



Efficiency of an active rehabilitation intervention in a pediatric population with atypical recovery following a mild traumatic brain injury

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Introduction

- ❖ Symptoms may persist beyond the expected recovery period in 11-17% of mTBI cases and may be longer in youth.
- ❖ Exercise is a promising therapeutic avenue as it may have a positive impact on depression, headaches, mood, dizziness, impairment of cognitive functions, balance, etc.



Objective

- ❖ Identify whether the addition of an active rehabilitation intervention influence recovery of young patients aged from 10 to 17 years old who are slow to recover following mTBI.



Methods

Participants and evaluation

- ❖ $n = 15$ (6M/9F) from 11 to 17 years old (mean = $15 \pm 1,69$) who sustained a sport-related mTBI.
- ❖ Postconcussion symptom inventory, neuropsychological, balance and coordination assessment were performed.

Pre-test	$48 \pm 88,73$ days post mTBI
Post-test	$9,73 \pm 2,12$ days without symptoms

Methods

Active Rehabilitation intervention

**Low intensity cycling for 5 to 15 minutes
(perceived exertion 2/10)**



**Moderate intensity cycling for 15 to 20 minutes
(perceived exertion 3/10)**



**Low to high intensity cycling for 20 minutes
(alternate 3 to 5 times 1 min 5/10, 1 min 2/10)**

**Sport specific motor
coordination
exercises**

**Balance and
coordination
therapeutic
exercises**

Methods

Assessment: Symptoms severity

		Before the injury	Current symptoms
1	Headache	0 1 2 3 4 5 6	0 1 2 3 4 5 6
2	Nausea	0 1 2 3 4 5 6	0 1 2 3 4 5 6
3	Balance problems	0 1 2 3 4 5 6	0 1 2 3 4 5 6
4	Dizziness	0 1 2 3 4 5 6	0 1 2 3 4 5 6
5	Fatigue	0 1 2 3 4 5 6	0 1 2 3 4 5 6
6	Drowsiness	0 1 2 3 4 5 6	0 1 2 3 4 5 6
7	Sensitivity to light	0 1 2 3 4 5 6	0 1 2 3 4 5 6
8	Sensitivity to noise	0 1 2 3 4 5 6	0 1 2 3 4 5 6
9	Irritability	0 1 2 3 4 5 6	0 1 2 3 4 5 6
10	Sadness	0 1 2 3 4 5 6	0 1 2 3 4 5 6
11	Nervousness	0 1 2 3 4 5 6	0 1 2 3 4 5 6
12	Feeling more emotional	0 1 2 3 4 5 6	0 1 2 3 4 5 6
13	Feeling slow down	0 1 2 3 4 5 6	0 1 2 3 4 5 6
14	Feeling mentally « foggy »	0 1 2 3 4 5 6	0 1 2 3 4 5 6
15	Difficulty concentrating	0 1 2 3 4 5 6	0 1 2 3 4 5 6
16	Difficulty remembering	0 1 2 3 4 5 6	0 1 2 3 4 5 6
17	Visual problems	0 1 2 3 4 5 6	0 1 2 3 4 5 6
18	Get confused with directions or tasks	0 1 2 3 4 5 6	0 1 2 3 4 5 6
19	Move in a clumsy manner	0 1 2 3 4 5 6	0 1 2 3 4 5 6
20	Answer questions more slowly than usual	0 1 2 3 4 5 6	0 1 2 3 4 5 6
21	In general, to what degree do you feel « differently » than before the injury (not feeling yourself)?	0 1 2 3 4 Circle your rating with « 0 » indicating « Normal » (No difference) and « 4 » indicating « major différence »	

Methods

Assessment: Balance/Coordination

❖ Sport Concussion Assessment Tool (SCAT3)



6 Balance examination
Do one or both of the following tests.
Footwear (shoes, barefoot, braces, tape, etc.) _____

Modified Balance Error Scoring System (BESS) testing⁵
Which foot was tested (i.e. which is the non-dominant foot) Left Right
Testing surface (hard floor, field, etc.) _____

Condition

Double leg stance:	Errors
Single leg stance (non-dominant foot):	Errors
Tandem stance (non-dominant foot at back):	Errors

