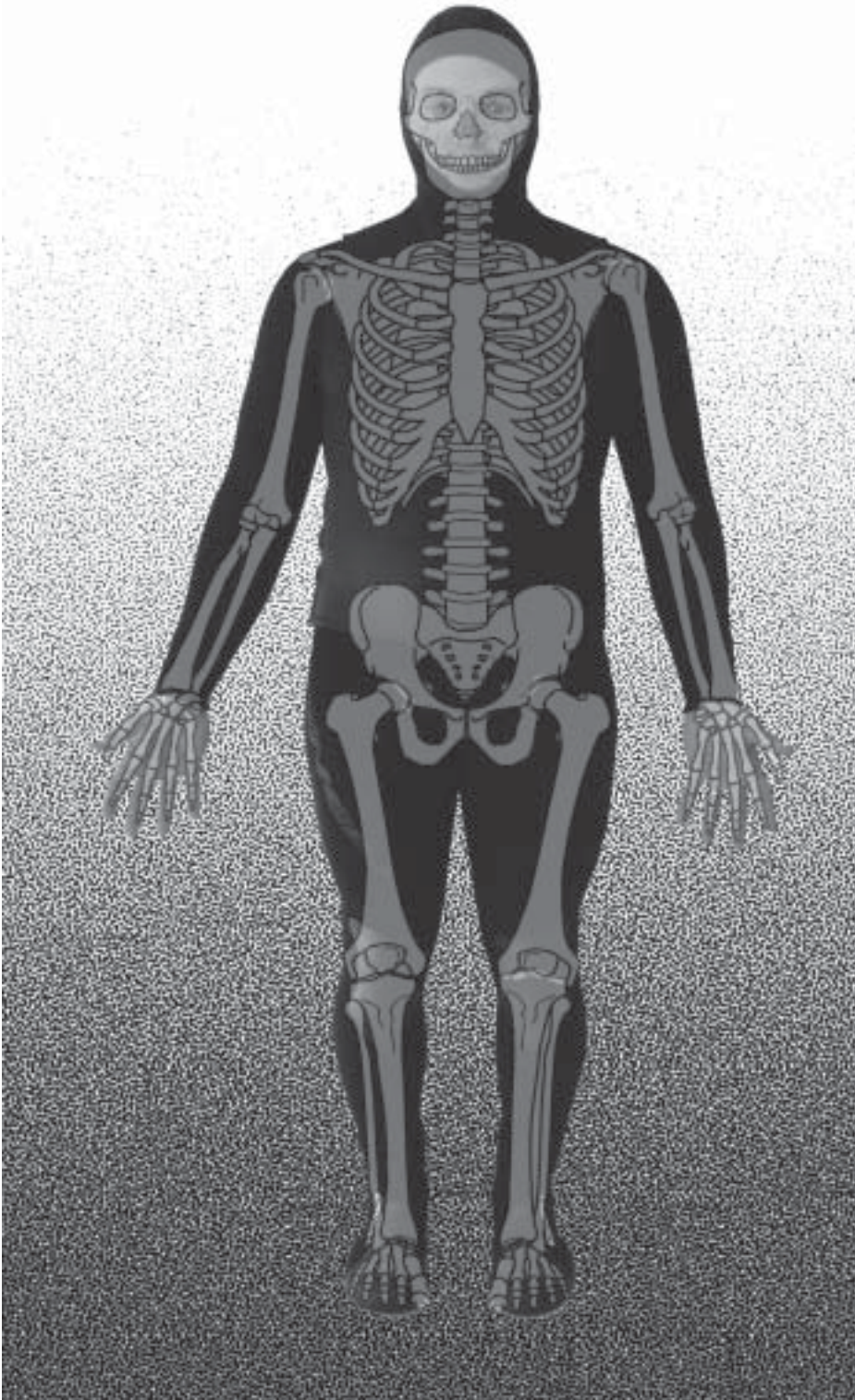


# Fitness Issues for Divers With Musculoskeletal Problems

MEDICAL LINE



**M**usculoskeletal abnormalities such as fractures, arthritis, tendonitis and sprains are common in young, healthy, athletic individuals; these ills still occur as a diver ages, and issues like joint replacement can arise. In this issue we will discuss generalized notions about musculoskeletal abnormalities and diving; in next month's issue, we'll follow with a description of each specific condition and the implications for scuba.

