

When Ears Can Cause a Failed Fit Test

How to troubleshoot a failed test that seems to defy all reasons for failure.

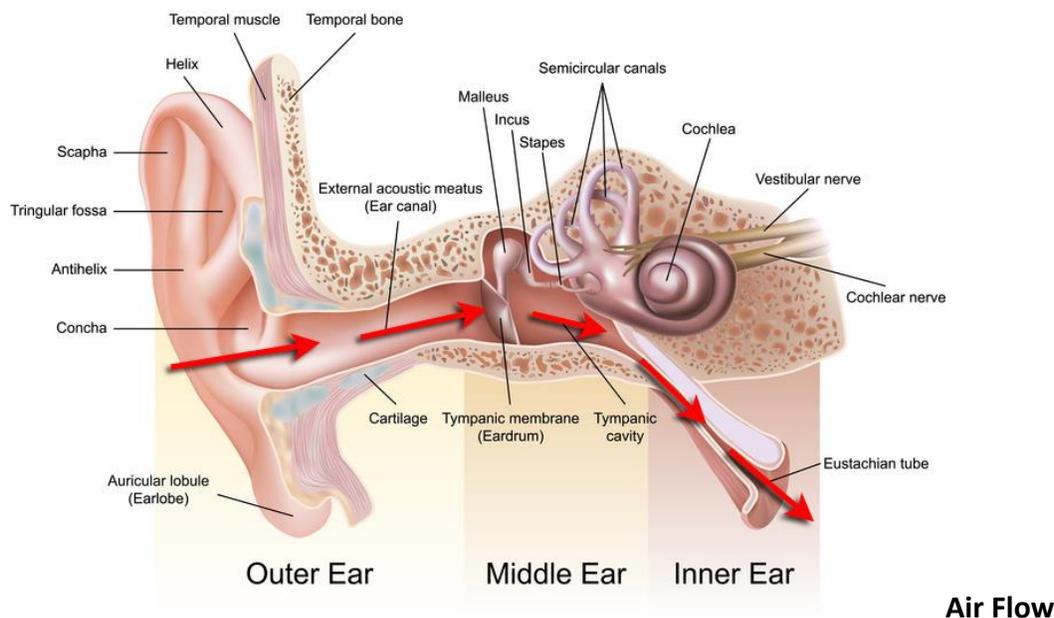
Problem: One particular person cannot pass the test even though the fit of the mask seems fine, the test is run correctly and others pass with no problem.

Solution: Follow the steps outlined here to determine source of leakage.

First, verify that the subject is actually holding his breath by closing the airway. Instruct subject to press tongue firmly against and towards the back of the roof of mouth. This will help close the throat completely and assure an airtight seal.

Second, examine the obvious causes for leakage which include facial scars, beard or stubble, exceptionally thin face or indented temples, hairline intercepting the seal of the mask or the mask pulled too tightly producing skin puckering around the seal.

After you have eliminated these as a possibility it is time to consider that the subject may have a perforation in the ear drum that is resulting in a leak to the mask. In the illustration below, you can see that if there was a perforation, there would be a clear passage way from the inner ear through the **Eustachian** tube and into the sinus cavity. A perforation in the ear drum (tympanic membrane) would open the ear to the outside and thus be measured as a leak.



What can cause perforation in an ear drum?

According to the American Academy of Otolaryngology, the leading causes of rupture or perforation to an ear drum are:

- The ear is struck directly
- Skull fracture
- After a sudden explosion
- If an object (such as a bobby pin, Q-tip, or stick) is pushed too far into the ear canal
- PE Tubes implanted during childhood.

Other causes to consider would be:

- **Ear infections.** An infection of the middle ear or inner ear can cause pus or fluid to build up behind the eardrum. This can make the eardrum burst open.
- **Sudden pressure changes.** Most of the time, the air pressure in the middle ear and the pressure in the environment are in balance. But some things — like flying in an airplane, driving at higher altitudes, or scuba diving — can cause a change in pressure that may rupture an eardrum

Regardless of the cause the proper approach would be to utilize tight-fitting ear plugs similar to those pictured below during the fit test. If the test subject then begins to show a seal during the test and subsequently passes with ear plugs in place then this confirms the likelihood of a perforation.



Note: A perforated ear drum can represent a serious condition and should be referred to an ENT or medical professional.

A person passing the fit test while wearing ear plugs should also utilize the ear plugs while wearing the mask in a real work environment. An open passageway through the ear can potentially introduce harmful vapors into the sinus cavity and beyond.

References:

http://kidshealth.org/teen/diseases_conditions/sight/eardrums.html

<http://www.entnet.org/content/perforated-eardrum>

<http://www.fauquierent.net/eardrumhole.htm>