And/Or

Tandem gait^{6,7}
Time (best of 4 trials): _____ seconds

7 Coordination examination
Upper limb coordination

Which arm was tested: Left Right

Coordination score _____ of 1

Methods

Assessment: Balance/Coordination

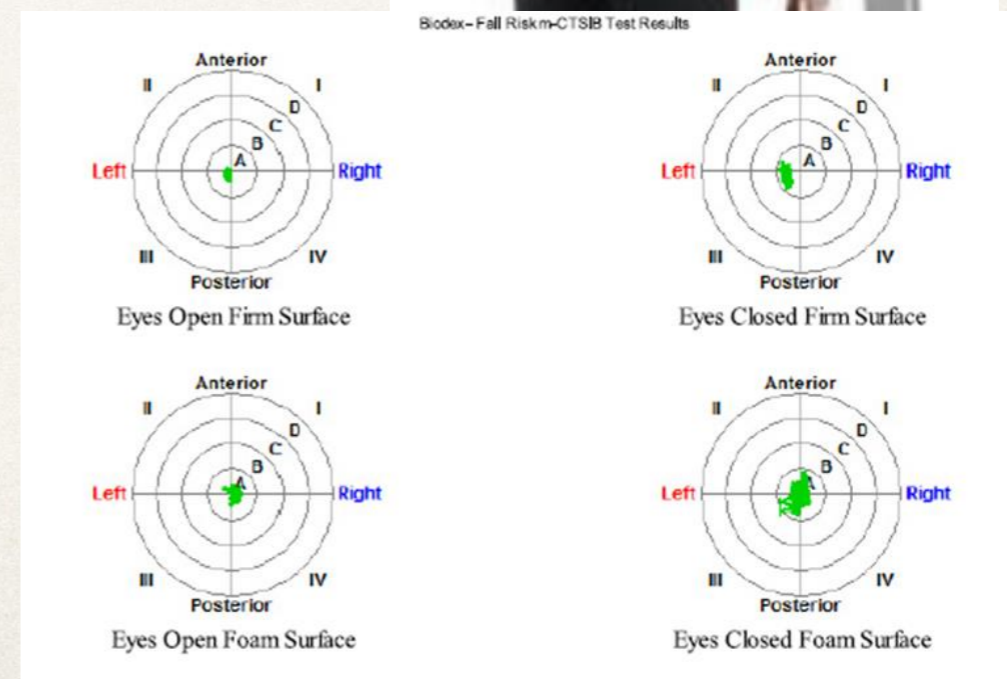
❖ BioSway

- 1) Modified Clinical Test of Sensory Interaction on Balance (mCTSIB)
- 2) Limits of stability (LOS)

Fall Risk m-CTSIB Test Results

Name: Morency Jean-Christophe	Date: 2014-02-11 11:24:00
Height: 151-165	Age: 14
Foot Placement	Protocol
Foot Angle: Left 10, Right 10	Conditions: Modified
Heel Position: Left D6, Right D16	Test Trial Time: 20 secs
	Test Trials: 1
	Cursor: OFF

Condition	Stability Index	Sway Index	Sway Index	
			Better	Worse
Eyes Open Firm Surface Baseline - Normals very stable	0.9	0.51	0.50	▲
Eyes Closed Firm Surface Somatosensory is predominant, Vestibular is secondary Normals have similar scores to eyes open firm	3.0	0.98	1.00	▲
Eyes Open Foam Surface Vision is predominant, Vestibular is secondary Normals sway more on foam than firm but remain stable	0.8	0.88	0.75	▲
Eyes Closed Foam Surface Vestibular is predominant Normals sway more with eyes closed on foam than with eyes open on foam, but remain stable	1.6	1.68	2.25	▲



Methods

Assessment: Balance/Coordination

- ❖ Bruininks-Oseretsky Test of Motor Proficiency (**BOT2**)

Subtest 4: Bilaterale coordination

Subtest 5: Balance

Subtest 7: Upper-Limb Coordination



Main results

- ❖ All participants reported full recovery.

1) Absence of postconcussion symptoms;

	Pre-intervention \pm SD	Post-intervention \pm SD	p
PCSI score (sum of 20 items)*	36.85 \pm 23.21	4.31 \pm 5.04	0.001
Self-reported abnormality score*	2.00 \pm 3.33	0.17 \pm 0.39	0.004

2) Cognitive function corresponding to standards when assessed by a neuropsychologist; and,

