



The Relationship between the Time in Each Step within a Return to Play Guideline for Sports-Related Concussion among High School Student-Athletes.



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Context:

Assessment and management of sport related concussion has been studied from various aspects. Current research demonstrated the importance of creating the safest return to play (RTP) guidelines for concussed student-athletes that minimizes risk. A graduated step wise RTP has been recommended for the management of sports related concussion.¹

Objective:

To investigate the relationship between the number of days concussed high school student-athletes spent in each step of the State of Hawaii RTP protocol.

Design:

Retrospective case review of concussions reported between SY 2010-2012 using concussion logs collected from certified athletic trainers from each high school.

Setting:

A comprehensive Concussion Management Program has been implemented by 64 high schools in the State of Hawaii to track a step wise RTP (Table 1). Concussed student-athletes progressed to the next step once asymptomatic for minimum of 24 hours. The completion date of each step was reported by certified athletic trainers at each school via the concussion log.

Table 1. Return to Play Guideline

Onset	
Return to Learning	Step 1 Cognitive rest / No school
	Step 2 Back to school full time
Gradual Return to Play Protocol	Step 3 Light exercise
	Step 4 Running / Sport specific
	Step 5 Non-contact drills
	Step 6 Full contact practice
	Step 7 Full return to play

Participants:

Participants included 375 concussed high school student-athletes who completed the RTP protocol during SY 2010-2012. 229 male (mean age \pm SD = 15.56 \pm 1.18) and 138 females (mean age \pm SD = 15.29 \pm 1.16). All of the concussed student-athletes were monitored by the schools' certified athletic trainers using the step wise RTP protocol.

Main Outcome Measures:

Correlation analysis (Pearson's R) and multiple regression analysis were conducted to analyze the relationship among the steps in the protocol. Multiple regression analysis was utilized to investigate the amount of variability each step accounted for in the total return to play time. Days between each step and the total days taken to complete the RTP protocol served as the primary outcome measures.

Results:

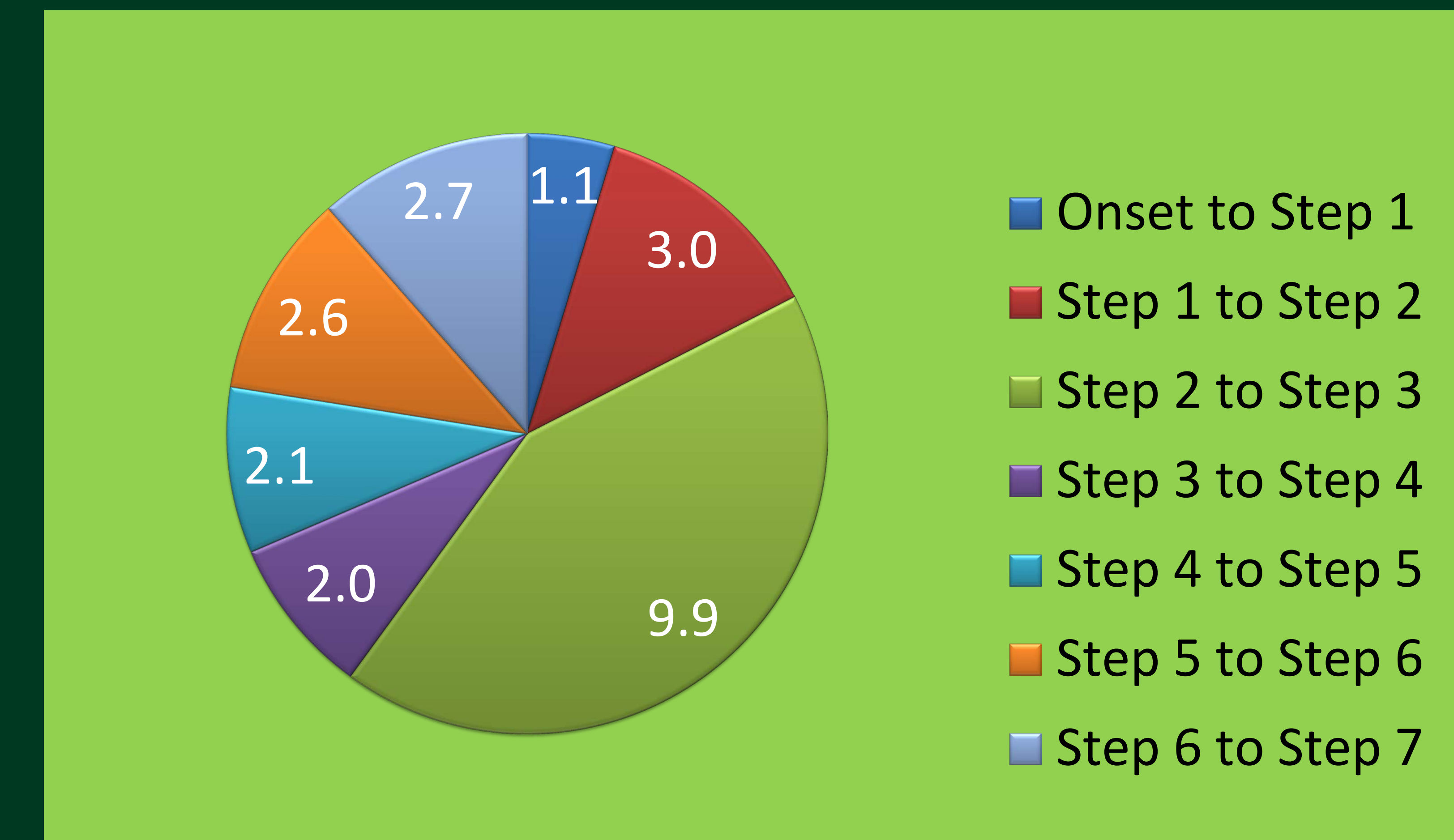
Days spent completing Step 2 and 3 had the strongest correlation with the total days taken to complete the protocol ($r = 0.84$, $p < 0.01$,). The result of multiple regression analysis indicated that 70% of the total days missed were accounted for by the time between Step 2 and 3 ($R^2 = 0.70$, $p < 0.001$).

Table 2. Relationship between each step of RTP protocol

		Step 1 to Step 2	Step 2 to Step 3	Step 3 to Step 4	Step 4 to Step 5	Step 5 to Step 6	Step 6 to Step 7
Step 1 to Step 7	Pearson Correlation (r)	0.154	0.835	0.15	0.115	0.297	0.347
	Variance (R square)	0.023	0.697	0.023	0.013	0.088	0.12

* $P < 0.027$

Figure 1. Average days spent in each step



Discussion:

Our results showed that concussed student-athletes struggled the most to complete Step 3 of the RTP protocol, accounting for 70% of the total days missed. The longer the concussed student-athlete spent in Step 2 to 3, the longer it took the student-athlete to return to full sport participation. Possible influential factors affecting the recovering period of Step 2 to 3 were the cognitive rest period and in-school adjustments.

Conclusions:

This study described the characteristics of the concussion recovery time period within a high school population. The results showed that Step 3 required the greatest amount of time for concussed student-athletes to complete. The recovery time after the completion of Step 3 was relatively consistent. Future studies should investigate the symptoms and neurocognitive scores reported during each step of the RTP protocol, as well as the effects of implementing in-school adjustments on recovery during a concussion.

References:

1. McCrory P, Meeuwisse WH, Aubry M et al. Consensus statement on concussion in sport: the 4th International Conference on Concussion in Sport held in Zurich, November 2012. *Br J Sports Med.* 2013;47:250-258.