Fitness Issues for Divers with Musculoskeletal Problems

By Dr. James Chimiak

Can abnormalities in your musculoskeletal system prevent you from scuba diving?

Can fractures, osteoarthritis, rheumatoid arthritis, tendonitis, sprains, dislocations, bursitis, scoliosis, carpal tunnel syndrome, muscular dystrophy, joint replacement, disc surgery or amputation halt your watery pursuits?

The answers are yes and no; it comes down to specifics such as the type of injury or other abnormality you may have experienced as well as the degree of healing that may have already taken place.

Here's a look at musculoskeletal issues. Remember to call DAN if you believe you're injured as a result of a scuba diving injury; and keep in close contact with your physician on medical matters that can affect your diving.

Condition: Osteoarthritis

Description: Osteoarthritis (OA), is a disease of the bone and cartilage. Specifically, it affects the hyaline cartilage, the most common type of joint cartilage, and subchondral bone, located beneath cartilage.

Osteoarthritis is linked to aging; it most often shows up as joint pain and can result in a significant decrease in the range of motion. By age 40, almost everyone has some evidence of OA; by age 60-70, most individuals have symptoms. Scientists have even seen OA in whales and dolphins, our mammalian kin.

Fitness and Diving: Keep alert to your body. An individual's progressive loss of function due to arthritis requires ongoing evaluation: simply turning a valve can become impossible for those with severe OA. The restricted range of motion in joints can make certain manoeuvres difficult or impossible. This requires adequate pre-dive training and suitable gear modifications such as bigger knobs, tabs and zippers. It may also necessitate a change in the position of equipment to allow easier access.

Altered tissue blood flow may alter normal inert gas exchange in two ways: inflammation increases blood flow, while degenerative changes and scarring can result in little or no blood flow. Either of these changes affect the way nitrogen is taken up and released.

Many individuals find a reduction in pain when exercising through the distraction of the activity - i.e., keeping the mind busy with another activity rather than concentrating on pain. Exercise also strengthens muscles and supporting structures for a given joint or for the spine and thereby reduces pain, and it releases endogenous pain killers, or endorphins, which provide pain relief. The pain can return, however, or even increase afterward

Painful joints can cause a diagnostic dilemma: it may be difficult to discern the difference between the joint pain of arthritis and the joint pain of decompression illness after a dive.

Immobilisation worsens OA, while a well-planned exercise program is essential to preserving joint function. Diving and other water activities are particularly beneficial for persons with OA: the buoyancy of a body in water reduces the weight-bearing capacity of the affected joints.

Medication Used: Aspirin and non-steroid medications, though helpful in reducing pain, impair platelet function. Properly functioning platelets are essential for adequate haemostasis, or clotting. The most obvious sign is bruising, but a theoretical risk includes increased bleeding at injury sites that include those affected by barotrauma as well as neural tissue.

Condition: Rheumatoid Arthritis

Description: Rheumatoid arthritis (RA) is a progressive disease, OA, but with more vascular effects. It causes symmetrical joint inflammation (involving both the left and right sides of joints) that can lead to their eventual destruction.

Rheumatoid arthritis can become systemic - that is, it can involve far more than bones and joints. A vasculitis, or blood vessel inflammation, may result in fever, skin breakdown, ulceration and infection. The mechanism of

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vasculitis is not completely understood, but in some conditions there is actual attack by the body's immune system on its vascular components

Other ailments that can come with RA include:

• mononeuritis multiplex - the inflammation of separate nerves in unrelated parts of the body;

• pleural and cardiac effusions - the escape of blood or lymphatics into tissues or a cavity of the body;

• lymphadenopathy, or diseases of the lymph nodes;

• Sjogren's syndrome - immunological disorder occurring in post-menopausal women;

• episcleritis - inflammation of the eye; specifically, in the subconjunctival layers of the sclera.;

RA can also cause spinal cord compression and carpal tunnel syndrome, described later in this article. Inflammation of a blood vessel (vasculitis), in combination with vasoconstriction, a narrowing of the blood vessels, can literally starve a limb of oxygen.

Fitness and Diving: As with osteoarthritis, an individual's progressive loss of function due to RA requires ongoing evaluation, and the restricted range of motion in joints can make certain maneuvers difficult or impossible. This requires adequate pre-dive training and suitable modifications, as described in the section on osteoarthritis.

Generally, it's advisable to minimise active exercise during periods of inflammation: altered blood flow can affect normal inert gas exchange. Joint pain that increases during a dive trip, for example, due to lifting and carrying of dive equipment, can be difficult to differentiate from DCI.