For a physician who evaluates the injury potential of a diver with musculoskeletal abnormalities, a strict, conservative determination is an easy approach. The results are often a quick disqualification for individuals who fall below the accepted standards for outstanding physical health. On closer examination, however, a quick dismissal may prove premature for some divers - careful, individualized exams may yield surprising results.

Strictly speaking, all humans are unfit to stay underwater for an hour: we have no gills; we are burdened by gas-filled spaces that can expand and contract with changes in pressure; we have minimally adapted cardiovascular systems; we are marginal swimmers; and we lack developed underwater senses.

*By James Chimiak, M.D.*



Only with specialized equipment and procedures can an extremely fit and healthy "qualified diver" overcome natural handicaps in the water. To dive with an acceptable risk, divers with various orthopedic conditions may require only some modification to equipment and procedures.

When evaluating a prospective diver, the dive physician must balance the person's desire to dive and any potential threat to the diver, dive buddy or others, keeping in mind that the rescue of an unfit or unprepared diver can pose a danger.

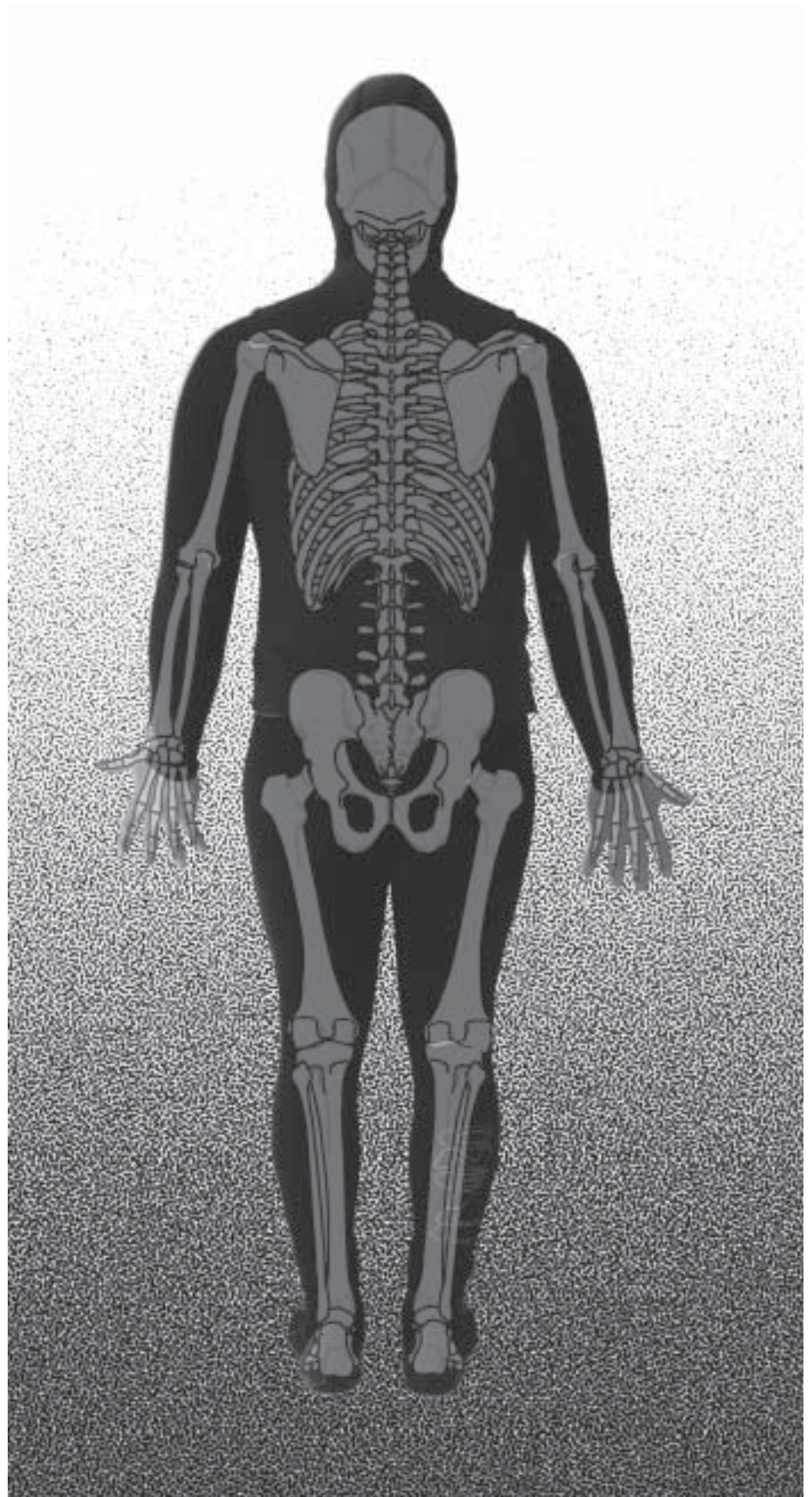
### **Courting the Rules**

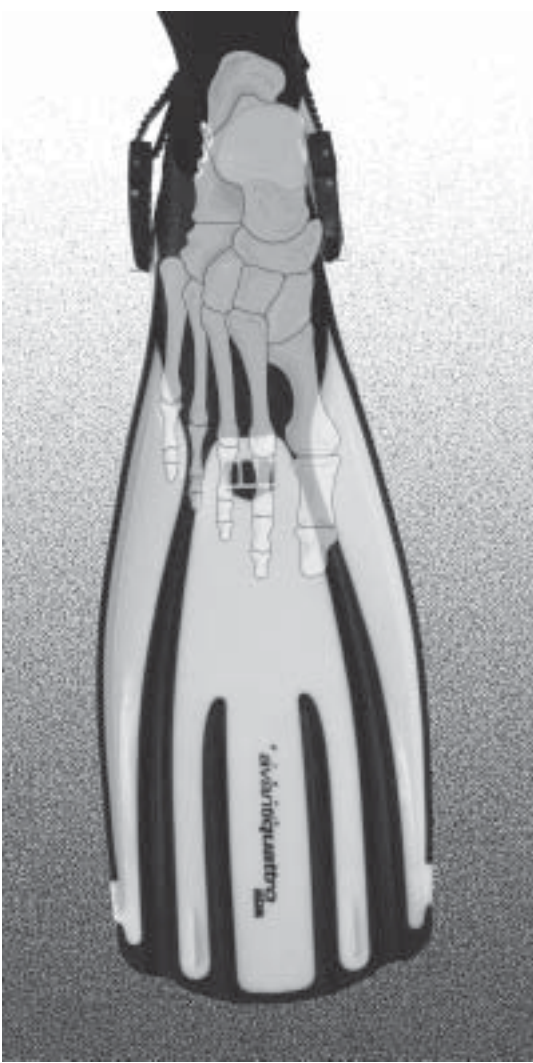
When a dive physician performs a medical evaluation, he or she attempts to weigh the desire and possible right of the prospective diver against possible risks to the individual or his buddies. These decisions often have to be made on medical conditions for which, in the context of diving, little or nothing is known.

This discussion addresses the issues in sport or recreational diving, not military or commercial diving. Sport diving conditions can approximate or even exceed those encountered by the professional diver. Moreover, sport divers perform within a wider range of physical conditioning and age. In this group, however, the initial dive physical exam may also be the last time a dive physician can evaluate an individual's fitness to dive.

### **Evaluating the Individual**

With these issues in mind, dive physicians can apply specific conditions to evaluate a person's s





a newly discovered neurological deficit, or symptom, is actually an established baseline condition or a result of an acute injury during his dive.

