



Development of concussion tests for para-athletes with cerebral palsy and muscular dystrophy

Francine Pilon, PhD, PT

Anousheh Vaezipour, MSc, Kin

Peter Leyser, MSc

Louis DeBeaumont, PhD

François Prince, PhD



HSCM

HÔPITAL DU SACRÉ-CŒUR
DE MONTRÉAL

Canadian Cerebral Palsy
Sports Association



L'Association canadienne de sports
pour paralytiques cérébraux



Mandate & Objectives

Mandate: Canadian Cerebral Palsy Sports Association (CCPSA)

Objectives:

- Develop a Screening and Monitoring Concussion Tests adapted to para-athletes with severe disabilities.
- Develop a Concussion Recognition Communication Board for para-athletes with speech / intellectual impairments.
- Find and adapt other standardized concussion assessment tests

BOCCIA

Paralympic sports

BC1-BC2: CP

BC3-BC4: MD, CP

International Paralympic Committee (IPC)

Eligible impairment types:

- Impaired muscle power
- Athetosis
- Impaired passive range of motion
- Hypertonia
- Limb deficiency
- Ataxia



SCAT5

Cognitive and Neurological Screening

Not Applicable:

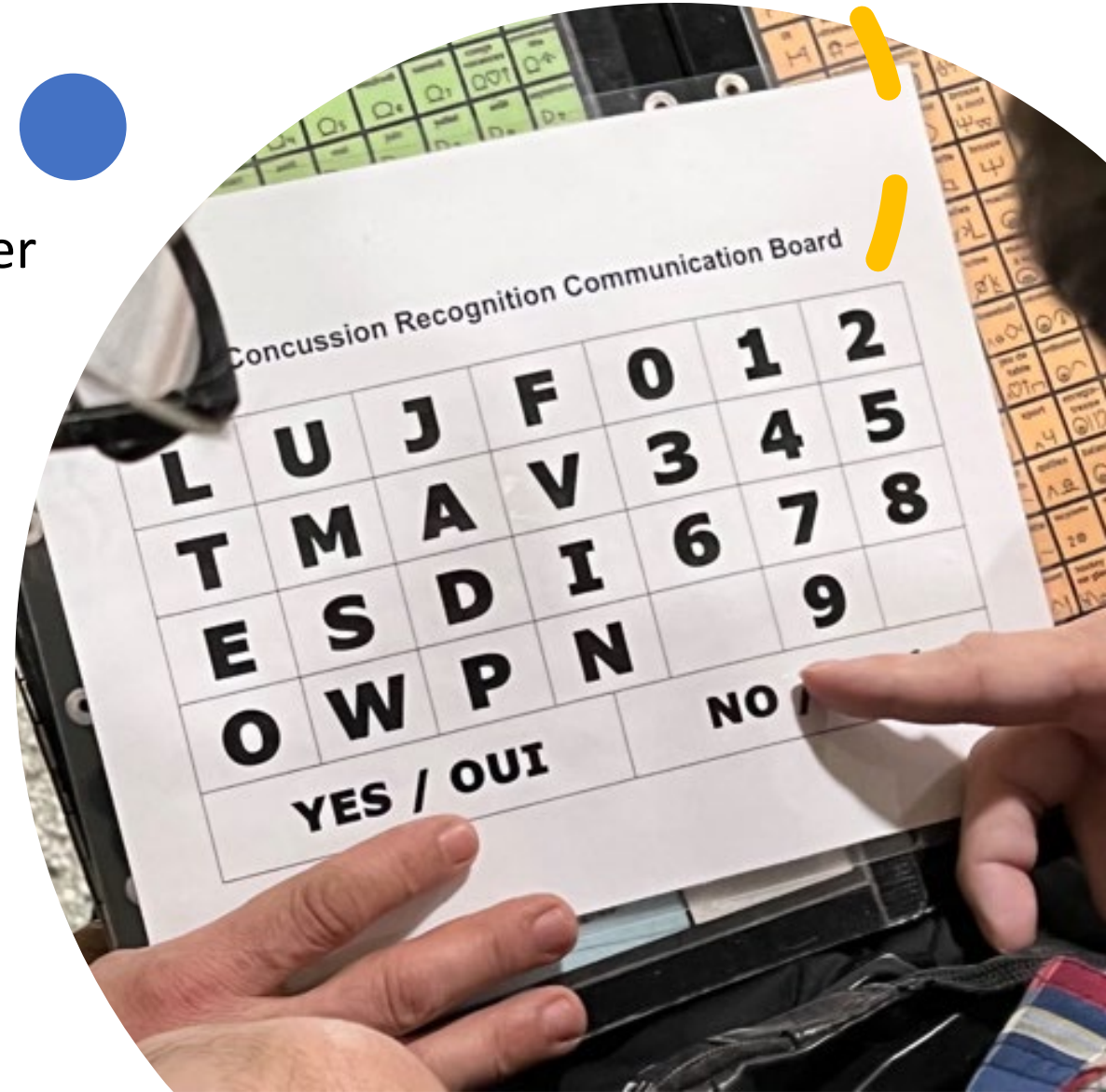
- Speech / Intellectual Impairment
- Coordination
- Walking / Standing Balance