Medication Used: Aspirin and non-steroid medications, helpful in reducing pain, can impair platelet function and hence blood-clotting ability. Steroid medications affect electrolyte balance and cause oedema (accumulation of excess watery fluid in cells, tissues or cavities). Gold preparations, used for treatment of RA, can cause lung irritation.

Cytotoxic drugs (cancer-fighting agents) such as methotrexate and azathioprine are used in severe cases because they help combat ongoing cartilage destruction. However, they, too, can cause a pneumonitis as well as affect the bone marrow or liver due to their toxic effects.

Condition: Tendonitis

Description: This acutely painful inflammation of the tendon may result from overuse or trauma. Often, however, there is no specific cause or event that can be linked to tendonitis. Usually, with a period of rest and anti-inflammatory medication, tendonitis will run its course. It also helps to evaluate possible positions or repetitive motions that may be causing or aggravating the condition.

Fitness and Diving: Because tendonitis is an injury or inflammation of the connective tissue between a muscle and another part of the body - and tendons transmit the force of movement - pain can significantly decrease the function of joints and muscles.

Remember to give it a rest: continued use of the inflamed tendon can maintain or even worsen the condition. There is even the danger of rupture, or a tear in the connective tissue, with subsequent loss of function. And as with arthritis, tendonitis can difficult to differentiate between the pain of decompression sickness after a dive.

Medication Used: Non-steroid medications, though helpful in reducing pain, alter platelet function hence blood-clotting ability. Steroid medication, often injected, is effective in reducing inflammation.

Condition: Sprains

Description: This traumatic injury to a joint damages the surrounding soft tissues and ligaments. The degree of disruption of the joint and supporting elements determines the severity of the injury.

Fitness and Diving: A sprain can cause a measurable decrease in function, which is secondary to the injury. It also causes mechanical impairment of the joint, which is secondary to ligament tear, connective tissue disruption and swelling.

After a sprain, soft tissue swelling may be severe, resulting in a diver's inability to comfortably fit into dive equipment. It can also result in a decrease in blood flow perfusion and alter the inert gas exchange.

Any change in the pain presents a diagnostic dilemma after a dive: is it the pain of a sprain or DCS? After a sprain, a physician should allow no diving until the injury has healed and the prospective diver can effectively perform all expected diving and swimming manoeuvres without pain. A good test is to try manoeuvres in a pool, swimming with fins.

Medication Used: Non-steroidal anti-inflammatory drugs (NSAIDs) affect platelet function. Rest, elevation of the injured limb and icing are the initial treatments, which are incompatible with diving.

Condition: Dislocations

Description: The dislocation of a joint is very painful and can cause swelling and loss of function. Once swelling is reduced or the joint is placed back in its anatomic location, the individual with a dislocation should take a prescribed a period of rest and rehabilitation before resuming normal activity. Due to structural abnormalities, some individuals may be subject to recurrent dislocations: under conditions of minimal stress from routine physical activity, the joint may be prone to dislocation. Some cases may require surgical repair.

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Fitness and Diving: If a diver is subject to recurrent joint dislocation, he should not dive: if dislocation occurs during a dive, the risk of DCS from the acute soft tissue trauma and the loss of function could be hazardous for the diver and his buddy. An orthopaedic surgeon may allow a return to diving after a period of rest and rehabilitation and if the diver can engage in strenuous exercise.

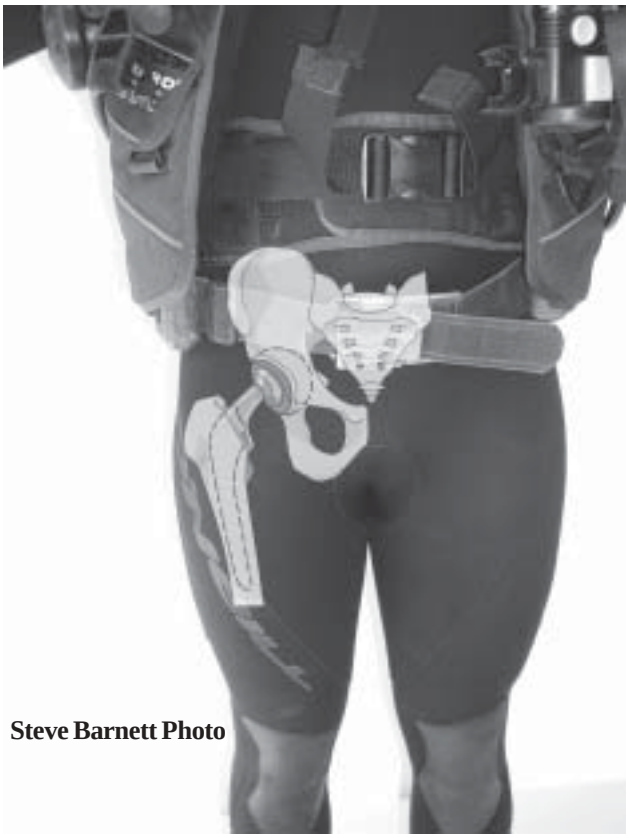
As with sprains, soft tissue swelling can hamper the normal exchange of inert gas and result in DCI. The resulting chronic joint pain can be confused with decompression illness post-dive. In addition, scars from corrective surgery pose a remote theoretical risk of impaired inert gas exchange.

