Dynamic Spirometry

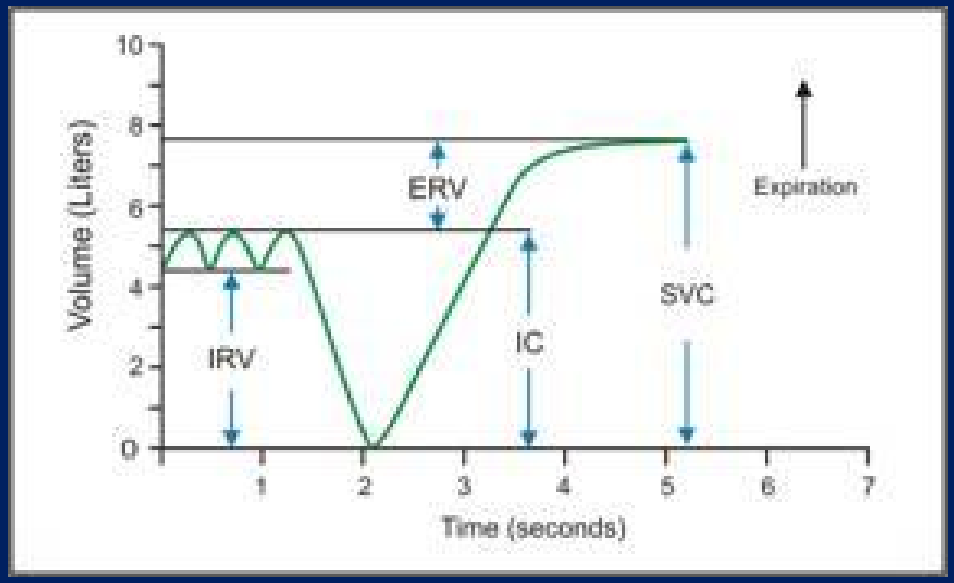
Spirometry

It provides an objective measurement of lung function.

It analyzes volume and velocity of expired air

Static test

Performed without regard to time



Relaxed Vital capacity: Volume of expired air measured after a maximal inspiration

Dynamic test

Performed at forcible and max effort against **time**

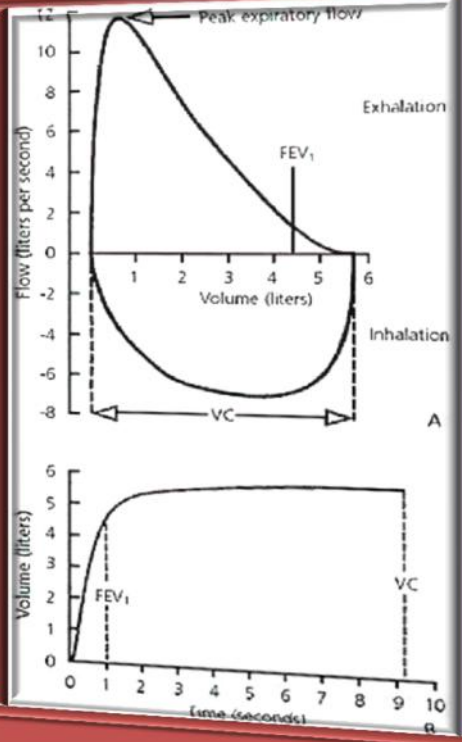
Measures the **rate** at which the lung changes volume during forced breathing.

Forced vital capacity

The max volume of air that can be forcibly and rapidly exhaled following a max inspiration.

Two types of curves can be obtained

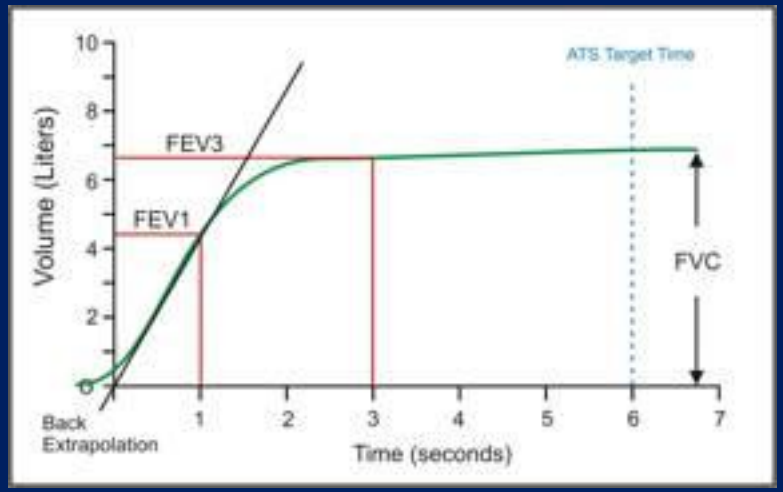
Forced expiratory curve



Flow Volume curve

Forced Expiratory Curve

- The subject takes a maximal inspiration and then exhales as rapidly, as forcibly,& as maximally as possible.
- A plot of volume against time:



FEV_1 : Volume of air expelled in the 1st sec of forced expiration starting from full inspiration

