminski et al[32]	2013	Medical Doctor, Physical Therapist, Certified Athletic Trainer
Lynch and Renstrom[33]	1999	Medical Doctor
Onieal[34]	1993	Registered Nurse
Richie and Izadi[35]	2015	Doctor of Podiatric Medicine
Smurawa and Congeni[36]	2007	Medical Doctor
Tassignon et al[37]	2019	Physiotherapist

athlete's RTS assessment.[27–29,31,34,37] While specific assessments and thresholds were provided, there was no consistency. Six studies reviewed (54.5%, partial agreement) also recommended that subjective assessments (ie, patient reported outcomes),[29–32,35,37] range of motion,[29–31,33,35,37] and strength[27,29–31,33,37] also be assessed to determine RTS. However, there was no consistency among the recommended tests or among the included thresholds. A minority of papers recommended dynamic balance (n = 5, 45.5%)[29,30,32,35,37] and running (n = 4, 36.4%)[27,28,33,37] as domains that should be assessed. Within the papers recommending dynamic balance, all 5[29,30,32,35,37] recommended the Star Excursion Balance Test be used. Consistency among listed thresholds (if provided) for these domains did not exist.

Discussion

The purpose of this investigation was to determine if consensus existed among published expert opinions related to RTS criteria for LAS. Our primary findings demonstrated consensus for the need to assess sport-specific movement when determining an athlete's readiness for RTS. Our findings also demonstrated partial agreement for the need to assess static balance, patient-reported outcomes, strength, and range of motion. Finally, partial agreement existed on using hop testing as an appropriate technique to assess

Table 2 Return-to-Sport Criteria From the 11 Published Expert Opinion Papers Included in This Investigation

Domain (percent agreement)	Assessment techniques	Criterion thresholds
Pain/swelling[27–29,31,34,37] (54.5%)	Pain Ability to bear weight[28] Visual analog scale[31] Foot and ankle ability index[37] Numeric pain scale[37] Swelling Limb girth[31]	Free of pain and swelling[34] Pain and swelling reductions from time of injury[27] No more than minimal levels of pain and swelling present[29]
ROM[29–31,33,35,37] (54.5%)	Dorsiflexion Heel Rocker Test[35] Goniometric[31,37] Weight-bearing lunge test[30,31,37]	10 successive heel rockers[35] Full range of motion[29,33]
Strength[27,29–31,33,37] (54.5%)	Manual muscle testing[29] Handheld dynamometry[37] Sargent/vertical jump testing[30] Standing jump[31] Calf raises until fatigue[31]	A return to normal strength[27] 90% of uninjured limb strength[29,33]
Static balance[27,29,31,34–37] (63.6%)	Single-leg balance test[29,34,36,37] Modified Rhomberg test with eyes closed[35] On a force platform[31] Balance error scoring system[37]	Ability to balance without pain[29] Maintain single-limb stance for 10 s[36] Sway amount equal to the uninjured[27]
Dynamic balance[29,30,32,35,37] (45.5%)	Star Excursion Balance Test[29,30,32,35,37] Y-Balance Test[30]	Compare with the uninjured limb[35] 80% of uninjured limb reach[32] Ability to complete Star Excursion Balance Test with little to no pain[29]
Running[27,28,33,37] (36.4%)	Complete a return to run program[27] Running technique[37]	Little to no pain while running[27] Run at max speed without pain[33]
Sport-specific movement[27–33,35–37] (90.9%)	Lateral hopping[29,35] Vertical hopping[29,35] Shuttle run[29,35] Sport-specific test[27,31] Jumping and cutting[28] Agility *T* test[29,30] Single-leg hop[29,36] Walk and tiptoe[36]	80% of the uninjured leg amount[32,35] Little to no pain while completing the test[27,29,33] Consistent *T*-test times between 8.9 and 13.5 s[30] Speed and quality movement during sport-specific test[31] Ability to take 3 steps and return[36] Ability to complete 6 hops[36]
Patient reported outcomes[29–32,35,37] (54.5%)	Foot and ankle ability measure[27,37] Lower-extremity function scale[27] Lower limb task questionnaire [30] Trait sport confidence inventory Injury-psychological readiness to return sport scale[33,37]	Athlete feels confident[32] The athlete is ready to return[34]

Abbreviation: SEBT, Star Excursion Balance Test.

the sport-specific movement domain. These findings support our a priori hypothesis that consensus among published expert opinions would be minimal.

