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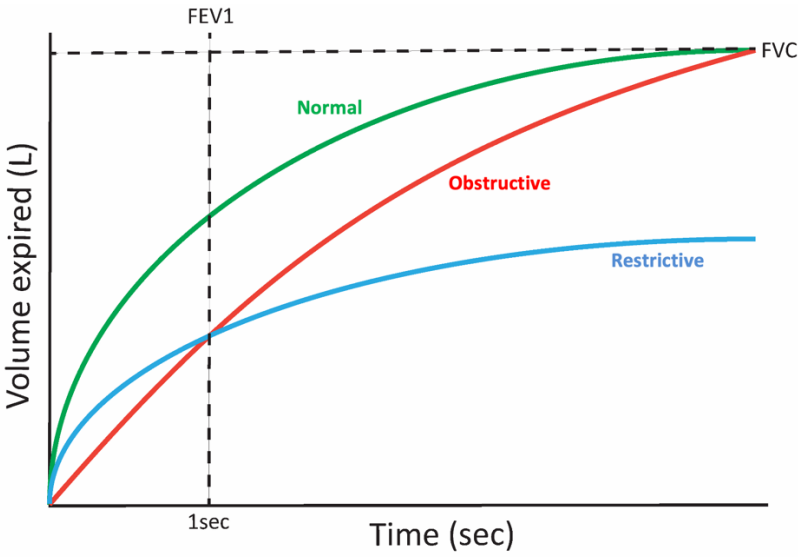
Lung Function Testing Explained

At NBST there are a series of tests we can perform to investigate different aspects of your lung function. These include spirometry, lung diffusion, lung volume, forced expired nitric oxide (FENO) and 6-minute walk testing. This info sheet will give you a better understanding of what these tests can show us.

Spirometry

Spirometry is the bread and butter of lung function testing. It allows us to look at the flow of air in and out of your lungs to determine if your breathing is **restricted** (you cannot get enough air in) or **obstructed** (you cannot get enough air out and air trapping is occurring). In this test we will have you breathe into a mouthpiece. You will fill your lungs all the way up with air and then try to push it all out in the first second of an exhalation. You will keep squeezing until we can see you have pushed all the air out of your lungs.

In spirometry we look at two important values; **FEV1** (the volume of air you can push out in the first second) and **FVC** (the volume of air you can push out in an entire exhalation). The FEV1 depends on your **airway diameter** (how open your airways are). If your airways are more open/dilated there will be less resistance to flow, and air will move faster (FEV1 will be higher). If your airways are inflamed and constricted/obstructed, they will be more resistance and air will move slower (FEV1 will be lower). An obstructive breathing pattern is seen when the FEV1 is lower than expected by the FVC is normal. A restrictive breathing pattern is seen when the FEV1 is normal, but the FVC is lower than expected, because the patient is struggling to get air in to then exhale.



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In the test you will be given Ventolin. Ventolin is a **bronchodilator** (it reverses any constriction that may be present in your airways). We use it as a tool to see if there is any reversible obstruction. A significant response will be a 12% change in the FEV1.

Common obstructive lung diseases include asthma and COPD (Emphysema & Chronic Bronchitis). Common restrictive diseases include interstitial lung disease (e.g., pulmonary fibrosis), sarcoidosis or conditions such as asbestosis or silicosis. Obstructive lung disease is far more common.

Diffusion Test

A diffusion test looks at how effectively gasses like oxygen and carbon dioxide move between your lungs and blood across a very important interface called the **respiratory membrane**. This membrane sits at the point where the gas containing sacs of your lungs and your blood supply meet and is incredibly thin (<0.5 mm) to ensure a speedy exchange.

To see test the efficiency of your gas exchange we will have you take a deep breath of a gas mixture into your lungs and hold it there for eight seconds so the gases can diffuse. In the gas mixture there will be a very small amount of carbon monoxide; a gas that follows the same path as oxygen to bind **haemoglobin** (the oxygen carrying protein in your blood) but has a much higher uptake. Because it binds so strongly to haemoglobin once you have inhaled it, it should stay in your blood, and we won't be able to measure it in your breath out. If we detect it in your breath out, it could mean:

1. There is damage to your lungs, limiting their ability to transfer gasses - this is the case in emphysema, interstitial lung diseases, or pulmonary fibrosis
2. You are anaemic – in this case it is important to provide us with any recent blood tests you may have had done so we can correct for your haemoglobin level.

In asthma, where airway obstruction is the only cause of breathlessness, the diffusing capacity will be normal. However, in COPD where there is scarring and obstruction the diffusing capacity will be reduced. Therefore, DLCO is a useful tool to rule physical damage to the lungs in or out.

Forced Expiratory Nitric Oxide (FENO) Testing

The aim of the FENO test is to look for **eosinophilic inflammation** in your airways. This type of inflammation is caused by higher-than-normal levels of white blood cells (**eosinophils**) in your lungs. Normally they will be called in to defend against respiratory viruses, but in allergic asthma this response is amplified and uncontrolled leading to chronic inflammation.

In this test we have you breathe out into a mouthpiece at a controlled constant rate so we can measure the particles of a gas called nitric oxide in your breath. This gas is released by

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the cells lining your airways when eosinophilic inflammation is present so is a reliable marker. It can indicate the use of a corticosteroid inhaler to dampen inflammation and resolve airway swelling. Normally the particle count should be below 25 parts per billion. Certain salicylate containing foods and coffee can generate some temporary inflammation so we will ask you to abstain from these things before testing. We will also ask you to not take any of your steroid inhalers prior as it can dampen inflammation and skew the result.

Body Plethysmography

This test allows us to look at your lung function and dimensions. With it we can measure your total lung capacity, residual volume, and airway resistance. This test can aid spirometry in identifying obstructive and restrictive patterns of breathing. In obstructive lung diseases gas trapping causes lung hyperinflation and a larger lung capacity. In restrictive lung diseases decreased lung elasticity, compliance or issues with chest wall expansion leading to smaller than expected lung volumes. Lung elasticity can be reduced by scarring and fibrosis caused by inflammation, inhaled particles (Silicone, Asbestos, Coal dust), or toxic chemicals. With that type of damage your lungs stiffen like an old sponge and can no longer expand like they used to.