Journal of Athletic Training 2021;56(10):1061–1063
doi: 10.4085/1062-6050-0117.21

www.natajournals.org

Return-to-Play Considerations After COVID-19 Infection in Elite Athletes

Ryan Ross, ATC, PT, DPT, CSCS*; Laura Irvin, DO*; Richard Severin, PT, DPT, CCS†; Brian Ellis, CSCS‡

*Baylor Athletic Medicine, †Baylor Doctor of Physical Therapy Program, and ‡Baylor Football, Baylor University, Waco, TX

The COVID-19 pandemic has created a unique challenge for sports medicine staffs as they attempt to safely transition elite athletes into sport participation after COVID-19 infections. Athletes must isolate for a period after testing positive for COVID-19 to prevent the spread of the virus in a community. After an isolation period, a battery of cardiac tests must be given to assess whether an athlete is ready to begin a reconditioning protocol. A return-to-play plan should be established to safely reintegrate high-level athletes into strength and conditioning, sport-specific drill work, and contact drill work. Elite athletes should also be gradually eased back into full training loads to avoid increases in orthopaedic injuries after a prolonged absence from training.

Key Words: isolation, cardiac testing, orthopaedic injuries

Key Points

- Management of elite athletes who are returning to competition after COVID-19 infections is a unique challenge for sports medicine professionals. Proper medical screening is needed to minimize the risk of complications.
- Establishing return-to-play protocols can be useful for teams seeking a measured way of returning elite athletes to high-level competition after COVID-19 infections.
- Athletic trainers and coaches should closely monitor elite athletes' training loads to decrease the risk of orthopaedic injury as they return to prior levels of performance.

With the onset of the COVID-19 pandemic in early 2020, many sports medicine practitioners were faced with a difficult question: How do I safely return high-level athletes to performance and competition after COVID-19 infections? With potential risks to the cardiac, respiratory, and renal systems, creating a return-to-play plan can be a challenging task.[1] Safely navigating elite athletes through the process of isolation, cardiac testing, reconditioning, and return to play requires a multidisciplinary approach. Team physicians, sports medicine staff members, strength and conditioning coaches, and sport coaches must work in unison to ensure that competitive athletes are properly transitioned into performance. Athletes performing at a high level of competition should be closely monitored to prevent cardiovascular and orthopaedic complications as they return to normal sport participation.

In this Current Clinical Concepts article, we discuss the different stressors that are placed on elite athletes during an isolation period and how to gradually transition these athletes back to their prior levels of performance after COVID-19 infections. The focus of the recommendations and suggested protocols in this article is on high-level athletes (ie, athletes participating in collegiate or professional competition). We recommend a protocol for monitoring and gradually increasing training loads after competitive athletes have finished an isolation period. To avoid complications from orthopaedic injuries as elite athletes transition to normal practice and competition training loads, strategies for load management are addressed.

ISOLATION

To mitigate the spread of the virus, social isolation is recommended to separate those infected with COVID-19 from those who are not infected. For athletes who are experiencing mild symptoms, in-home isolation is advised to control the spread of COVID-19 within a team.[2,3] Currently, the Centers for Disease Control and Prevention (CDC) recommend a 10-day isolation period for those who test positive and are asymptomatic. For those who are symptomatic, the CDC recommends isolation for $\geq$10 days from symptom onset and until fever has subsided for 24 hours without the use of fever-reducing medication. Patients who experience severe illness from COVID-19 (eg, those who were admitted to a hospital and received supplemental oxygen) may receive guidance from their health care provider to remain in isolation for $>$10 days after symptom onset.[2] We feel that it is important for sports medicine practitioners to be vigilant in following updated COVID-19 guidelines as new information becomes available on this rapidly evolving topic. The mental health of athletes should also be closely monitored during this isolation period, as they are unable to be around their teammates, coaches, and family members.[3] Daily check-ins from support staff can boost morale as athletes complete their mandatory isolation period.