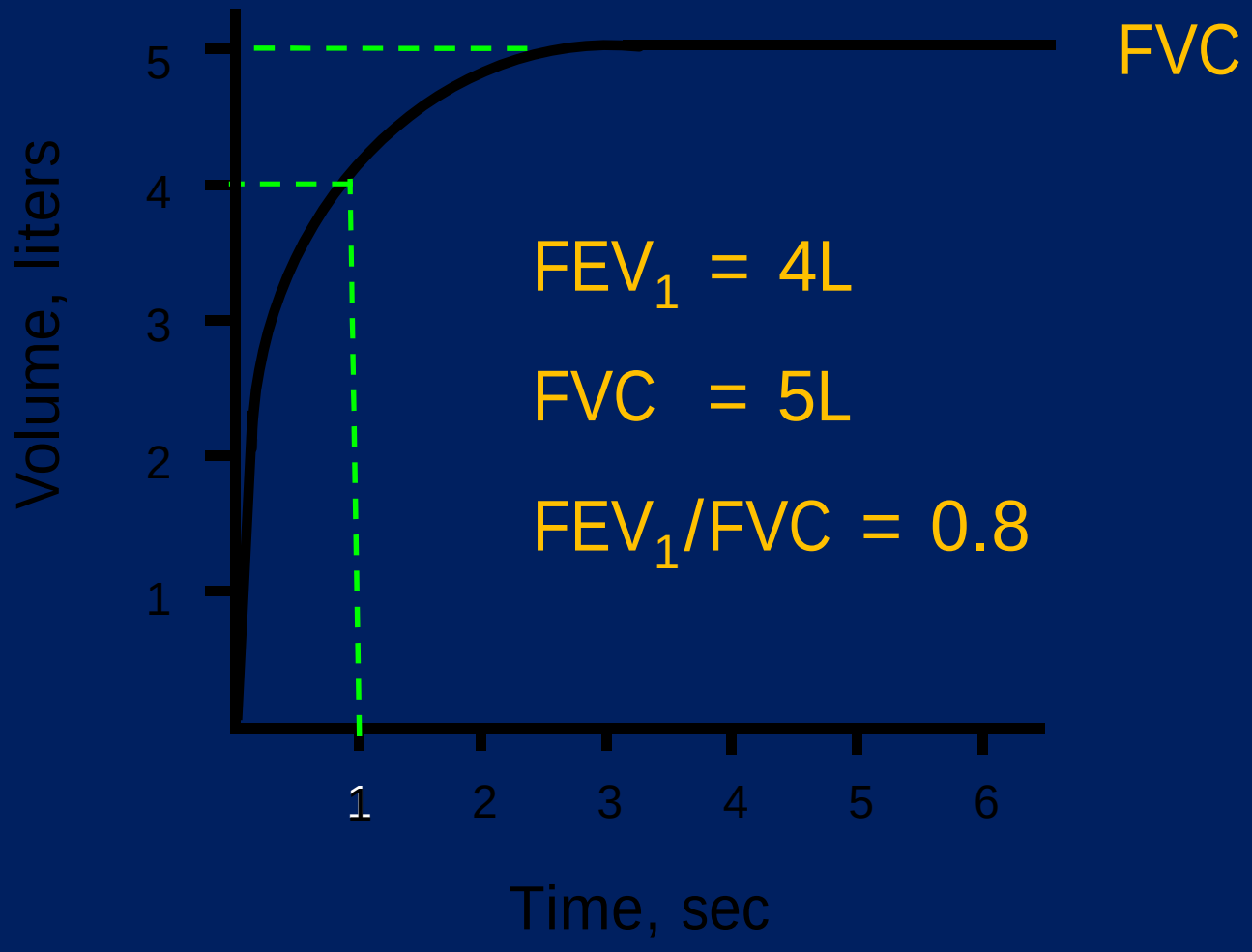
FEV_1 = 4l/sec

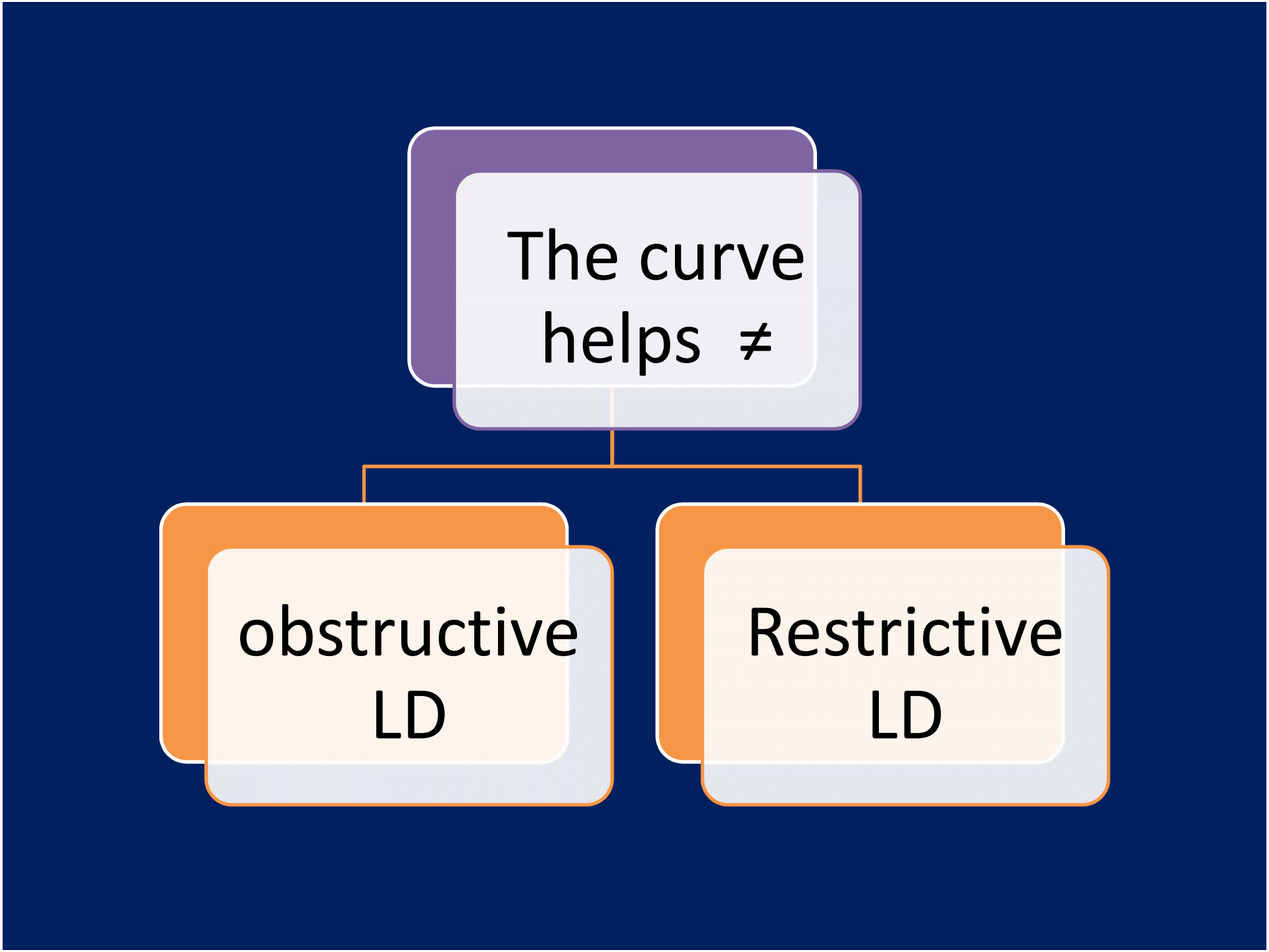
(plateau) **FVC = 5l/sec**

$(FEV_1/FVC) * 100 \geq 80\%$

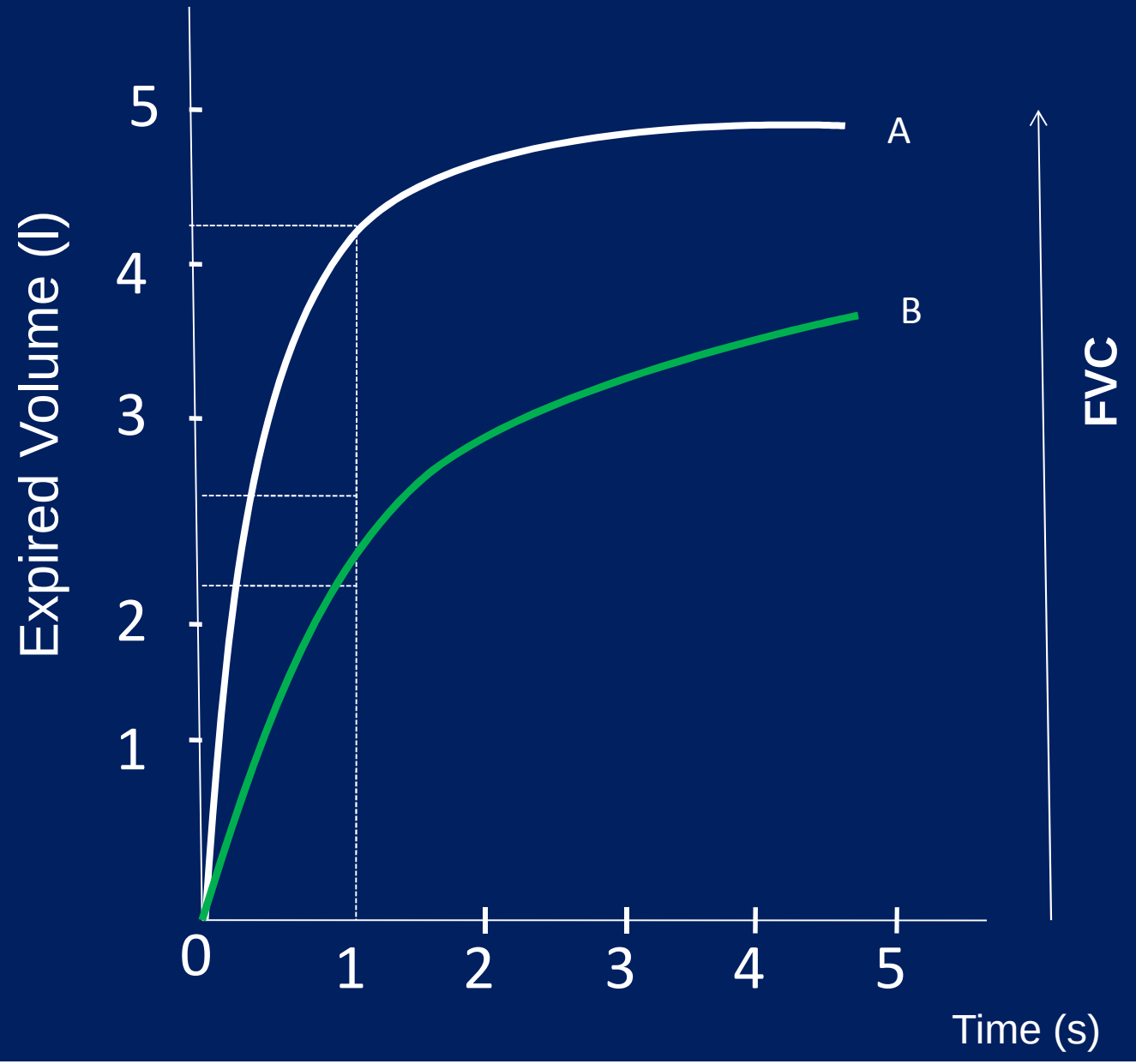
NL: able to exhale 80% from VC in the 1st sec

