


AllinaHealth  COURAGE KENNY REHABILITATION INSTITUTE

## Concussion Challenge – Return to Play

Erin Vesey, DPT  
6/27/2019

---

---

---

---


---

---

---

### Objectives

- Verbalize and understand the Return to Play Guidelines
- Identify when a patient is appropriate to advance to the next stage of Return to Play Guidelines
- Understand the Exposure-Recovery Model to ensure patient is safe while advancing through stages
- Describe the steps of the Concussion Challenge Test and when it is appropriate to administer
- Verbalize a basic understanding of exertion therapy

1 AllinaHealth  COURAGE KENNY REHABILITATION INSTITUTE

---

---

---

---

---

---

---

### When you disregard RTP guidelines:



2 AllinaHealth  COURAGE KENNY REHABILITATION INSTITUTE

---

---

---

---

---

---

---

### Recovery

- Most athletes improve rapidly during the first 2 weeks after a concussion.
- Generally, they are recovered and returning to sport within 10 days post-injury.
- During the past 10 years, there has been steadily accumulating literature that a sizeable minority of youth, high-school and collegiate athletes take much longer than 10 days to clinically recover and return to sport.
- Children and adolescents should not return to sport until they have successfully returned to school.

Allina Health | COURAGE KENNY REHABILITATION INSTITUTE

---

---

---

---

---

---

---

### Background

- Recent research suggests symptomatic recovery is an unreliable determination for readiness to RTP
- The physiological time for recovery may outlast symptom recovery
- Symptom reports are complicated due to subjective nature and athletes underreporting in order to RTP
- Final step to RTP is 'medical clearance' but no consensus on what that should entail

Allina Health | COURAGE KENNY REHABILITATION INSTITUTE

---

---

---

---

---

---

---

### Return To Play Guidelines

- After a brief period of initial rest (24–48 hours), symptom-limited activity can begin while staying below a cognitive and physical exacerbation threshold
- Once concussion-related symptoms have resolved, the athlete should continue to proceed to the next level if he/she meets all the criteria (ex: activity, heart rate, duration of exercise, etc) without a recurrence of concussion-related symptoms.
- Generally, each step should take 24 hours, so that athletes would take a minimum of 1 week to proceed through the full rehabilitation protocol once they are asymptomatic at rest.
  - In athletes who experience prolonged symptoms and inactivity, each step may take longer than 24 hours simply because of limitations in physical conditioning and recovery strategies.
  - If any concussion-related symptoms occur during the stages, the athlete should drop back to the previous asymptomatic level and attempt to progress again after being free of concussion-related symptoms for a further 24 hour period at the lower level.

Allina Health | COURAGE KENNY REHABILITATION INSTITUTE

---

---

---

---

---

---

---

### Return to Play Guidelines

- The time frame for RTP may vary with player age, history, level of sport, etc, and management must be individualized.
- Must satisfy the following criteria:
  - Symptom free at rest
  - Symptom free with physical and cognitive exertion
  - Neurocognitive functioning intact
  - Off any medication that may mask the symptoms of concussion

6

Allina Health | COURAGE KENNY REHABILITATION INSTITUTE

### Neuropsychological Assessment

- Recommended that all athletes have an assessment
- Evaluation of the following:
  - Mental status/cognition, oculomotor function, gross sensorimotor, coordination, gait, vestibular function and balance
- Post-injury testing is not required for athletes for RTP
  - If present, optimally done by neuropsychologist
  - Ultimate decision, however, is medical one made by an entire team
- In absence of an assessment, a more conservative RTP might be utilized
- Neuropsych assessment is typically done when asymptomatic
  - Can be used earlier to assist with Return to School