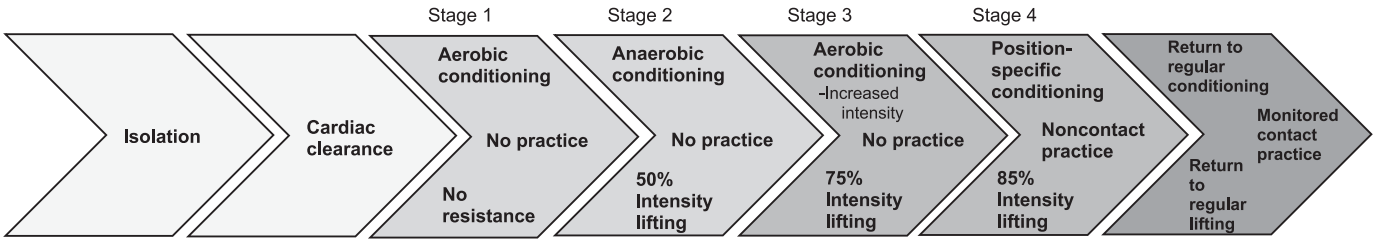

Figure. Sample return-to-play progression for athletes transitioning back into competitive sports after COVID-19 infections.[1,8,9]

CARDIAC TESTING

Once an athlete has finished an isolation period, cardiac testing is advised before proceeding with a return-to-play progression so that any undiagnosed conditions can be detected.[4] Similar to most viruses, COVID-19 has been associated with complications such as myocarditis, cardiac arrhythmias, and rapid-onset heart failure.[4,5] Cardiac conditions have been found in some patients who were asymptomatic, reinforcing the need for clinical investigation and measurement of cardiac biomarkers.[4] The use of electrocardiography (such as 12-lead echocardiography) in combination with blood biomarker level testing is recommended to screen athletes before exercise progressions begin.[4,6] This cardiac testing will help to identify underlying myocardial inflammation and injury.[1,6]

RETURN TO PLAY

For elite athletes who are recovering from COVID-19 infections, returning to competition is a gradual process that must be closely monitored. Athletes should have $\geq$10 days of rest during their isolation period and be symptom free before starting their return-to-play progression. At-risk athletes with medical conditions such as asthma, diabetes, or cardiac conditions should be thoroughly screened by a team physician before starting their exercise progression.[7] Resting heart rate, heart rate during both exercise and postexercise intervals, rate of perceived exertion levels, and blood oxygen levels are useful for monitoring elite athletes' physiological responses to reconditioning after a COVID-19 infection.[8] Athletes should pause their return-to-play process and be evaluated by a physician if new COVID-19 symptoms occur during the reconditioning process.[1,8,9]

We recommend a 4-stage return-to-play reconditioning progression, with each stage lasting $\geq$1 day[1,8,9] (Figure and Table). The protocol consists of a mixture of progressive-intensity aerobic and anaerobic conditioning, resistance training, contact drills, and sport-specific drill work before returning to competition.[1,8–10] This protocol can be modified to accommodate the aerobic and anaerobic demands of different sports. For example, an endurance athlete could increase the intensity and volume of aerobic exercise as he or she progresses though each stage as opposed to advancing through the suggested aerobic and anaerobic phases.

LOAD MANAGEMENT

A unique aspect to transitioning an elite athlete into high-level performance after a COVID-19 infection is the high risk of orthopaedic injury due to an acute spike in training load after a prolonged rest period. In a recent study, Bowen et al[11] found that a low chronic workload followed by a high acute increase in workload was associated with a high risk of noncontact injuries in English Premier League football players. National Football League (NFL) players unfortunately also experienced this large spike in injuries after the 2011 NFL lockout. Injury rates were extremely high when NFL players were exposed to an acute increase in training load after minimal offseason training.[12] The 2020 NFL football season has seen similar trends, with injury rates nearly as high as during the 2011 NFL season and many high-profile players sustaining season-ending injuries. Additionally, athletes with a preexisting injury who are required to isolate are at a high risk of reinjury as they return to competition. Use of a global positioning system or other microsensor data monitoring can be helpful for quantifying sport-specific training loads and safely increasing intensity during each phase of the return-to-play process.

