Ear Squeeze – The Most Common Dive Injury

It's no surprise that ear squeeze, the most common injury in scuba diving, results in the most frequently asked question to Divers Alert Network. At the same time, many middle ear barotraumas may be one of the most preventable injuries in diving. It takes awareness, training, practice and a lot of patience. Sinus squeeze is equally prevalent as a dive injury. It's simply an issue of space: at some time in their diving careers, most divers will have a problem related to clearing their ears or sinuses. A little knowledge of the condition and a few preventive measures can go a long way toward avoiding squeeze. When we talk about barotrauma, we mean a pressure- related injury to the soft tissue lining the body's air spaces – for example, in the middle ear and sinus cavities. Although this is where we feel discomfort, the problem begins in the air passageways that connect these airspaces to the back of the throat.

These mucous membrane-lined passages serve the body in two important ways: They moisten or humidify the air moving through the connecting passages, and they help protect the body from foreign material such as pollen and bacteria by producing protective mucus. This mucus traps the material and allows it to be transported to the back of the throat, where it is swallowed and destroyed by stomach acid. A normally functioning mucous membrane is a remarkable defense mechanism. For new divers, equalizing the ears may involve a learning curve: Their previous experience may have been only an airplane ride or a trip across a mountain range. For some, it's hard to concentrate on breathing through a regulator while trying to remember to clear the ears, especially during the first few exposures to scuba. Normally this gets easier with experience. Even veteran divers, however, can encounter ear problems. In fact, most calls to DAN come from experienced divers, as they may have a more developed sense of recognizing a pressure-related injury. Most of these divers suffer from allergies, head colds or other viral illnesses that cause the swollen and inflamed mucous membranes to close or narrow the passageways. Some divers may have abnormalities in the Eustachian tube, the small passage leading to the middle ear space located in the back of the throat). This may consist of a narrowing of that passage, or there may be scars and subsequent thickening from chronic childhood ear infections or long-term allergies. Although it is sometimes possible for an ear, nose and throat (ENT) surgeon to release some adherent scars, surgery is rarely a solution for Eustachian tube dysfunction. Finally, a deviated septum or broken nose can cause an inability to clear both ears at the same time during descent. The result is barotrauma.

Prevention

Once you've experienced a squeeze, this may require a break from diving. This type of jury can make it impossible to equalize the middle ear, leading to intense pain, rupture of the eardrum or even more serious injury such as hearing loss.

The best strategy is to avoid barotrauma. This begins by learning the various maneuvers for ear equalizing and allowing yourself to discover the one that works best for you. It is advisable that new divers get exposure to all of the popular clearing techniques. Although the Valsalva maneuver is the most familiar and the easiest earclearing method to explain, it does not work for everybody. Plus, a technique that works one day may not work the next. For example, at times, the Valsalva will not open the Eustachian tube, but moving the jaw side to side while swallowing may open it.

Medication?

Although surgery is usually ineffective for equalizing problems – unless they are related to nasal septum deviations or polyps – the judicious use of anti-inflammatory, anti-allergy and decongestant medications may be helpful. A local ENT physician can assist you in finding the best and most effective medications. Not all are equally effective, however. Finding what works best may require some patience and many attempts using various regimens. While you and your doctor are searching for your ideal dosage and

frequency, keep these factors in mind: Nasal sprays may help to constrict the nasal mucosa, but they do not reach the Eustachian tube itself. Also, you can develop a tolerance after five to seven days of continuous use. Many individuals have found pseudoephedrine to be effective as a sinus and middle ear decongestant, but it may not work equally well for everyone. Always follow the directions for taking any medication, and note the restrictions for taking drugs like pseudoephedrine, including heart problems. As a general rule, divers should try a new medication a day or two prior to their dive. This usually allows enough time for the medication to be absorbed into the system and for the diver to notice any unusual side effects. You may need to contact your personal physician about combining your medications or potential interactions between medications.

If all goes well, new divers soon become experts at clearing their middle ear and sinus cavities. Remember that conditions such as seasonal allergies and head colds may still present challenges. A runny nose or fullness and pain over the eyebrows and cheekbones – especially when bending forward – may be signs of inflammation or infection of the nasal passages and the harbinger of equalizing difficulties. Although symptoms may resolve briefly with medications, the underlying problem of membrane inflammation and swelling may persist for days or weeks after primary symptoms have resolved. It is common to experience a resurgence of problems after colds or allergy attacks if you dive too soon afterward. Such changes in pressure during a flight or while diving, while equalizing or "duck diving" (i.e., descending head-first), can cause enough additional engorgement of the Eustachian tube to result in closure of the air passage. When this happens, this may either prevent air from passing into the sinus or middle ear cavity during descent – causing a "squeeze" – or it can prevent air from escaping during ascent, a condition known as "reverse block."

