The Frenzel Technique, Step-by-Step

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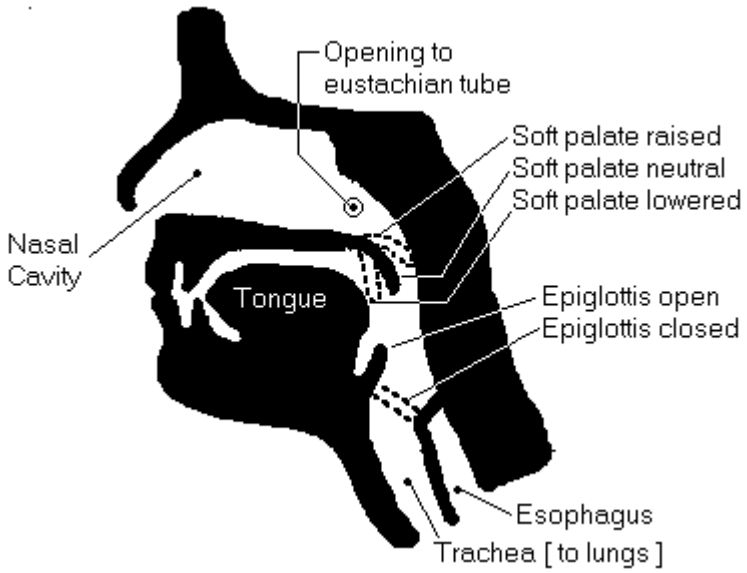
Disclaimer: All freediving and breath-hold activities should be done in the presence of an experienced partner
NOTE: This document concentrates on the frenzel technique to equalize the ears. However, the frenzel technique, and all advanced variations, can also be used to equalize a mask at great depth. To equalize a mask, simply perform the frenzel without plugging the nose.

Part 1: Physiology

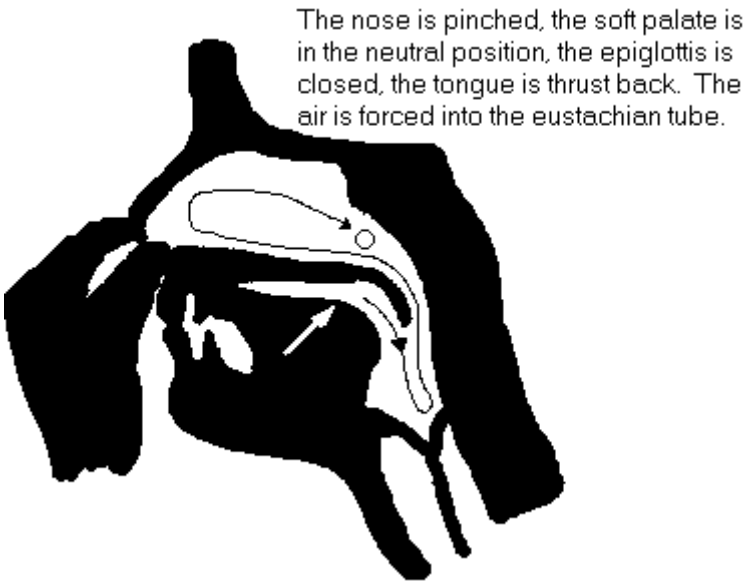
Below is a cut-through view of a human head:



- The passage that leads to the lungs is called the Trachea. It can be opened or closed by the epiglottis.
- The passage that leads to the stomach is called the Esophagus. It can be opened or closed, but it is always closed except during the act of swallowing.
- Air flowing in or out of the lungs can be directed by the soft palate. If the soft palate is in the neutral position (as shown above), then air is free to flow through both the nose and the mouth.
- If the soft palate is raised, the nasal cavity is sealed off, and air can flow only through the mouth.
- If the soft palate is lowered, the mouth is closed off, and air can flow only through the nose.
- The openings to the eustachian tubes are in the nasal cavity. The key to equalizing the ears is to force air into the eustachian tubes.