7

Allina Health | COURAGE KENNY REHABILITATION INSTITUTE

### Exposure-Recovery Model

- **Exposure-Recovery Model:** Exposing yourself to provocative situations and environments (ex: shopping malls, restaurants) until symptoms increase to about a 3 or 4 on a scale of 1-10, then removing yourself to allow for recovery (symptoms go away). Each time you do this, recovery time should be shorter.
- Take baseline symptoms at start of exercise or physical activity from 1-10 in the following areas:
  - Headache, Dizziness, Nausea, Fogginess
- If patient increases symptoms by more than 3-4 points, it is important to stop and rest until symptoms return to baseline
  - If symptoms return within a reasonable time frame (less than 5-10 mins) then resume
  - If symptoms do not resume within this time frame, stop
- Make sure if they do become symptomatic that it doesn't interfere with safety, like losing balance on a treadmill/elliptical, or significant change in quality of movement

8

Allina Health | COURAGE KENNY REHABILITATION INSTITUTE

Return to Play Guidelines			
Stage	Aim	Activity	Goal
1	Symptom-limited activity (24-48 hour rest)	Daily activities that do not provoke symptoms	Gradual reintroduction to work/school activities.
2	Light aerobic exercise • 15-30 minutes twice daily	Walking or stationary cycling at slow to medium pace. No resistance training.	Increase heart rate
3	Sport-specific exercise • 2 additional 30 minute sessions	Running or skating drills. Moderate physical activity.	Add movement
4	Non-contact training drills • Up to 3 hours per day	Harder training drills (e.g. passing). Moderate to vigorous activity. May start progressive resistance training.	Exercise, coordination and increased thinking
5	Full contact practice	Participate in normal training activities. Vigorous physical activity. May have contact.	Restore confidence and assess functional skills by coaching staff
6	Return to sport	Normal game play	

9

Allina Health | COURAGE KENNY REHABILITATION INSTITUTE

---

---

---

---

---

---

---

---

Stage 1 - Rest	
<ul style="list-style-type: none"> <li>• International Conference on Concussion:             <ul style="list-style-type: none"> <li>– Rest until you are asymptomatic</li> </ul> </li> <li>• New idea is to become active sooner with the recommendation that this stage only last for 24-48 hours post injury</li> </ul>	

10

Allina Health | COURAGE KENNY REHABILITATION INSTITUTE

---

---

---

---

---

---

---

---

Stage 2 – Return to Play	
<ul style="list-style-type: none"> <li>• Light/Low Aerobic Exercise</li> <li>• Duration: 15-30 minutes up to twice a day</li> <li>• Heart Rate Range: 100-140 bpm</li> <li>• RPE: 4/10</li> <li>• Prefer Day 1 to be in a stationary setting for supervision purposes: (i.e. at home or under the close supervision of ATC/PT)</li> </ul>	

11

Allina Health | COURAGE KENNY REHABILITATION INSTITUTE

---

---

---

---

---

---

---

---

### Stage 2 – Example of Session

- Low speed/Low resistance
  - Elliptical
  - Stationary Bike
  - Treadmill
  - UE ergometer
  - Flexibility exercises
  - Balance training (static)

12

Allina Health | COURAGE KENNY REHABILITATION INSTITUTE

---

---

---

---

---

---

---

### Stage 3 – Return to Play

- Medium/Moderate Aerobic Exercise
- Sport Specific Non-Contact Exercise
- Duration: 45 minutes
- Heart Rate Range: 120-160 bpm
- RPE: 4-6/10

13

Allina Health | COURAGE KENNY REHABILITATION INSTITUTE

---

---

---

---

---

---

---

### Stage 3 – Example of Session

- 15 minutes: medium pace and minimal intensity on the Elliptical or Treadmill
- 15 minutes: Stationary bike at a moderate pace or 10 minutes of stair running (at a continuous moderate pace) followed by 5 minutes of sit-ups, push-ups, lunges, and jumping jacks; rotating every 30 seconds.
- Finish with 15 minutes of Circuit Training:
  - Jog quickly in place: 30 seconds
  - Squats: 30 seconds
  - High knees: 30 seconds
  - Butt kicks: 30 seconds
  - Mountain climbers: 30 seconds
  - Burpees: 30 seconds
  - Rest for 1 minute
  - Repeat the above cycle 4 times for a grand total of 15 minutes

