THE ASSOCIATION BETWEEN EARLY EXERCISE AND CLINICAL CHARACTERISTICS FOLLOWING PEDIATRIC SPORT-RELATED CONCUSSION

Julie C. Wilson, MD1, Morgan N. Potter, BA2, Michael W. Kirkwood, PhD3, Pamela E. Wilson, MD4, Aaron Provance, MD5, David R. Howell, PhD6

1Children’s Hospital Colorado, Aurora, CO, USA, 2Children’s Hospital Colorado, USA, 3Children’s Hospital Colorado, USA, 4Children’s Hospital Colorado, USA, 5Children’s Hospital Colorado, Aurora, CO, USA, 6Sports Medicine Center, Colorado Children’s Hospital, Aurora, CO, USA

Background: Historically, exercise has been discouraged while patients are experiencing concussion symptoms. However, recent evidence suggests that exercise soon after concussion is not detrimental and may be beneficial to recovery. Few studies have assessed the impact of early exercise in pediatric sport-related concussion. Therefore, the purpose of our investigation was to evaluate if clinical characteristics vary between patients who engaged in early exercise post-injury relative to patients who had not resumed physical activity at initial clinical evaluation.

Methods: We conducted an analysis of data collected from a prospective clinical registry of pediatric patients with concussion. Included subjects were evaluated in a pediatric sports medicine concussion clinic between January 1, 2015 and August 31, 2017, less than 19 years of age and evaluated within 20 days of a sport-related concussion. The independent variable was whether or not the patient reported participating in early exercise, defined as exercise occurring since the injury and prior to initial clinical evaluation. Type of exercise was classified by corresponding stage of the return to play protocol. Other variables were collected from routine clinical evaluation including: demographics, injury details, medical history form (pre-injury history of attention deficit/hyperactivity disorder, learning disability, anxiety, depression, and migraine/headaches), the Health and Behavior Inventory (HBI) symptom frequency questionnaire, and a set of balance, vestibular, and oculomotor function tests [Balance Error Scoring System (BESS), Romberg, tandem gait, gaze stability, and near point of convergence]. We performed univariable comparisons of demographic and medical history variables between the early exercise and no exercise groups using Mann-Whitney U and Fisher’s exact tests. Variables that demonstrated potential significance between groups (defined as p < 0.20) were included as covariates in subsequent multivariable models. In order to identify the clinical variables that were associated with early exercise, we constructed a series of regression models where exercise (yes vs. no) was the predictor variable and clinical measures were the outcome variables. Linear regression models were used with continuous outcome variables (e.g. number of BESS errors), while logistic regression models were used with binary outcome variables (e.g. presence of current headache or not).

Results: We examined data from 575 pediatric patients: 69 reported engaging in early exercise and 506 did not report exercising (Table 1). The no exercise group was seen approximately 4 days earlier post-injury than the early exercise group, had longer symptom resolution times (median= 16 [interquartile range (IQR)= 8-24] vs. 10.5 [IQR= 4-17] days; p= 0.02), and had a higher proportion of participants with pre-injury history of migraine/headaches. The majority (65%) of the early exercise group indicated participation in light aerobic activity prior to the initial clinical evaluation, with a minority reporting participation in more rigorous exercise (Table 2).

The exercise group consisted of a lower proportion of individuals experiencing a headache and exhibiting an abnormal Romberg test during the initial evaluation (Table 3). In addition, the early exercise group had fewer median BESS errors than the no exercise group for testing in single leg and tandem stance on a firm surface (Table 3). Patients in the early exercise group and their parents reported significantly lower HBI scores than the no exercise group (Figure 1). When controlling for pre-existing headache history and time from injury until clinical evaluation, several factors were associated with early exercise (Table 5). Patients who engaged in early exercise after concussion were less likely to report current headache and also recorded lower self- and parent-reported HBI scores. They also demonstrated fewer BESS errors in single leg stance.
firm, tandem stance firm, and tandem stance foam conditions.

Conclusions: The impact of early exercise following concussion is an emerging area of research, and to date, few studies have examined this in pediatric patients with sport-related concussion. In our study, patients who did not engage in early exercise had greater odds of headache, worse postural stability, and higher patient- and parent-symptom rating at initial clinical evaluation. Given our study design, we cannot determine if patients engaged in early exercise due to lower symptom burden and higher functioning at the time of assessment, or whether early exercise actually positively affects clinical characteristics. However, our results suggest that early exercise is associated with better post-injury outcomes, and not universally detrimental in pediatric sport-related concussion. Future research, including prospective randomized controlled trials, is needed to determine the causal relationship between exercise and pediatric concussion outcomes.

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