# BOXING CANADA
# CONCUSSION MANAGEMENT PROTOCOL

## CONCUSSION MANAGEMENT SUMMARY

If an athlete is suspected to have a concussion, then he/she must go through physical and cognitive rest for 24-48 hours. The athlete is required to see a physician to fill out a **medical assessment letter** for the diagnosis of concussion and to rule out other possible injuries to the brain or spine.

It is advised that a coach, physiotherapist or certified athletic therapist supervise the athlete through each step of the return-to-sport protocol to ensure safety and optimal progression. The general steps include:

1. Symptom-limited activity
2. Light aerobic exercise
3. Sport-specific exercise
4. Non-contact training drills
5. Full-contact practice, and
6. Return to competition.

Once a step is completed, the athlete must not have any new symptoms or worsening of symptoms for least 24h before starting the next step. If symptoms appear, the athlete must stop the activity and rest until symptoms resolve (minimum 24h) and return to the previous step. If symptoms appear during steps 5 or 6 of the Return-to-Sport protocol, the athlete must stop the activity and consult with a health professional before returning to their sport.

Boxing Canada recommends a minimum period of 30 days after a concussion is diagnosed before the athlete returns to sparring (step 5) or any training with the risk of physical contact. Before this step, the athlete must obtain a **medical clearance letter** from a physician and give it to their coach.

Concussion symptoms can include:

- Headache
- "Pressure in head"
- Neck plain
- Nausea or vomiting
- Dizziness
- Blurred vision
- Balance problems
- Sensitivity to light
- Sensitivity to noise
- Feeling slowed down
- Feeling like "in a fog"
- "Don't feel right"
- Difficulty concentrating
- Difficulty remembering
- Fatigue or low energy
- Confusion
- Drowsiness
- More emotional
- Irritability
- Sadness
- Nervous or anxious
- Trouble falling asleep

# BOXING-SPECIFIC RETURN-TO-SPORT PROTOCOL

**Step 1: Daily activities that do not worsen symptoms**

The athlete must avoid any physical or mental activity that worsen symptoms as well as limit looking at cellphone, computer and television screens.

Activities can include taking short walks, doing light chores, listening to music and reading a book (up to 15 min at a time).

**Step 2: Light aerobic exercise**

It is safe to begin step 2 while still having slight symptoms. It is strongly recommended that the athlete performs a cardiovascular threshold test such as the buffalo concussion treadmill test (see appendix A) with a kinesiologist to determine their symptom threshold. If this option is not available, a generic intensity level can be calculated using the Karvonen formula:

Heart rate reserve (HRR) = (220 – Age – Resting heart rate (RHR)) x % Intensity + RHR

Cardio (running or stationary bike)

- 5 min warm-up at 40% intensity
- 20 min at 60% intensity

**Step 3a: Low intensity boxing without contact**

The athlete must not have any concussion symptoms when starting step 3.

Boxing

- Footwork drills (ex: ladder, cones, displacements), 2x3 min, 1 min rest
- Shadow boxing with minimal head movements, 2x3 min, 1 min rest
- Coordination drill (ex: reflex ball, throwing ball on wall, dribbling ball on ground, throwing hacky sack with partner), 3 min

Cardio (running or stationary bike)

- 5 min warm-up 50% max heart rate (HR)
- 6x (1 min 80% max HR, 2 min 50% max HR)
- 5 min cooldown 50% max HR

Total: 50 min

**Step 3b: Medium intensity boxing without contact**

Boxing

- Light intensity jump rope (no doubles), 3 min
- Shadow boxing with moderate head movements, 3x3 min, 1 min rest
- Light intensity heavy bag, 2x3 min, 1 min rest
- Coordination drill (ex: reflex ball, throwing ball on wall, dribbling ball on ground, throwing hacky sack with partner), 5 min

Cardio (running or stationary bike) OR resistance training*

- 5 min warm-up 50% max HR
- 6x (1 min 90% max HR, 2 min 50% max HR)
- 5 min cooldown 50% max HR

