

CRITERIA-BASED RETURN TO SPRINTING PROGRESSION FOLLOWING LOWER EXTREMITY INJURY

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ABSTRACT

In the terminal phases of athletic rehabilitation, transitioning back to sport is a critical aspect to prepare an athlete for return to full participation. Numerous interval sport programs have been published in the literature and return to sports guidelines and criteria-based progressions for returning to sport have been published, but no such protocol exists for returning to the task of sprinting. Any field or court athlete must be able to sprint as part of his/her sport demands. Because of the absence of a specific progression, sports rehabilitation professionals lack knowledge about objective criteria to progress to sprinting as well as a progressive program to do so. Given that sports rehabilitation professionals have limited visits to complete rehabilitation or their athletes have limited financial resources to do so, it is imperative that a structured, criteria-based progression be available. The purpose of this clinical suggestion is to provide a criteria-based return to sprinting progression.

Level of Evidence: 5

Keywords: Criteria-based progression, Interval sports program, return to sport, sprinting

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THE PROBLEM

Return to running and eventually sprinting is an objective in the terminal phases of rehabilitation after every lower extremity injury, especially for field and court sport athletes. Athletes in anaerobic field and court sports that require interval sprinting should reach top speed in a controlled, predictable environment prior to engaging in competition. Given that prior research has shown that up to 19% of athletes do not return to sport for fear of re-injury after ACL reconstruction,¹ fostering limb confidence by successfully reaching maximum sprint speed may help facilitate improvements in the ability to return to sport. Criteria-based progressions have been published previously to progress athletes through a rehabilitation program,²⁻⁹ but there remains little agreement and consistency in the literature about when the appropriate time is to begin jogging,⁷ and when an athlete does begin, what specific distances or work:rest ratios should be completed. There are several papers that have highlighted work: rest ratios in a number of sports,¹⁰⁻¹⁵ and technological advances have allowed the rehabilitation professional to use Global Positioning Systems (GPS) to determine distances athletes run during completion.^{9,15} Furthermore, numerous interval sport programs have been published in the literature,¹⁶⁻¹⁹ but no such protocol exists for returning to actual sprinting. There is little guidance for the rehabilitation professional to utilize when returning an athlete back to high speed running (sprinting). Given that many sports rehabilitation professionals have athletes with reduced or minimal visits in the terminal phases of rehabilitation and that, to the author's knowledge, no return to sprinting progression has been published to date, a structured program for both the rehabilitation professional and the athlete is necessary. The purpose of this clinical suggestion is to provide a criteria-based return to sprinting progression. In circumstances where an athlete will be performing more self-guided workouts due to lack of financial resources, insurance limitations, or any inability to continue supervised rehabilitation, the program will help minimize the guesswork that often transpires in the terminal phases of rehabilitation.

THE SOLUTION

The first step in considering readiness to begin the return to sprinting progression is to ensure a

screening of other potential lower extremity impairments has been performed and any limitations or deficits have been addressed. Secondly, physician clearance should be obtained. Prior to initiation of the return to sprint progression, the author suggests athletes complete a four-week return to jogging program. For many patients, it might be reasonable to expect readiness to return to running around the 8th–16th postoperative weeks,⁷ provided they have physician clearance, meet testing criteria, and have no effusion or pain. While a number of these return to running progressions are available online, there have been some published in the literature.^{20,21} Essentially, all of these programs involve walk: jog intervals that progressively reduce time walking and increase time jogging, most of them up to about thirty minutes of jogging. The authors are not aware of any research comparing these programs to determine the ideal time frame with associated walk:jog ratios. The purpose completing a walk:jog interval program is to build an aerobic base to prepare for more intense runs in the return to sprinting program. A previous review has proposed guidelines to begin return to running and it is suggested the clinician consider strength and performance-based criteria including hamstring and quadriceps limb symmetry index (LSI) and quadriceps LSI >70% evaluated by isometric assessments and hop test LSI >70%. The addition of a single-leg squat or step-up assessment performed without increase in knee valgus may also be considered. Return to running decision-making should be individualized for each athlete/patient.⁷

