Artistic Swimming Sports Concussion

Introduction
Concussions most commonly occur in organized contact sports such as football, wrestling, and soccer, but they can also occur in artistic swimming. Because, concussions can lead to serious health consequences, it is essential that artistic swimmers, coaches, parents, and healthcare providers learn the signs and symptoms of concussion and what to do if a concussion occurs.

What is a Concussion?
A concussion is a type of mild traumatic brain injury (or mTBI) caused by either a direct blow to the head, face, or neck or elsewhere on the body with an impulsive force transmitted to the head (ex. whiplash). This initiates a series of events in response to the injury causing changes in the brain that can lead to possible nerve injury, blood flow change, and inflammation. In artistic swimming, common causes of concussion are from a collision with another athlete, hitting the wall, falling from a lift, direct blow to the head by an arm or a leg, etc. What ensues are a variety of possible symptoms. that may adversely affect the athlete's mood and personality, ability to perform daily mental and physical tasks, and ability to safely participate in artistic swimming. Because a concussion is a complex physiological/functional injury involving chemical alterations to the brain, each concussion is unique and can affect the injured athlete in a different way. Recognition and proper response to concussions when they first occur is important to help prevent further injury, prolonged symptoms, or even death.

Concussion Recognition:
Although concussion is categorized as a mTBI, there is no abnormality seen on standard structural neuroimaging studies (CT-scan or MRI). And note that less than 10% of concussions involve a loss of consciousness. The skew of possible symptoms combinations can make recognizing and diagnosing concussion difficult. Formal diagnosis of concussion can only be made by a licensed medical professional following a comprehensive (physical & cognitive) medical assessment. However, if a concussion is suspected and a medical provider is not available, the artistic swimmer should be removed from play and pursue a medical referral. "When in doubt, sit them out."

A concussion should be suspected in any artistic swimmer who (1) experiences appropriate mechanism of injury AND (2) demonstrates ANY concussion-like signs or symptoms in any intensity or quantity.

(1) Mechanism of Injury

- Sustains direct, indirect or rotational impact to the head, face, neck or body
- Experiences whiplash effect, where the head forcibly moves forward & backward due to impact elsewhere on the body
- Jarring effect from the trunk up to the head and brain (such as a hard impact from lift)

(2) Signs and Symptoms

Signs (observable by others)	Symptoms (reported by artistic swimmer)
• Confusion • Foggy • Forgetful • Disoriented • Lack of coordination • Slow to respond • Brief unconsciousness • Mood, behavior, or personality changes • Inability to recall events prior to hit or fall • Inability to recall events after hit or fall • Seizures immediately after the hit/fall	• Headache or "pressure" in head • Nausea, vomiting, numbness or tingling • Balance problems or dizziness • Double or blurry vision, ringing in the ears • Sensitivity to light and noise • Increased emotional behavior/irritability • Concentration or memory problems • Feeling sluggish, low energy, foggy, or groggy • Confusion • Does not "feel right" or "feeling down" • Problems with insomnia or excessive sleep

Some additional points to note:

- Not all athletes will experience or report symptoms right away. Some may wait for hours or even days after the injury to report a problem, which could be a conscious decision, or symptoms may not present until this point.
- The list above are common signs and symptoms of concussion; however, it is not uncommon to have some of the symptoms prior to possible concussion (i.e. at baseline). For example, an athlete may have one or more of the symptoms prior to possible concussion due to other causes like sleep deprivation. Therefore, it is important to pair concussion recognition with the injury mechanisms mentioned above, and a concussion would be an increase in the severity or number of symptoms.

In some cases, these same mechanisms of injury can cause more serious head or spine injury, which always warrant immediate referral to emergency medical care. If an artistic swimmer demonstrates any of the following "Red Flags", a more severe head or spine injury should be suspected. Red Flags immediately following impact require the artistic swimmer to remain still and in place until medical professionals arrive. Delayed Red Flags require the artistic swimmer be taken to an Emergency Department immediately.

