

# The Role of Balance and Neck Strength in Youth Concussion

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## Introduction

### Concussion

A concussion is a trauma-induced alteration in mental status that may or may not involve loss of consciousness; this can include a direct blow to the head or a blow to the body resulting in the head and brain moving quickly back and forth (1).

### Current Screen

Current concussion screen consists of: symptom checklist, cognitive assessment known as Sport Concussion Assessment Tool (SCAT), and Balance Errors Scoring System (BESS) (2).

### Purpose

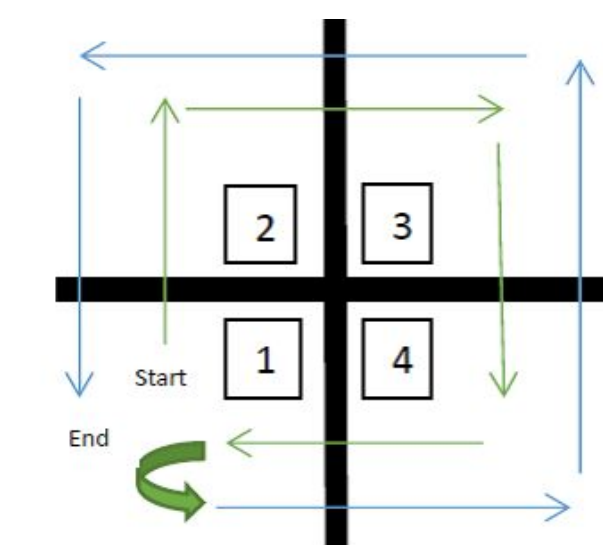
The purpose of this study is to determine an assessment to screen an individual's risk of sustaining a sport-related concussion.

### Hypothesis

We hypothesized the SCAT 4, BESS, Four Square Step Test, and Mirror Star Trace would identify deficits in adolescent athletes who sustained a concussion.

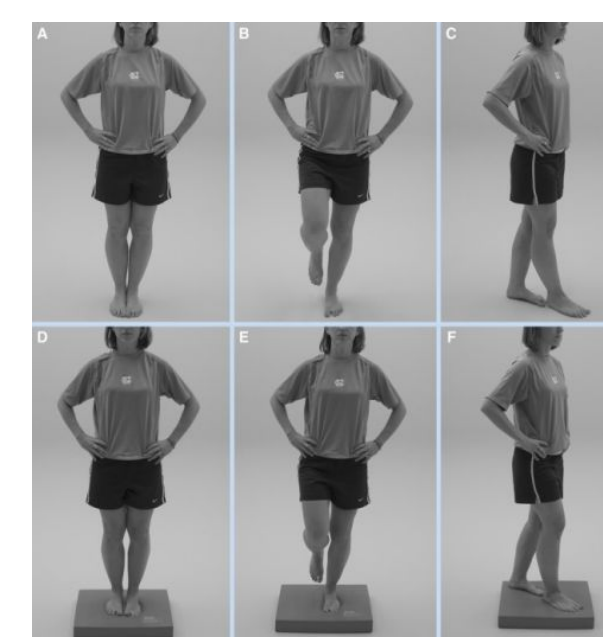
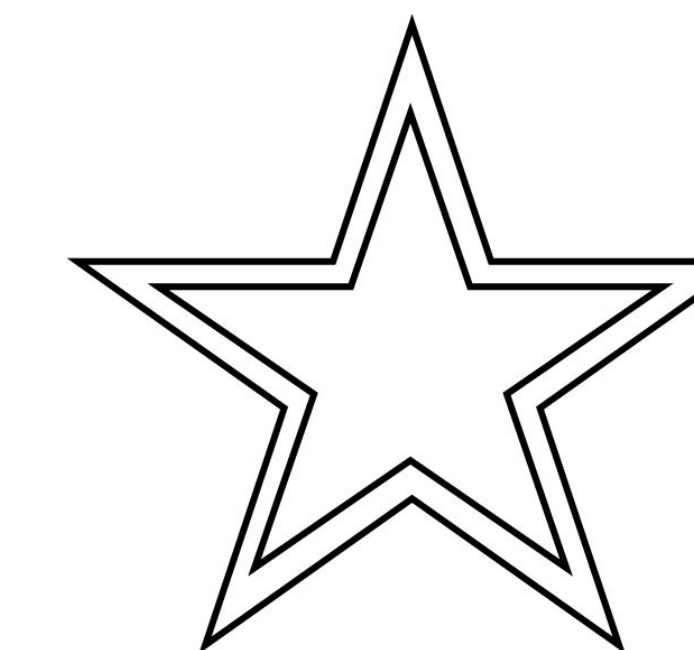
## Methods

