



SURFING
AUSTRALIA

Sharing the Stoke

CONCUSSION POLICY

Version 2.0 | July 2023

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1. Introduction

This policy is a guideline for athletes, coaches and staff as an overview on concussion and its management. Surfing Australia acknowledges concussion as a serious medical condition in sport and an area of significant importance in surfing. This guideline is adapted from the Australian Institute of Sport (AIS) Concussion and Brain Health Position Statement, the Consensus statement on concussion in sport: the 6th International Conference on Concussion in Sport¹, Sports Medicine Australia resources and from surfing specific literature. As these resources are updated and our knowledge of concussion management evolves, this policy will be reviewed and updated.

2. What is Concussion?

Concussion is defined as a traumatic brain injury caused by contact to the head, neck or body with impulsive forces transmitted to the brain¹. This causes short-lived neurological impairment. There are multiple potential symptoms and these may evolve over the hours or days following the injury¹. Some symptoms can involve headaches, nausea, sensitivity to light, unusual fatigue and impaired balance however there are many possible symptoms and a more extensive list is below.

In surfing, a concussion can occur via numerous mechanisms such as contact with the water surface, contact with the ocean floor, through rapid acceleration-deceleration movements under water or through contact with a surfboard.

3. Education & Research

Concussion is a high priority to Surfing Australia. Surfing Australia is committed to further research in this area to ensure surfing is safe for current and future surfing generations. Surfing Australia strives to understand the prevalence and impact of concussion in surfing, promoting increased awareness alongside safety and prevention measures.

Head and neck injuries are the most common acute injury in surfing and despite this concussions are one of the least common acute injury diagnoses². A systematic review by McArthur et al., 2020², analysed 19 cross sectional studies investigating traumatic surfing injuries in competitive and recreational surfers. This reported face, head and neck injuries were the most common region across both healthcare facility studies and survey based studies at combined 33.8% of all injuries. However, of all injury types 2.3% were concussion.

Surfing Australia is currently undertaking multiple research projects in this area in particular looking at whether concussion is under diagnosed and how we can incorporate cervical and vestibular testing into prevention.

Surfing Australia also provides an annual education session to nationally categorised athletes at the High Performance Centre (HPC) which is also live streamed and recorded for access on the Surfing Australia website.

4. Concussion Baseline Testing

All Surfing Australia athletes are required to have an annual medical screen. This can be done directly through Surfing Australia's Chief Medical Officer or via the athlete's state sports institute or academy medical provider. Alternatively, this can be arranged via their local sports doctor. This screen includes a concussion history detailing previous concussions, severity and time to recovery. This also includes a mental health history detailing any symptoms of mental illness, personal history of mental illness or risk factors such as a family history of mental illness or alcohol or drug misuse. This is followed by a baseline Sports Concussion Assessment Tool 6 (SCAT6)³ and a baseline abbreviated neurocognitive test (Cognigram). The athlete's concussion history, mental health history and SCAT baseline testing are all included in the Athlete

Management System (AMS) National Institute Network (NIN) Medical Screen. Additional mental health baseline screening is recommended using Depression Anxiety and Stress Scale 21 (DASS-21)⁴.

Cognigram testing needs to be performed in a quiet area with no distractions for accurate results. This can be completed in clinic or out of clinic via the athlete's email. For any athletes needing to complete their Cognigram this can be organised via Surfing Australia through their subscription.

If the Cognigram result is 'Reproducibly Borderline' the athlete is recommended to undertake formal neuropsychological testing. If the Cognigram result is 'Abnormal' the athlete must undertake formal neuropsychological testing.

5. Training or Competition Management

A systematic review of return to learn and return to sport following sports related concussion have shown that continuing to play after a head injury and delayed access to health care providers are associated with longer recovery⁵. It is critical that concussion symptoms and/or signs are recognised early to ensure the diagnosis is not missed and that it is managed appropriately. The following protocols are to be followed if there is an incident where a surfer has a wipeout or fall involving head trauma, head knock or whiplash incident.

5.1. Medical Practitioner Present

The medical practitioner at the event or training should assess the injured surfer. If a diagnosis of concussion is made, the athlete must not resume participating on the same day under any circumstances. If the injured athlete is a coach or staff, they must not resume their coaching or work duties until cleared to do so. The athlete must adhere to the return to sport protocols.

If the medical practitioner decides the athlete is not concussed, they can resume participating as soon as they feel ready. The athlete needs to be aware that concussion symptoms can be delayed and that if any symptoms or signs develop to revisit their medical practitioner. To prevent any missed diagnoses the athlete needs to have a review after 48-72 hours to ensure no symptoms or signs have developed.

If the medical practitioner does not witness the incident they can carefully consider first responder reports. If this is the case, medical practitioners are encouraged to approach head injury from a more conservative perspective for the safety of the athlete.