Red Flags Include:

- Severe or worsening headache
- Weakness or numbness in more than one arm or leg
- Repeated vomiting
- Slurred speech
- Neck pain or tenderness
- Loss of vision or double vision
- Seizure activity or convulsions
- Loss of consciousness or deteriorating conscious state (going in and out of consciousness)
- Increasing confusion
- Increasing agitation or combative
- Visible deformity of the skull

[A reliable resource, containing on overview of concussion recognition for non-medically trained individuals is the Concussion Recognition Tool (CRT-6). See Appendix 1 for details.]

Poolside Assessment

If the artistic swimmer demonstrates any of the Red Flags listed above, then there is concern for a more severe head injury, or a cervical spine event, and Emergency Medical System (EMS, 911) should be activated for transportation and evaluation at the nearest medical facility. Cap and goggles should only be removed by emergency medical provider to minimize potential head/neck motion.

Licensed healthcare professional is present:

In the event of a suspected concussion, the on-site licensed healthcare professional should complete primary and secondary assessments of the artistic swimmer. Once no life-threatening injuries are determined to be present, the artistic swimmer should be taken to a secure area and undergo a sideline medical assessment using the Sport Concussion Assessment Tool 6 (SCAT 6) (Appendix 2) or the Child SCAT6 (used for ages 8-12) (Appendix 3). See also Maddocks Questions modified for artistic swimmers, which can be found in Appendix 4. The SCAT 6 and Child SCAT 6 are clinical tools that should only be used by a licensed healthcare professional that has experience using them.

It is important to note that the results of SCAT6 and Child SCAT6 testing can be normal in the setting of acute concussion. As such, these tools can be used by licensed healthcare professionals to document initial neurological status but should not be used to make sideline return-to-sport decisions in artistic swimming. Any artistic swimmer who is suspected of having sustained a concussion, or has been diagnosed with a concussion, must NOT return to practice or competition and must be referred for further medical assessment by a physician. Until further assessment is obtained, the artistic swimmer should be monitored for new or worsening symptoms and/or signs of concussion.

Licensed health professional is NOT present:
If concussion is suspected and no red flags are present, then utilize the CRT-6 (Appendix 1) to document date/time and any present symptoms. If the artistic swimmer has any one or more of the visible clues of suspected concussion, symptoms of suspected concussion, or change in awareness, then then the artistic swimmer should be removed from practice or competition and referred immediately for medical assessment. The artistic swimmer must not return to sport until receiving formal medical clearance.

If the artistic swimmer does not have symptoms, please ask the artistic swimmer to remain poolside and continue to monitor the artistic swimmer every 10 – 15 minutes as symptoms can occur over time. If the athlete has no symptoms at the end of the training session, inform the parent/guardian that impact has occurred and advise them to continue monitoring the athlete for symptoms at home for the next 24 hours. If symptoms develop, the athlete should be evaluated by a licensed health professional trained in concussion management within 24 hours of the start of symptoms. Until further assessment is obtained, the artistic swimmer should be monitored for new or worsening symptoms and/or signs of concussion.

Concussion Management:
When an artistic swimmer has been diagnosed with a concussion, it is important that the artistic swimmer's parent/legal guardian, teachers, (if applicable), coaches, and healthcare team.

If an artistic swimmer is diagnosed with a concussion, the athlete, parents/guardian, teachers, and coaches, should be provided with education about the signs and symptoms of concussion, strategies about how to manage their symptoms, the risks of returning to sport without medical clearance and recommendations regarding a gradual return to school (if applicable) and sport activities. Second impact syndrome, a repeat concussion that occurs before the brain has recovered from the first trauma —usually within a short time period (hours, days, weeks), can slow the recovery process and/or increase the chances for long-term problems including death.

The average return to school and sport timeline post-concussion for adults is 7-10 days and children/adolescents 2-4 weeks given timely and proper care. But for some individuals, signs and symptoms of concussion can last for days to months longer and may be present during daily functioning and/or exercise/artistic swimming. Some research has found that some aspects of cognition and the bodies balance system can be affected for months following concussion.

Concussion management includes both physical and cognitive (mental) rest, initially. However, under the guidance of a healthcare provider experienced in managing concussion, early return to modified activity may be resumed even with symptoms. This should only be done under this expert guidance.