Total 60 min

*Resistance training: max intensity 80% of 1 repetition maximum (RM)
Avoid Olympic lifts, jumps and exercises where head is lower than waist (e.g., back extension)
Avoid Valsalva maneuver (ensure exhale on effort)

**Step 4a: High intensity boxing without contact**

Training # 1 (priority) – Boxing

- 15 min warm-up with the team
- Jump rope without restrictions, 5 min
- Shadow boxing without restrictions, 3x3 min, 1 min rest
- Pad word OR medium intensity heavy bag, 2x3 min, 1 min rest
- Coordination drill (ex: reflex ball, throwing ball on wall, dribbling ball on ground, throwing hack sack with partner), 5 min
- 10 min cooldown / stretching

Total: 60 min

Training #2 (optional) – Cardio (running or stationary bike) OR resistance training*

- 10 min warm-up 50% max HR
- 3x (20 sec at 100% intensity, 2 min 40 sec at 50% max HR)
- 5 min cooldown at 50% max HR

Total: 24 min
*Resistance training: no restrictions

**Step 4b: Shadow boxing in pairs without contact**

During this step, if the athlete had a previous neuropsychology baseline evaluation, it is recommended that he/she returns for a second evaluation for comparison.

Shadow boxing in pairs is a technical drill where two boxers face one another and react to each other's movements to practice proper timing of attacks and defense. A coach must provide close supervision to ensure that there is enough distance between the boxers to avoid the risk of physical contact.

Training #1 (priority) – Boxing

- 15 min warm-up with the team
- Jump rope, 5 min
- Shadow boxing, 2x3 min, 1 min rest
- Shadow boxing in pairs (non-contact), 3x3 min, 1 min rest
- Heavy bag at regular intensity, 2x3 min, 1 min rest
- Coordination drill (ex: reflex ball, throwing ball on wall, dribbling ball on ground, throwing hacky sack with partner), 5 min

- 10 min cooldown / stretching

Total: 65 min

Training #2 (optional) – Cardio (running or stationary bike) OR resistance training*

- 10 min warm-up 50% max HR
- 3x (1 min at 100% intensity, 3 min at 50% max HR)
- 5 min cooldown 50% max HR

Total: 27 min
*Resistance training: No restrictions

**Step 5a: Full contact sparring: Short duration**

Before starting this step, the athlete must obtain a medical clearance letter from a physician and give it to their coach. Student-athletes must complete the Return-to-Learn protocol (see appendix B) and have returned to their previous level of school activity before this step.

There must be at least 48h between sparring sessions to allow time for rest and to assess the athlete for symptoms. Increased rest time between rounds allows the coach or therapist to assess the athlete for any concussion symptoms. If any symptoms appear, the athlete must immediately stop sparring and consult with a physician before continuing the protocol.

Training #1 (priority) – Boxing

- 15 min warm-up with the team
- Jump rope, 5 min
- Shadow boxing, 2x3 min, 1 min rest
- Full contact sparring, 3x1 min, 3 min rest (check with athlete between rounds for presence of any symptoms)
- Coordination drill (ex: reflex ball, throwing ball on wall, dribbling ball on ground, throwing hacky sack with partner), 5 min
- 10 min cooldown / stretching

Total: 60 min

Training #2 (optional) – Cardio (running or stationary bike) OR resistance training*

- 10 min warm-up 50% max HR
- 5x (1 min 30 sec at 90-95 max HR, 2 min 30 sec at 50% max HR)
- 5 min cooldown 50% max HR

Total: 35 min
*Resistance training: No restrictions

**Step 5b: Full contact sparring: Medium duration**

There should be at least 48h between sparring sessions. If any symptoms appear, the athlete must immediately stop sparring and consult with a physician before continuing the protocol.

Training #1 (priority) – Boxing

- 15 min warm-up with the team
- Jump rope, 5 min
- Shadow boxing, 2x3 min, 1 min rest

- Full contact sparring, 3x2 min, 2 min rest (check with athletes between rounds presence of any symptoms)
- Coordination drill (ex: reflex ball, throwing ball on wall, dribbling ball on ground, throwing hacky sack with partner), 5 min
- 10 min cooldown / stretching

Total: 60 min

Training #2 (optional) – Cardio (running or stationary bike) OR resistance training*

- 10 min warm-up 50% max HR
- 3x (3min at 90-95% max HR, 3 min walk)
- 5 min cooldown at 50% max HR

Total: 33 min
*Resistance training: No restrictions

**Step 5c: Full contact sparring: Regular duration**

There should be at least 48h between sparring sessions. If any symptoms appear, the athlete must immediately stop sparring and consult with a physician before continuing the protocol.