5.2. No Medical Practitioner Present

If there is no medical practitioner available then the Concussion Recognition Tool below is designed to help those without medical training in concussion.

It is strongly encouraged that any concussion in a Surfing Australia athlete is reported to Surfing Australia Chief Medical Officer and/or Surfing Australia Physiotherapist to provide any assistance if required, support to the surfer and for accurate injury surveillance.

5.3. Who to see

The diagnosis of concussion must be made by a medical practitioner. This is ideally with a doctor that is familiar with concussion in sport.

For an injury WITH RED FLAGS (see Concussion Recognition in Surfing below), the surfer needs to be attended to immediately by an ambulance and sent to hospital for assessment.

For a suspected concussion WITHOUT RED FLAGS the surfer needs to see a medical doctor as soon as possible. In the first instance this should be the event doctor as above. However, if there is no doctor present, the surfer should see their nearest sports physician clinic, Emergency Department or local GP clinic for an assessment that day.

6. Concussion Recognition in Surfing

The surf specific Concussion Recognition Tool (CRT) shown below in Figure 1 has been adapted from the Concussion Recognition Tool 6⁶ which is adopted by numerous other sporting codes. This is to be used by non-medically trained individuals for the identification and immediate management of suspected concussion. It is not intended to diagnose concussion. This tool is to be made familiar to Surfing Australia coaches and performance support personnel.

Figure 1. Concussion Recognition Tool

CONCUSSION RECOGNITION TOOL

TO HELP IDENTIFY CONCUSSION IN CHILDREN, ADOLESCENT & ADULT SURFERS

RECOGNISE & REMOVE:

Head impacts can be associated with serious potential fatal brain injuries. This Concussion Recognition Tool is to be used for the identification of suspected concussion. It is not designed to diagnose concussion.

STEP 1. RED FLAGS - CALL AN AMBULANCE

If there is a concern after an injury including whether ANY of the following signs are observed or complaints are reported, then the surfer should be safely and immediately removed from surfing/activity. If no doctor or paramedic is available, call an ambulance for urgent medical assessment:

- Neck pain or tenderness
- Double vision
- Weakness or tingling
- burning in arms or legs
- Severe, or increasing headache
- Seizure or convulsion
- Loss of consciousness
- Deteriorating conscious state
- Vomiting
- Increasingly restless, agitated or combative

In all cases the basic principles of first aid should be followed:

Danger, Response, Send for help, Airway, Breathing, CPR, Defibrillation
- in a safe setting (DRS ABCD).

This includes:

- Ensure safe setting away from water, rocks or any dangers
- CALL AMBULANCE
- Call for help from surrounding people/staff
- CPR if reduced level of consciousness or not breathing as per first aid training
- Cervical spine precautions
- Do not attempt to move the surfer (other than required for airway support) unless trained to do so.
- Do not remove a helmet unless trained to do so safely.

If there are no Red Flags, identification of possible concussion should proceed to the following steps.

STEP 2. VISIBLE CLUES OF SUSPECTED CONCUSSION

Visual clues that suggest possible concussion include:

- Loss of consciousness or responsiveness
- Lying motionless on the ground
- Falling unprotected to the ground
- Facial injury
- Disorientation or confusion, staring or limited responsiveness, or an inability to respond appropriately to questions
- Dazed, blank or vacant look
- Seizures, fits or convulsions
- Slow to surface and regain balance after fall or hit to head
- Unsteady on feet / balance problems or falling over / poor coordination / wobbly

STEP 3. SYMPTOMS OF SUSPECTED CONCUSSION

PHYSICAL SYMPTOMS

- Headache
- "Pressure in head"
- Balance problems
- Nausea or vomiting
- Drowsiness
- Dizziness
- Blurred vision
- Sensitivity to light

- Sensitivity to noise
- Fatigue or low energy
- "Don't feel right"
- Neck Pain

CHANGES IN EMOTION

- More emotional
- More irritable
- Sadness
- Nervous or anxious

CHANGES IN THINKING

- Difficulty concentrating
- Difficulty remembering
- Feeling slowed down
- Feeling like "in a fog"

STEP 4. AWARENESS (IN ATHLETES OLDER THAN 12 YEARS)

Failure to answer any of these questions correctly may suggest a concussion:

- "What beach are we at today?"
- "What month is it?"
- "What day of the week is it?"
- "What year is it?"
- "What is the date today?"
- "What time is it (to nearest hour)?"

SURFERS WITH SUSPECTED CONCUSSION SHOULD:

- NOT be left alone until assessed by a medical practitioner
- NOT use any medication or drugs until they have seen a medical practitioner
- NOT drive
- NOT drink alcohol

ANY SURFER WITH A SUSPECTED CONCUSSION NEEDS TO BE SEEN BY A MEDICAL PRACTITIONER, EVEN IF THE SYMPTOMS OR SIGNS RESOLVE.