Part 2: The Frenzel Technique in Action

Below is a cut through view of a human head as the frenzel technique is performed:



The tongue acts as a piston; by thrusting the tongue back and up, the entire volume of the throat airspace is crushed. The air must go somewhere. It tries to go into the lungs, but the epiglottis is closed. It tries to go into the stomach, but the esophagus is closed. It tries to exit via the nose, but the nose is plugged by the fingers. The only place to go is into the eustachian tubes. The pressure of air forced into the eustachian tubes is limited only by the strength of the tongue. The tongue is incredibly strong. The tongue can provide enough air pressure to rupture the eardrums.

To perform the frenzel technique:

1. Pinch your nose.
2. Fill your mouth up with a little bit of air.
3. Close the epiglottis.
4. Move the soft palate to the neutral position.
5. Use the tongue as a piston and push air towards the back of your throat.

Unfortunately, most people do not know how to control the epiglottis or the soft palate, and most people do not know how to use the tongue as a piston. The purpose of this document is to describe step-by-step procedures to learn each of the above steps. As long as each individual step is mastered, success is guaranteed.

The individual steps which must be learned can be broken down as follows:

1. Learn to fill the mouth up with air
2. Learn to control the epiglottis
3. Learn to control the soft palate
4. Learn to apply the ‘tongue block’
5. Learn to use the tongue as a piston

6. Learn to control the epiglottis and soft palate independently
7. Put it all together
8. Test it in the water
9. Learn the advanced variations

Step 1: Learn to fill the mouth up with air

Fill your cheeks up like a balloon, and hold the air there for a few seconds.
Then, using your cheeks, push the air back into your lungs.
Repeat this several times, until you can do it at will.
To do a 'complete cheek fill', fill your cheeks until they are bursting.
To do a 'moderate cheek fill', fill your cheeks until they just start to bulge.
When I say 'Fill your mouth up with a little bit of air', I mean do a 'moderate cheek fill.'

Step 2: Learn to control the epiglottis

There are many ways to learn to control the epiglottis:
Method 1: Gargling water or mouthwash
1. Take a sip of water
2. Tilt your head back, but do not allow the water to flow down your throat. Do not swallow the water.
3. The water does not enter your throat because you have closed the epiglottis.

Method 2: Exhaling and stopping the air
1. Open your mouth, and keep it wide open.
2. Exhale, but don't allow any air to escape.
3. In other words, 'close your throat' and exhale against your closed throat
4. No air comes out because you have closed the epiglottis

Method 3: Inhaling and stopping the air
1. Open your mouth, and keep it wide open.
2. Inhale, but don't allow any air to enter your lungs
3. In other words, 'close your throat' and inhale against your closed throat
4. No air enters your lungs because you have closed the epiglottis

Method 4: Epiglottis music
1. As in method 2, exhale against your closed throat. Continue to apply pressure.
2. Now, for just an instant, let air through, then stop it again. It should make a funny choked noise.
3. Let air out, stop it, let air out, stop it, again and again, as fast as possible.
4. The muscle you are controlling is the epiglottis.

Method 5: Epiglottis music on an inhale
As in method 4, but inhale, stop the air, let it pass, stop it, let it pass.

Continue practising methods 4 & 5 until you have mastered the epiglottis.