Medication Used: NSAIDs, often helpful in pain reduction, result in decreased platelet function and hamper blood clotting ability.

Condition: Bursitis

Description: A bursa is a collection of tissue and fluid that decreases the friction between opposing bony surfaces of the body. Bursitis is the inflammation of this structure due to overuse or trauma. As with tendonitis, there is often no identifying cause. The pain and swelling can be severe; an individual can experience a considerable loss in a joint's range of motion. Often, with rest and anti-inflammatory medication, the condition is self-limiting - i.e., like tendonitis, it will run its course.

Fitness and Diving: Increased tissue swelling secondary to the inflammation carries the theoretical risk of hampered inert gas exchange and, subsequently, the development of DCI. Extreme pain can cause a loss of function. If the pain or loss



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of function worsens, the individual with bursitis should postpone diving and other strenuous athletic activity until the condition resolves and the joint is pain-free during activity.

Medication Used: Anti-inflamatory drugs are helpful in pain reduction, but NSAIDs affect platelet function and hamper blood clotting ability. Corticosteroids may be injected into the bursa but can cause systemic glucocorticoid effects - i.e., fluid or electrolyte abnormalities, associated with osteoporosis - with repeated use.

Condition: Scoliosis

Description: This condition is an abnormal curvature of the spine. Various degrees of scoliosis result in a range of symptoms, from pain to neurological problems to difficulty in breathing.

Fitness and Diving: Severe spinal curvature can result in pulmonary compromise, making even moderate exercise impossible. The abnormal posture seen in individuals with scoliosis may require equipment modification to allow donning and optimal balancing, with special weight-bearing considerations or restrictions.

With scoliosis, the individual may experience neurological abnormalities continuously or intermittently. Muscles near the spine can develop asymmetrically with scoliosis: overuse leading to muscle strain can result in significant back pain and spasm. The spasm can cause a pinching in the nerves coming out of the vertebral column, resulting in a new neurological deficit.
Correction of severe scoliosis can employ the placement of steel rods to support vertebral column when it is straightened to improve function and symptoms. Once healed, an individual may resume diving, but at a moderate pace. Mild cases of scoliosis are found sometimes during routine exams and have little or no impact on the person. Before making plans to dive, individuals with severe scoliosis should be evaluated by a physician knowledgeable in dive medicine.

Medication Used: NSAIDs affect platelet function. Muscle relaxants may be used for occasional spasms topside, but they are incompatible with diving because of their sedating effects.

Condition: Carpal Tunnel Syndrome

Description: This mechanical entrapment of the median nerve at the wrist results in paresthesias (altered sense of touch, like numbness or other changes in normal sensation) of the thumb, index and middle finger. Severe, long-standing cases result in the atrophy of muscles at the thumb. For these individuals, surgery is the treatment of choice.

Carpal tunnel syndrome results from overuse of the hands and wrists, abnormal positioning of the hands for extended periods, and soft tissue swelling; in some cases, however, there is no identifiable cause. Sometimes hyperbaric oxygen treatment can cause numbness in the hand - a phenomenon not completely understood - and is neither DCI nor carpal tunnel syndrome.

Fitness and Diving: Severe cases can cause a weakness in grip. The numbness common to most cases is difficult to evaluate after a dive, particularly if new or worsening symptoms are discovered post-dive.

Medication Used: If conservative rest and redesign of the working environment are ineffective, surgery is the treatment of choice. Oedema associated with CTS can cause sensory changes, as the fluid may

actually compress an area where the nerve passes. Renowned dive physician Dr. Carl Edmonds has reported the gradual onset of the condition when a diver stopped taking her diuretic (medication to relieve oedema) during a week of diving.