In addition to orthopaedic complications after an increase in training loads, concern exists for increased cardiac and respiratory complications.[9,13] The "neck-check rule" has been used by many physicians to determine if symptoms from an upper respiratory tract infection are limited to above the neck, such as coughing, sneezing, or sore throat.[14] Halabchi et al[14] suggested that an individual jog for 10 minutes at a low-intensity pace to determine whether symptoms were exacerbated. If lower respiratory symptoms such as chest tightness or persistent cough occur, the athlete

Table. Sample Monitoring Program[a]

	Conditioning			Strength Training			Practice		
Stage	Duration, min	HR Max, %	RPE	Duration, min	Intensity, %	RPE	Duration, min	Type	RPE
1	30	65	4/10	NA	NA	NA	NA	NA	NA
2	30	70	5/10	30	50	5/10	NA	NA	NA
3	30	75	5/10	30	70	5/10	NA	NA	NA
4	30	80	6/10	30	80	6/10	30	Noncontact	6/10

Abbreviations: HR max, maximum heart rate; NA, not applicable; RPE, rate of perceived exertion.

[a] Athletes should be monitored closely during the return-to-play process. Exercise should be stopped and an athlete's progression should be delayed if he or she has any increase in symptoms or experiences a rate of perceived exertion >7/10 or if the heart rate increases to >90% of predicted maximum.[1,8,9]

should delay sport participation until symptoms resolve. Athletes who do not experience lower respiratory symptoms during the 10-minute jog may begin low to moderate physical activity (<80% V_{O_2}max).[14]

DISCUSSION

Guiding an elite athlete through the process of isolation, cardiac testing, reconditioning, and returning to play presents a new challenge for sports medicine professionals. This process requires appropriate communication between the sports medicine team and sport coaches to ensure that high-level athletes are gradually integrated into competition. Because athletes are returning to competition after a prolonged training absence, they should be closely monitored for signs of orthopaedic injury risk and slowly eased into full participation to avoid complications. Failure to implement procedures that will gradually increase an elite athlete's training load after an isolation period can lead to an increased risk of orthopaedic overuse injuries.

Sports medicine staffs must establish a return-to-play plan for athletes who are recovering from COVID-19 infections to avoid orthopaedic, respiratory, and cardiac complications. A return-to-play protocol should include a monitored increase in sport-specific loading that incorporates components of aerobic and anaerobic capacity, general strengthening, and sport-specific training.[10,15] Low-intensity aerobic training such as low- to moderate-speed running has been correlated with a lower risk of soft tissue injuries in elite athletes.[16] Anaerobic training such as high-speed sprint intervals has been shown to positively affect performance and reduce the injury risk while exposing the athlete to high-velocity scenarios.[17] Resistance training should be closely monitored, with gradual increases in intensity and volume and beginning with work:rest ratios of 1:4 or longer.[18] Sport-specific training is the most difficult aspect to replicate in a return-to-play protocol but is crucial for injury prevention as athletes transition into normal sport participation.[19] In addition to cardiac testing protocols before entering a return-to-play protocol, athletes should be monitored during their return-to-play progression to prevent cardiac complications.[1,6] Exercise progressions should be stopped if athletes report a new onset of symptoms or experience abnormal heart rate, oxygen saturation, or rate of perceived exertion values.[1,8,9]