A progressive recovery process should include:

1. Initial physical and cognitive modifications to facilitate symptom resolution
    a. 24-48 hours of relative rest (i.e. activities of daily living and minimal screen time)
2. Periodic medical assessment to:
    a. Evaluate and monitor recovery progress
    b. Screen for additional symptom generators
    c. Referral to additional medical specialties for multidisciplinary approach when applicable, such as:
        - Neurology
        - Optometry/ Ophthalmology
        - Physical therapy
        - Psychology/ Psychiatry
        - Vestibular rehabilitation
        - Vision therapy
        - Mental health professional
        - Guidance on return to academic and sport activities
3. Initiation and completion of a sport-specific return-to-artistic-swimming strategy, under the supervision of a physician. (See below for details regarding the Artistic Specific Return to Sport Guideline)

Once the artistic swimmer has completed the Artistic Swimming Specific Return to Sport Guideline, a qualified medical physician should reassess the artistic swimmer for clearance back to full participation.

The following general guidelines should be provided to the artistic swimmer, parent/guardian, and/or roommate.

- **Monitor for mental or physical deterioration over the** initial 24 hours after injury is essential (see red flags)
- **Rest**
  - Like any injury, the injured body part (in this case the brain) needs rest from activity to promote the healing.
  - Limit initial mental activity including screen time (phones, tablets, TV, video games, school work)
  - No physical activity until evaluated by a medical professional
  - Limit social gatherings, loud noises and bright lights
  - There is no need to wake the athlete to check on them (unless specifically instructed by a medical provider)
- **Limit Medications**
  - Avoid NSAIDs (i.e. Ibuprofen, Advil, Aspirin, or any other anti-inflammatory medications)
  - Acetaminophen (Tylenol) can be taken safely
  - Avoid taking any medications to help the athlete sleep
  - If you take prescription medications, discuss with your doctor if these should be continued while you recover
- **Eat a healthy, well-balanced diet and stay hydrated**
- **DO NOT**
  - Drive a car
  - Drink alcohol or use recreational drugs
  - Return to physical activity prior to medical assessment
  - Take part in activity at risk for further head trauma
  - Take medication for specific concussion symptoms (unless specifically instructed by a medical provider)

Artistic Swimming Specific Return to Sport Strategy:

The following is an outline of the return-to-sport strategy that should be used to help artistic swimmers, coaches, certified athletic trainers, and medical professionals facilitate a safe and gradual return to artistic swimming. Monitoring for eventual symptom resolution is the priority. While the artistic swimmer is being monitored, a return-to-sport strategy can be considered and should be guided by symptom status. During the return-to-sport process, a successful return to school, work, or other cognitive activities without symptoms and with baseline performance should also be prioritized before full return to practice.

Note: It is highly recommended that the healthcare provider be able to directly communicate with the coach in return to sport guidance. To facilitate this communication, it is recommended that athletes and/or parents/guardians sign a waiver prior to each season allowing for this direct communication.

Guidelines to Artistic Swimming Specific Return to Sport Strategy:

- Artistic swimmers may begin Stage 1 within 24-48 hours of injury
- Each stage should be ≥ 24 hours
- Stage 2 max heart rate calculation can be done with Max Heart Rate = 220 – athlete's age
- Stage 1-3 Progression/Regression
  - <u>Medical clearance is required to progress from Stage 1 to Stage 2.</u>
  - The athlete may progress to the next stage if the athlete can complete current stage with no exacerbation of symptoms or mild and brief exacerbation of symptoms*
  - If more than mild exacerbation of symptoms* occurs during Steps 1–3, the athlete should stop and attempt same stage the next day.
  - * Mild and brief exacerbation of symptoms = an increase of no more than 2 points on a 0–10 point scale for less than 1 hour when compared with the baseline value reported prior to physical activity
- Athletes experiencing any concussion-related symptoms during Steps 4–6 should return to Step 3 to establish full resolution of symptoms with exertion before engaging in at-risk activities.
- Return to school can progress independently and more quickly than return to physical activity. If applicable, the athlete should be at baseline performance of return to school, work, or other cognitive activities without symptoms before starting Stage 5.