1. Development of a
Concussion Recognition
Communication Board

Concussion Recognition Communication Board

- 16 letters, 10 numbers and a Yes or No answer
- Applicable to :
 - List of symptoms
 - Cognitive Screening





2. Coordination

Coordination Assessment for BC1



Arm Extension Coordination Test

General Considerations:

- Adapted for CP with high degree of spasticity (dystonia, chorea, athetosis).
- Seated position with the footrest of the wheelchair (WC) against the wall.

Instructions:

- Use the hand that throws the bocchia ball, start with the hand at the shoulder and reach for the target on the wall at shoulder height.
- Do as many repetitions as possible in 10s.

Coordination Assessment for BC3



General Considerations:

- Adapted for athletes with highest degree of disabilities.
- Seated position in WC with the footrest against the wall.
- The targets are positioned 30cm apart at eye level.

Instructions:

- Use your pointer to touch the two targets (Blue-Red)
- Repeat as many times as possible in 10s.

Target Coordination Test using the Pointer

Coordination Assessment for BC2 and BC4



Moving the Ball to a Target Coordination Test

General Considerations:

- Adapted for MD and CP athletes.
- Target height and distance must be adjusted according to the maximum reach capability of the subject's arm.

Instructions:

- Transfer the six balls, one by one, towards the open target positioned lateral to the WC.
- Time (in seconds) to complete the task is recorded.



3. Balance and Locomotion



Balance and Locomotion

Description:

- The test is conducted in a manual WC (when possible).
- Distance of 12m (back and forth with turn around) staying within the width of the wheelbase.
- Time (in seconds) required to complete the task and the number of errors are recorded.
- Evaluator will note the subject postural responses and concussion symptoms triggered by the task.

Instructions:

- You can use your arms or feet to propel the WC.
- Stay within the lines and at the end of the path, Turn around as quickly as possible and Return to the starting point.



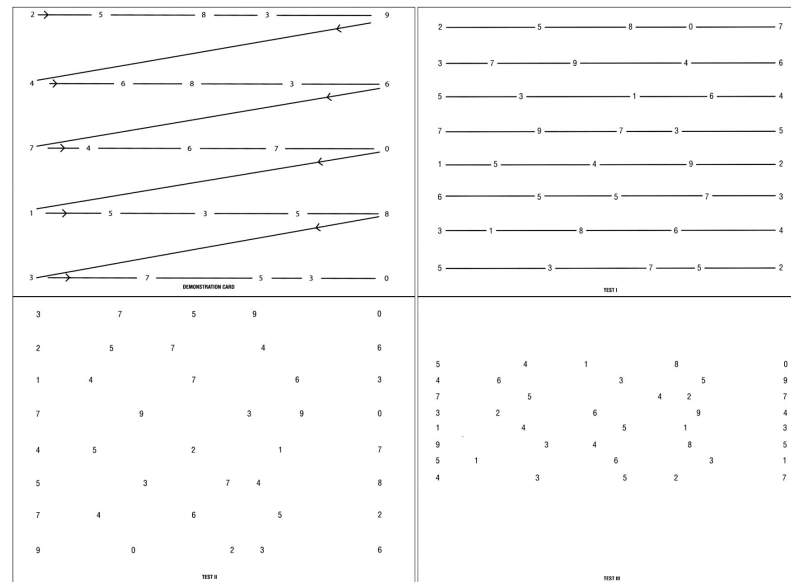
4. Other Performance Tests
Vision-Based and
Reaction Time