REFERENCES

1. Elliott N, Martin R, Heron N, Elliott J, Grimstead D, Biswas A. Infographic. Graduated return to play guidance following COVID-19 infection. *Br J Sports Med*. 2020;54(19):1174–1175. doi:10.1136/bjsports-2020-102637
2. Isolate if you are sick: separate yourself from others if you have COVID-19. Centers for Disease Control and Prevention Web site. https://www.cdc.gov/coronavirus/2019-ncov/if-you-are-sick/isolation.html. Updated February 18, 2021. Accessed June 8, 2021.
3. Toresdahl BG, Asif IM. Coronavirus disease 2019 (COVID-19): considerations for the competitive athlete. *Sports Health*. 2020;12(3):221–224. doi:10.1177/1941738120918876
4. Dores H, Cardim N. Return to play after COVID-19: a sport cardiologist's view. *Br J Sports Med*. 2020;54(19):1132–1133. doi:10.1136/bjsports-2020-102482
5. Resocialization of collegiate sport: action plan considerations. National Collegiate Athletic Association Web site. https://www.ncaa.org/sport-science-institute/resocialization-collegiate-sport-action-plan-considerations. Accessed June 8, 2021.
6. Baggish A, Drezner JA, Kim J, Martinez M, Prutkin JM. Resurgence of sport in the wake of COVID-19: cardiac considerations in competitive athletes. *Br J Sports Med*. 2020;54(19):1130–1131. doi:10.1136/bjsports-2020-102516
7. Madjid M, Safavi-Naeini P, Solomon SD, Vardeny O. Potential effects of coronaviruses on the cardiovascular system: a review. *JAMA Cardiol*. 2020;5(7):831–840. doi:10.1001/jamacardio.2020.1286
8. Stokes KA, Jones B, Bennett M, et al. Returning to play after prolonged training restrictions in professional collision sports. *Int J Sports Med*. 2020;41(13):895–911. doi:10.1055/a-1180-3692
9. Shaefer M. Returning to sports or exercise after recovering from COVID-19. Recommendations for reintroducing physical activity. Cleveland Clinic Web site. https://health.clevelandclinic.org/returning-to-sports-or-exercise-after-recovering-from-covid-19/. Published February 15, 2021. Accessed April 11, 2021.
10. Gabbett T, Sancho I, Dingenen B, Willy RW. When progressing training loads, what are the considerations for healthy and injured athletes? *Br J Sports Med.* 2021. doi:10.1136/bjsports-2020-103769
11. Bowen L, Gross AS, Gimpel M, Bruce-Low S, Li FX. Spikes in acute:chronic workload ratio (ACWR) associated with a 5-7 times greater injury rate in English Premier League football players: a comprehensive 3-year study. *Br J Sports Med*. 2020;54(12):731–738. doi:10.1136/bjsports-2018-099422
12. Myer GD, Faigenbaum AD, Cherny CE, Heidt RS Jr, Hewett TE. Did the NFL lockout expose the Achilles heel of competitive sports? *J Orthop Sports Phys Ther*. 2011;41(10):702–705. doi:10.2519/jospt.2011.0107
13. Hull JH, Loosemore M, Schwellnus M. Respiratory health in athletes: facing the COVID-19 challenge. *Lancet Respir Med*. 2020;8(6):557–558. doi:10.1016/S2213-2600(20)30175-2
14. Halabchi F, Ahmadinejad Z, Selk-Ghaffari M. COVID-19 epidemic: exercise or not to exercise; that is the question! *Asian J Sports Med*. 2020;11(1):e102630. doi:10.5812/asjsm.102630
15. Gabbett TJ. How much? How fast? How soon? Three simple concepts for progressing training loads to minimize injury risk and enhance performance. *J Orthop Sports Phys Ther*. 2020;50(10):570–573. doi:10.2519/jospt.2020.9256
16. Gabbett TJ, Ullah S. Relationship between running loads and soft-tissue injury in elite team sport athletes. *J Strength Cond Res*. 2012;26(4):953–960. doi:10.1519/JSC.0b013e3182302023
17. Malone S, Roe M, Doran DA, Gabbett TJ, Collins K. High chronic training loads and exposure to bouts of maximal velocity running reduce injury risk in elite Gaelic football. *J Sci Med Sport*. 2017;20(3):250–254. doi:10.1016/j.jsams.2016.08.005
18. Caterisano A, Decker D, Snyder B, et al. CSCCa and NSCA joint consensus guidelines for transition periods: safe return to training following inactivity. *Strength Cond J*. 2019;41(3):1–23. doi:10.1519/SSC.0000000000000477
19. Buckthorpe M. Optimising the late-stage rehabilitation and return-to-sport training and testing process after ACL reconstruction. *Sports Med*. 2019;49(7):1043–1058. doi:10.1007/s40279-019-01102-z

Address correspondence to Ryan Ross, ATC, PT, DPT, CSCS, Baylor Athletic Medicine, Baylor University, 2220 Columbus Avenue, Unit D, Waco, TX 76701. Address email to ryan_n_ross1@baylor.edu.