Training #1 (priority) – Boxing

- 15 min warm-up with the team
- Jump rope, 5 min
- Shadow boxing, 2x3 min, 1 min rest
- Full contact sparring, 3x3 min, 1 min rest (check with athlete between rounds for presence of any symptoms)
- Coordination drill (ex: reflex ball, throwing ball on wall, dribbling ball on ground, throwing hacky sack with partner), 5 min
- 10 min cooldown / stretching

Total: 60 min

Training #2 (optional) – Cardio (running or stationary bike) OR Resistance training*

- 10 min warm-up 50% max HR
- 3x (3min at 90-95% max HR, 1 min 30 sec walk)
- 5 min cooldown 50% max HR)

Total: 29 min
*Resistance training: No restrictions

**Step 6: Return to boxing competition**

If any symptoms appear during practice or competition, the athlete must immediately stop the activity and consult with a physician for evaluation.

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# APPENDIX A

## BUFFALO CONCUSSION TREADMILL TEST (BCTT) – INSTRUCTION MANUAL

(Adapted from Leddy, J. J., & Willer, B)

### Purpose

- To investigate exercise tolerance in patients with post-concussive symptoms (PCS) lasting more than 3 weeks.
- To help establish appropriate levels of exercise to aid in return to play for concussed athletes and assist in treatment protocols.
- To aid in differentiating between possible diagnoses for concussive symptoms (cervicogenic injury, PCS, etc.) and etiology of the concussion.
- To identify physiological variables associated with exacerbation of symptoms, and the patient's level of recovery.

### Eligibility

- Before beginning the BCTT, participants should be evaluated for medical and physical ability to exercise. Considerations may include (but are not limited to): cardiovascular illness, respiratory dysfunction, serious vestibular/balance problems, motor dysfunction, and certain orthopedic injuries.

  Do not follow the BCTT if the patient is experiencing such cervical dysfunction that the test could cause considerable pain or harm, is experiencing severe vestibular/balance issues that would impair walking on a treadmill, has a history of unstable cardiac or respiratory disease, or has a lower extremity or spinal orthopedic pathology that compromises safe walking

- The BCTT is not recommended for patients scoring higher than 7/10 for symptom severity.

**Table 1.** Contraindications to Exercise Testing

Absolute
- Acute myocardial infarction (within 2 d)
- High-risk unstable angina*
- Uncontrolled cardiac arrhythmias causing symptoms or hemodynamic compromise
- Symptomatic severe aortic stenosis
- Uncontrolled symptomatic heart failure
- Acute pulmonary embolus or pulmonary infarction
- Acute myocarditis or pericarditis
- Acute aortic dissection

Relative†
- Left main coronary stenosis
- Moderate stenotic valvular heart disease
- Electrolyte abnormalities
- Severe arterial hypertension‡
- Tachyarrhythmias or bradyarrhythmias
- Hypertrophic cardiomyopathy and other forms of outflow tract obstruction
- Mental or physical impairment leading to inability to exercise adequately
- High-degree atrioventricular block

*ACC/AHA Guidelines for the Management of Patients With Unstable Angina/Non-ST-Segment Elevation Myocardial Infarction (350) (see Table 17).
†Relative contraindications can be superseded if the benefits of exercise outweigh the risks.
‡In the absence of definitive evidence, the committee suggests systolic blood pressure of >200 mm Hg and/or diastolic blood pressure of >110 mm Hg. Modified from Fletcher et al.[7]

(Gibbons, R. J. et al, 1997)