Condition: Muscular Dystrophy

Description: This condition is characterised by generalised weakness of skeletal musculature associated with various muscle diseases: Landouzy-Dejerine, Leyden-Mobius, Duchenne and Becker are common muscular dystrophies that demonstrate a range and severity of Muscular Dystrophy (MD). The condition can affect one's ability to swallow, stand erect, maintain balance, walk, swim, hold a regulator and even talk.

Many individuals with MD are confined to a wheelchair by their late teens. These individuals can also have cardiac dysrhythmias, or irregular heartbeats. An active exercise program can benefit them, aiding in maintaining function.

Fitness and Diving: Critical issues concerning the diver's ability to even exit and enter the water safely require careful consideration. Weakness not only impairs the diver's ability to react to emergency situations, but it also demands significant gear and routine modification during diving. The disease, often progressive and ongoing, requires careful expert evaluation, but diving may prove impractical.

Diving as part of an exercise program, versus diving as a recreational activity, is considered therapeutic. Just as trained personnel assist the therapy of the individual on land, the underwater environment requires no less attention to detail. Careful planning should include modifying both gear and operating procedures. If a diver with MD requires assistance, the risk to the dive buddy should be considered.

Medication Used: Corticosteroids have been used in aiding joint movement, but they also cause fluid or electrolyte abnormalities.

Condition: Joint Replacement Surgery

Description: Destruction of a joint for whatever reason may require its replacement by an artificial joint. After surgery, aquatic activities are excellent sources of exercise, because they decrease weight-bearing stress.

Fitness and Diving: Theoretical concerns exist as to altered blood flow to the joint, resulting in impaired inert gas exchange. After a period of rehabilitation and subsequent authorisation by an orthopaedic surgeon for return to strenuous activity, individuals can dive, but they must document episodes of post-op neurological deficits. If severe pain or neurological symptoms persist, the individual should stop diving. Physicians should assess individually the loss of function or range of motion, noting appropriate changes to enhance underwater safety.

Medication Used: None required.

Condition: Disc Surgery

Description: The disc is a shock-absorbing structure that lies between two successive vertebrae. When injured, it can be a source of severe pain and neurological abnormalities. A herniation of the disc may result

in the expulsion of disc material into the spinal canal, often causing excruciating pain and neurologic deficits.

The condition may require surgery for the removal of part of the vertebrae and the injured disc. The surgery, which can result in remarkable relief of the symptoms, can allow return to full activity after a period of rest and rehabilitation. To prevent re-injury, individual should use a regular program of back exercise. A small percentage of such persons may experience no symptom relief or even worsening of the pain or neurological deficit even after surgery.

Fitness and Diving: Once a person has fully recovered and is symptom-free, a surgeon might authorise a return to strenuous exercise. Those individuals whose symptoms remain should be cautious. An increased risk for DCI theoretically exists if persistent inflammation causes impaired inert gas exchange. Also, persistent neurological abnormalities pose a diagnostic dilemma, especially if they worsen or a new deficit shows itself after a dive.

The diver must be careful not to re-injure his back while balancing himself or lifting his equipment on a shifting boat: this advice is easier said than done. For the person who considers diving after disc surgery, his plans should include expert evaluation and a detailed neurological exam.

Medication Used: NSAIDs help relieve pain but impair platelet function. The need for narcotic medications may indicate a degree of pain that precludes diving. Narcotics, anticonvulsants, membrane stabilisers, muscle relaxants and tricyclic antidepressants (all commonly prescribed for significant back pain) may have an adverse effect on the central nervous system and even work synergistically with the effects of nitrogen to further impair performance and judgment while diving.

Condition: Amputation

Description: Loss of limb due to trauma or surgical removal, as well as the congenital (existing since birth) absence of a limb, pose obvious challenges to a person's overall function. Adaptation by the diver, however, can greatly decrease that impact. Both task modification and prosthetics have enhanced the lives of amputees.

The effects of amputation vary, ranging from near complete return to full function to incapacitation. If the amputation is due to a medical condition, such as peripheral vascular disease, specialists should evaluate the diver's cardiovascular status and required medicines. Chronic phantom sensations and phantom pain can affect quality of life, and any ongoing infection can hamper robust activity.

Fitness and Diving: The ability to perform both topside and underwater must be thoroughly assessed. Even the most motivated diver with an amputation will have difficulty with some aspect of the dive, but it's possible to undertake modifications of gear and procedures. Professional divers who have undergone amputations have made adaptations in order to continue diving. After amputation, divers should define their limitations and risks - to themselves and their buddy.

Medication Used: Many medications used to treat pain may cause sedation and are not recommended for diving. Any medications used for associated conditions must also be examined before diving under their influence.