It is advised to perform a general warm-up to increase blood flow, which can consist of a light jog, cycling, elliptical, or calisthenics for 5-10 minutes or until the athlete breaks a sweat. Following the general warm-up, a more specific/dynamic warm-up should take place consisting of activities including but not limited to walking lunges, “toy soldiers”, skipping, bounding, high knees, “butt kickers”, ankling, and other similar activities to potentiate more explosive activities. The return to sprinting program should be performed on alternating days. Progression/regression should be based on soreness and effusion,⁸ as well as the athlete's ability to complete all runs in the specified work:ratio. If the athlete is unable to complete the specified runs due to fatigue, the step

should be repeated without progression until they are able to do so. If an athlete completes the prescribed runs in the specified work:rest ratio but they have yet to achieve criteria to advance stages, the authors suggest repeating the runs at the same intensity, but shorter work:rest ratio. For example, if the athlete has completed all Stage 2 runs but has yet to achieve strength and hop testing criteria to advance to Stage 3, start back over at Step 1 and do the same runs in a 1:4 or 1:3 work:rest ratio. The rationale for this is that the athlete will have a greater overall fitness as the same volume was achieved but in less time.

There are a few potential limitations of this program that are worth noting. Tolerance of running volume will likely be athlete-specific. The program outlined may have too much volume and can be adjusted accordingly. For example, the volume may be adjusted down for an offensive tackle in American football, but may be increased for a soccer athlete. Similarly, distance of runs can be decreased based on sport and position. An American football wide receiver or defensive back may have run distances that cover >30 yards, while a defensive lineman may have more runs that cover <30 yards. The sports rehabilitation professional should ensure that the volumes are systematic and progressive and allow the athlete to match work:rest ratios prescribed. The objective is to build tolerance to sprinting and to achieve top speeds with specific rest times to replicate sport demands. Secondly, the program does not involve any change of direction, nor any perceptual or decision-making tasks. Most anaerobic sports require cutting/change of direction at top speeds and in unpredictable environments. Clearly, these activities will need to be incorporated into a comprehensive rehabilitation/return to sport program. The return to sprinting program be completed at full speed before an athlete attempts achieves full speed in change of direction tasks as sprinting is a single plane activity and change of direction involves multiple planes. That being said, change of direction tasks at lower speeds can be completed concurrently with the return to sprinting progression. To build in more change of direction movement, the rehabilitation professional might consider performing the drills over the provided distances in the program, but put in cones for cutting tasks. During these later stages,

athletes will likely be returning to participation with team activities or individual drills. This program can be done after sport-specific drills are complete with team activities. Any explosive or power-based activities take priority over completion of this program, except for the final stage which is approaching or at maximum effort.

Return to Sprint Progression: Stage 1 (Appendix A)

Criteria to begin: Completion of a four week walk:jog program for 30 minutes, strength testing of quadriceps and hamstrings at least 70% of the uninjured side, hop testing at least 70% of the uninjured, no pain, no effusion.

Objectives: Build work capacity for higher intensity runs, build overall fitness

Athlete cue: "Run about 50% of your maximum effort"

In Stage 1, the athlete begins building intensity during the runs. Rather than long-slow distance as in the return to jogging programs, the athlete is asked to keep a 1:3 work:rest ratio. The program says "untimed" in steps 1 and 2 to leave the athlete and rehabilitation professional the ability to adjust the program should the individual fitness levels not tolerate the demands of the work:rest ratio. Note that both volume of runs and overall distance increases as Stage 1 progresses to build anaerobic endurance due to specific work:rest ratios, rather than untimed runs. Distances are moderate to high. It is advised that the athlete achieve the runs with the work:rest ratio suggested to ensure appropriate fitness base for later phases. While the amount of runs may seem high, even at the peak distance, the athlete has not even run $\frac{3}{4}$ of a mile.