- Diving with symptoms, disc problems, old injuries or other evidence of pre-existing damage to the spinal cord requires careful re-evaluation and consideration by the diver. A recurring injury or dive accident involving an old lesion may result in a more severe injury. The nervous system normally has multiple redundant pathways that allow continued function and sensation, should a partial injury occur; a subsequent injury to the remaining neurons could lead to complete loss of function and significant neurological impairment.

fitness for diving. When addressing musculoskeletal issues, dive physicians must use dive medicine and physiology to determine fitness.

- In experimental dives, muscle strength is reduced by more than 15 percent when temperatures are dropped from 28°C to 22° C. This will affect a diver with significant muscle weakness.
- Careful baseline neurological exams, critical when evaluating healthy divers for suspected decompression illness (DCI), are even more important for the handicapped, or physically challenged, diver. That information will help document an advancing disease and perhaps prompt a review into whether a diver should continue diving. With these results, supervisory personnel and on-station medical personnel can determine if

for both the disabled diver and dive buddy. For maximum control, such programs restrict diving conditions.

### Reviewing the Disorder

We must discuss musculoskeletal disorders generically for the following reasons:

- their impact on the type of diving expected;
- whether the physical activity may worsen the condition;
- whether an impaired blood flow might increase the probability of DCI;
- the impact on the crucial buddy system;
- the ability of the facility or organization to accommodate the individual; and
- the potential for a chronic disability or illness to make the diagnosis or exclusion of DCI more difficult.

**1) Type of diving:** A commercial or military diver does not always have control over the conditions of the dive, which often requires a higher set of standards for conditioning. Remote operations can be sparsely supplied, with minimal medical support for common, expected emergencies.

Conversely, sport divers dive for recreation; the dive is not required for a livelihood, and the divers can choose to avoid stormy or other adverse conditions when they dive.

One could therefore make the argument that if a sport diver's physical condition does not equal or exceed minimally accepted standards, then he should not

We must not confuse active sport diving conducted by an independent, fit diver from an in-water experience for someone with a disability. Well-designed diving programs for disabled divers have been created, in essence, as a technically advanced form of hydrotherapy, which offers tremendous positive effects for that diver. But remember these programs are designed with medical support



continue diving. One may plan a "short, easy, shallow dive that does not require decompression stops," but events and conditions may change quickly, requiring all the shared physical and mental resources a buddy dive team can muster.

## **2) Exacerbation of the condition:**

With periods of decreased activity or even immobilization, the likelihood improves that musculoskeletal problems will heal. Diving, considered a strenuous activity, should not be recommended during a prescribed convalescence that requires decreased activity.

## **3) Impaired tissue blood flow:**

Injuries that impair the ability of tissues to exchange inert gas via blood flow pose a theoretical risk of causing decompression illness (DCI). This occurs when nitrogen released by the tissues is hampered by the injury, leading to an excess of nitrogen during a normal decompression; bubbles can then form in that tissue. Where these bubbles form dictates the extent and nature of the subsequent injury.

## **4) Compromised buddy system:**

A significant musculoskeletal disorder may make the diver dependent on the aid of others at various stages of the dive. If the assisting buddy is not immediately available, a life-threatening condition can occur. Minor changes in the underwater environment can make buddy intervention more likely. The assisting buddy should expect little or no assistance if he has problems.

Some very safe, successful dive programs have been established for disabled divers and some have been modified to be actual therapeutic / rehabilitation programs. The buddy of the disabled diver must be aware of the diver's physical impairment, freely accept the risk and responsibility of diving with that person, then make the necessary accommodations.

## **5) Physical accommodations:**

The diver's specific condition might require change in the dive site or a change in equipment. In addition, special emergency procedures need to be established for anticipated problem scenarios. Resources must be readily available to address the special needs of the diver with a musculoskeletal condition. One should not expect a divemaster or the crew to have the necessary advanced medical expertise and equipment to handle a medical condition that is easily managed by medical professionals. Again, the diver and those supporting the dive must know the additional risk and freely accept that risk.