14

Allina Health | COURAGE KENNY REHABILITATION INSTITUTE

---

---

---

---

---

---

---

### Stage 4 – Return to Play

- High/Heavy Aerobic Exercise
- Non-Contact Training Drills
- Duration: 60 minutes
- Heart Rate: 140-180 bpm
- RPE: 6-8/10

15

Allina Health | COURAGE KENNY REHABILITATION INSTITUTE

---

---

---

---

---

---

---

### Stage 4 – Example of Session

- 20 minutes: medium pace and minimal intensity on the elliptical/treadmill
- 20 minutes: Stationary bike at a moderate pace OR 15 minutes of stair running (at a continuous moderate pace) followed by 5 minutes of sit-ups, push-ups, lunges, and jumping jacks; rotating every 30 seconds.
- Finish with 15 minutes of Circuit Training:
  - Jog quickly in place: 30 seconds
  - Squats: 30 seconds
  - High knees: 30 seconds
  - Butt kicks: 30 seconds
  - Mountain climbers: 30 seconds
  - Burpees: 30 seconds
  - Rest for 1 minute
  - Repeat the above cycle 4 times for a grand total of 15 minutes
- Finish with 5 minutes of running or sprinting intervals at a high pace

16

Allina Health | COURAGE KENNY REHABILITATION INSTITUTE

---

---

---

---

---

---

---

### Stage 5 – Return to Play

- Athlete attends practice with the team and can resume contact at this time
- If they become symptomatic, they must stop and return to Stage 4 and be pulled from practice
- If they can tolerate return to practice symptom free for 24 hours, they may return to full play.
- But, are they truly ready....

17

Allina Health | COURAGE KENNY REHABILITATION INSTITUTE

---

---

---

---

---

---

---

### Use of Exercise Testing for RTP

- The use of provocative exercise testing may help clinicians make RTP decisions by challenging the physiological recovery and reducing the use of self-reported symptoms
- To be eligible to participate in exercise testing for RTP, athletes must complete all return to learn protocols and non-contact RTP steps

18

Allina Health | COURAGE KENNY REHABILITATION INSTITUTE

---

---

---

---

---

---

---

### Current Literature on Exercise Testing

- Adding physical exertion tests to concussion protocols can prevent nearly 15 percent of high-risk athletes from returning to sport too soon
  - Study found that 15% of athletes who were 'cleared' to play using standard protocols became symptomatic with exercise testing
  - This indicates incomplete physiological recovery
- Greater initial symptom severity had a significant impact on whether they passed exercise testing and was associated with longer RTP time
  - Literature supports higher initial symptom presentation is single strongest predictor of prolonged recovery
- Study suggests athletes refrain from reporting symptoms for fear of being removed or withheld from play and underreported symptoms in RTP protocol
  - This emphasizes the need for a more objective tool to assist with RTP decision-making

19

Allina Health | COURAGE KENNY REHABILITATION INSTITUTE

---

---

---

---

---

---

---

### Concussion Challenge Test

- Designed to identify athletes who have not fully recovered despite completing standard return to play (RTP) protocols and are no longer reporting symptoms.
- Used for patients who are ready to return to sport and helps identify if they are ready through a series of exertional, rotational, linear, and vertical movements to ensure symptoms are not reproduced
- This done prior to RTP can help in ruling out potential symptom provocation with physical activity
- Can also be utilized on those that are returning to a more strenuous job or active lifestyle
- Testing should not be started if baseline symptoms are above 5/10. Testing should be paused at any point if symptoms rise above 5/10. Resume only if symptoms fall below 5/10 within 5 minutes.