The agreed upon domains are consistent with the domains most commonly targeted in rehabilitation protocols for LAS.[17] However, the lack of prospective data related to RTS following LAS makes it impossible to determine if assessing these domains can provide meaningful information about an individual's risk for reinjury following RTS. Furthermore, few objective thresholds against which a RTS decision could be made were provided. This is problematic, in that practitioners can only rely on their subjective feeling of a patient's readiness when determining RTS. Unfortunately, relying on subjective feelings alone can allow RTS decision making to be influenced by pressures from various stakeholders.

However, some inferences about objective criteria can be drawn based on how the agreed upon domains relate to known modifiable risk factors for LAS. For example, hop testing,[38] limited dorsiflexion range of motion,[39,40] poor strength/strength asymmetries,[40–42] and poor static,[40,43–46] and dynamic postural control[38,47,48] have all been identified as modifiable risk factors for LAS. These risk factors significantly overlap with the recommended domains found in the current investigation. However, it is important to note that (1) the previously mentioned risk factors are for LAS broadly and are not specific to recurrent LAS; (2) few objective thresholds (ie, cutoff scores) were calculated; and (3) additional risk factors, outside of the agreed upon domains (eg, body mass index, reaction time, coordination, running speed, etc), were identified in these investigations as well as in a more comprehensive review.[17]

The alignment of known modifiable risk factors provides face validity to the domains agreed upon within published expert opinions. These same domains represent areas of deficiency in those with CAI providing further face validity to the results.[13–15] However, no agreement on testable thresholds either in this study or previous investigations has been established. More importantly, there is no evidence that any of the suggested thresholds opined from the current investigation are effective indicators of risk/no risk of recurrent injury following RTS after a LAS.

It is also important to note that injury rates for LAS are higher at the end of a game[49] suggesting that fatigue may be a risk factor. Those with a history of a LAS appear to be more sensitive to the effects of fatigue than their uninjured counterparts.[50,51] However, evidence suggests that although comprehensive treatment programs improve a wide variety of dependent variables in those with CAI in a nonfatigued state, such treatment programs do not reduce fatigue sensitivity.[52] Further, only one of the included expert opinions[37] mentioned the importance of assessing domains under a fatigued state to determine RTS readiness in athletes. Thus, future research should further investigate how to reduce fatigue sensitivity following LAS and determine if and how fatigue sensitivity should be evaluated as it relates to determining RTS post LAS.

Although there remains much work to be done in developing objective RTS criteria for LAS, no expert suggested time from injury as a criterion for determining RTS readiness. Historically, LAS severity has been graded based on a variety of scales that were associated with estimated times until RTS.[53–55] From a RTS perspective, scales based on anatomical damage are not practical because diagnostic imaging is needed to confirm the number of ligaments damaged or level of trauma (ie, micro vs macro) and such imaging is rarely ordered.[53,54] Grading LAS based on functional limitations is also not helpful from a RTS perspective. First, functional limitations are not associated with time until RTS,[56] and functional deficiencies have been noted in patients who were cleared for RTS.[23] Thus, like others, we recommend that grading LAS and providing time to RTS estimates to stakeholders be avoided as they place artificial constraints on the provider.[37] Finally, providers must consider how to best phase an athlete back to full participation. Although many providers already take a phased RTS approach, there is no evidence to support how to safely progress an athlete from phase to phase. However, recently published guidelines provide an excellent review of how a continuum of RTS across musculoskeletal injuries can be structured to help providers throughout the rehabilitation process broadly[57] and have been applied preliminarily to LAS RTS scenarios.[37] These guidelines for transitioning from phase to phase of a rehabilitation process can be easily implemented and facilitate an evidence-based approach to LAS RTS procedures.

Conclusion

Based on the expert consensus obtained, practitioners should assess sport-specific movement when determining athlete RTS following a LAS. Based on the partial agreement noted, practitioners should use a hop test to assess sport-specific movement. Self-reported function, strength, range of motion, and balance should also be assessed when determining athlete RTS readiness following LAS. Finally, prospective research is needed to quantify a broad range of outcomes at RTS and determine how those outcomes influence LAS reinjury rates (ie, establish an evidence-based RTS assessment battery and thresholds).

Practice Recommendations

(1) Return-to-sport decisions following LAS need to be based on objective and scalable assessments that inform practitioners about future injury risk.

(2) Agreement among published experts indicate that sport-specific movement, static balance, patient-reported outcomes, range of motion, and strength should all be assessed before a RTS decision is made for an athlete with a LAS.

(3) Due to lack of agreement, each practitioner is encouraged to establish an objective threshold for their assessments to standardized LAS RTS decisions. This data could help guide future recommendations.

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