7. Managing Concussions

It is important the athlete is educated on concussion, its management and current medical evidence on potential short and long term consequences. The responsibility in management of concussion is shared between the athlete, parents, coaches, medical doctor and physiotherapist. In a complex concussion this can sometimes also involve other providers such as neuropsychologists, clinical psychologists, vestibular physiotherapists and neurologists.

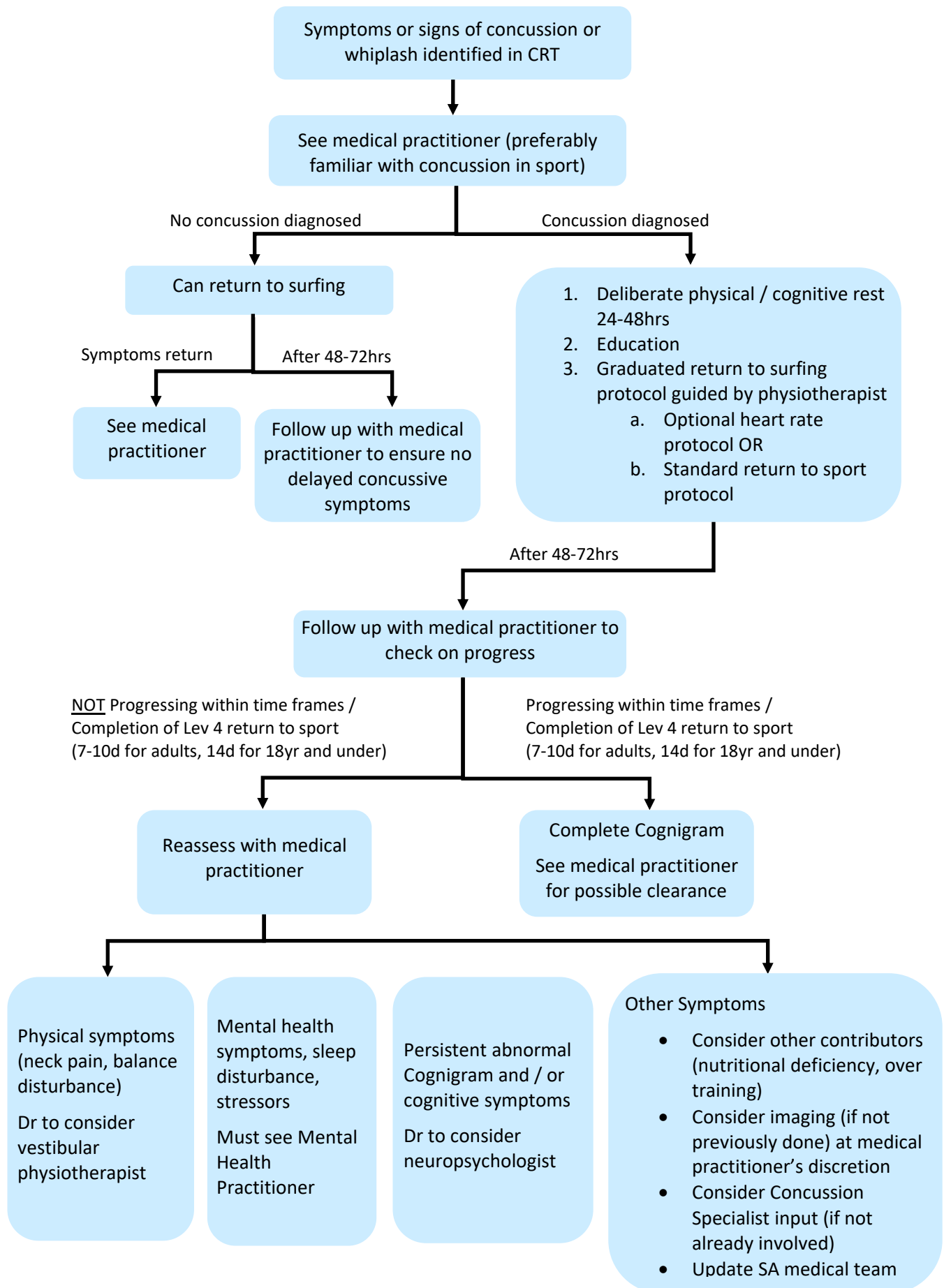
7.1. Medical Assessment of Concussion

The diagnosis of concussion should be made by a medical practitioner familiar with concussion and sports medicine policy. This will generally be through history and examination and include a Sports Concussion Assessment Tool 6 (SCAT)³ assessment within the first 72 hours alongside any video footage if available. The Sport Concussion Office Assessment Tool (SCOAT6)⁷ may be used in the sub-acute setting, typically from 72 hours (3 days) after injury.