Sports Concussion: Artistic Swimming Specific Return to Sport and School Strategy

STAGE	PHYSICAL ACTIVITY		SCHOOL ACTIVITY
1	**SYMPTOM-LIMITED ACTIVITY**		**DAILY ACTIVITIES**
	Goal: Gradual reintroduction of daily activities that do not exacerbate symptoms		**Goal:** Gradual return to typical activities
	Land	**Water**	- Typical activities during the day while minimizing screen time. - No school, homework, studying, or take-home tests. - If there are no symptoms, then can start reading 5-15 minutes at a time and increase gradually
	- Walking short distances to get around. - Passive stretching (avoid inverting head) - Breathing exercises	- None	
	Avoid		
	- Inversions	- Holding breath for more than 10 seconds	
	- No exercise that increases heart rate of any kind		
2	**AEROBIC EXERCISE** **2A—LIGHT** (up to approximately 55%max heartrate) **THEN** **2B—MODERATE** (up to approximately 70%max heartrate)		**SCHOOL ACTIVITIES**
	Goal: Increase heart rate		**Goal:** Increase tolerance to cognitive work
	Land	**Water**	- Focus on homework, reading, or other cognitive activities outside of the classroom. - Complete necessary assignments only - Ideally, no tests or quizzes - May need more time to complete assignments. - Multiple choice or verbal assignments may be better than lots of long writing. - Consider tutoring if needed - Some school may be tolerated depending on symptoms. - If the athlete can complete 60-90 minutes of light mental activity without a worsening of symptoms he/she may go to the next step.
	- Stationary bike - Slow to medium pace walk - Active stretching (avoid inverting head) - Light core strengthening (ex. Plank) - Light resistance training - Light land drills (avoid rapid head/body movements)	- Kicking with kickboard but stop if neck hurts - Limit water time	
	Avoid		
	- Inversions - Holding breath for more than 10 seconds - Sharp/rapid head/body movements	- No resistance training - No memorization of routines	
	- Bright lights/sun and loud noises (wear sunglasses and earplugs as needed)		
3	**SPORT-SPECIFIC EXERCISE**		**RETURN TO SCHOOL PART TIME**
	Goal: Add body and head movement with changes of direction		**Goal:** Increase academic activities
	Land	**Water**	- Gradual return to school (start with 1-2 hours) or advance time at school - May need greater access to rest breaks during the day (nurses office every 2 hours) - Progress gradually to at least 4 hours/day - Increase schoolwork but still may need extra time accommodations - Resume tests but try to spread them out if possible
	- Jogging/stationary bike >70% max heart rate - Full participation in all stretches - Progress core strengthening - Progress resistance training - Full land drill	- Swimming all strokes - Progress to flip turn when athlete can swim all strokes without increased symptoms - Ballet leg - Eggbeater and body boosts - Sculling <15 seconds	
	Avoid		
	- Activities at risk of head impact	- Swimming in pattern	
4	**NON-CONTACT TRAINING DRILLS**		**RETURN TO SCHOOL FULL TIME**
	Goal: Resume usual intensity of exercise, coordination, and increased thinking		**Goal:** Return to full academic activities and catch up on missed work.
	Land	**Water**	- Progress to attending core classes for full days of school. - Add in electives when tolerated. - Ideally, no more than 1 test/day - Must return to baseline academic level and participation to complete stage
	- Full participation in resistance training	- Reintroduction of figures and elements - Gradual increase in intensity with hybrids and routine sections	
	Avoid		
	- Activities at risk of head impact	- Swimming in pattern	
5	**FULL CONTACT PRACTICE**		
	Goal: Restore confidence and assess functional skills by coaching staff		
	Land	**Water**	
	- Full participation in all land training	- Gradual progression of swimming in pattern - Consider position in acrobatic skills when progressing participation - Consider the depth that skills are done at (increased pool depth can cause more pressure on head)	
6	**RETURN TO SPORT**		
	Goal: Full return to artistic swimming		
	Land	**Water**	
	- Full participation	- Full participation	

