CONCUSSION MANAGEMENT

A Clinical Education Resource for Osteopaths

Based on a clinical education presentation by HeadWise Concussion Care

This resource is intended for osteopaths and allied health practitioners in Aotearoa New Zealand

Osteopaths New Zealand | Ngā Mātanga Wheua o Aotearoa

Introduction

Concussion is the most common form of traumatic brain injury encountered in clinical practice. Despite its prevalence, it remains one of the most frequently under-assessed and under-managed conditions in Aotearoa New Zealand. This resource draws on a clinical education presentation delivered by HeadWise Concussion Care during Brain Injury Awareness Month, and is designed to support osteopaths in understanding current best practice around concussion recognition, assessment, and management.

As part of an allied health team, osteopaths are well-positioned to contribute meaningfully to concussion care. The current landscape in New Zealand presents both challenges and opportunities for our profession to play a greater role.

Learning Objectives

After reviewing this resource, practitioners should be able to:

1. Describe the pathophysiology of concussion as a functional, not structural, injury
2. Recognise the signs and symptoms of concussion, including delayed presentation
3. Understand the concept and clinical value of baseline testing
4. Apply the 4Rs framework: Recognise, Remove, Refer, Return
5. Understand wraparound, multidisciplinary care in concussion recovery
6. Discuss the current landscape of concussion management in New Zealand, including the role of ACC

1. What Is a Concussion?

Definition

A concussion is a traumatic brain injury caused by a blow, bump, or jolt to the head or body that disrupts normal brain function. Symptoms may appear immediately or be delayed, sometimes by up to 14 days after the injury. This delayed presentation is a key clinical consideration.

Critical Point

A concussion does NOT require a blow to the head. A significant impact to the body alone can cause sufficient acceleration forces to the brain to result in concussion.

Loss of consciousness is NOT required. Only 10% of people who suffer a concussion lose consciousness.

Pathophysiology: A Functional, Not Structural, Injury

Contemporary understanding recognises concussion as primarily a functional injury rather than a structural one. This distinction has important clinical implications.

The mechanism involves rapid acceleration and deceleration of the brain within the skull. The white and grey matter of the brain, having different densities, move at different rates during this motion. This shearing effect disrupts cell membranes without necessarily causing visible structural damage.

As a result:

- Concussion does not appear on CT or MRI scans
- Patients who present having had a 'clear scan' following head injury may still have had a concussion
- The absence of visible injury on imaging must not be communicated as 'all clear'

Following the initial mechanical event, two distinct phases of physiological disruption occur:

Phase	What Happens	Clinical Implication
Phase 1 - Electrical Storm	Rapid firing of brain cells produces a barrage of neurological symptoms. Chemical exchanges disrupt normal cell function. The brain requires more energy at a time when less is being produced - creating an energy crisis.	Ringing in ears, visual disturbance, cognitive symptoms, confusion, headache, memory difficulties.
Phase 2 - Metabolic Vulnerability	Symptoms may resolve but the brain has not returned to its pre-injury metabolic state. This is the most dangerous period. Cerebral energy levels remain low while the individual may feel symptom-free.	Most 'return to activity' decisions are made incorrectly at this stage. A minimum of 30-40 days away from risk activities is indicated, irrespective of symptom resolution.

Second Impact Syndrome

Second impact syndrome occurs when a second concussive event happens before the brain has metabolically recovered from the first. Although rare, the consequences can be severe and permanent.

The ATP (adenosine triphosphate) energy levels in affected brain cells, which have already been depleted by the first injury, drop further following a second insult. If energy levels fall below a critical threshold, cell death can occur - with potential for permanent neurological change.

Clinical Note for Osteopaths

When assessing patients involved in equestrian, cycling, rugby, football, or other contact/risk sports, always take a detailed concussion history. Do not assume that prior concussions have fully resolved simply because the patient reports feeling well. Ask specifically:

- Have you had previous concussions?
- Did you feel you fully recovered each time?

- Are you getting concussed more frequently or with less force over time?