**Safety Considerations**

- On testing, participants must be dressed for exercise (comfortable clothing, running shoes), wearing any vision or hearing aids (glasses, etc.), and should be hydrated and well rested.
- It is suggested that two persons assist in conducting the BCTT, in order to assure safety of the participant, with one individual positioned behind the participant (at back of the treadmill) at all times while test is in progress. It is also recommended that one or more persons with cardiopulmonary resuscitation (CPR) training are present during testing.
- It is important to engage in casual conversation with the patient during the exercise test to assess his/her confidence level as well as any changes in cognitive and communicative functioning. As exercise intensifies, note if patient seems to have difficulty communicating, looks suddenly pale or withdrawn, or otherwise appears to be masking serious discomfort.
- Be aware of postural and structural changes (slouching, rounding the back, leaning head) - noting the patient's thoracic and cervical posture can offer clues on the etiology of the injury.

## Preparation

### Equipment Requirements

- Treadmill with capacity to reach 15 degrees of elevation

  *Note*: Test can be adapted for treadmills, which can reach a minimum of 12 degrees elevation
- Heart rate monitor (Polar brand recommended)
- Borg RPE Scale (Rating of Perceived Exertion) and Concussion Symptom Severity Scale (Likert scale) – see appendix C and D
- Test Results form for monitoring heart rate, changes in RPE and symptoms, and relevant observations
- Chair, water and towel for participant recovery after exercise

### Setup

- Attach heart rate monitoring device according to manufacturer's instructions
- Post RPE and Symptom scales within comfortable viewing distance of participant while on treadmill (it is suggested that participant should **not** have to turn head to view scales)

## Test Protocol

### Starting the Test

1. Inform participant about test procedures and what to expect during the BCTT.

2. Explain and demonstrate the RPE and Likert scales and obtain resting scores. Remind participant that he/she will be asked to rate exertion and symptom severity at each minute during exercise.

   The RPE scale is a measure of perceived physical activity, and can be explained to participants as a measure of "how hard you feel like your body is working". The scale's numbers (6-20) and descriptors should be pointed out.

   The Likert symptom scale is a measure of symptom severity ("how good/bad your symptoms are making you feel right now"), and should be distinguished as being distinct from RPE. The scale's numbers (1-6) and pictures (expressions of physical pain) should be pointed out.

3. Patient should begin by standing on the ends of the treadmill while the treadmill is turned on. The experimenter should set treadmill at a speed of **3.6mph (5.8kph)** for patients over 5'5", and **3.2mph (5.1kph)** for those 5'5" and under. Starting incline is **0 degrees**. Speed can be adjusted depending on athletic status or overall comfort of treadmill speed – patients should be moving at a brisk walking pace.

4. After one minute at this pace, treadmill incline is increased to 1 degree. Participant is asked to rate RPE and symptom severity. Subjective scores and heart rate (bpm) are recorded. This procedure is repeated each minute, with ratings and heart rate being recorded, and treadmill increasing in incline at a rate of 1 degree/minute.

Changes to Likert rating should be specifically clarified/noted (for example, if the rating moves from 2 to 3, it should be clarified if this reflects the addition of a new symptom, increased severity of an existing symptom, etc.).

Experimenter should also record general observations as the test progresses.

5. Once treadmill reaches maximum incline (15 degrees or 12 degrees in modified test), speed is increased by **0.4mph (0.6kph)** each minute in lieu of increased incline.

6. Once test is terminated (see below), speed is reduced to **2.5mph (4.0kph)** and incline reduced safety back to 0 for a 2-minute cooldown (if participant is safe to continue). During this time, Likert ratings should continue to be reported each minute.

**Terminating the Test**

Test continues until:

- Maximum exertion (RPE score of 19.5) is reported **or**
- Test is terminated by experimenter due to a symptom exacerbation that causes significant increase in pain or symptom severity (an increase of more than 3 points on the Likert scale from resting score, addition of several new symptoms, or marked increase in severity of symptoms resulting in difficulty continuing test) **or**
- Experimenter notes a rapid progression of complaints (ex. headache to searing focal pain) between symptom reports, patient appears faint or unsteady, or determines that continuing the test constitutes significant health risk for the participant, **or**
- Patient reports an inability to continue the test safely

**Outcomes**

**Diagnosis**

- The BCTT can be used in conjunction with balanced error scoring, cervical proprioceptive screening, manual assessment and soft tissue palpation to determine the presence/absence of post-concussion syndrome or cervical/thoracic injuries.