What If You Already Have Symptoms?

If you feel you already have experienced some barotrauma, further diving may be difficult. Divers should be instructed to halt their descent on the first indication of sinus or middle ear discomfort. Forceful clearing or continuing a descent can lead to more serious injury, including hearing loss. At the first sign of clearing difficulty, whether in a sinus or the middle ear, divers should stop the descent and ascend two to three feet – or until they are able to clear and there is no further discomfort. If this is not effective, it is a clear signal to abort the dive. If it works, however, make further descent slowly while clearing every one or two feet. Use the maneuvers that work best for you. Remember that pain is abnormal during a dive: It usually means a vacuum is being drawn on an airspace somewhere. Blood or fluid will be drawn from the surrounding tissue into the air space, causing gas trapping when returning to the surface.

Sadly, at times, someone's dive day will end because of an inability to clear the ears. Denying the problem or forcing the ears is not a solution. The only way to resume diving is by allowing the injured tissues to rest and by taking appropriate medication to reduce inflammation and swelling. It will take time, usually a few days, but in rare circumstances it may take weeks – especially if the injury is not properly addressed when it happens. In the meantime, don't force things. Even the additional pressure of lifting a heavy object may cause further injury. Ear clearing without force – wriggling the jaw to open the Eustachian tube – is appropriate and helpful, and it can relieve pressure in the middle ear. In general, once a diver has experienced discomfort or pain, start a course of therapy. That begins with a visit to the doctor.

Preventing Squeeze

Barotrauma is not only the most common injury in scuba diving, it is also preventable. The simplest advice to preventing it includes these tips.

- Don't dive if you can't clear your ears.
- To get a head start, clear before you get in the water.

- If you are no longer able to clear, stop your descent immediately. Ascend a few feet and try again. If you are able to clear without pain, continue slowly. If the problem recurs, follow the same procedure. If you cannot clear your ears, abort the dive.
- Equalize early and often.
- Never force your ears.
- Only dive with decongestant medication* if it improves equalizing – not if you need it to be able to clear (this means the problem is serious) – and if you have tried the medication on land without side effects.

Most dive physicians recommend that you do not dive deeper than 80 feet (24 meters) if you are taking any medication. This avoids the risks of nitrogen narcosis and the theoretical concerns about increased oxygen toxicity if you're diving using enriched air nitrox.

*Always read the directions for use and precautions on over-the-counter drugs. Some medications do carry a precaution against diving while using enriched air nitrox.

How Can Dive Professionals Help?
Work with your divers and offer alternative ear-clearing techniques. Ear and sinus barotrauma can happen to any diver, regardless of experience. Try these pressure equalization techniques:

Valsalva Maneuver
The most common ear-clearing technique, this maneuver involves holding the nose, closing the mouth and blowing gently. This raises the pressure in the pharynx, forcing air up the Eustachian tubes into the middle ear. Avoid forcefully performing this maneuver because it can damage the inner ear.

Toynbee Maneuver
Performed by holding the nose and swallowing simultaneously. The Eustachian tubes open momentarily, allowing air to enter the middle ear. This technique may also relieve reverse squeezes.

Frenzel Maneuver
This atraumatic method of adding air to the middle ear is accomplished by closing the nose, mouth and glottis voluntarily, then driving the tongue backward, which acts as a piston to compress air into the nasal cavities and through the Eustachian tubes.

Yawn and Swallow
This simple maneuver involves thrusting the lower jaw forward and slightly opening the jaw. At the same time, keep the lips pursed around the regulator and swallow.

Head Tilt
Many divers find that one ear clears more easily than the other. By tilting the head so the "bad" ear points upward, the stretching of the opening of the Eustachian tube may make it easier to equalize.

Tip
It's a good idea to "pre-clear" before you go under: Hold your nose and swallow to see if you get that characteristic release.

Remember, equalize early and often – before you experience discomfort.

Take the 'Ears and Diving' Seminar Despite being one of the least understood, the ears are one of the most important body parts in the human body – especially as they relate to diving. The outer ears capture sound and protect the eardrum. The middle ear processes sound and must be equalized to ambient

pressure, or injury can result. The inner ear controls our sense of balance. Each of these three sections is susceptible to injury. This hourlong online seminar is designed as a primer on how the ears function and the things divers must do to take care of their ears. It is not a program intended to make anyone an expert on ears. What it does, however, is help divers understand their ears and how they are affected during a dive.

About the Author

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