Head injury advice should be given to all surfers with concussion. Any surfer with suspected or confirmed concussion should remain in the company of a responsible adult and not be allowed to drive. They should be advised to avoid alcohol and check medications with their doctor. Specifically, they should avoid aspirin, non-steroidal anti-inflammatory drugs (including ibuprofen), sleeping tablets and sedating pain medications.

The following Concussion Management Flow Chart (Figure 2) illustrates the process that will be followed with athletes who present with signs and symptoms of concussion or whiplash as identified using the Concussion Recognition Tool (CRT) shown in Figure 1.

Figure 2. Concussion Management Flow Chart



7.2. Whiplash and Concussion in Surfing

There is symptom overlap between whiplash injuries and concussion with neither having a gold standard diagnostic tool. Whiplash can cause headaches, fatigue, dizziness and cognitive impairment⁸. Given the overlap of symptoms, similarities with the neurophysiology and biomechanical forces and that they are not exclusive to each other raises the possibility of these being undiagnosed concussive episodes⁸. All surfers who have a 'whiplash' diagnosed need to be assessed and have concussion excluded.

7.3. Mental Health and Concussion

It has been recognised that mental health is central to concussion recovery with significantly higher levels of mental health difficulties post concussion⁹. A recent position paper estimates about 30% of sport-related concussions will require emotional and mood-related support¹⁰. In the acute phase, it seems these symptoms are reasonably common and the majority resolve without targeted intervention. However, it is the experience of Surfing Australia that in cases where these symptoms continue and/or pre-existing mental health issues are present, more targeted psychological intervention is required.

Surfing often represents a way of life these athletes and plays an active role in their ongoing wellbeing. This alongside financial implications, unpredictability of the injury and the strenuous surfing calendar can all contribute to the added mental health burden.

All surfing athletes diagnosed with concussion require a mental health assessment and are offered mental health support. The Depression Anxiety Stress Scale (DASS-21)⁴ which contains subscales for Anxiety, Depression and Stress should be completed by the concussed athlete no sooner than 48 hours post-concussion and no later than 7 days and then again 2 weeks later to assess the continued presence of affective symptoms which require referral to an appropriate psychologist.

The DASS-21⁴ does not assess for behavioural symptoms such as social withdrawal and avoidance which is worth noting, particularly in cases where individuals may be at risk of under reporting emotions. When encountering clinical features such as isolation, anger, confusion, fear/anxiety of return to sport, it can be challenging to determine whether the dominant drivers are physiological, as opposed to a psychological response to injury e.g., isolation, anger, confusion, fear/anxiety of return. Finally, pre-existing mental health issues (e.g., mood, anxiety, PTSD, insomnia) present as a risk factor for prolonged recovery and should be given consideration in terms of rehabilitation plans and assessing outcomes.

7.4. Cervical and Vestibular Function and Concussion

Surfing requires frequent and prolonged cervical extension while paddling and vestibular function for balance. Neck dysfunction, neck pain and impaired balance are common symptoms of head and neck injury, particularly when resulting from a whiplash mechanism, and may significantly impede surfing capability. Impaired balance can also increase the risk of subsequent musculoskeletal injury.

A surfer who has impaired balance, dizziness or neck pain persisting beyond 7-10 days for adults or 14 days for those 18 years and under, should consider seeing a vestibular and/or cervical physiotherapist for assessment.

7.5. Graduated Heart Rate and Treadmill Protocol and Concussion

The standard return to surf protocol is below and is based on AIS recommendations. Some concussion clinics also utilise an individualised treadmill or bike protocol to assess the degree of exercise tolerance in patients with concussion and to individualised heart rate based exercise prescription. This approach can be useful in establishing a safe level of exercise intensity while recovering; to help differentiate between concussion and other possible diagnoses for concussive symptoms; and to identify physiological variables associated with exacerbation of symptoms, and the patient's level of recovery. The Buffalo Concussion Bike Test (BCBT)¹¹ is recommended for this purpose and the test protocols and recording sheets can be found in Appendices 1-5.

7.6. Helmets and Concussion in Surfing

Helmets are currently optional in surfing. Helmets are known to reduce the risk of a structural brain injury, skull fracture and skin laceration however the evidence for concussion prevention is limited¹². Surfing Australia supports helmet use for preventing structural brain injuries and skin lacerations however further research with helmet use and concussion in surfing is required and is currently being conducted with our research partners.

8. Return to Surfing, Competition, Coaching & Official Duties

A surfer with diagnosed concussion must obtain a medical clearance from a qualified medical doctor before returning to any surfing activities. It is the surfer's/parent's responsibility to ensure that the surfer is medically cleared before returning to surfing activities.

8.1. Standard protocol in adults over 18 years of age

Once the diagnosis of concussion has been made, immediate management is physical and cognitive rest. This may include time off school or work and relative rest from cognitive activity. Having rested for 24-48 hours after sustaining a concussion, the surfer can commence a return to light intensity physical activity under medical guidance, as long as such activity does not cause a significant and sustained deterioration in symptoms. The majority of concussive symptoms should resolve in 7-10 days.