Return to Sprinting Progression: Stage 2

Criteria to begin: Completion of Stage 1, all strength and functional testing 80-85% or better, full passive flexion restored.

Objectives: Continue building sport-specific work:rest ratios, build repeated sprint ability.

Athlete cues: "Don't reach top gear, but go harder than you did in Stage 1," or "Run about 75% of your maximum effort"

Because intensity is increasing, rest periods will increase. The athlete should focus at this time on running technique. Full passive flexion of the knee is critical to allow the leg to complete the recovery cycle and to promote proper sprint mechanics. The rehabilitation professional can test this with the prone knee bending test.²² While the athlete is prone, the rehabilitation professional places one hand on the posterior pelvis and the other on the ankle. The knee is passively flexed to end range or when the athlete reports pain or discomfort. Symmetry in range of motion and soft tissue compliance should be symmetrical. While the rehabilitation professional can measure this with a goniometer, assessment of this involves more “feel” comparing side-to-side passive mobility. The effort for the rehabilitation professional to reach full passive flexion should feel the same as well as the resistance from the athlete’s knee and/or soft tissues. Volume and distance decreases significantly compared to Stage 1. Distances are more moderate and distances >60 yards will be emphasized less. Total yardage decreases as this stage progresses because intensity should be increasing and rest periods should be followed. Fatigue will likely become more a factor as intensity increases, so total distance is decreased.

This phase also involves building repeated sprint ability (RSA). RSA describes the ability of an athlete to recover and maintain maximal effort during subsequent sprints, an attribute considered important to team sports. It is often trained and measured via high-intensity sprints, interspersed with brief recovery bouts (≤ 30 seconds). Most strength and conditioning coaches agree that for validity and correspondence to the actual sport, the RSA training session or testing protocol should resemble the work to rest ratio of the sport in question. Because of this, it is important that the athlete achieve prescribed repetitions with prescribed rest periods.²³

Return to Sprinting Progression: Stage 3

Criteria to Begin: Completion of Stage 2, all strength and functional testing 90% or better. No effusion or pain.

Objective: Achieve maximum effort, normal mechanics, improve limb confidence, prepare for sport-specific work: rest ratio

Athlete cue: “You should be very close to or at maximum effort” or “Run at 90-100% of your maximum effort”

In this phase, maximum effort as well as maximum recovery should be practiced. While there are more runs than in Stage 2, the distance of each run is markedly less, most of which are <30 yards. These distances can of course be adjusted based on the athlete’s position or specific work:rest ratio in their sport. In Steps 1 and 2 of this stage, the rehabilitation professional might allow full subjective recovery between sprints if the athlete’s conditioning level cannot tolerate the work:rest ratios prescribed. If the athlete is not able to maintain the prescribed work:rest ratio in the final two steps, the program should stop for that workout as there clearly is a decline in maximum sprint performance and the quality of the session will be sacrificed. Instead, the rehabilitation professional can encourage a “finish” attitude by completing the remaining runs at a lower intensity, perform lower intensity runs from previous steps, or perform more sport-specific drills/activities. The athlete should be reminded that in this phase, they have to “train fast to be fast.” Once there is a decline, further attempts at running at maximum effort in this session will likely not be beneficial. Much like Stage 2 the volume of runs is relatively the same, but the total distance decreases as the stage progresses due to likely increase in sprinting intensity.

DISCUSSION

A specific progression for the rehabilitation professional in the terminal phases of rehabilitation to return an athlete to maximum effort sprinting has not been previously published, to the author’s knowledge. A progressive, structured program with specific distances as well as appropriate work:rest ratios helps take what is often guesswork out of the late stage rehabilitation programming. What is more, many rehabilitation professionals are forced to provide programming for self-guided sessions due to financial or insurance visit limitations. Therefore, a return to sprinting program is something the rehabilitation professional can provide to their athletes should more independent, unsupervised workouts be necessary.