Participants: middle school parks and recreation basketball athletes (age 10-14), both males and females



Four Square Step Test: 4 canes placed on the floor to create 4 squares. The participants were shown the pattern and told: "try to complete the sequence as quickly as possible without touching the canes. Both feet must make contact with the floor in each square"

Mirror Star Trace: The subjects were told; "trace the star staying in between the lines trying not to go outside the lines. You will have five minutes to complete as much of the star as possible." They used only the mirror to see their hand and the star due to the blinder which was over the sheet



BESS Test: subjects performed 3 stances (feet together, single leg stance, tandem stance) on a flat surface and unstable surface with eyes closed and eyes open. Researcher counted number of errors made based on BESS criteria

Neck Strength Assessment: A hand held dynamometer was used to collect isometric flexion, extension, and lateral flexion data in pounds



### SCAT 4

SCAT 4: cognitive assessment for orientation, immediate memory, concentration, delayed recall

## Discussion

The data shows females have decreased neck flexion and extension strength compared to age matched males (Table 2).

The data shows correlations between the FSST, BESS test and age were significant (Table 4); the older athletes performed the balance assessments better with decreased times for the FSST and decreased errors on the BESS test.

Errors in the study include: BESS protocol was not followed correctly for first 5 participants and the star trace test was modified to a 5 minute time limit due to time constraints.

More research will need to be conducted to identify risk factors in sustaining a concussion including assessments for static and dynamic balance and neck strength.

The data from the tests performed did not determine a significant assessment tool to identify an individual's risk of sustaining a sport-related concussion.

## References

1. Concussion 101. National Athletic Trainers' Association website. <https://www.nata.org/sites/default/files/concussion-infographic-handout.pdf>. Accessed May 2017.
2. Daneshvar, Daniel H., Christopher J. Nowinski, Ann C. Mckee, and Robert C. Cantu. "The Epidemiology of Sport-Related Concussion." *Clinics in Sports Medicine* 30.1 (2011): 1-17. Web.
3. Covassin, T., & Elbin, R. (2011). The Female Athlete: The Role of Gender in the Assessment and Management of Sport-Related Concussion. *Clinics in Sports Medicine*, 30(1), 125-131. doi:10.1016/j.csm.2010.08.001

## Results

### Neck Strength

Boys displayed increased neck flexion ( $t(65) = 2.26$ ,  $p < 0.03$ ,  $d = .55$ ) and extension ( $t(65) = 2.42$ ,  $p < .02$ ,  $d = .59$ ) compared to girls as seen in Table 2.

### Four Square Step Test

The correlation between Times 1 and 2 is  $r(53) = .89$ ,  $p < .001$  as seen in Table 3.

### Mirror Star Trace

Mean completion time for the star tracing task was 3.40 min ( $SD = 1.24$ ). The mean errors on the task was 15.77 ( $SD = 12.04$ ).

	Flexion	Extension	Lateral Flexion Left	Lateral Flexion Right
<b>Mean</b>	15.63	23.15	19.12	18.61
<b>Standard Deviation</b>	5.697	8.329	5.218	5.152

Table 1: Descriptive statistics for neck flexion, extension, and lateral flexion

	Gender	N	M	SD	SE
<b>Flexion</b>	F	35	14.17	4.348	0.735
	M	32	17.23	6.581	1.163
<b>Extension</b>	F	35	20.88	6.060	1.024
	M	32	25.63	9.757	1.725

Table 2: Descriptive statistics of flexion and extension by gender

	Time 1	Time 2	Mean
<b>Mean</b>	5.334	5.235	5.283
<b>Standard Deviation</b>	1.163	1.143	1.118
<b>Minimum</b>	3.450	3.290	3.410
<b>Maximum</b>	8.500	8.090	8.295

Table 3: Descriptive statistics of Four Square Step Test

Step Test	BESS	Age
<b>Time 1</b>	.249*	.246
<b>Time 2</b>	.220	.352*
<b>Mean</b>	.244*	.300*

\* $p < .05$

Table 4. Correlations between the Four Square Step Test and the BESS and age