

9 TIPS FOR EASY EQUALIZING

- 1 **EQUALIZE BEFORE YOU DIVE.** Prior to descent, while you are neutrally buoyant with no air in your buoyancy control device (BCD), gently inflate your ears using your preferred equalization technique to check that you are able to equalize.
- 2 **DESCEND FEET FIRST.** This allows air to travel upward into the Eustachian tube and middle ear, a more natural direction. Use a descent line or the anchor line to control the speed of descent.
- 3 **EQUALIZE OFTEN.** Inflate your ears gently every few feet for the first 10 to 15 feet.
- 4 **PAIN IS NOT ACCEPTABLE.** If there is pain, you have descended without adequately equalizing. Ascend a few feet until the pain stops.
- 5 **STAY AHEAD.** If you do not feel your ears opening, stop and try again; you may need to ascend a few feet to diminish the pressure around you. Do not bounce up and down.
- 6 **TRY TILTING.** If you are having trouble equalizing on one side, it may be helpful to tilt the blocked ear toward the surface.
- 7 **STOP IF IT HURTS.** If you are unable to equalize, abort the dive. The consequences of descending without equalizing could ruin an entire dive trip or cause permanent damage and hearing loss.
- 8 **DO NOT DIVE WITH CONGESTION.** Decongestants and nasal sprays may be used prior to diving to reduce swelling in the nasal and ear passages. If your doctor agrees with your decision to use decongestants, take them one to two hours before descent. They should last from eight to 12 hours, so you don't need to take a second dose before a repetitive dive. Nasal sprays should be used approximately 30 minutes before descent and usually last 12 hours. Take caution when using over-the-counter nasal sprays; repeated use can cause a rebound reaction resulting in increased congestion and possible reverse block on ascent. Decongestants may have side effects. Do not use them before dive if you do not have previous experience.
- 9 **KNOW WHEN TO CALL IT.** If at any time during the dive you feel pain, experience vertigo or note sudden hearing loss, abort the dive. If these symptoms persist, do not dive again and consult your physician.



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THE EARS & DIVING: UNDERSTANDING EQUALIZATION



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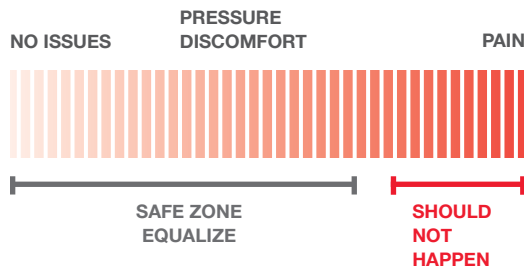


WHY YOU MUST EQUALIZE

As divers descend in the column of water, environmental pressure on the body increases in a linear fashion at a rate of one-half pound per square inch (PSI) for each foot (0.1 kg/cm² for each meter) and transmits across the body. For the pressure in gas-filled spaces like the middle ear cavity to increase accordingly, the volume has to decrease or more gas has to be added. As diver descends, the volume of middle ear can be reduced by bowing of the eardrum inward. After the eardrum stretches to its limits, further reduction of middle ear cavity volume is not possible and if descent continues the pressure in the middle ear cavity remains lower than its surroundings.

To prevent pressure-related injuries such as bleeding, edema (swelling) of soft tissues, leakage of fluid into the air space and membrane rupture, divers must actively enable air from the throat to enter through the Eustachian tubes into the middle ear by using equalization techniques.

DISCOMFORT SCALE



On ascent, the surrounding pressure decreases and the pressure in the middle remains higher if the gas has no way to leave the middle ear cavity. When the pressure in the middle ear exceeds surrounding pressure by 15-80 cm of water (cmH₂O), which corresponds to an ascent in water of 0.5-2.5 feet, the Eustachian tubes open and surplus gas escapes. If your ears do not equalize at the same rate and the pressure difference reaches about 66 cmH₂O (2 feet), alternobaric vertigo may occur.

For more information, explore DAN.org/HEALTH.

HOW TO EQUALIZE

There are several techniques divers can employ to effectively equalize their ears. Here are some useful techniques to try:

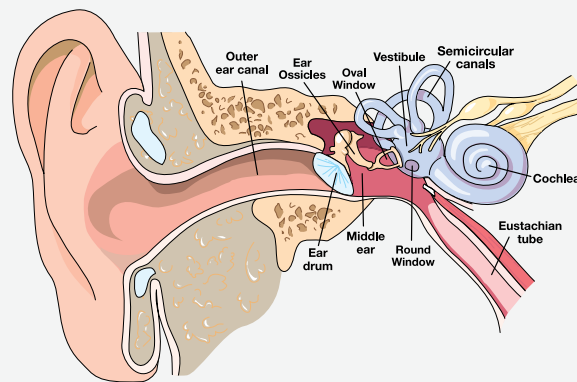
- ▮ **PASSIVE:** Requires no effort. Occurs during ascent.
- ▮ **VOLUNTARY TUBAL OPENING:** Try yawning or jaw wiggling.
- ▮ **VALSALVA MANEUVER:** Pinch your nostrils and gently blow through your nose.
- ▮ **TOYNBEE MANEUVER:** Pinch your nostrils and swallow (good technique, if equalization is needed during ascent).
- ▮ **FRENZEL MANEUVER:** Pinch your nostrils while contracting your throat muscles and make the sound of the letter “k.”
- ▮ **LOWRY TECHNIQUE:** Pinch your nostrils and gently try to blow air out of your nose while swallowing (think Valsalva Maneuver meets the Toynbee Maneuver).
- ▮ **EDMONDS TECHNIQUE:** Push your jaw forward and employ the Valsalva Maneuver or the Frenzel Maneuver.

PRACTICE MAKES PERFECT

Divers who experience difficulty equalizing may find it helpful to master several techniques. Many are difficult until practiced repeatedly, but this is one scuba skill you can practice anywhere—in a pool, on a plane or even at your desk. Just do it gently!

ANATOMY OF AN EAR

The ear is the organ of hearing and balance. Understanding its anatomy can help better illustrate why it's essential to equalize. The ear consists of three distinctive spaces filled with either air or liquid: the external, middle and inner ear.



THE EXTERNAL EAR

The external ear includes the pinna (auricle) and the ear canal up to the eardrum (tympanic membrane), which separates it from the middle ear. The lining of the external ear is skin rich with glands that produce earwax.

THE MIDDLE EAR

The middle ear is a cavity in a temporal bone lined with a thin layer of tissue similar to that found in the nose and throat. It is separated from the ear canal by the eardrum and connected to the throat via the Eustachian tube. It includes three tiny bones (auditory ossicles) forming the chain attached to the eardrum on one side and to the oval window membrane on the inner ear side. The middle ear space is filled with air at ambient pressure, which needs to be equalized when ambient pressure changes (as occurs in diving or flying). This is accomplished by using equalization techniques like the Valsalva maneuver to move air in or out through the Eustachian tubes.

THE INNER EAR

The inner ear includes the cochlea (hearing organ) and the vestibule and semicircular canals (balance organs). The cochlea and the vestibule are the origin of both the auditory and vestibular nerves.