Normal Trace Showing FEV_1 and FVC



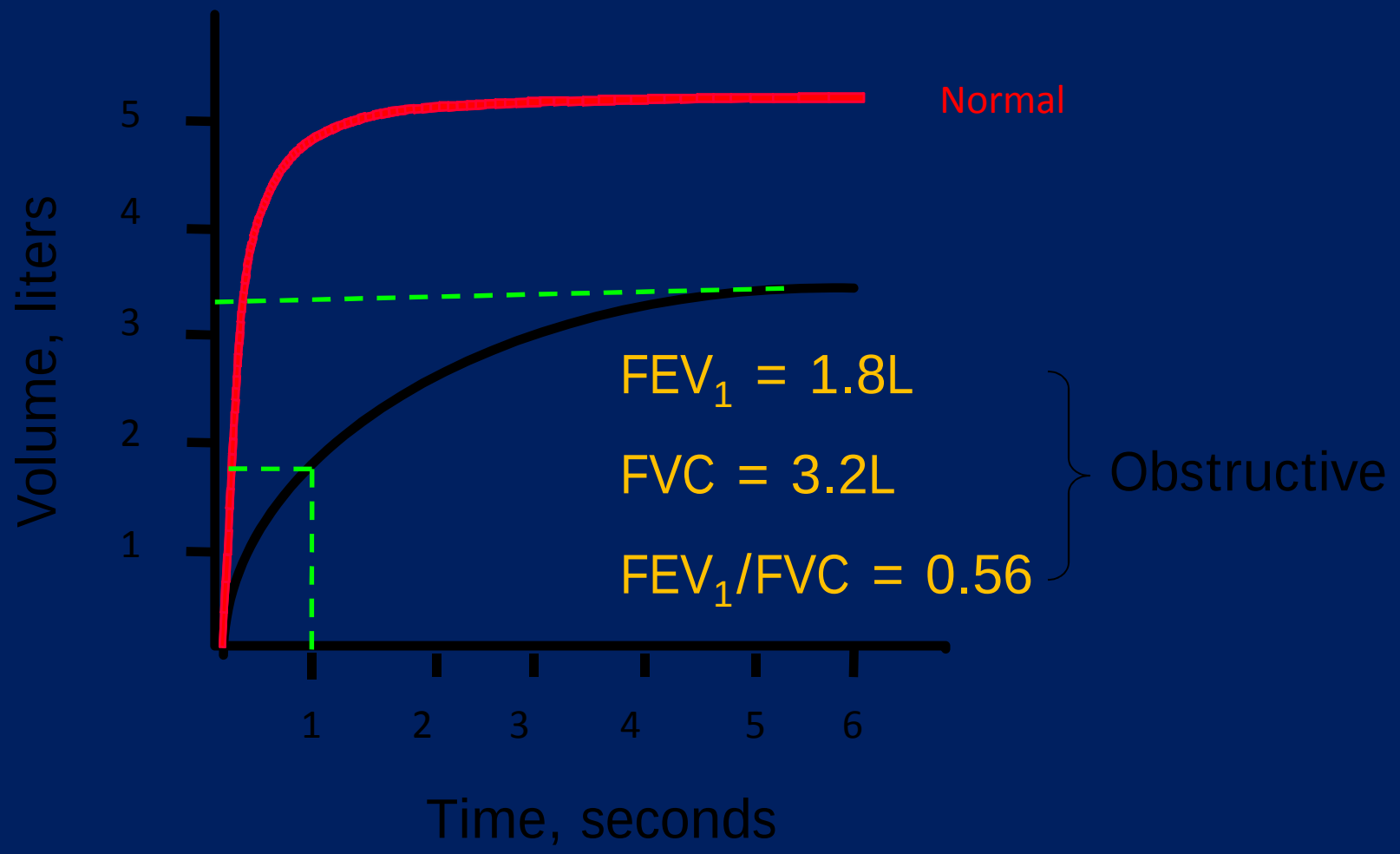

The curve helps ≠
obstructive LD
Restrictive LD

Obstructive lung disease



CRJ1

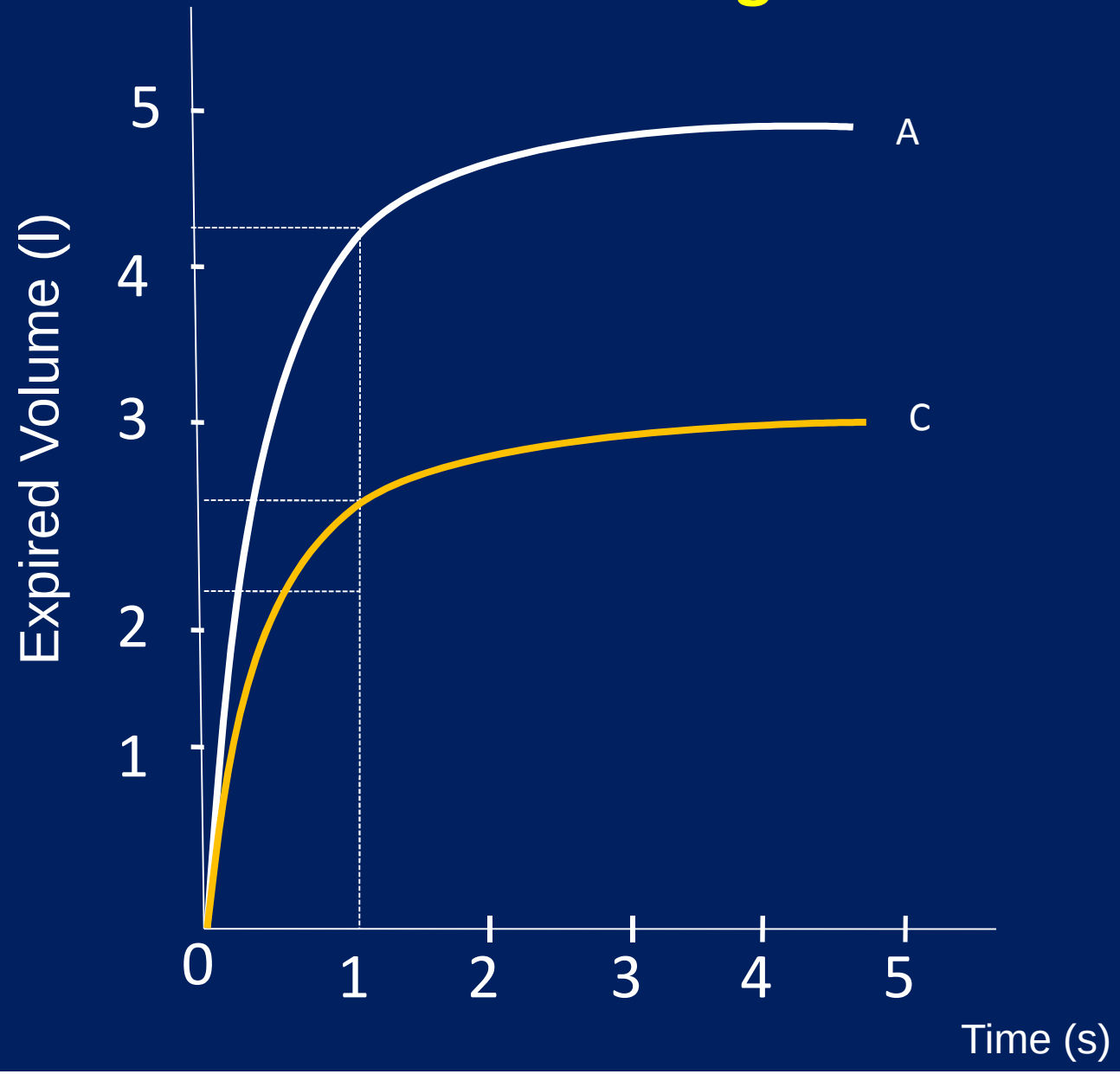
Obstructive Disease



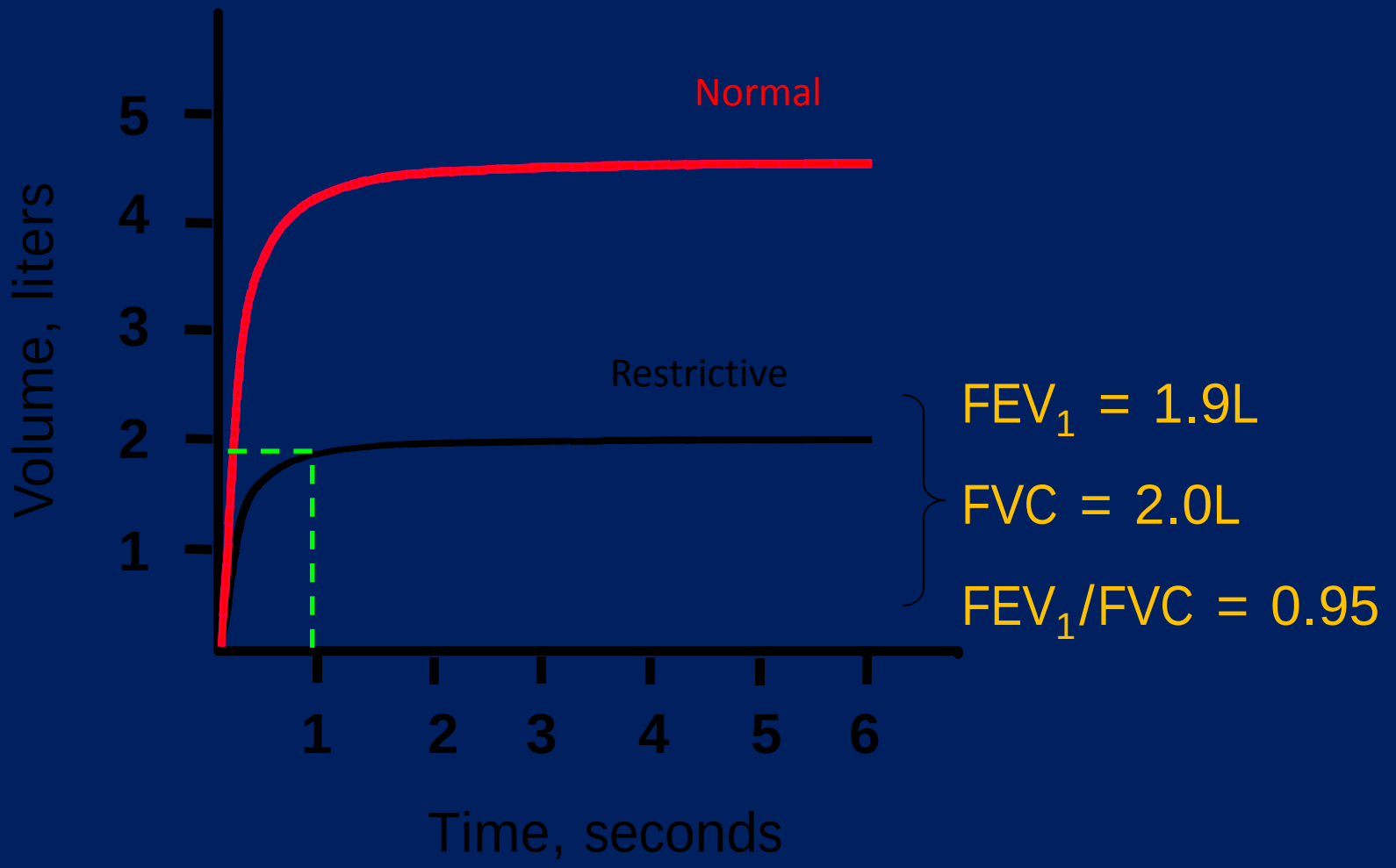
CRJ1 Sue i have inserted a bracket and shifted the obstructive label. The FVC in this slide is about 3.4 by eyeball - shoudl be moved down to 3.2 or the numbers should be changed