20

Allina Health | COURAGE KENNY REHABILITATION INSTITUTE

---

---

---

---

---

---

---

### Concussion Challenge Test

- Recent study suggests the following RTP protocol with the inclusion of a Concussion Challenge Test:
  - Asymptomatic through cognitive activity, Return to School, pass the Buffalo Concussion Treadmill Test (BCTT), and at least two sport-specific non-contact practices of increasing intensity
  - Athletes in this study had maintained a symptom-free status for at least 7 days prior to attempting the challenge test.

21

Allina Health | COURAGE KENNY REHABILITATION INSTITUTE

### Example of Return to Play Guideline



22

Allina Health | COURAGE KENNY REHABILITATION INSTITUTE

### Concussion Challenge Test

- Start with taking vitals as well as baseline symptoms
  - Resting Vitals:
    - Heart Rate
    - Blood Pressure
    - SpO2
  - Symptoms (rated from 0/10 with emphasis on headache, dizziness, nausea, foggiess)
- Calculate their HR range to know an appropriate level for exertion:
  - Calculated HR Max (220-age)
  - Calculated target HR ( $RHR + .75(MHR - RHR)$ )
- Cervical AROM screen

23

Allina Health | COURAGE KENNY REHABILITATION INSTITUTE



### Pre-Challenge Testing

- Balance Screen: \*\*\* errors
  - Tandem with eyes closed on floor, counting backwards by 7's for 20 seconds
- Perform VOMS Testing
  - Smooth Pursuits
  - Saccades: Horizontal and Vertical
  - Convergence (near point)
  - VOR: Horizontal and Vertical
  - Visual Motion Sensitivity

24

AllinaHealth | COURAGE KENNY REHABILITATION INSTITUTE

---

---

---

---

---

---

---

---

### Concussion Challenge Test

Exertion Activity	HA (0-10)	Dizziness (0-10)	Nausea (0-10)	Fogginess (0-10)	RPE (0-10)	Heart Rate (bpm)	Comments
<b>Post Stop sign</b> 6 min stop x 2 minutes							
<b>Killars</b> Turning forward then backward 2 stop points at 10 ft increments, pt taps floor at each point, repeat at least twice							
<b>Lateral step-ups</b> pt starts on step, steps down to one side, shuffles to tap cone off away, shuffles back to step, repeat to 5 times to each side							
<b>Medicine ball:</b> 1-10 reps 10 side lunges with torso to each side 10 horizontal swings 10 vertical swings							
<b>Ball toss</b> pt in the middle of two therapists, pt performs 180 deg jump x 10							

25

AllinaHealth | COURAGE KENNY REHABILITATION INSTITUTE

---

---

---

---

---

---

---

---

### Concussion Challenge Test

Exertion Activity	HA (0-10)	Dizziness (0-10)	Nausea (0-10)	Fogginess (0-10)	RPE (0-10)	Heart Rate (bpm)	Comments
<b>Treadmill Running (10 minutes)</b>							
2 minutes, *** mph							
4 minutes, *** mph							
6 minutes, *** mph							
8 minutes, *** mph							
10 minutes, *** mph							
<b>Cycling (20 minutes)</b>							
5 minutes							
10 minutes							
15 minutes							
20 minutes							

26

AllinaHealth | COURAGE KENNY REHABILITATION INSTITUTE

---

---

---

---

---

---

---

---

### Post-Challenge Test

- **Re-Test Balance and VOMS**

- **5 minutes Post Exercise:**

- Symptoms
- Heart Rate
- Blood Pressure

- **Pass/Fail:**

- If failed, list why:

27

Allina Health | COURAGE KENNY REHABILITATION INSTITUTE

### Concussion Challenge Pass/Fail

- **To Pass:**

- No increase in baseline symptoms from that day with any of the activities performed
- If coming in with 2/10 headache and finished with 2/10 headache, they can still pass

- **If they become symptomatic and fail:**

- Continue the test if able (using exposure-recovery model) in order to determine what symptoms/movements still need to be addressed for full return to play