Step 3: Learn to control the soft palate

1. Close your mouth
2. Inhale through your nose
3. Exhale through your nose
4. Inhale through your nose
5. Open your mouth
6. Exhale through ONLY your nose; NO AIR should come out of your mouth
7. Inhale through ONLY your nose, NO AIR should flow into your mouth
8. Keep breathing through your nose only, while keeping your mouth open
9. Now, breathe through JUST your mouth, without any air flowing through your nose
10. Once you are sure you can breathe through either your nose or mouth (keeping mouth open), proceed to the next step.
11. Inhale deeply
12. Open your mouth wide, and keep it wide open
13. Begin exhaling SLOWLY through your MOUTH ONLY.
14. Still exhaling, keeping your mouth WIDE OPEN, exhale through your NOSE ONLY
15. Still exhaling, switch again, continuing to exhale through your MOUTH ONLY.
16. Keep exhaling slowly, switching back and forth between nose and mouth as fast as possible.
17. Try the same thing when inhaling – keep the mouth wide open, switch back and forth rapidly between inhaling through the mouth and nose
18. As you switch back and forth, you will feel something soft and fleshy at the upper back of your throat moving. That is the soft palate. You raise the soft palate to breathe through your mouth, you lower the soft palate to breathe only through your nose.
19. Keep repeating the above exercises until you can 'raise' or 'lower' the soft palate at will.
20. When you exhale through BOTH your mouth and your nose, the soft palate is in the NEUTRAL position (neither up nor down).

Step 4: Learn to apply the 'tongue block'

Now you must learn to stop air flow with your tongue only

1. Begin exhaling through your mouth
2. Stop the air flow by closing your mouth (your cheeks should fill momentarily)
3. Inhale again, and begin exhaling again
4. Stop the air flow by closing the epiglottis.
5. So, you already know of two ways to prevent air from flowing out of your mouth—you can either close the epiglottis, or you can just close your mouth.
6. Now you must learn a third way to stop the air from flowing out of your mouth.
7. Inhale, and exhale slowly through your mouth, saying the syllable 'th' as in the word 'theatre.'
8. Now, keeping your tongue in that position, touch the tip of your tongue to the roof of your mouth, just behind your front teeth.
9. Try to stop the air from flowing past your tongue, by making a seal with your tongue. The tip of your tongue touches the roof of your mouth behind your front teeth; the sides of your tongue touch the roof of your mouth just inside your molars.
10. Keep repeating the above steps until you can stop air from flowing out of your mouth by using your tongue.

11. Make sure you are not cheating by closing the epiglottis or closing your mouth. Your lips should remain OPEN, and your jaw will be almost closed – it can be done with the jaw totally closed, or only closed enough so that your front teeth (upper and lower) touch each other.
12. Once you have mastered stopping the air with your tongue, remember what you do with your tongue—remember the position of the tongue—that is called the 'tongue block.'

Step 5: Learn to use the tongue as a piston

1. If you do not already know how to pack your lungs, refer to Appendix 'A'
2. Once you can pack your lungs easily and unconsciously, proceed to the next step.
3. Find a snorkel
4. Put the snorkel in your mouth
5. Pinch your nose
6. Pack your lungs through the snorkel
7. You cannot use your cheeks to pack—it won't work. You must use your tongue.
8. In other words, suck air through the snorkel, then apply the 'tongue block', then raise your tongue backward, to push the air back into your throat and lungs.
9. When doing this, the sides of your tongue touch your gums on the roof of your mouth, by your molars. The tip of you tongue touches the roof of your mouth. Once you have created a 'seal' with your tongue, all your teeth will be in the outer 'air chamber', and all the air behind your tongue will be in the 'rear air chamber'. When your tongue is in this position, it is not possible to exhale. The tongue blocks the air.
10. Once you can pack through your snorkel (using your tongue as described), you have mastered 'using the tongue as a piston.' Now you know how to push air into your lungs using your tongue.

Step 6: Learn to control the epiglottis and soft palate independently

Unfortunately, the epiglottis and soft palate are 'coupled', in the sense that your ears are coupled. It is hard to move one ear and not the other. It is hard to move one eyebrow and not the other. If you can move one eyebrow and not the other, then you have successfully 'uncoupled' those two muscles. You can control those two muscles independently. The epiglottis and soft palate are coupled. When you close the epiglottis, you almost certainly raise your soft palate (which thus prevents airflow through the nose). This is a problem. To do the frenzel technique, you must learn to close the epiglottis while keeping the soft palate in the neutral position. This can be quite difficult and time consuming to learn, and it is often the most difficult part of the entire technique.