The rehabilitation continuum is a combination of science and art. There is so much variability and individualization of rehabilitation programs based on a number of factors including but not limited to injury history, sport, level of sport, residual impairments, and response to training. Providing a specific, criteria-based progression to return to sprinting is necessary to provide the rehabilitation professional and the athlete the ability to follow a structured program in order to help ensure safe return to sport. Given that recent literature has proposed lengthening the return to release to full sports participation after anterior cruciate ligament reconstruction specifically,^{9,24-33} the program suggested here will assist the sports rehabilitation professional in providing a structured, criteria-based progression. Furthermore, it should help the athlete progress back to activity while at the same time “buy time” to extend and enhance recovery.

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APPENDIX A

PROGRESSION TO SPRINTING

Stage 1. 50% INTENSITY (1:3 work to rest ratio).			
Objective: Build work capacity for anaerobic conditioning/endurance			
Step 1	Step 2	Step 3	Step 4
20 yd x 3 untimed	20 yd x 4 untimed	20 yd x 3	20 yd x 3
40 yd x 2 untimed	40 yd x 3 untimed	40 yd x 4	40 yd x 4
60 yd x 2 untimed	60 yd x 2 untimed	60 yd x 2	60 yd x 2
80 yd x 2 untimed	80 yd x 2 untimed	80 yd x 2	80 yd x 2
100 yd x 1 untimed	100 yd x 1 untimed	100 yd x 1	100 yd x 2
80 yd x 2 untimed	80 yd x 2 untimed	80 yd x 2	80 yd x 1
60 yd x 2 untimed	60 yd x 2 untimed	60 yd x 2	60 yd x 2
40 yd x 2 untimed	40 yd x 3 untimed	40 yd x 4	40 yd x 4
20 yd x 3 untimed	20 yd x 4 untimed	20 yd x 3	20 yd x 3
19 runs @ 940 yds	23 runs @ 1060 yds	23 runs @ 1100 yds	23 runs @ 1120 yds

Stage 2. 75% INTENSITY (1:5 work to rest ratio).			
Objective: Speed development, improve technique, and build repeated sprint ability			
Step 1	Step 2	Step 3	Step 4
20 yd x 3	20 yd x 3	20 yd x 2	20 yd x 2
40 yd x 2	40 yd x 2	40 yd x 2	40 yd x 2
60 yd x 2	60 yd x 1	60 yd x 1	60 yd x 2
80 yd x 1	80 yd x 1	80 yd x 1	80 yd x 1
100 yd x 1	100 yd x 1	100 yd x 1	60 yd x 2
80 yd x 1	80 yd x 1	80 yd x 1	40 yd x 2
60 yd x 2	60 yd x 1	60 yd x 1	20 yd x 2
40 yd x 2	40 yd x 2	40 yd x 2	
20 yd x 3	20 yd x 3	20 yd x 2	
17 runs @ 780 yds	15 runs @ 660 yds	13 runs @ 620 yds	13 runs @ 560 yds

Stage 3. 90 - 100% INTENSITY (1:7 work to rest ratio).			
Objective: Achieve maximum effort. Work:rest ratio should replicate sport demands in step 3 and 4			
Step 1	Step 2	Step 3	Step 4
20 yd x 6	10 yd x 3	10 yd x 3	10 yd x 2
40 yd x 2	20 yd x 4	20 yd x 3	20 yd x 3
60 yd x 1	40 yd x 2	30 yd x 2	30 yd x 2
40 yd x 2	60 yd x 1	40 yd x 2	40 yd x 1
20 yd x 6	40 yd x 2	60 yd x 1	60 yd x 1
10 yd x 3	30 yd x 1	30 yd x 2	40 yd x 1
	20 yd x 4	20 yd x 3	30 yd x 2
	10 yd x 2	10 yd x 3	20 yd x 3
**Full subjective recovery	**Full subjective recovery		10 yd x 2
20 runs @ 490 yards	19 runs @ 460 yards	19 runs @ 440 yds	17 runs @ 420 yds