  Patients who have symptoms, but do not have a physiologic threshold (can exercise to max) should be evaluated for dysfunction of the cervical spine, vestibular system or temporomandibular region.

**Treatment/Return to Play**

- On completion of the BCTT, concussion patients may be given an exercise prescription based on 80% of the maximum heart rate reached **without** symptom exacerbation. Patients are instructed to exercise at this level for 20 minutes daily without exceeding the time, or heart rate constraints.

  Patients may increase heart rate by swimming, walking or stationary cycling - the athlete should not attempt resistance training.

  If any post-concussion symptoms return along the progression, the athlete must return to the previous asymptomatic stage/maximum heart rate.

- If the patient can exercise to voluntary exhaustion on the BCTT without eliciting symptoms, you

may begin the process of returning him/her to play by following the five- step return to play program of the Zurich Consensus Statement.

- Other prescriptions and recommendations will be based on the patient's particular complaints. A patient may be recommended for cervical physical therapy, vestibular physical therapy, infusion therapy or treatment for temporomandibular joint disorders.

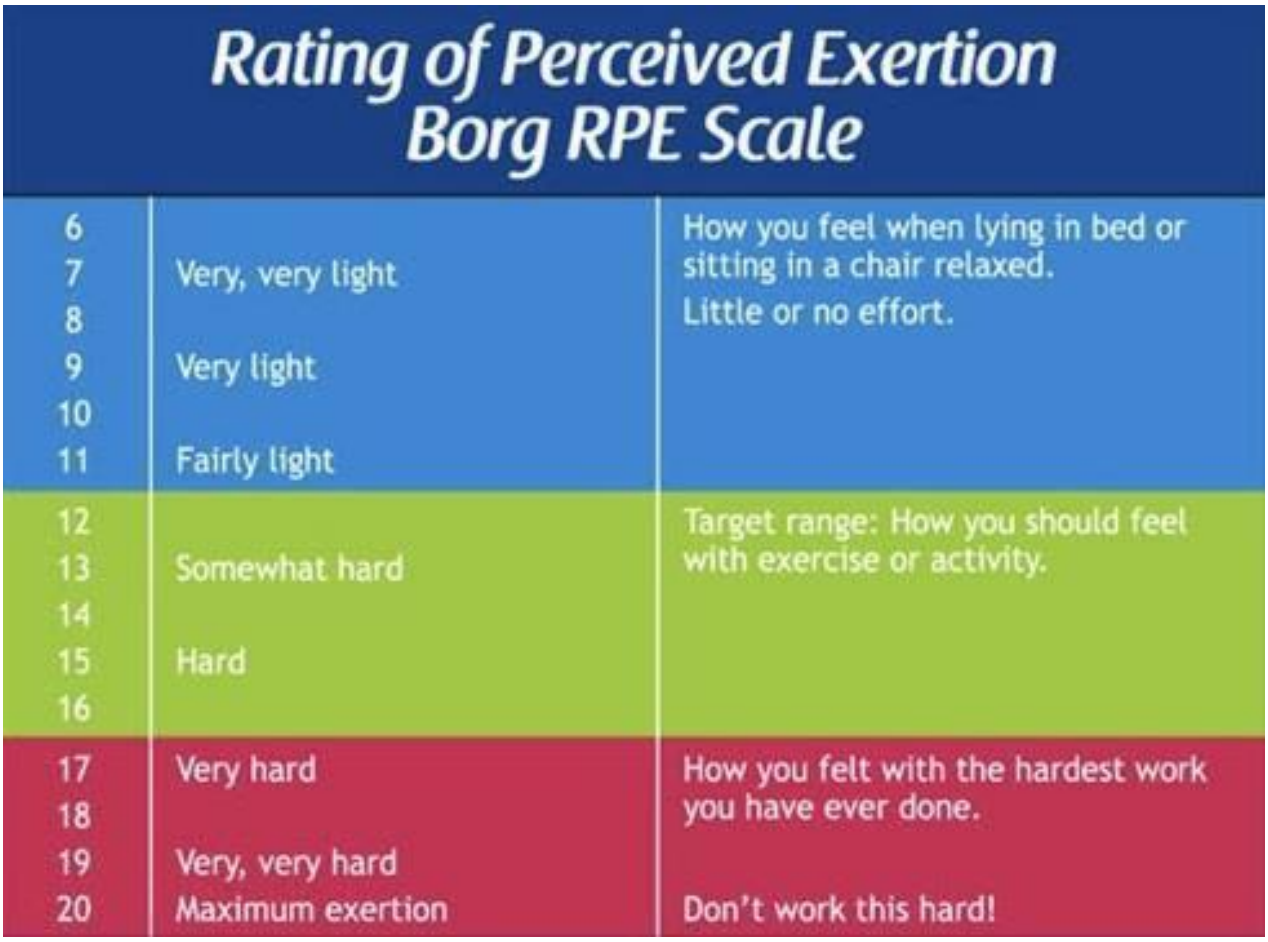
# APPENDIX B

## RETURN-TO-LEARN PROTOCOL

| Step | Aim | Activity | Goal |
|---|---|---|---|
| 1 | Daily activities at home that do not give the child symptoms | Typical activities of the child during the day as long as they do not increase symptoms (e.g., reading, texting, screen time). Start with 5–15 min at a time and gradually build up | Gradual return to typical activities |
| 2 | School activities | Homework, reading or other cognitive activities outside of the classroom | Increase tolerance to cognitive work |