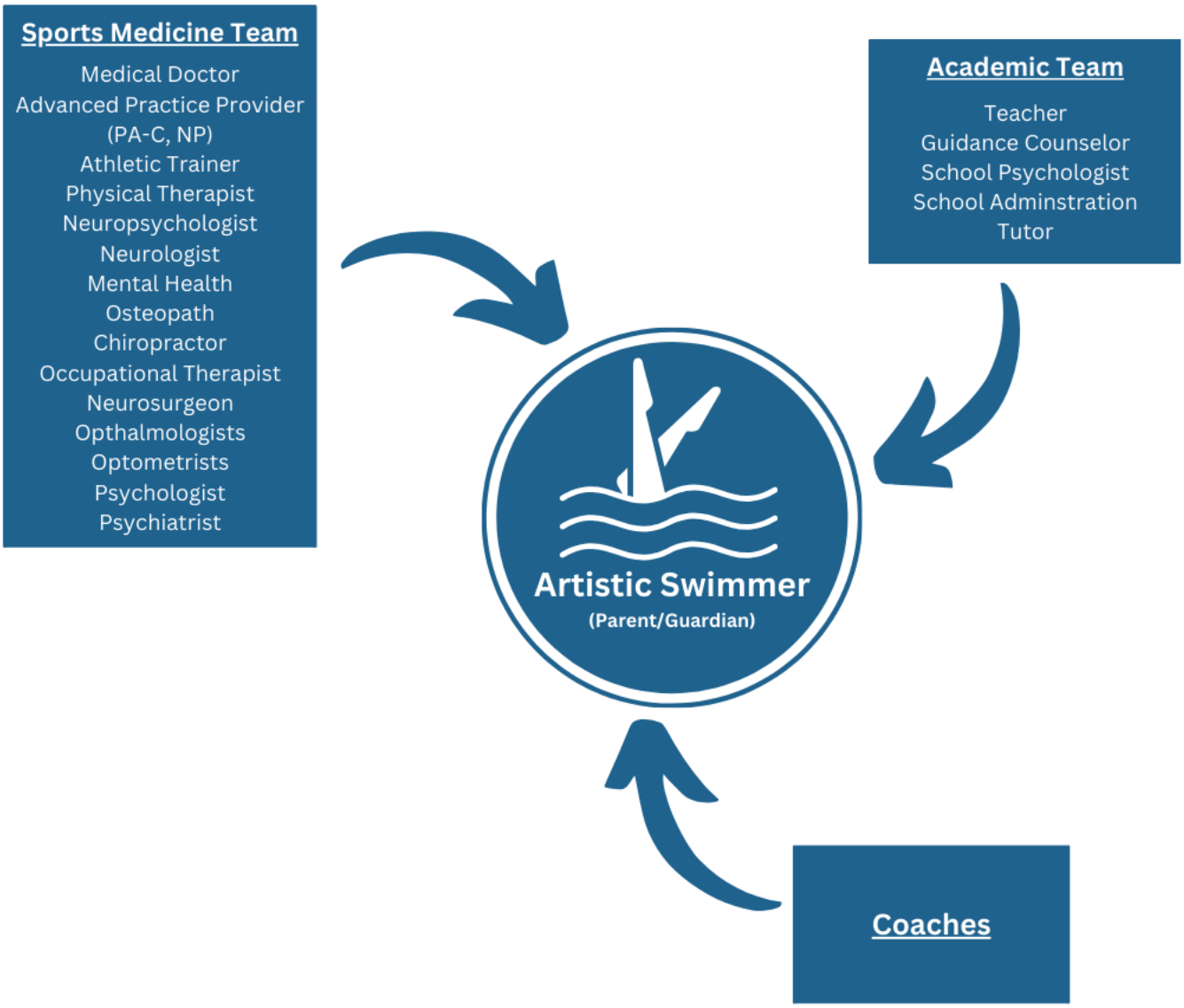
USA ARTISTIC SWIMMING

Multidisciplinary Concussion Care

Most artistic swimmers who sustain a concussion while participating in sport will make a complete recovery and be able to return to full school and sport activities within 2-4 weeks of injury. However, some individuals will experience symptoms that persist beyond this time frame. If available, individuals who experience persistent post-concussion symptoms (>4 weeks for children/adolescents, >2 weeks for adult) may benefit from a supervised multidisciplinary approach that may include medical doctors and advanced practice providers who are experts in sport concussion. The following is a list of possible providers: certified athletic trainers, physical therapists, occupational therapists, neuropsychologists, neurologists, chiropractors, osteopathic physicians, neurosurgeons, neuro-optometrists, mental health providers, and other medical providers trained in concussion management.