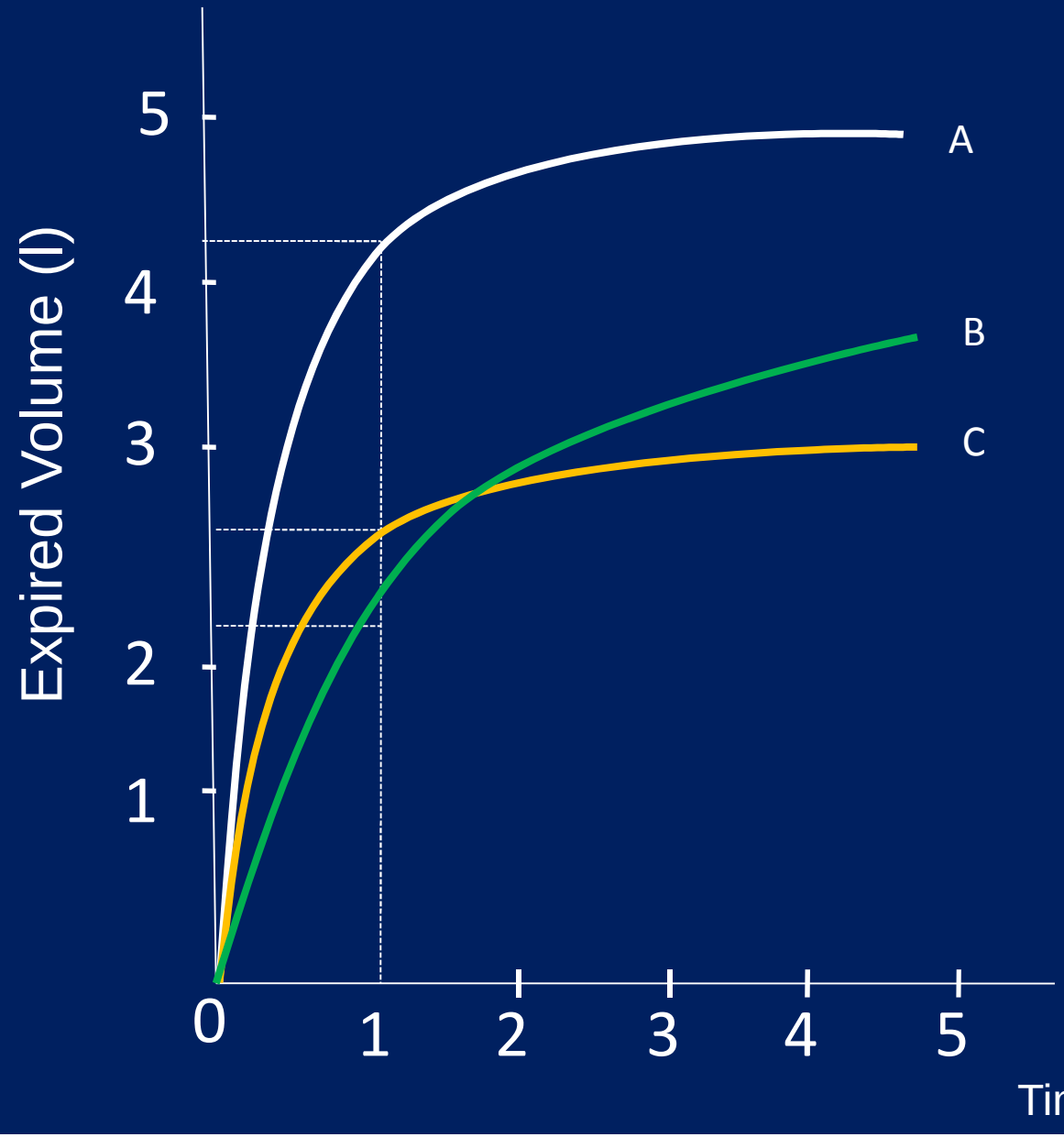
Christine Jenkins, 14/04/2008

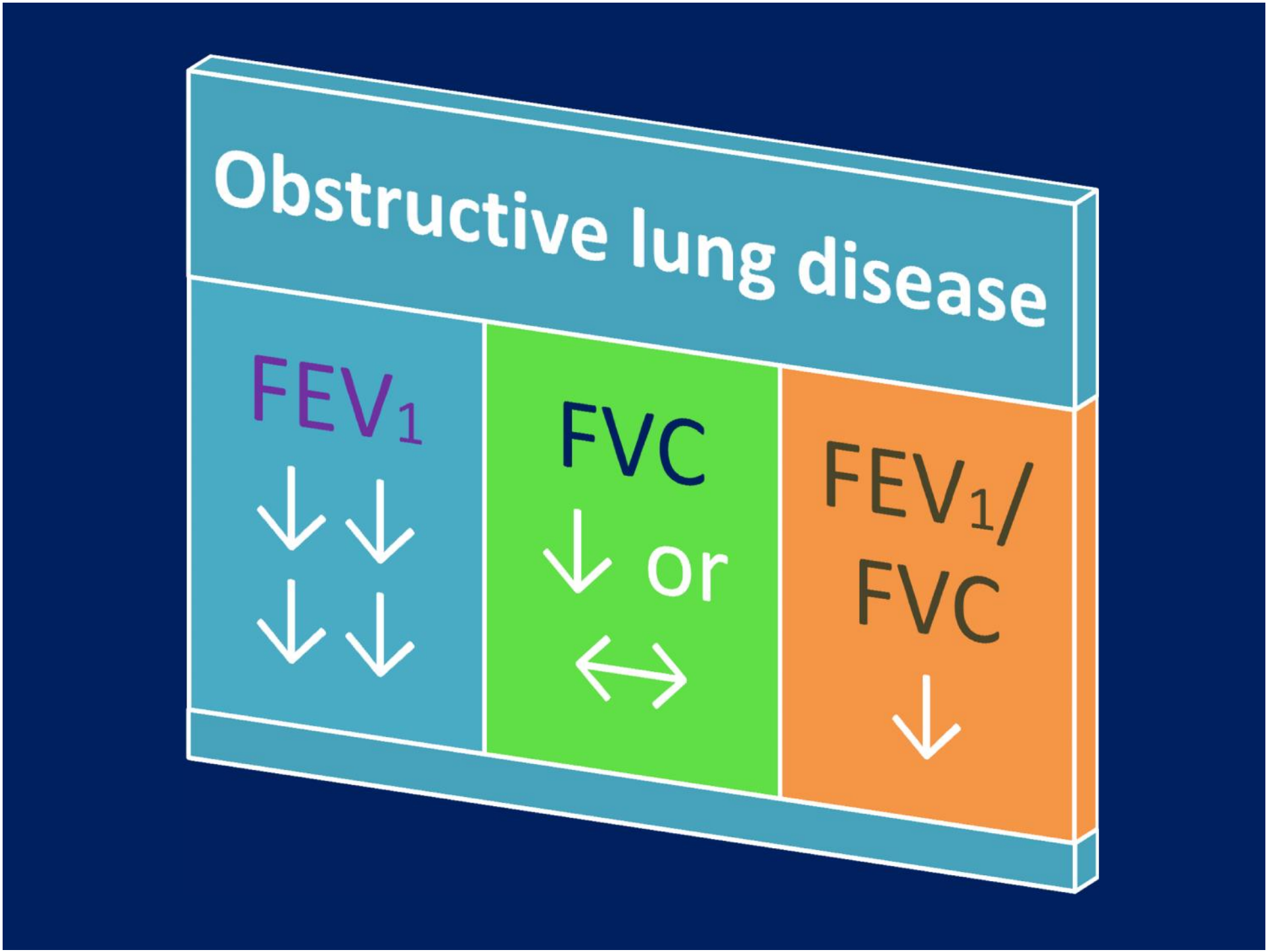
Restrictive lung disease

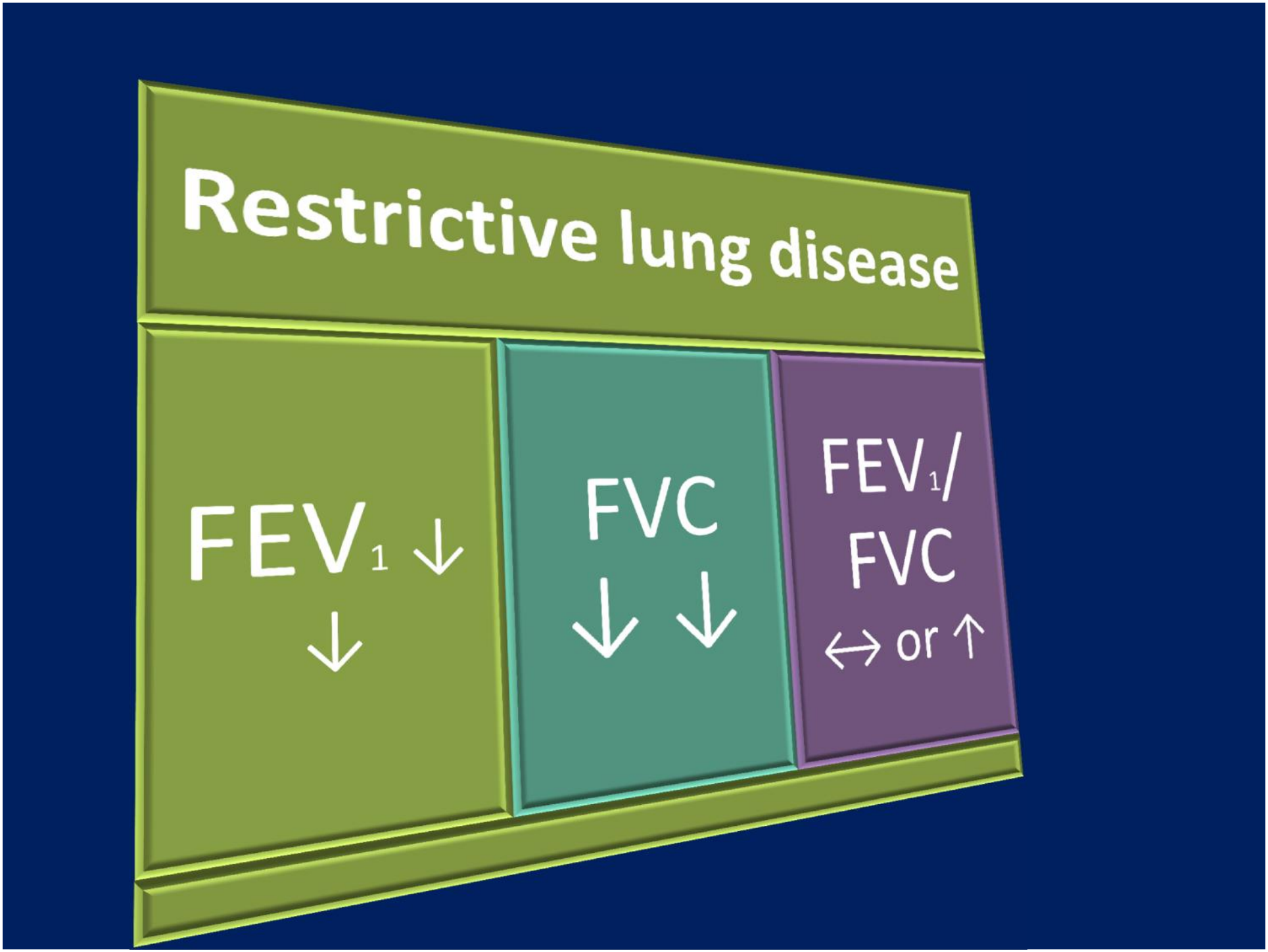


Restrictive Disease




Expired Volume (l)
5
4
3
2
1
0
1
2
3
4
5
Time (s)
A
B
C


Obstructive lung disease
FEV1
↓ ↓
↓ ↓
FVC
↓ or
↔
FEV1/
FVC
↓


Restrictive lung disease
FEV1 ↓
↓
FVC
↓ ↓
FEV1/
FVC
↔ or ↑

Volume	Normal	Obstructive	Restrictive
FVC	5	↓ or ↔ (5)	↓ (3)
FEV_1	4	↓↓↓ (2)	↓ (2.7)
$FEV_1\%$	80%	↓ (40%)	↔ or ↑ (90)

Results interpretation

- Results are reported as absolute values (litre) ,and as percentages of predicted values based on age, height, sex, ethnicity.

