

Basic Steps on How to Perform Spirometry

Spirometry requires maximal effort from the patient and it takes time to perform quality spirometry. It is essential the procedure is carefully and clearly explained and to actively coach, coax, and motivate the patient to perform maximally. The volume and flow parameters measured are defined in the terms of maximal effort and maximal exhaled volume. The performance of spirometry while seated upright in a chair with both feet flat on the floor is the preferred method as this is the most stable position should the patient experience dizziness during the test.

The key steps are to instruct the patient to:

1. **Breathe in fully** (the lungs must be completely full)
2. **Seal the lips** and teeth tightly around the mouthpiece and then immediately...
3. **BLAST** the air out as fast and as long as possible until the lungs are completely empty (10 seconds is optimal), and then...
4. **Breathe in** fully again without removing the mouthpiece from the patient's mouth
5. Repeat the test until three acceptable and reproducible results/tests are obtained (up to a suggested maximum of 8 efforts)
6. The highest FEV1 and FVC should be reported (along with other tests measurements dictated by the ordering physician), even if these are from separate blows. But must be from the same overall series of tests on the same day.

*Nose clips should be used on all patients to prevent loss of measured volume through the nose.

Acceptable Results and Real-Time Display

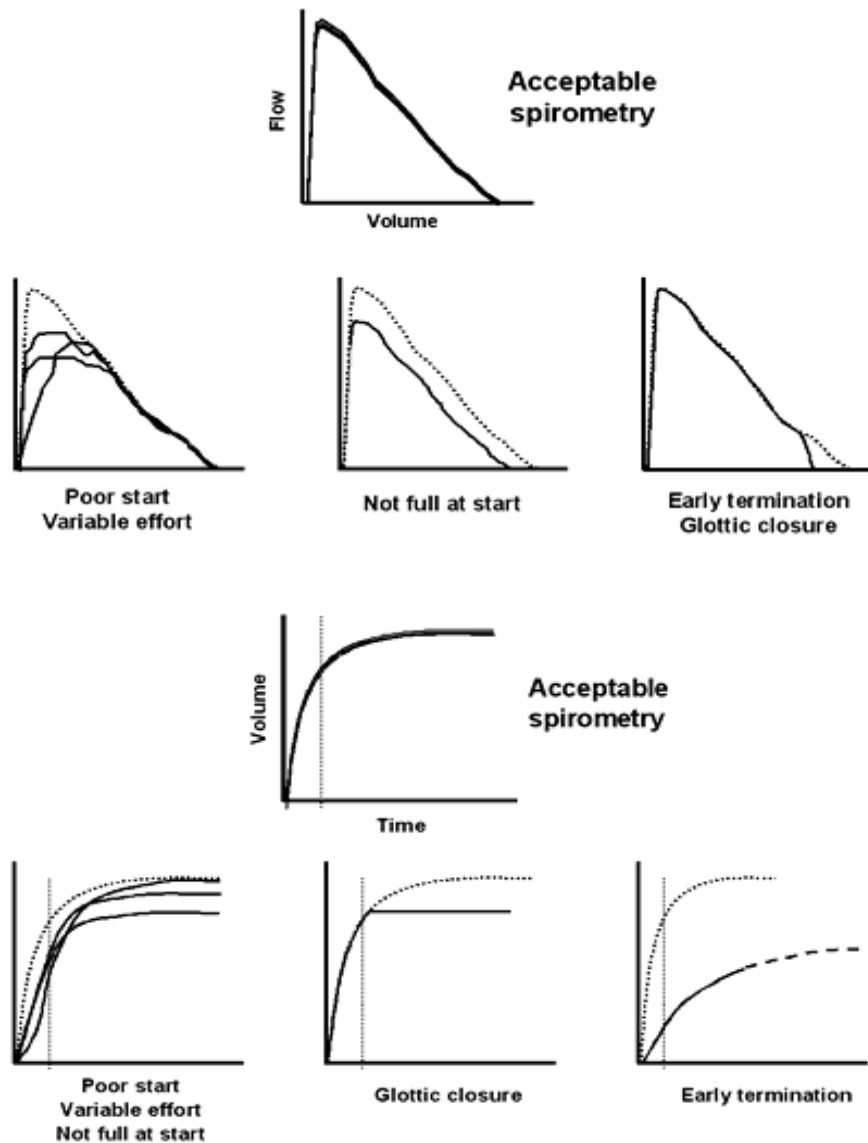
Acceptable results are those that were initiated at full lung inflation, and with maximum expiratory effort (without hesitation at the start, no pauses, or coughing throughout the blowing phase) until no more air can be expired from the lungs. The results are reproducible if there is less than 200ml variation in the FEV1 and FVC between the two best blows.

A spirometer that allows you to see the graph of the flow-volume loop curve in real-time and provides alert messages about test quality and patient performance makes it much easier to determine the acceptability of each test. It is preferable to have both a flow-volume loop and volume-time graphic so that the acceptability of the results can be easily judged.

Common Causes of Poor Quality Spirometry

- Sub-maximal effort (due to poor coaching, full bladder or full stomach)
- Failure to fully inflate the lungs prior to performing the forced exhalation
- Incomplete expiration (removing mouth from mouthpiece, coughing, etc.)
- Hesitation at the start of expiration
- Leaks (between the lips and mouthpiece; lack of nose clips)
- Poorly calibrated/maintained spirometer
- Untrained or poorly trained operator
- Inability to comprehend the instructions
- Coughing
- Glottic closure
- Obstruction of mouthpiece by the tongue or teeth
- Vocalization during the exhalation
- Poor posture (slouching or leaning forward)

Examples of acceptable and poorly performed spirometry for a healthy patient.



Contraindications for Spirometry

Spirometry is a very safe procedure. However, it is physically demanding as it requires maximal patient effort and involves the generation of high airway and intrathoracic pressures. It is advisable that spirometry be delayed or cancelled for:

- Recent eye surgery
- Recent thoracic and/or abdominal surgery
- Aneurysms (cerebral, abdominal)
- Unstable cardiac function
- Hemoptysis of unknown origin (tuberculosis)
- Untreated Pneumothorax
- Chest and/or abdominal pain
- Nausea and diarrhea
- Inability to comprehend instructions

Additionally, children below the age of 7 may have difficulty in performing the test consistently or at all.