2. Concussion in Aotearoa New Zealand

The Scale of the Problem

Concussion is a significant public health issue in New Zealand. Key statistics from ACC and related sources highlight the burden:

Key Statistics

- Estimated 36,000 people in New Zealand suffer a concussion every year
- 95% of concussions are classified as mild
- 34% of people who sustain a concussion do not have their injury assessed
- 21% of all head injuries in NZ are sports-related
- In 2023, ACC accepted approximately 10,500 claims for sports-related concussions, at a cost of $64 million - the highest number in five years
- 11% of sports-related concussion claimants had multiple concussions within a two-year period
- Evidence shows repeat concussions may cause decline in general health and quality of life for up to 10 years post-injury
- Up to 40% of concussion sufferers will experience prolonged symptoms beyond 40 days (previously estimated at 20%)

Equestrian and Cycling Context

For practitioners working with equestrian athletes or cyclists, specific data is relevant:

- In 2021, females made up 94% of horse-related concussions
- The most susceptible age groups for horse-related injury were 10-14 year olds, followed by 15-19 year olds
- A Mountain Bike New Zealand study found that one-third of riders over a seven-day competition did not recognise when they had sustained a concussion
- 67% of riders with concussion symptoms continued to ride

The Access and Referral Problem

One of the most significant barriers to good outcomes in New Zealand is the delay between injury and appropriate assessment. The current pathway typically requires a GP referral to an ACC concussion service, with an average wait of seven weeks from injury to first specialist contact.

Research clearly indicates that the strongest predictor of a positive outcome following concussion is how quickly a person accesses appropriate professional care - ideally within the first week of injury.

Implication for Allied Health

Concussion management is currently heavily medicalised in New Zealand. Allied health, including physiotherapy and osteopathy, remains on the periphery of the formal concussion care pathway. Sports physicians attending relevant conferences have acknowledged this gap and are calling for allied health to take a greater role. The opportunity for osteopaths to be early-access, well-informed clinicians is significant.

ACC Policy Changes

ACC has introduced new community sport concussion policy changes, to be rolled out through grassroots sporting codes. Key changes include:

- Players must be symptom-free for 14 days post-injury before commencing a graduated return to play
- A mandatory 21-day period away from full competition before clearance to return
- Medical clearance required prior to return to play

This standardisation across sporting codes is a positive development, particularly for young people who may participate in multiple sports with previously inconsistent protocols.

3. Recognition: Signs, Symptoms and Differential Diagnosis

Signs vs Symptoms

Understanding the distinction between signs and symptoms is important when assessing and documenting concussion:

Signs (Observable by Others)	Symptoms (Reported by Patient)
Appears dazed, stunned, or confused	Headache
Disorientation	Nausea or vomiting
Behaviour or personality changes	Dizziness or balance problems
Cannot recall events before or after impact	Double or blurred vision
Loss of consciousness (minority of cases)	Sensitivity to light or noise
Evidence of facial injury or helmet damage	Concentration or memory difficulties
	Feeling sluggish, hazy, or 'not right'

It is critical to note: not every sign or symptom will be present in every case. Symptoms can develop gradually and may not appear immediately after the injury event.

Concussion vs Whiplash: Differential Considerations

There is significant symptom overlap between whiplash and concussion, and the two conditions can co-exist. A detailed mechanism of injury assessment is essential for accurate differentiation.

Whiplash	Concussion
Typically 7G of force	Typically 70-120G of force
Primarily cervical musculoskeletal	Primarily neurological/functional brain injury
No cognitive impairment expected	Cognitive symptoms common (memory, concentration)
Responds to musculoskeletal treatment	Requires structured graduated return to activity protocol
Imaging may show relevant findings	Imaging is typically normal - NOT diagnostic

Clinical Caution

Some patients may have been told by a previous practitioner that their presentation is 'definitely a concussion.' Take care to form your own evidence-based assessment from a thorough mechanism of injury history. Patients can be strongly attached to a diagnosis they have carried for years. It is equally important not to dismiss a concussion that has been appropriately identified.

4. The 4Rs of Concussion Management

The 4Rs provide a simple, memorable framework for concussion management. They align with Sport New Zealand guidance and ACC-endorsed protocols.