28

Allina Health | COURAGE KENNY REHABILITATION INSTITUTE

### Exertion Therapy

- If patient fails Concussion Challenge Test may consider Exertion Therapy through a physical therapist
- Exertion therapy is an individualized program to decrease exercise sensitivity post concussion
- A monitored active rehab program that involves sub-symptom threshold exercise has been shown to be safe and beneficial for recovery
- Several studies demonstrated a reduction in symptoms, improvement in exercise tolerance and return to normal lifestyle and sport participation in patients treated with an individualized sub-symptom threshold aerobic exercise program

Allina Health | COURAGE KENNY REHABILITATION INSTITUTE

### Exertion Therapy

- Removing an athlete from sport may increase the risk for depression and other concussion-like symptoms to develop, yet the point at which an athlete can begin physical activity following concussion is unclear.
- Athletes engaging in a medium level of physical and cognitive activity (i.e. school activity and light activity at home) performed better on the neurocognitive test than those with no physical and cognitive activity
- Athletes that continue to report concussion related symptoms well beyond the acute stage of injury may benefit from a progressively intensive exercise protocol to return them to their sport.

30

Allina Health | COURAGE KENNY REHABILITATION INSTITUTE

---

---

---

---

---

---

---

### Exertion Therapy

- Appropriate:
  - Minimal to no symptoms
  - In patients with PCS, especially if they have not been active
  - Those with active lifestyles with hesitations with return to exercise
- Precautions (should consult with team):
  - Significant mood profile
  - Post traumatic migraine
  - Limited progress overall

31

Allina Health | COURAGE KENNY REHABILITATION INSTITUTE

---

---

---

---

---

---

---

### Exertion Therapy

- Leddy et al Study:
  - 6 concussed athletes (at least 6 weeks post-concussion) participated in a graded return to activity protocol
  - Exercised 5-6 days per week with intensity monitored by heart rate
  - After 6 weeks, athletes had significant decrease in symptoms and were able to return to sport

32

Allina Health | COURAGE KENNY REHABILITATION INSTITUTE

---

---

---

---

---

---

---

### References

- Broglio SP, Collins MW, Williams RM, Mucha A, Kontos AP. Current and emerging rehabilitation for concussion: a review of the evidence. *Clin Sports Med*. 2015;34(2):213–231. doi:10.1016/j.csm.2014.12.005
- McCrory P, Meeuwisse W, Dvorak J, et al. Consensus statement on concussion in sport—the 5<sup>th</sup> international conference on concussion in sport held in Berlin, October 2016. *British Journal of Sports Medicine* 2017;51:838-847.
- Marshall CM, Chan N, Tran P, DeMatteo C. The use of an intensive physical exertion test as a final return to play measure in concussed athletes: a prospective cohort. *Phys Sportsmed*. 2018;47:2, 158-166
- Mucha A, Whitney, S. Exertion Considerations After Concussion. 2019.
- Kochick, V. UPMC Concussion Program Exertion Therapy. 2018.
- Makdissi M, Schneider K, Feddermann-Demont N, et al. Approach to investigation and treatment of persistent symptoms following sport-related concussion: a systematic review. *Br J Sports Med*. In Press. 2017.
- Leddy JJ, Kozlowski K, Donnelly JP, Pendergast DR, Epstein LH, Willer B. A preliminary study of subsymptom threshold exercise training for refractory post-concussion syndrome. *Clin J Sport Med*. 2010;20(1):21–7.

33

Allina Health | COURAGE KENNY REHABILITATION INSTITUTE

### THANK YOU!

- Erin Vesey, DPT
  - Courage Kenny Rehabilitation Institute
  - Physical Therapy Concussion Lead
  - [Erin.Vesey@allina.com](mailto:Erin.Vesey@allina.com)

34

Allina Health | COURAGE KENNY REHABILITATION INSTITUTE