Any surfer diagnosed with a concussion should remain in the company of a responsible adult and should not drive or consume alcohol. A concussed surfer should check with their doctor before taking medication.

8.2. Children 18 Years of Age and Under

Children and adolescents aged 18 years or younger take longer to recover from concussion. The approach to management should be more conservative than for adults, with the graduated return to sport protocol extended so that the child does not receive full clearance to return to sport (stage 6 below) **until at least 14 days from resolution of symptoms**. Return to learn should take priority over return to sport.

8.3. Return to work and study protocol

Having rested for 24 - 48 hours after sustaining a concussion, school-aged surfers can return to school or study - as long as these activities don't worsen symptoms. Reduced screen use in the first 48 hours after injury is warranted but may not be effective beyond that^{13,14}. Thinking or concentrating for long periods can bring on or worsen symptoms of concussion. Gradually increasing the load on the brain without provoking symptoms is recommended. School programs may need to be modified to include more regular breaks, rests and increased time to complete tasks. Exams during that period may need to be postponed.

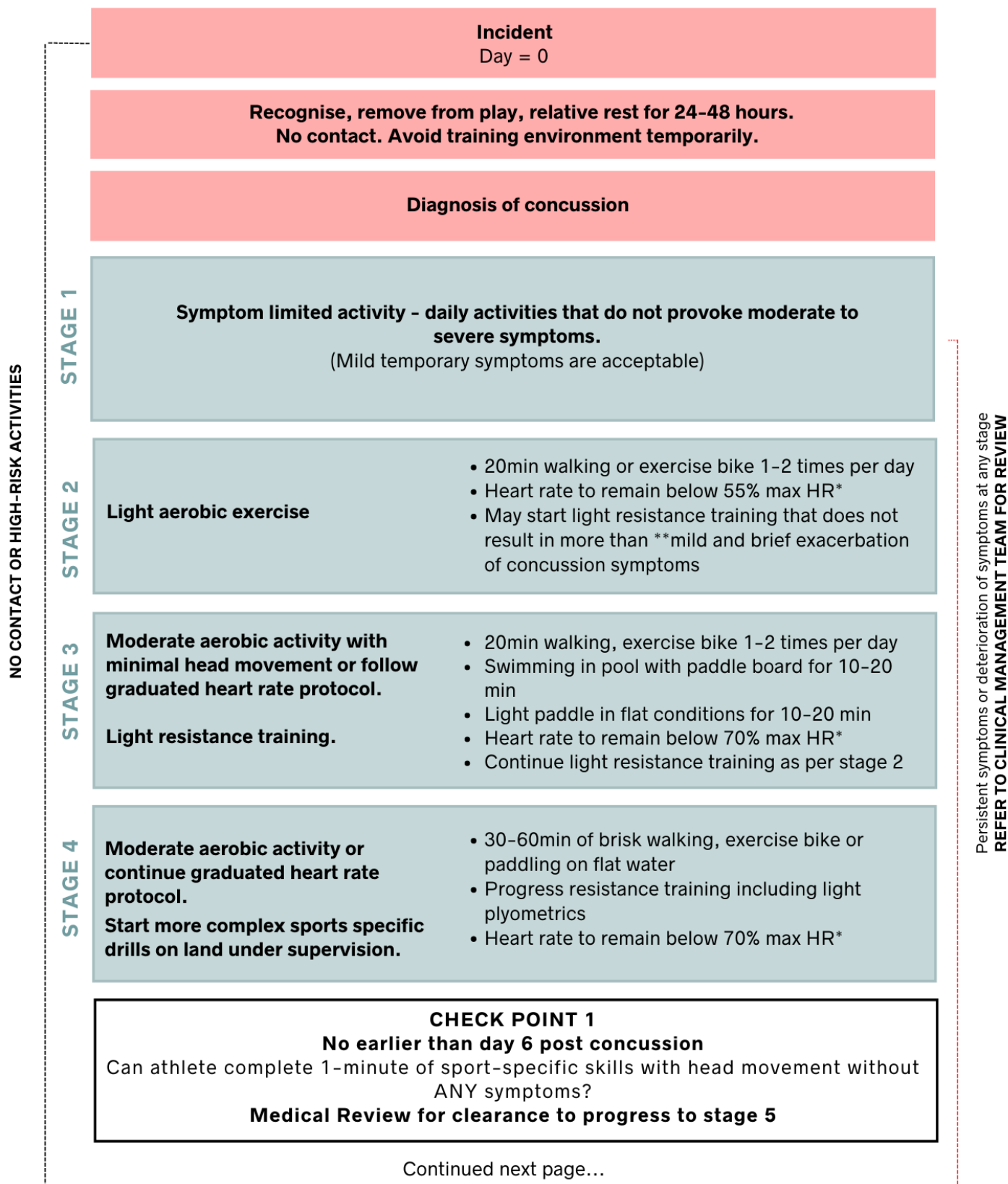
Return to school and learning should take priority before returning to sport. A concussed child should not return to sport until they have successfully returned to normal school activities.