R	Action	What This Means in Practice
RECOGNISE	Know the signs and symptoms	Assess the mechanism of injury. Look for both signs and symptoms. Do not rely on loss of consciousness as a prerequisite. Symptoms may be delayed.
REMOVE	Remove from activity immediately	The person should not return to play, riding, or any activity with risk of re-injury on the day of suspected concussion, regardless of symptom severity.
REFER	Refer to a medical professional	Confirm diagnosis and initiate treatment plan. Early referral (within the first week) is the strongest predictor of positive outcome. Telehealth can be effective for initial assessment.
RETURN	Graduated return to sport/work/school	Return must be evidence-based and gradual. Minimum 14 days symptom-free before commencing return-to-play progression. Minimum 21 days before full competition. Medical clearance required.

5. Concussion Management: Evidence-Based Guidance

What to Do

- Seek professional assessment early - within the first week of injury
- Follow a low-carbohydrate, gluten-free diet during recovery (reduces inflammatory load)
- Exercise safely - this is medicine, but must be appropriately dosed (see below)
- Take short naps if fatigued - approximately 20 minutes; avoid extended daytime sleep
- Manage energy carefully - understand the 'flat battery' effect of concussion
- Obtain appropriate supplementation advice from a qualified practitioner
- Follow a documented, individualized treatment plan
- Get sunlight exposure in the morning to support circadian rhythm
- Gradually desensitise to light and noise rather than avoiding them

What to Avoid

- Waiting to see 'how it goes' before seeking help
- Returning to any activity with risk of re-injury before medical clearance
- Alcohol or caffeine during recovery
- High-carbohydrate, high-processed-fat diets
- Allowing heart rate to spike excessively during exercise
- Locking yourself in a dark room with noise-cancelling earphones
- 'Toughing it out' - this approach is not effective and risks worsening outcomes
- Extensive daytime sleep that disrupts circadian rhythm

Commonly Misunderstood Advice

Recommending complete rest and isolation in a darkened room is outdated advice that can worsen sensitisation to light and noise. Our nervous system requires gradual re-exposure to stimuli - not avoidance. Similarly, the instinct to 'wait and see' delays access to care that is most impactful in the first week.

Exercise as Medicine

Controlled, graduated exercise is an important component of concussion rehabilitation. However, the correct approach requires understanding of the autonomic changes that occur following concussion:

- Heart rate variability is altered following concussion, producing unpredictable spikes in heart rate
- These spikes correlate with symptom exacerbation and can reduce confidence in exercise
- The aim of exercise rehabilitation is not cardiovascular fitness - it is normalisation of the sympathetic nervous system and restoration of appropriate blood supply to the brain

The Buffalo Concussion Treadmill Test is the clinical standard for establishing safe exercise thresholds. The protocol involves a graduated walking test with continuous heart rate monitoring and symptom scoring. If symptoms increase by three or more points on the symptom severity scale, the test is stopped. Exercise is then prescribed at 80% of the heart rate at which symptoms emerged.

For patients who cannot access clinic-based treadmill testing:

- Stationary cycling is ideal - provides steady-state cardio without postural variability or risk of fall
- Use a smart watch or heart rate monitor to track and limit spikes
- Outdoor walking on flat terrain can be an early starting point

Practitioner Note

If a patient on a stationary bike reports headache onset after 10 minutes, do not advise them to 'push through.' Investigate whether symptoms are vestibular in nature (dizziness, balance changes). Consider whether posture or cervical load may be contributing. The Buffalo Treadmill Test would provide objective threshold data in this scenario.

Nutritional and Supplementation Considerations

There is good evidence supporting targeted nutritional supplementation during concussion recovery:

Supplement	Rationale
Omega-3 Fatty Acids (high quality)	Strong research evidence. Concussion triggers a significant neuroinflammatory response. Omega-3 fatty acids help reduce this inflammatory load. Quality and dose are critical - not all products are equivalent.
Magnesium (minimum 400mg/day)	Following concussion, disrupted cell membranes allow calcium to enter cells, binding to mitochondria and contributing to the energy depletion. Magnesium acts as a calcium channel blocker. Also critically important for sleep quality.
Low-carbohydrate diet	Reduces inflammatory load and supports brain energy metabolism during the recovery phase.

Patients should be directed to obtain supplementation guidance from a qualified practitioner rather than purchasing over-the-counter products without clinical oversight.

6. Baseline Testing: The Gold Standard

What Is Baseline Testing?

