

FPIN's Clinical Inquiries

Early Aerobic Exercise for Postconcussion Symptoms in Adolescent Patients

Thomas J. Kern, MD; Daniel Yee, DO; Alberto Benjamin Chong, DO; and Rachel Conkin Kaminski, MD, University of Oklahoma Health Sciences Center, Tulsa, Oklahoma

Toni Hoberecht, MA, MLIS, AHIP, University of Oklahoma-Tulsa, Schusterman Library, Tulsa, Oklahoma

Clinical Question

Does early aerobic exercise following concussion improve or impair recovery in adolescent patients?

Evidence-Based Answer

Early aerobic exercise for symptoms of concussion more than 72 hours after injury may decrease symptom severity and frequency (Strength of Recommendation [SOR]: A, meta-analysis of three randomized controlled trials [RCTs]) and time to recovery from the day of injury (SOR: B, one prospective nonrandomized study). Early aerobic exercise does not impair recovery from sport-related concussions. (SOR: B, one small RCT and one multicenter, nonrandomized study.)

Evidence Summary

A 2020 systematic review and meta-analysis of seven RCTs (N = 326) assessed the effects of aerobic exercise on symptom intensity in sport-related concussions.¹ Patients 13 to 17 years of age had either an acute sport-related concussion or symptoms that persisted for more than 10 days. The interventions studied varied in exercise intensity and involved 10 to 30 minutes of aerobic exercise. The control groups included stretching programs, rest, and clinical management without aerobic exercise. Compared with those in the control group, patients with acute concussion who participated in aerobic exercise significantly reduced

symptom intensity (three trials; n = 206; standardized mean difference = -0.35; 95% CI, -0.71 to -0.15). No significant differences in symptom intensity were observed between the aerobic exercise groups and control groups for patients with persistent symptoms of concussion. Three trials reported only mild adverse effects.

A 2021 RCT (N = 118) examined the effect of early aerobic exercise on clinical recovery from sport-related concussions.² Although research assistants and participants were not blinded to allocation, physicians and outcome evaluators were. Patients were athletes 13 to 18 years of age with sport-related concussions presenting within 10 days of injury and were recruited from three sports medicine concussion centers. Those in the intervention group (n = 61) were instructed to exercise at home, up to 90% of maximum target heart rate, for at least 20 minutes per day. Those in the control group (n = 57) were instructed to do a combination of light stretches and breathing exercises that would not increase heart rate. The primary outcome was clinical recovery (i.e., return to baseline symptoms, normal exercise tolerance, and normal physical examination) without developing any persistent symptoms within four weeks after an injury as measured by the Post-Concussion Symptom Inventory (PCSI). The PCSI assesses symptom severity on a 7-point scale (0 = no symptoms; 6 = maximum severity),

Clinical Inquiries provides answers to questions submitted by practicing family physicians to the Family Physicians Inquiries Network (FPIN). Members of the network select questions based on their relevance to family medicine. Answers are drawn from an approved set of evidence-based resources and undergo peer review. The strength of recommendations and the level of evidence for individual studies are rated using criteria developed by the Evidence-Based Medicine Working Group (<https://www.cebm.net>).

The complete database of evidence-based questions and answers is copyrighted by FPIN. If interested in submitting questions or writing answers for this series, go to <https://www.fpin.org> or email: questions@fpin.org.

This series is coordinated by John E. Delzell Jr., MD, MSPH, associate medical editor.

A collection of FPIN's Clinical Inquiries published in *AFP* is available at <https://www.aafp.org/afp/fpin>.

Author disclosure: No relevant financial relationships.

with scoring of 0 to 126 for adolescents 13 to 18 years of age. Patients in the aerobic exercise group experienced a higher level of clinical recovery within the first four weeks after injury compared with the stretching group (hazard ratio = 0.52; 95% CI, 0.28 to 0.97; number needed to treat = 10). No adverse effects were noted.

A 2021 RCT (N = 37) examined the effect of aerobic exercise on symptoms following concussion.³ Because of the study design, no blinding was performed. Patients were 14 to 21 years of age with a clinical diagnosis of concussion and an initial assessment score greater than 9 on the PCSI. The average initial score was 14.5 for the exercise group and 24 for the control group. Patients in the intervention group (n = 17; mean age = 17 years; 41% female) were instructed to engage in eight weeks of exercise for 20 minutes per day five times per week at a target heart rate based on an exercise test at the initial assessment. Patients in the control group (n = 20; mean age = 17 years; 50% female) were instructed to follow their physician-recommended physical activity level for eight weeks. The primary outcome was symptom severity measured by the PCSI at baseline and at one- and two-months of follow-up. When measured by PCSI score, there were no significant differences in symptom severity observed between the intervention and control groups after one month (4 in the exercise group vs. 5.5 in the control group; $P = .96$) or two months (6.5 vs. 0; $P = .11$). No adverse effects were noted.