1. Place your index finger and thumb below your nostrils, so that your nose is very gently plugged.
2. It should be possible to exhale through your nose—your nostrils should flare.
3. Fill your cheeks up completely, until they are bursting.
4. Close the epiglottis.
5. Try to squeeze your cheeks and force the air OUT OF YOUR NOSE.
6. You should feel the air pass over your index finger and thumb, and your nostrils should flare.
7. If the air disappears and your nostrils don't flare, the air went back into your lungs—you must not have closed the epiglottis
8. If the air won't go anywhere, and is just JAMMED, it means your soft palate is raised, which is blocking your nasal passage. Redo the soft palate exercises to gain a feeling of that muscle.

9. Repeat the above steps again, concentrating on the soft palate—keep the soft palate in the NEUTRAL position! The only way you can squeeze your cheeks and force the air out of your nose is if the soft palate is in the NEUTRAL position.
10. If you still cannot master the above exercise, try the following:
11. Once again, pinch your nose gently.
12. Exhale 90% of your air out your mouth.
13. Close your mouth, and exhale the last 10% of your air into your cheeks, filling them until they are bursting.
14. Close the epiglottis.
15. Now your lungs should be completely empty, and your cheeks should be full. The air should be trapped in your mouth because your epiglottis is closed.
16. Now, inhale against your closed throat. Of course, no air will rush into your lungs, because the epiglottis is closed. Instead, you create an uncomfortable vacuum in your lungs.
17. Maintain the lung vacuum. Now try to squeeze your cheeks and force the air in your cheeks out of your nose. Concentrate on the soft palate. Relax it—keep it in the neutral position. If you succeed, the air will come rushing out of your nose. Do not let the air rush into your lungs.
18. Keep practising the above exercises until you can fill your cheeks, close your epiglottis, squeeze your cheeks and force the air out of your nose. When you do that, the epiglottis is closed, and the soft palate is in the neutral position. That is the muscle state that you must remember.

Another way to learn to control the epiglottis and soft palate independently is to pack your lungs through your nose. In other words, try to learn to pack your lungs with your mouth closed. You must 'suck' air through your nose.

Step 7: Put it all together

1. Plug your nose.
2. Fill your cheeks up just a tiny bit.
3. Close the epiglottis and keep the soft palate in the neutral position, as you just learned.
4. Apply the tongue block, and, force the air to the back of your throat as if packing through a snorkel. The air cannot enter the lungs, but instead, it will flow into the nasal passages—but since your nose is plugged, the air will be forced into the eustachian tubes, which 'pops' your ears.
5. Once your ears have popped, you can continue to apply pressure with your tongue, bending your eardrums outward. In fact, you should feel as though you could break your own eardrums (outward), if you applied enough pressure with your tongue (of course, don't try to break your eardrums!)

Keep practising the frenzel technique on land until you can pop your ears instantly, by plugging your nose, and 'pop'.

Step 8: Test it in the water

1. Go to a swimming pool which is at least 10 feet deep.
2. Descend to 10-12 feet, upside down, without equalizing. Your ears should hurt slightly.
3. Now, plug your nose and EQUALIZE! You should be able to pop your ears INSTANTLY.
4. Continue applying pressure with your tongue until you feel your ears stretching outward.

5. Try the same thing in a lake or ocean.

Step 9: Learn the advanced variations

To perform the frenzel technique, there must be an airspace in the throat. The tongue must push, like a piston, against that airspace. If there is no airspace in the throat, the technique cannot be performed.

As a freediver descends, his lungs compress. When inverted, the remaining volume of compressed air will rise into the lungs. At a certain depth, the freediver will find that suddenly there is no longer sufficient air in his throat to perform the frenzel technique. This also happens when a freediver descends feet first, but it happens much sooner when descending head first. The actual depth of 'failure' depends on the diver. I have heard it happen as shallow as 25 meters.