8.4. Graded return to surf protocol

The return to surf protocol shown in Figure 3 below is modelled on the SCAT6 Sport Concussion Assessment Tool- 6th Ed³ Graduated Return to Sport Strategy and the Australian Institute of Sport Graded return to sport framework. The protocol follows the same exercise steps however has been adapted be surfing specific to provide greater clarity of this process within the sport.

Figure 3. Graded return to surf protocol

Following a suspected concussive episode a graded return to surf framework (GRTSF) should be initiated after appropriate removal from surf has occurred. After a period of 24 hours of relative rest, resumption of daily activities can begin. Unless otherwise indicated, each stage, highlighted in green below, should be at least 24 hours and symptoms should return to baseline prior to commencing the next activity or stage. If symptoms do not return to baseline and are prolonged or severely exacerbated, further testing may be warranted. In these situations review by a member of the clinical management team, ideally a physiotherapist or doctor, is recommended.



STAGE 5a

Introduce surfing in rolling waves less than 3ft on user friendly surfboard such as soft top or board of moderately increased size or volume.

Minimum 3 days for ≤ 18 years

- Surf 30–60min 1 session per day
 - excludes aerial manoeuvres, tow surfing or jet ski step offs
- Moderate weight training
- Increase cardiovascular activities up to 80% HRmax

STAGE 5b

When ready and tolerating surfing in mild conditions, progress to surfing a normal short board in similar conditions.

Minimum 3 days for ≤ 18 years

- Surf 30–60min 1–2 sessions per day
 - excludes aerial manoeuvres, tow surfing or jet ski step offs
- Increase cardiovascular activities up to 90% HRmax

STAGE 5c

When ready and tolerating surfing on a normal short board progress to surfing more challenging conditions such as dumping waves and waves over 6ft in height.

Minimum 2 days for ≤ 18 years

- Surf 60min–2hr 1–2 sessions per day
 - excludes aerial manoeuvres, tow surfing or jet ski step offs
- Continue cardiovascular activities up to 90% HRmax
- Return to full capacity of school or work

CHECK POINT 2

When symptom-free for at least 14 days for ≤ 18 years and 10 days for ≥ 19 years

Have you remained concussion symptom-free? **Y N**

Is skill-level below what is expected? **N Y**

Do you get symptoms during or after activity? **N Y**

Do you simply "not feel right"? **N Y**

Medical review for clearance to return to full training and high-risk activity

STAGE 6

Return to full training

Return to competition

The stages above may be modified if the surfer has significant neck issues after a concussion to avoid positions such as neck extension which may exacerbate symptoms.

**Individualised heart rate protocols can be provided by our Chief Medical Officer or Physiotherapist*

***Mild and brief exacerbation of symptoms (i.e., an increase of no more than 2 points on a 0–10 point scale for less than an hour when compared with the baseline value reported prior to physical activity).*

Athletes may begin Stage 1 (i.e. symptom limited activity) within 24 hours of injury, with progression through each subsequent stage typically taking a minimum of 24 hours. If more than mild exacerbation of symptoms (i.e. more than 2 points on a 0–10 scale) occurs during Stages 1–4, the athlete should stop and attempt to exercise the next day. If an athlete experiences concussion-related symptoms during stages 5–6, they should return to stage 4 to establish full resolution of symptoms with exertion before surfing.

Written determination of readiness to RTS should be provided by physician with expertise in concussion before unrestricted RTS.

9. Staff Roles and Responsibilities

Concussion diagnosis and management is a medically-driven condition, involving and relying on input from all Surfing Australia staff and other staff and health professionals involved in surfing including coaches and performance staff. All staff are required to comply with the protocol and act in the best interests of the athlete's health and wellbeing.

10. Multiple and Concerning Concussions

Surfing Australia requires athletes to be formally assessed by a specialist with a recognised interest in sport related concussion management (Neurologist, Neurosurgeon or Sport and Exercise Physician) as part of a multi-disciplinary team approach when an athlete has:

- sustained 2 diagnosed concussions within a 12 month period;
- has concussion symptoms lasting more than 14 days or an unusual presentation; or over time (months or years):
 - is developing concussion symptoms with less force; or
 - is experiencing progressively increasing length of concussion symptoms; or
 - has an increasing symptom load (a greater number of concussions symptoms); or
 - has a decreasing time period between concussive / possible concussive events; or
 - has significant mental health issues that may be potentially influencing recovery from concussion (e.g. anxiety, depression, sleep disturbance).