- Normal: Both FVC and FEV1 ≥ 80% of predicted

- If one of the parameters is < 80% predicted, calculate FEV_1 ratio:
- $FEV_1\% \geq 90\%$ ------→ Restrictive
- $FEV_1\% < 80\%$ ------→ Obstructive

Calculating percentage of predicted values

Patient: 45 year old woman, height 5'3"

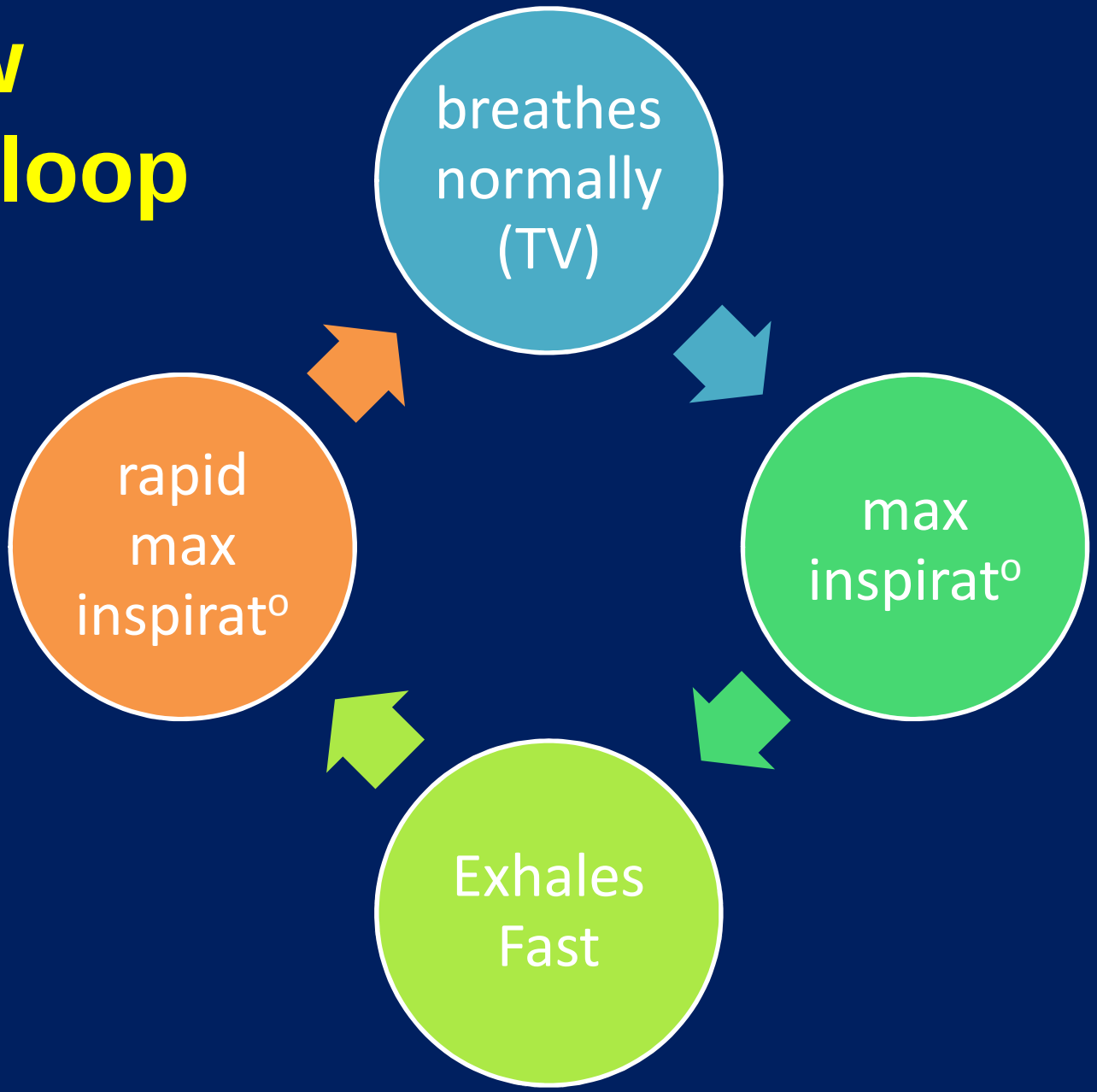
$$FEV_1 \quad \frac{\text{Reading } 1.43}{\text{Predicted value } 2.60} \times 100\% = 55\% \text{ of predicted normal}$$

$$FVC \quad \frac{\text{Reading } 2.5}{\text{Predicted value } 3.03} \times 100\% = 82.5\% \text{ of predicted normal}$$

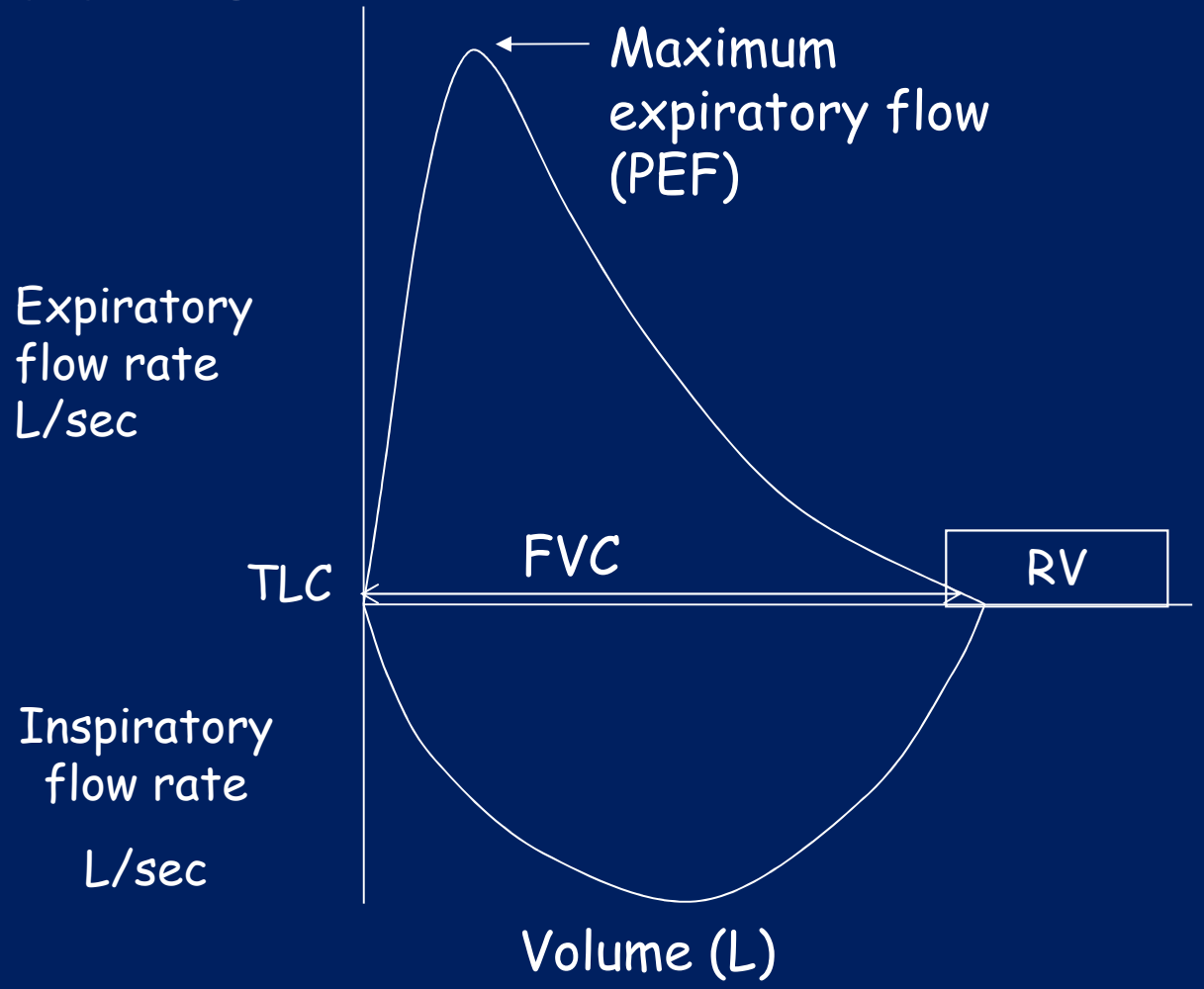
$$\frac{FEV_1}{FVC} \quad \frac{\text{Reading } 1.43}{\text{Reading } 2.5} = 0.57$$