Baseline testing involves a series of pre-injury assessments conducted when an individual is well, establishing their individual normal levels of cognitive and physical functioning. These results serve as a personal benchmark against which post-injury performance can be compared.

Baseline testing is multimodal - combining physical and neurocognitive assessments. It is the most effective objective method for determining whether the brain has recovered from a concussion, independent of symptom reporting.

Why Baseline Testing Matters

Research shows that 35% of patients who feel 100% symptom-free and believe they are ready to return to activity will fail objective cognitive testing - meaning their brain has NOT recovered. Symptom resolution is an unreliable indicator of brain recovery.

What Does Baseline Testing Include?

- Detailed concussion history - frequency, mechanism, trends over time
- Full medical history including ADHD, depression, and other relevant factors (individuals with ADHD are statistically more likely to experience prolonged concussion symptoms; those with a history of depression are 50% more likely to experience prolonged symptoms)
- Symptom severity scoring using the SCAT5 (Sport Concussion Assessment Tool) - 22 symptoms graded 0-6, maximum score 132
- Concentration, visual tracking, and processing speed assessment
- Balance testing including dual-task conditions
- Postural sway and reaction time measurement
- Delayed recall testing

Clinical and Practical Information

- Baseline tests are quick and inexpensive
- Results are valid for approximately one year
- Tests should be conducted when the individual is well
- A baseline test is not required to diagnose concussion - but it removes guesswork from return-to-activity decisions
- Post-injury testing can be compared directly to baseline, providing objective evidence of recovery regardless of symptoms

Baseline testing is standard practice in North American sporting organisations. In Aotearoa New Zealand, it remains relatively uncommon but is gaining traction - particularly in schools and with sporting codes. Practitioners who offer baseline testing are currently early adopters in this space.

7. Wraparound Care and the Multidisciplinary Team

Comprehensive concussion management requires a coordinated, multidisciplinary approach that addresses the physical, cognitive, and psychological dimensions of recovery.

Components of Wraparound Care

Domain	What It Involves	Team Members
Medical	Diagnosis, medication management if needed, clearance for return to activity	GP, sports physician, neurologist if required
Neurological / Vision	Assessment of visual tracking, oculomotor function, neuro-optometry	Neuro-optometrist, neurophysiotherapist
Musculoskeletal / Osteopathic	Assessment of cervical spine, posture, vestibular contributions; manual therapy as appropriate	Osteopath, physiotherapist
Cognitive Rehabilitation	Memory strategies, cognitive load management, graduated return to school or work	Occupational therapist, neuropsychologist
Psychological Support	Mental health monitoring and support, managing grief around pre-injury self	Psychologist, counsellor
Nutritional	Dietary modifications, appropriate supplementation	Practitioner with concussion knowledge

The Psychological Burden of Concussion

Concussion patients frequently experience significant psychological distress - an aspect of care that is often under-addressed. This applies to both acute presentations and chronic, ongoing concussion situations.

Patients may face:

- Inability to work or reduced work capacity
- Absence from school and falling behind academically
- Social disconnection and loss of contact with friends and family
- A profound sense of gap between their pre-injury self and who they are now

Addressing this psychological dimension is not optional - it is essential. A therapeutic approach focused not on revisiting the past but on building strategies and tools for moving forward is most effective.

Education as Treatment

Education is one of the most impactful components of early concussion care. A structured first appointment - taking a thorough history, explaining concussion clearly, and providing a written care plan - is often more valuable than hands-on treatment at that stage.

Concussion patients particularly benefit from having a written, individualised plan that specifies:

- Where they are in the recovery process
- What they should and should not do
- What to expect in terms of symptom fluctuation
- What triggers an escalation in care

This structure provides certainty and agency during a disorienting and often frightening experience.

8. Chronic and Historical Concussion

Recovery from concussion is not limited to the acute phase. People who have sustained concussions years - even decades - earlier can still make significant functional improvements with the right care plan and commitment.

Case Example Shared in Presentation

A patient was seen during the COVID-19 period whose concussion had occurred seven years prior. With no access to hands-on care, a carefully constructed telehealth treatment plan was implemented. The patient maintained daily symptom reporting and strict adherence to the plan. Over three months, her symptom severity score reduced from the high 70s to the low teens - with no manual therapy. The key drivers were the quality of the care plan and the patient's recovery mindset.