A 2019 prospective nonrandomized trial (N = 151) compared the effects of aerobic exercise, stretching, and rest on concussion recovery.⁴ Athletes were 13 to 18 years of age who presented within 10 days of a sport-related concussion. The exercise group (n = 52; mean age = 15 years; 46% female) received an aerobic exercise program at 80% of the calculated maximum heart rate. Aerobic exercises were performed daily under supervision for 20 minutes with a five-minute warm-up and cooldown. Those in the placebo group (n = 51; mean age = 15 years; 47% female) were given a progressive stretching program for 20 minutes per day, and the rest group (n = 48; mean age = 15 years; 25% female) received relative rest and were told not to participate in any sports or other forms of exercise. The primary outcome was days to recovery from the date of injury as measured by symptom resolution with the Post-Concussion Symptom Scale. Delayed recovery (i.e., more than 30 days) was the secondary outcome. The exercise group observed a statistically significant faster median recovery time compared with the placebo and rest groups (13 days in the exercise group vs. 17 days in the placebo group vs. 16 days in the rest group; $P = .02$). The recovery rates were not statistically different between groups.

A 2020 multicenter, nonrandomized study (N = 49) evaluated the effect of active rehabilitation on concussion recovery.⁵ Patients eight to 17 years of age with concussion were placed in an experimental group (n = 36; mean age = 14 years; 58% female) who participated in an active rehabilitation

intervention with aerobic activity, coordination, mental imagery, education, and daily home exercise for six weeks or a control group (n = 13; mean age = 13 years; 38% female) who received standard care consisting of rest, light activity, education, and gradual return to school with restriction from vigorous physical activity. Postconcussion symptoms were measured at the initial assessment and at two and six weeks of follow-up using the PCSI. No significant differences in PCSI scores were observed between the exercise and control groups. No adverse effects were noted in either group.

Limitations common to these studies included variations in exercise type, intensity, and duration; small sample size; limited number of RCTs to analyze; and low compliance with exercise regimens. Studies completed during the COVID-19 pandemic greatly affected the number of participants because of parents' unwillingness to provide consent for their children to be involved in the study.

Recommendations From Others

A 2018 Centers for Disease Control and Prevention evidence-based guideline recommends that health care professionals offer an active progressive rehabilitation program focused on the reintroduction of noncontact aerobic activity that does not exacerbate concussion symptoms.⁶ This could be started once the patient has resumed symptom-limited, gradual, scheduled activity after a period of full cognitive and physical rest (level B recommendation). The optimal timing to initiate an aerobic program has not been established, but evidence suggests that inactivity beyond the first three days after injury may worsen symptoms.

Copyright © Family Physicians Inquiries Network. Used with permission.

Address correspondence to Thomas J. Kern, MD, at Thomas-Kern@ouhsc.edu. Reprints are not available from the authors.

References

1. Langevin P, Frémont P, Fait P, et al. Aerobic exercise for sport-related concussion: a systematic review and meta-analysis. *Med Sci Sports Exerc.* 2020;52(12):2491-2499.
2. Leddy JJ, Master CL, Mannix R, et al. Early targeted heart rate aerobic exercise versus placebo stretching for sport-related concussion in adolescents: a randomised controlled trial. *Lancet Child Adolesc Health.* 2021;5(11):792-799.
3. Howell DR, Hunt DL, Aaron SE, et al. Influence of aerobic exercise volume on postconcussion symptoms. *Am J Sports Med.* 2021;49(7):1912-1920.
4. Willer BS, Haider MN, Bezherano I, et al. Comparison of rest to aerobic exercise and placebo-like treatment of acute sport-related concussion in male and female adolescents. *Arch Phys Med Rehabil.* 2019;100(12):2267-2275.
5. Gauvin-Lepage J, Friedman D, Grilli L, et al. Effectiveness of an exercise-based active rehabilitation intervention for youth who are slow to recover after concussion. *Clin J Sport Med.* 2020;30(5):423-432.
6. Lumba-Brown A, Yeates KO, Sarmiento K, et al. Centers for Disease Control and Prevention guideline on the diagnosis and management of mild traumatic brain injury among children [published correction appears in *JAMA Pediatr.* 2018;172(11):1104]. *JAMA Pediatr.* 2018;172(11):e182853. ■