In order to continue to equalize past the 'failure depth', air must be moved into the throat. This can easily be done by pulling the stomach in, and exhaling forcefully against a closed mouth, which may cause the cheeks to inflate. Once there is air the mouth and cheeks, the epiglottis must be closed *immediately*, before the air can flow back into the lungs. Once the epiglottis is closed, the air is trapped in the throat, and the frenzel can be performed.

The above technique is often called a 'diaphragmatic-frenzel', and it is used by almost all deep freedivers. However, even with the diaphragmatic frenzel, there will come a depth when the remaining air volume in the lungs is so small that it is no longer possible to fill the mouth and throat. After that depth, even the diaphragmatic frenzel fails. The only way to continue to equalize beyond that depth is to store sufficient air in the mouth and cheeks, before reaching that depth. Here is the procedure, I call the 'frenzel-fattah' technique:

1. Find the depth at which the diaphragmatic frenzel technique fails for you. It should probably be somewhere between 50 and 90 metres when diving inverted. Assume the failure depth is X metres.
2. Set your dive watch depth alarm to a depth of [X – 15]m. In other words, if your failure depth is 60 metres, set your alarm for 45m.
3. Begin your dive.
4. When you hear the depth alarm, bend forward slightly, pull your stomach in, and exhale all possible air into your mouth. Your cheeks should fill up completely.
5. Immediately close the epiglottis, and keep it closed for the entire remainder of the descent. You may find it useful to 'inhale' against the closed epiglottis. It helps to keep it closed.
6. Now, keeping the soft palate in the neutral position, you can continue to equalize with the frenzel technique. You must continue to keep the epiglottis closed.
7. You should be able to equalize 3 to 5 more times with the air in your mouth and cheeks.
8. Amazingly, using this technique, your lungs will collapse completely, and fill with fluid, and yet you will still have lots of air in your mouth to equalize. You can also equalize your mask with the air in your mouth. Do do that, simply do the frenzel but don't plug your nose.

The 'frenzel-fattah' technique can be practised in a swimming pool, but it is dangerous so you must have a spotter/partner!

1. Go to a swimming pool which is at least 10 feet deep.
2. Relax your body and prepare yourself.
3. After a proper breathing pattern, exhale 95% of your air.

4. Close your mouth.
5. Continue to exhale the last 5% of your air into your mouth—your cheeks should fill up completely.
6. Immediately close the epiglottis.
7. Descend to the bottom of the pool.
8. Equalize with the air in your mouth.

The same technique can be practised in a lake or ocean. You should be able to descend to 15-20m, using only the air in your mouth and cheeks to equalize.

Appendix A: How to pack your lungs

1. Close your mouth
2. Exhale against your closed mouth, filling up your cheeks
3. Squeeze your cheeks and push the air back into your lungs
4. Repeat 1-3 again and again until you can fill your cheeks, and push the air back into your lungs easily
5. Find a drinking straw
6. Put the straw in your mouth
7. Suck air through the straw
8. Inhale through the straw
9. Notice the difference between inhaling through the straw, and sucking through the straw
10. Inhale to your maximum through the straw
11. Suck air through the straw, into your mouth
12. Take the straw out
13. Use your cheeks to push that air back into your lungs
14. Suck air into your mouth without using the straw
15. Use your cheeks to push that air back into your lungs (do not swallow the air into your stomach)
16. One suck/push cycle is called one ‘pack’
17. Start over, with no straw
18. Inhale to your maximum
19. Pack your lungs, again and again, until you can’t fit anymore air in your lungs, or until you feel discomfort. Count how many packs you can get. If you have access to a spirometer, you can measure how much extra air you are actually getting. Most people get between 0.8L and 4.0L of extra air.