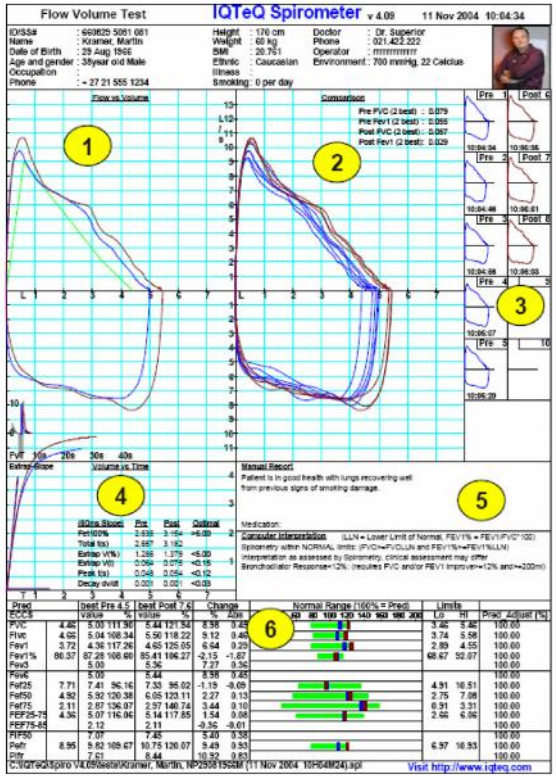
Interpretation: patient has mild airflow obstruction as FEV_1 is between 50% and 80% of predicted normal and FEV_1/FVC is <0.7.

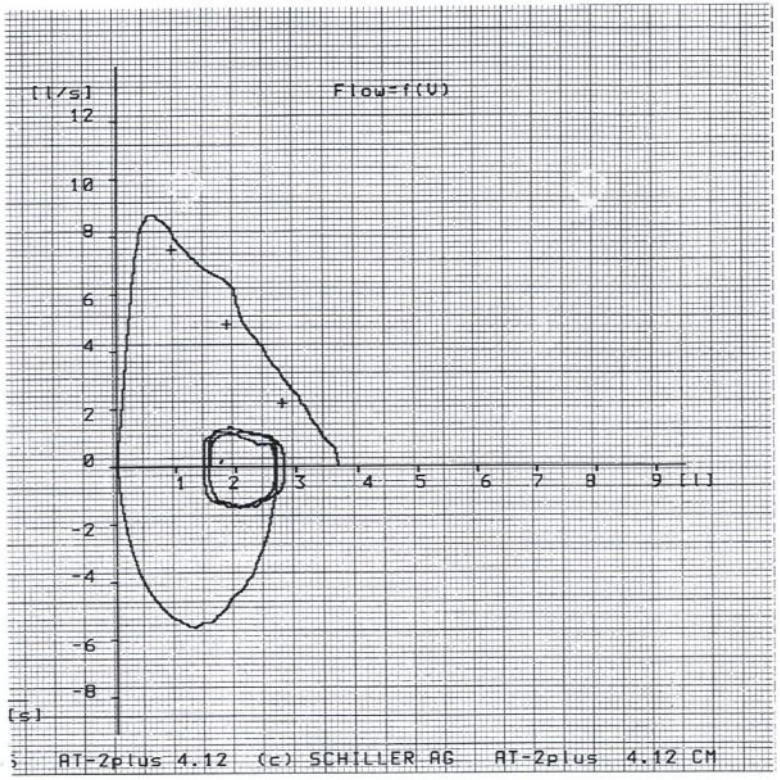
Flow Volume loop



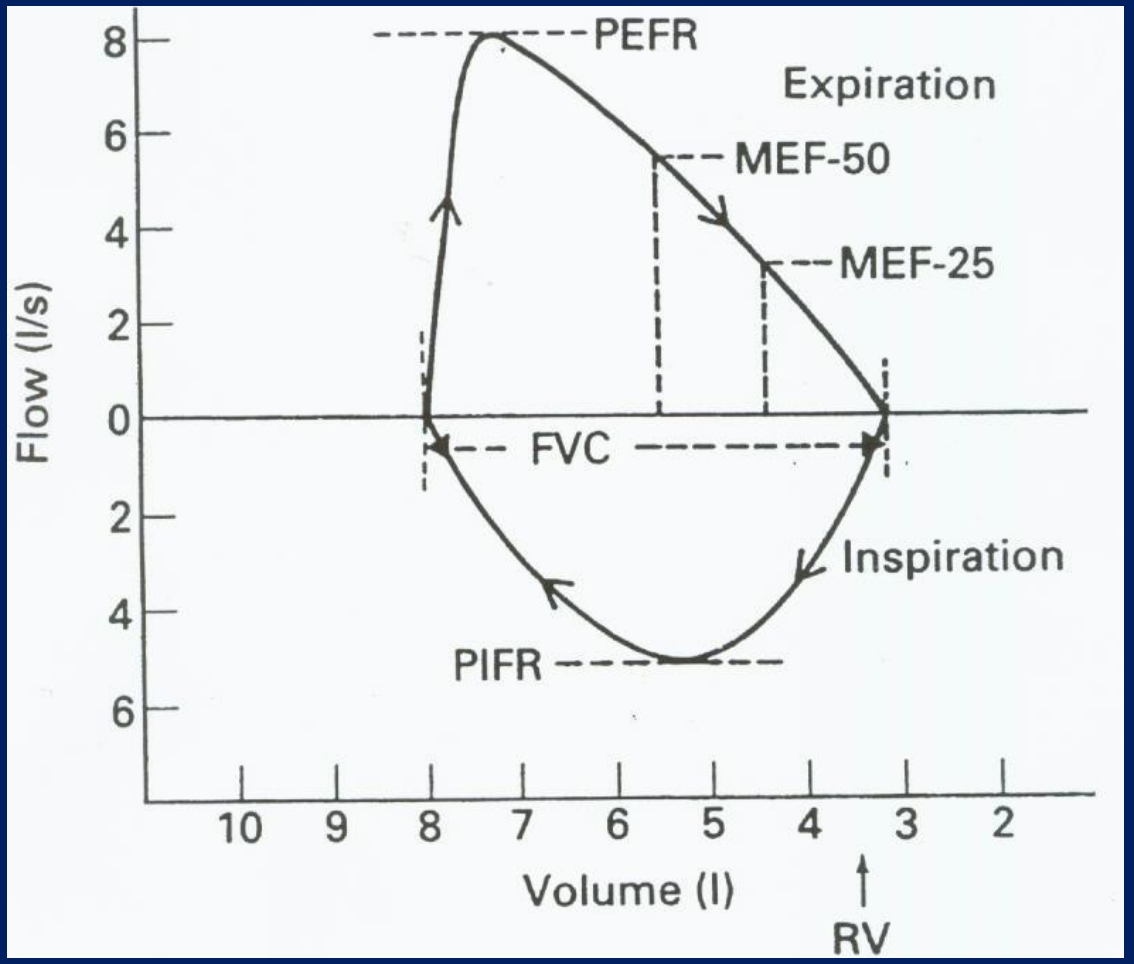
This measures exp & insp flow as a function of exhaled volume rather then against time.