The assessment should also include formal neuropsychological testing if recommended by the Concussion Specialist providing the opinion. This should occur to ensure the surfer has fully recovered from their concussions, to assess the risks of further concussions and to determine whether the surfer is currently fit to participate in training and/or competition.

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12. Appendix 1. Buffalo Concussion Bike Test Protocol

1. Inform participant about test procedures and what to expect during the BCBT. Review in detail that the purpose is not to “push through” symptoms but to honestly report them.
2. Explain and demonstrate the RPE and VAS and obtain resting scores. Remind participant that he/she will be asked to rate RPE and symptom severity every 2 minutes during exercise.
3. Obtain resting HR after 2-minute seated position before getting the patient on cycle ergometer.
4. Care should be taken to ensure the cycle ergometer settings, such as seat and handle bar heights, are appropriate to the participant. The participant should not assume a standing position at any time during the protocol.
5. The HR at Stage 0 is the HR when the patient is sitting on the cycle ergometer immediately after starting the BCBT and not after the 2-minute seated rest.
6. Tell the participant to start pedalling at a cadence they will feel comfortable holding for the duration of the test. For surfers, it is recommended to use a cadence of 80-90 rpm. Participant must maintain a relatively consistent cadence of ± 5 rpm throughout the test.
7. After 2 minutes at this power output, adjust power output for Stage 1. Ask participant to provide their RPE and symptom severity on VAS at the beginning of each stage. Record HR at the beginning of each stage. Examiner should also record general observations as the test progresses if needed. This procedure is repeated every 2 minutes with the power output at the subsequent stage. Changes to VAS 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 and/or increased severity of an existing symptom. 1-point is given for any worsening of a symptom and 1-point for the addition of a new symptom, for example, if the patient reports symptom severity change from 2/10 to 3/10 and reports slight increase of headache and onset of light sensitivity, then this should be considered a 2-point increase to 4/10.
8. Once test is terminated (see Stopping Criteria below), power output is reduced to starting level (Stage 0) for a 2-minute cool down (if patient is able). For the cool down, the patient is asked to pedal at the lowest resistance the bike offers and a comfortable cadence of ~ 60 rpm. HR, RPE, VAS plus any additional comments (if needed) are recorded after the 2- minute cool down.
9. Patient is allowed to rest on a chair in a quiet environment until symptom severity returns to pre-BCBT value or patient feels like they are able to continue with remainder of the clinical visit.

Stopping Criteria

The BCBT is terminated based on the following criteria:

1. Symptom exacerbation - defined as an increase of 3 or more points on the VAS scale from resting VAS score.
2. Voluntary exhaustion – defined as an RPE of > 17 without significant symptom exacerbation. If the patient has not reached at least 80% of age predicted maximum (calculated as $220 - \text{age}$), the examiner should encourage the patient to try and keep going but should not push the patient if they are too exhausted.
3. Examiner notes a rapid progression of complaints (pressure in head to searing focal headache) or patient appears faint or has stopped communicating or continuing the test constitutes a significant health risk for the patient.
4. Patient has reached 90% or more of age predicted maximum without any increase in symptoms and still reporting low RPE. The RPE scale should be discussed with the patient at this time to make sure they accurately understand it before we begin the cool down period.
5. Patient requests to stop for any reason. The reason for stopping, other than the above mentioned, should be recorded in the BCBT Assessment Form.

Interpretation

- The maximum HR achieved on the BCBT at symptom exacerbation is called the Heart Rate threshold (HRt) and a safe level of exercise is considered to be below 90% of HRt.
- If the patient is able to exercise to voluntary exhaustion without any increase in symptoms (i.e. does not have symptom-limited exercise intolerance) but is not cleared to return-to-play because of symptoms at rest or physical examination impairments, then the patient can perform aerobic exercise at any HR up to the maximum achieved or at 85% of age appropriate maximum.
- Patients who have symptoms at rest, but do not have a physiologic threshold (can exercise to max without increase in concussion-specific symptoms) should be evaluated for dysfunction of the cervical spine, vestibular system or temporomandibular region.

13. Appendix 2. Buffalo Concussion Bike Test Assessment Form

Patient: _____ Date: _____ Weight: _____ kg

Stage	Minute	HR	RPE	VAS Scale	Symptom Reports	Observations
REST	REST		N/A			
0	0					
1	2					
2	4					
3	6					
4	8					
5	10					
6	12					
7	14					
8	16					
9	18					
10	20					
11	22					
12	24					
13	26					
14	28					
15	30					
16	32					
17	34					
18	36					
19	38					
20	40					
Post (2min)	Post (2min)					

Max HR at symptom exacerbation: _____ /NA Tester: _____

Additional comments: _____

14. Appendix 3. Borg Rate of Perceived Exertion (RPE) Scale

Scoring	Level of Exertion
6	No Exertion
7	Extremely Light
8	
9	Very Light
10	
11	Light
12	
13	Somewhat Hard
14	
15	Hard (Heavy)
16	
17	Very Hard
18	
19	Extremely Hard
20	Maximal Exertion