Vision-Based Performance Test

BC2 & BC4

King-Devick Test

- Easy to administer
- Best for detection of concussion (Harmon et al., 2022).
- When concussed, reading time is slower (Leong et al., 2014).
- Variables impacting the score at baseline (Chrisman et al., 2019):
 - Learning disabilities
 - Primary language other than English



Reaction Time Performance Tests

- Reaction Time App (non-grasping task)
- For BC1

- Drop Stick Test (grasping task)
- For BC2 & BC4



So What?

- This is the first research that proposed an adaptation of the SCAT5 for Para-Athletes diagnosed with CP and MD.
- It provides an easy assessment (baseline) to determine the impact of concussion prior to implementing the Return to Play Protocol in severely impaired para-athletes.



Key Take Away

- Need to adapt existing evaluation tools to better assess the impact of concussion in severely impaired (i.e. CP, MD) para-athletes



Next steps:

- Content Validity
- Reliability Tests (test-retest, inter-rater)





Merci de votre attention

Thank you for your attention

References

- Chrisman, S. P. D., Harmon, K. G., Schmidt, J. D., Kaminski, T. W., Buckley, T. A., Kontos, A. P., Clugston, J. R., McCrea, M., McAllister, T., Broglio, S. P., & Ortega, J. (2019). Impact of Factors that Affect Reading Skill Level on King-Devick Baseline Performance Time. *Ann Biomed Eng*, 47(10), 2122-2127. <https://doi.org/10.1007/s10439-018-02150-8>
- Del Rossi, G. (2017). Evaluating the Recovery Curve for Clinically Assessed Reaction Time After Concussion. *Journal of Athletic Training*, 52(8), 766-770. <https://doi.org/10.4085/1062-6050-52.6.02>
- Galetta, K. M., Liu, M., Leong, D. F., Ventura, R. E., Galetta, S. L., & Balcer, L. J. (2015). The King-Devick test of rapid number naming for concussion detection: meta-analysis and systematic review of the literature. *Concussion (London, England)*, 1(2), CNC8-CNC8. <https://doi.org/10.2217/cnc.15.8>
- Harmon, K. G., Whelan, B. M., Aukerman, D. F., Bohr, A. D., Nerrie, J. M., Elkinton, H. A., Holliday, M., Poddar, S. K., Chrisman, S. P. D., & McQueen, M. B. (2022). Diagnostic accuracy and reliability of sideline concussion evaluation: a prospective, case-controlled study in college athletes comparing newer tools and established tests. *British Journal of Sports Medicine*, 56(3), 144-150. <https://doi.org/10.1136/bjsports-2020-103840>
- Leong, D. F., Balcer, L. J., Galetta, S. L., Liu, Z., & Master, C. L. (2014). The King-Devick test as a concussion screening tool administered by sports parents. *J Sports Med Phys Fitness*, 54(1), 70-77.
- MacDonald, J., Wilson, J., Young, J., Duerson, D., Swisher, G., Collins, C. L., & Meehan, W. P., 3rd. (2015). Evaluation of a simple test of reaction time for baseline concussion testing in a population of high school athletes. *Clin J Sport Med*, 25(1), 43-48. <https://doi.org/10.1097/jsm.0000000000000096>