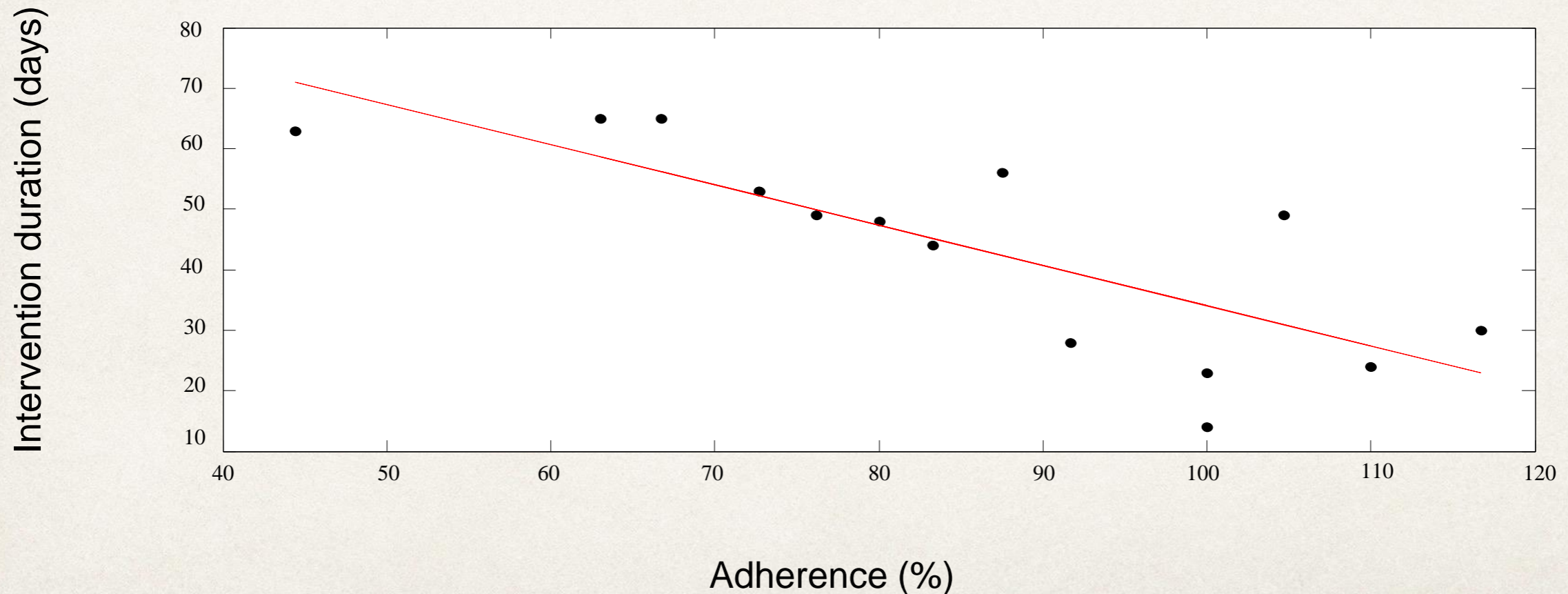
3) Absence of deficits in coordination and balance.

Main results

		Pre- Intervention ± SD	Post-Intervention ± SD	P
SCAT3				
	BESS Double leg stance	0.07 ± 0.26	0.00 ± 0.00	0.317
	BESS One leg stance*	5.20 ± 2.96	1.73 ± 2.63	0.002
	BESS Tandem stance*	2.80 ± 2.48	1.20 ± 2.01	0.032
	Tandem gait*	17.93 ± 7.89	13.21 ± 4.08	0.001
	Finger-to-nose*	3.54 ± 0.55	3.00 ± 0.48	0.001
Biosway				
	mCTSIB Eyes opened Firm surface*	0.53 ± 0.27	0.39 ± 0.17	0.027
	mCTSIB Eyes closed Firm surface	1.12 ± 0.88	0.69 ± 0.21	0.061
	mCTSIB Eyes opened Foam surface*	0.78 ± 0.21	0.67 ± 0.19	0.021
	mCTSIB Eyes closed Foam surface*	2.27 ± 0.60	1.87 ± 0.46	0.050
	LOS*	56.6 ± 13.14	70.8 ± 9.92	0.002
BOT2				
	Bilateral coordination*	12.33 ± 4.69	16.07 ± 4.03	0.008
	Balance	12.07 ± 4.82	13.27 ± 4.43	0.400
	Upper-limb coordination*	13.73 ± 4.08	18.33 ± 4.03	0.002

Main results

- ❖ Duration of the intervention (44 ± 16.5 days) was correlated to self-reported adherence to the active rehabilitation intervention program.



Conclusion

- ❖ A progressive sub-maximal active rehabilitation intervention may be beneficial when recovering from mTBI in youths.
- ❖ The majority of motor-cognitive assessment tests presented a significant improvement following the active rehabilitation intervention.
- ❖ Future studies are needed to validate this promising new approach.

Thank you!

Affiliations

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