In Borg RPE;

- 9 = 'very light' exercise which equals walking slowly for a few minutes at the own pace of a healthy individual.
- 13 = 'somewhat hard' but the individual is still able to continue the activity.
- 17 = 'very hard'. A healthy person can continue but must push themselves beyond their comfort of being very fatigued.
- 19 = extremely strenuous exercise for most people, the hardest they have ever experienced

15. Appendix 4. Visual Analogue Scale (VAS)

VISUAL ANALOGUE SCALE (VAS)

Rate Your Overall Condition
Choose a number from 0 to 10 and describe your condition.

Feeling Good

012345678910

Worst I have ever felt


0
Feel Terrific
No Symptoms


2
Feel some
symptoms but
quite tolerable


4
Symptoms a
little worse


6
Symptoms
worse


8
Symptoms
much worse


10
Feel Terrible
Worst I ever felt

BE SURE TO TELL YOUR DOCTOR THE CONDITION YOU ARE IN

16. Appendix 5. BCBT weight to power conversion table

		Weight in KG																	
Stage	Min	35.0	37.5	40.0	42.5	45.0	47.5	50.0	52.5	55.0	57.5	60.0	62.5	65.0	67.5	70.0	72.5	75.0	77.5
0	0	18	19	20	21	23	24	25	26	28	29	30	31	33	34	35	36	38	39
1	2	22	24	26	27	29	30	32	34	35	37	39	40	42	43	45	47	48	50
2	4	27	29	31	33	35	37	39	41	43	45	47	49	51	53	55	57	59	61
3	6	32	35	37	39	42	44	46	49	51	53	55	58	60	62	65	67	69	72
4	8	37	40	43	45	48	51	53	56	59	61	64	67	69	72	75	77	80	83
5	10	42	45	48	51	54	57	60	63	66	69	73	76	79	82	85	88	91	94
6	12	47	51	54	57	61	64	68	71	74	78	81	84	88	91	95	98	101	105
7	14	52	56	60	63	67	71	75	78	82	86	90	93	97	101	104	108	112	116
8	16	57	61	65	69	74	78	82	86	90	94	98	102	106	110	114	118	123	127
9	18	62	67	71	76	80	84	89	93	98	102	107	111	116	120	124	129	133	138
10	20	67	72	77	81	86	91	96	101	105	110	115	120	125	129	134	139	144	149
11	22	72	77	82	88	93	98	103	108	113	118	124	129	134	139	144	149	154	160
12	24	77	83	88	94	99	105	110	116	121	127	132	138	143	149	154	160	165	171
13	26	82	88	94	100	105	111	117	123	129	135	141	146	152	158	164	170	176	181
14	28	89	95	101	108	114	120	127	133	139	146	152	158	165	171	177	184	190	196
15	30	92	98	105	112	118	125	131	138	144	151	158	164	171	177	184	190	197	204

		Weight in KG																	
Stage	Min	80.0	82.5	85.0	87.5	90.0	92.5	95.0	97.5	100.0	102.5	105.0	107.5	110.0	112.5	115.0	117.5	120.0	
0	0	40	41	43	44	45	46	48	49	50	51	53	54	55	56	58	59	60	
1	2	51	53	55	56	58	59	61	63	64	66	67	69	71	72	74	75	77	
2	4	63	65	67	69	71	73	74	76	78	80	82	84	86	88	90	92	94	
3	6	74	76	79	81	83	86	88	90	92	95	97	99	102	104	106	109	111	
4	8	85	88	91	93	96	99	101	104	107	109	112	115	117	120	123	125	128	
5	10	97	100	103	106	109	112	115	118	121	124	127	130	133	136	139	142	145	
6	12	108	111	115	118	122	125	128	132	135	138	142	145	149	152	155	159	162	
7	14	119	123	127	131	134	138	142	146	149	153	157	160	164	168	172	175	179	
8	16	131	135	139	143	147	151	155	159	163	167	172	176	180	184	188	192	196	
9	18	142	147	151	155	160	164	169	173	178	182	187	191	195	200	204	209	213	
10	20	153	158	163	168	173	177	182	187	192	197	201	206	211	216	220	225	230	
11	22	165	170	175	180	185	191	196	201	206	211	216	221	227	232	237	242	247	
12	24	176	182	187	193	198	204	209	215	220	226	231	237	242	248	253	259	264	
13	26	187	193	199	205	211	217	222	228	234	240	246	252	258	263	269	275	281	
14	28	203	209	216	222	228	235	241	247	254	260	266	273	279	285	292	298	304	
15	30	210	217	223	230	236	243	250	256	263	269	276	282	289	295	302	309	315	