**6) Diagnostic dilemma:** Some musculoskeletal disorders can mimic DCI, either with the onset of pain or appearance of symptoms.

A new onset of symptoms, a worsening or a change in the characteristics of a baseline symptom raises the suspicion of DCI. Even if only minor changes in a pre-existing symptom occur, a greater risk of DCI may result due to impaired blood flow in the involved tissues.

In a diagnostic dilemma - that is, if the diver is not certain he's experiencing symptoms - it may prompt him to seek emergency medical attention and even recompression treatment. Apart from the expense and small risk of recompression treatment, one must consider the actual medical evacuation of such a diver to a hyperbaric treatment facility. This may require that dive companions abort their dive trip, even if it's a weeklong liveaboard cruise, to return to port. Or the confusing symptoms can even prompt a dangerous night air evacuation from a remote landing site.

The physician must remember that many dive accident management protocols are run by divers who may have little or no latitude in interpreting a complicated medical picture and who may be bound to proceed with recompression therapy or prompt evacuation.

## **Diving Can Be Good**

Diving, like most water activities, reduces the load on the musculoskeletal system. This can provide rehabilitation and reconditioning for musculoskeletal disorders. Individuals with acute traumatic injuries should avoid diving until the condition has healed. In addition, they should be free of pain and no longer use medication during rigorous exercise, including swimming with fins.

In summary, when dealing with musculoskeletal fitness-to-dive issues, each individual must consider these generic issues. Relaxation of the stringent standards adopted by

industry and the military must be tempered by an understanding of these general concepts, which the diver should understand. Thus the diver, accepting the increased risk to both himself and those assisting his dive, has the responsibility of thoroughly briefing others involved in his dive.

Life is a balancing act between risk and benefit. Man's thoughtful acceptance of the imbalance in favor of the former is a large contributor to his survival.

#### ABOUT THE AUTHOR

DAN referral physician James Chimiak, M.D. is Chief of Anaesthesiology at the Naval Hospital in Camp Lejeune, N.C., a Navy Diving Medical Officer and a Hyperbaric Medicine Adviser.

### MEDICATIONS USED IN THE TREATMENT OF MUSCULOSKELETAL DISORDERS

A diver should take any medication well before an active dive. This will rule out any adverse side effects unrelated to the hyperbaric environment but does not totally preclude a future drug reaction. The following drugs are commonly used for musculoskeletal disorders.

- NSAIDs / Aspirin: The use of anti-inflammatory medications for musculoskeletal problems is common. Allergic reactions to aspirin and non-steroidal anti-inflammatory drugs (NSAIDs) have been reported. Aspirin and NSAIDs (such as Motrin<sup>®</sup>, Naprosyn<sup>®</sup>, etc.) have negative effects on platelet clotting capability that can last up to one week. Theoretically, impaired platelet function may cause in increased bleeding in the event of barotrauma or even DCI. This has occurred in haemorrhagic lesions identified during the microscopic examination of spinal cords of animals experiencing DCI.

Conversely, before a dive, some divers take aspirin to decrease the ability of platelets to clot, preventing the cascade leading to DCI. This effect has prompted some physicians in the past to use aspirin and NSAIDs in the treatment of acute DCI. Today, neither aspirin nor NSAIDs are recommended by most dive physicians in treatment of DCI. A scientific study to determine whether they have any value in treating DCI is under way in Australia.

- Corticosteroids: The use of these drugs may result in electrolyte and fluid imbalance, mood changes and muscle weakness.
- Narcotics, muscle relaxants and benzo-diazapines: These are potent medications used to relieve moderate to severe pain and muscle spasm. Conditions requiring this level of pain relief generally will not permit diving. The effects of these medications on the user's mental status restrict their use. Their interaction with nitrogen narcosis can result in significant mental impairment, which can lead to loss of consciousness, even in those with well-controlled pain.



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