A referral to other multidisciplinary practitioners for assessment should be made on an individualized basis at the discretion of an artistic swimmer's medical team. Depending on the clinical presentation of the individual, this treatment plan may involve a variety of health care professionals with areas of expertise that address the specific needs of the artistic swimmer.

If the artistic swimmer is currently enrolled in school, it may be beneficial to discuss their care with their academic team to make necessary modifications. This may include teachers, guidance counselors, school psychologists, and school administrators.



Appendix

Appendix 1	Concussion Recognition Tool 6 (CRT-6)	https://bjsm.bmj.com/content/bjsports/57/11/692.full.pdf
Appendix 2	Sports Concussion Assessment Tool 6 (SCAT6)	https://bjsm.bmj.com/content/bjsports/57/11/622.full.pdf
Appendix 3	Child – Sports Concussion Assessment Tool 6 (Child-SCAT6)	https://bjsm.bmj.com/content/bjsports/57/11/636.full.pdf
Appendix 4	Maddocks Questions for Artistic Swimming Maddocks questions are used in many sports as part of the on-field assessment for concussion.	Below we propose the following as an appropriate set of Maddocks Questions for Artistic Swimming: - Where are you swimming today? - What skill were you attempting? - What routine were you last swimming? - Who was in the routine with you? - What routines do you have left?

Additional Information

- https://www.cdc.gov/headsup/index.html
- http://www.nata.org/position-statements

Concussion Education Courses (free)

- NFHS Concussion in Sports (for coaches and parents): https://nfhslearn.com/courses/concussion-in-sports-2
- ConcussionWise (for coaches/parents and age-specific athletes): https://sportsafety.com/

References

Broglio, Steven P., et al. "National Athletic Trainers' Association bridge statement: Management of sport-related concussion." *J Athl Train*, vol. 59, no. 3, 1 Mar. 2024, pp. 225–242, https://doi.org/10.4085/1062-6050-0046.22.
https://www.nata.org/sites/default/files/bridge_statement_management_of_sport_related_concussion.pdf

Harmon KG, Clugston JR, Dec K, et al. American Medical Society for Sports Medicine position statement on concussion in sport. *British Journal of Sports Medicine* 2019;53:213-225.
https://bjsm.bmj.com/content/bjsports/53/4/213.full.pdf

McLeod TC, Lewis JH, Whelihan K, Bacon CE. Rest and Return to Activity After Sport-Related Concussion: A Systematic Review of the Literature. *J Athl Train.* 2017;52(3):262-287. doi:10.4085/1052-6050-51.6.06
https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5384824/pdf/i1062-6050-52-3-262.pdf

Adapted from:

- Tips on Concussion for Dancers by Dance/USA Task Force on Dancer Health
  https://dance-usa.s3.amazonaws.com/page_uploads/CONCUSSION%20FINAL%20JUNE%2020%20PDF.pdf
- USA Gymnastics Sports Concussion Guidelines
  https://static.usagym.org/PDFs/About%20USA%20Gymnastics/wellness/concussionpolicy.pdf
- California Interscholastic Federation (CIF) Concussion Return to Learn (RTL) Protocol
  https://cifstate.org/sports-medicine/concussions/CIF_Concussion_RTL_Protocol.pdf

Prepared By:

Chelsea Fan, PT, DPT, OCS, SCS, CSCS
Team Physical Therapist USA Artistic Swimming
Los Angeles, CA
chelsea@usaartisticswim.org

Selina Shah, MD, FACP
Team Physician USA Artistic Swimming
Walnut Creek, CA 94598
Office: 925-979-5327

USA ARTISTIC SWIMMING | WE MOVE AS ONE