Key principles for managing historical or chronic concussion:

- A history of prior concussion does not mean a person cannot recover
- Recovery mindset and patient engagement are the strongest modifiable predictors of outcome
- Clinicians should not tell patients they 'cannot get better'
- The Buffalo Concussion Treadmill Test remains a valid tool for establishing safe exercise parameters, even long after the initial injury
- Multiple prior concussions require careful assessment. If a patient is getting concussed more easily or with less force over time, this warrants a frank discussion about risk and activity modification

For patients with multiple prior concussions, the key questions are:

7. Did you feel you fully recovered from each previous concussion?
8. Have you noticed that you are becoming concussed more easily, with less force?
9. Are your symptoms taking longer to resolve with each subsequent concussion?

A positive answer to questions 2 or 3 warrants a serious, collaborative conversation with the patient about their activity choices, risk exposure, and long-term health.

9. The Role of Osteopaths in Concussion Care

Where We Fit

Osteopathy is well-suited to play a role in concussion management, particularly in the following areas:

- Cervical spine assessment - differentiating cervicogenic contributions from primary concussion symptoms
- Vestibular assessment and management contributions
- Postural assessment
- Musculoskeletal treatment of co-existing whiplash or injury
- Patient education and care plan support
- Monitoring symptom progression and flagging need for further referral

What We Cannot Do

It is important that osteopaths understand the limits of our scope within concussion management:

- We cannot make the primary diagnosis of concussion (currently a medicalised diagnosis in New Zealand)
- We cannot clear a patient for return to sport or contact activity - this requires medical clearance
- We should not provide manual therapy to the head in the acute phase without appropriate training

ACC and Future Funding Considerations

At present, concussion management in New Zealand remains a medicalised pathway. Osteopaths are not formally integrated into the ACC concussion referral framework.

However, this is an area of active discussion. Sports physicians themselves have acknowledged that allied health must play a greater role given the volume of presentations and the referral delays inherent in the current system. ACC is also in dialogue with providers about what evidence and data would be required to support broader allied health involvement.

Advocacy Opportunity

Osteopaths New Zealand is well-positioned to engage with this evolving conversation. Contributing to research, building relationships with concussion care networks such as CCMI (Complete Concussion Management International), and documenting clinical outcomes within our existing ACC work all support the case for expanded allied health involvement.

10. Quick Reference Summary

Red Flags: Refer Urgently to Emergency Services

- Prolonged loss of consciousness
- Seizure activity
- Repeated vomiting
- One pupil larger than the other
- Worsening headache
- Slurred speech or inability to be woken
- Suspected skull fracture

Do's and Don'ts at a Glance

DO	DON'T
Seek assessment within the first week	Wait to see how it goes
Follow a written, individualized care plan	Return to risk activity without medical clearance
Exercise safely with heart rate monitoring	Exercise to the point of symptom spike
Eat a low-carbohydrate, anti-inflammatory diet	Eat high-carbohydrate or high-processed-fat foods
Take short naps (approx. 20 minutes)	Sleep for hours during the day
Get morning sunlight exposure	Isolate in a darkened room
Gradually desensitise to light and noise	Wear dark glasses inside or use noise-cancelling earphones continuously
Consider omega-3 and magnesium supplementation with clinical guidance	Self-prescribe supplements without guidance
Support your mental health	Tough it out alone

Key Organisations and Resources

- HeadWise Concussion Care (New Zealand): headwise.co.nz
- CCMI - Complete Concussion Management International: completeconcussions.com
- ACC Concussion Information: acc.co.nz
- Sport New Zealand Concussion Guidelines: sportnz.org.nz
- Equestrian Sport New Zealand: equestriansportnz.org.nz
- Buffalo Concussion Treadmill Test protocol - available through CCMI-affiliated clinics

This resource was compiled by Osteopaths New Zealand based on a clinical education presentation by HeadWise Concussion Care. It is intended as a professional development resource and does not constitute clinical protocol. Practitioners should seek further training and appropriate supervision before expanding their scope of practice in concussion management. The science around concussion is evolving rapidly; practitioners are encouraged to remain current with the literature.

Osteopaths New Zealand | info@osteopathsnz.co.nz | osteopathsnz.co.nz