| 3 | Return to school part-time | Gradual introduction of schoolwork. May need to start with a partial school day or with increased breaks during the day | Increase academic activities |
| 4 | Return to school full-time | Gradually progress school activities until a full day can be tolerated | Return to full academic activities and catch up on missed work |

## APPENDIX C

**Borg RPE Scale (Rating of Perceived Exertion)**



# APPENDIX D

## CONCUSSION SYMPTOM SEVERITY SCALE (Likert Scale)

Player's Name: _____ Team: _____ Position: _____

| SYMPTOM | RATING None Mod. Severe | BASELINE Date: | TESTING 2 Date: | TESTING 3 Date: | TESTING 4 Date: | TESTING 5 Date: |
|---|---|---|---|---|---|---|
| Headache | 0 1 2 3 4 5 6 | | | | | |
| Nausea | 0 1 2 3 4 5 6 | | | | | |
| Vomiting | 0 1 2 3 4 5 6 | | | | | |
| Balance problems | 0 1 2 3 4 5 6 | | | | | |
| Dizziness | 0 1 2 3 4 5 6 | | | | | |
| Fatigue | 0 1 2 3 4 5 6 | | | | | |
| Trouble falling asleep | 0 1 2 3 4 5 6 | | | | | |
| Sleeping more than usual | 0 1 2 3 4 5 6 | | | | | |
| Sleeping less than usual | 0 1 2 3 4 5 6 | | | | | |
| Drowsiness | 0 1 2 3 4 5 6 | | | | | |
| Sensitivity to light | 0 1 2 3 4 5 6 | | | | | |
| Sensitivity to noise | 0 1 2 3 4 5 6 | | | | | |
| Irritability | 0 1 2 3 4 5 6 | | | | | |
| Sadness | 0 1 2 3 4 5 6 | | | | | |
| Nervousness | 0 1 2 3 4 5 6 | | | | | |
| Feeling more emotional | 0 1 2 3 4 5 6 | | | | | |
| Numbness or tingling | 0 1 2 3 4 5 6 | | | | | |
| Feeling slowed down | 0 1 2 3 4 5 6 | | | | | |
| Feeling mentally "foggy" | 0 1 2 3 4 5 6 | | | | | |
| Difficulty concentrating | 0 1 2 3 4 5 6 | | | | | |
| Difficulty remembering | 0 1 2 3 4 5 6 | | | | | |
| TOTAL SCORE | | | | | | |

Lovell, M. R., & Collins, M. W. (1998)

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