Flow Volume Test
IQTeQ Spiromoter v 4.09
11 Nov 2004 10:04:34
Flow vs Volume
Comparison
Volume vs Time
Manual Report
Patient is in good health with lungs recovering well from previous signs of smoking damage.
Computer Interpretation
Visit http://www.iqteq.com


Flow=f(V)
[l/s]
[l]
AT-2plus 4.12 (c) SCHILLER AG AT-2plus 4.12 CM

Flow Volume loop



- **Measurements on flow V loop**

- **PEFR** : Greatest flow achieved during the maneuvre = 6- 12l/sec
- **PIFR** = 6l/sec

- **MEF50**: max expiratory flow at 50% of FVC = 4- 6 l/sec
- **MEF25**= 2.5 l/sec

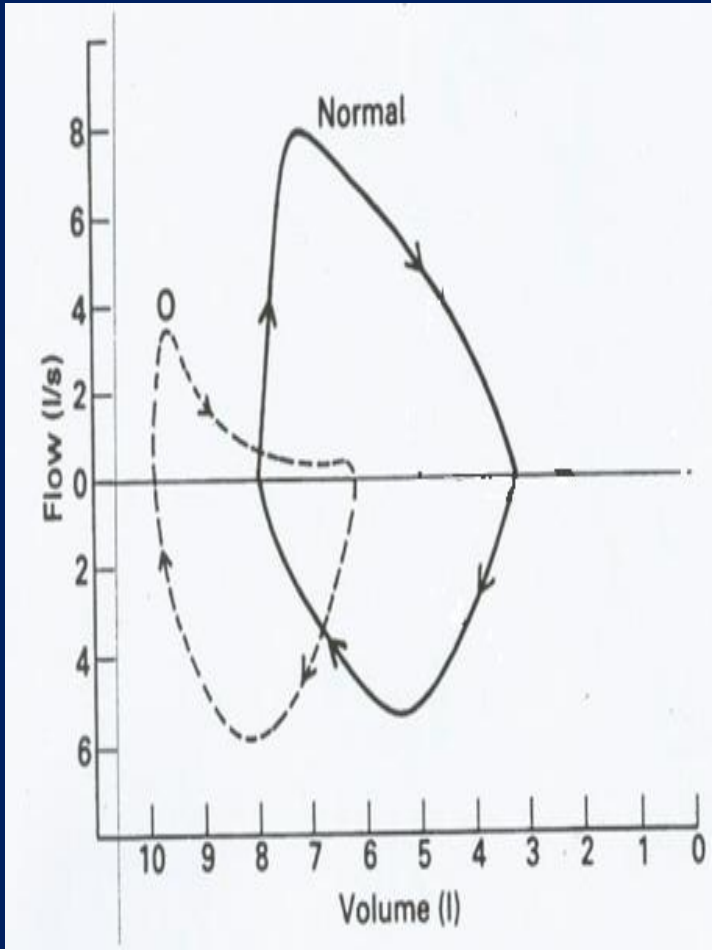
Obstructive LD

MEF50↓

Effort independent part of curve: concave

PEFR↓

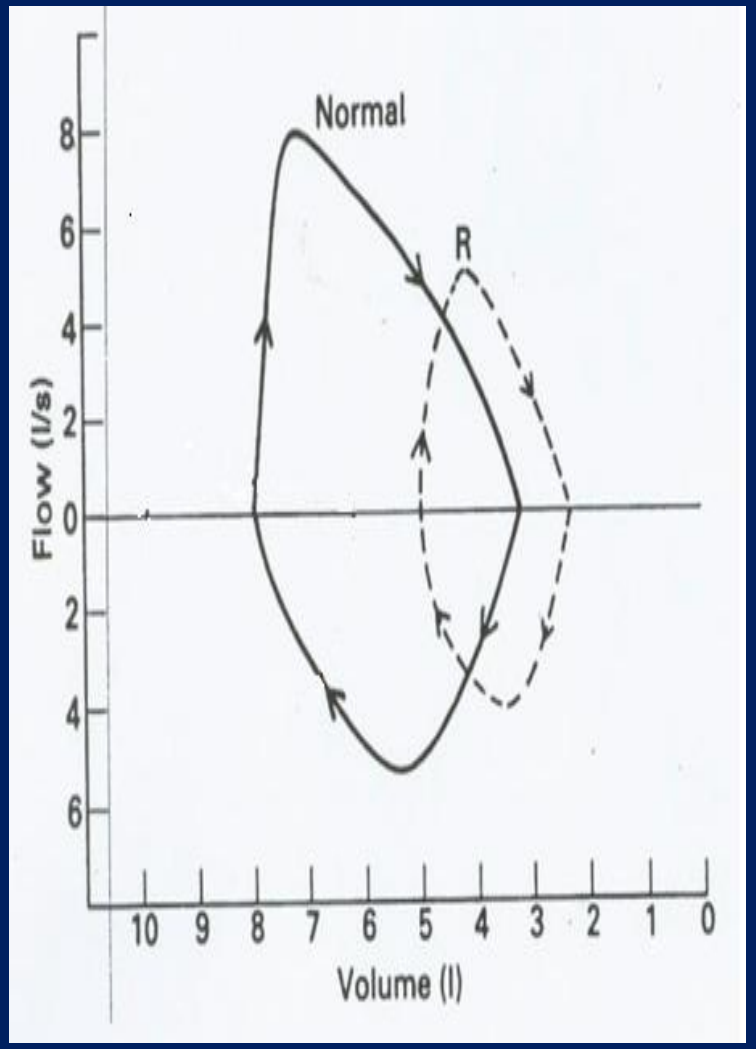
Inspiratory loop Normal

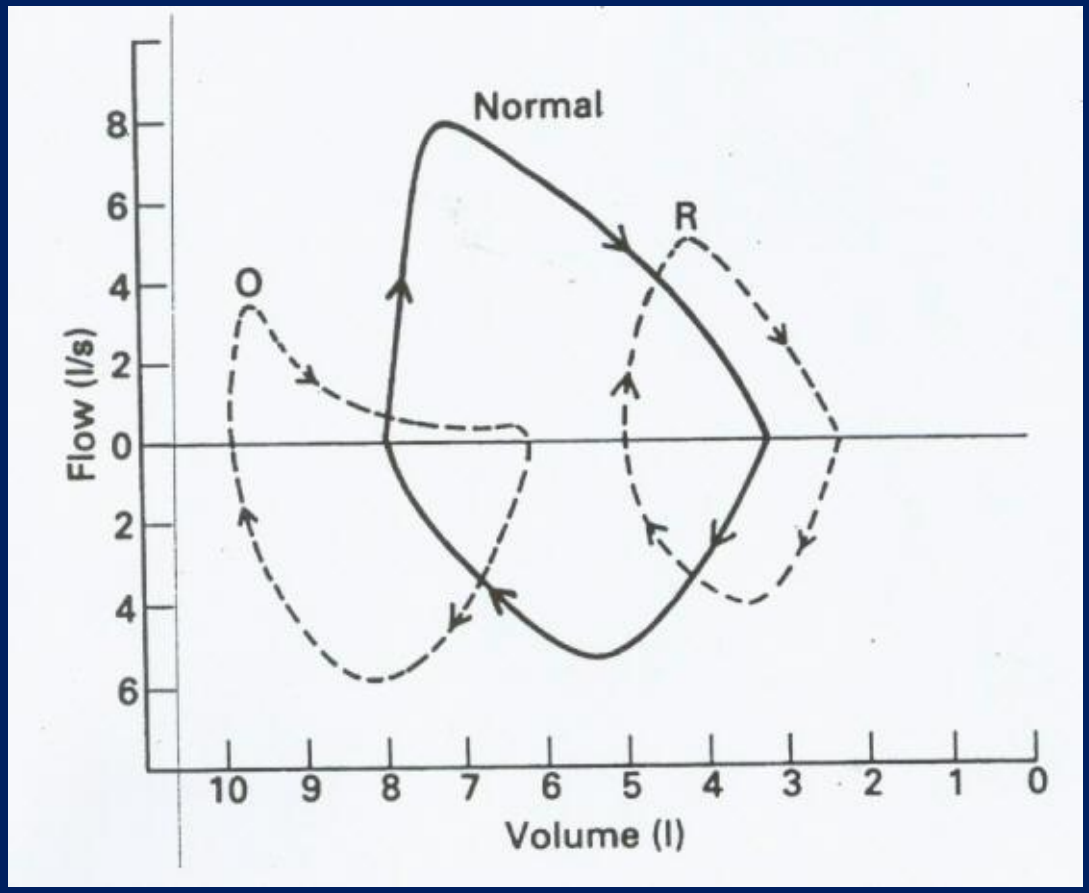


Restrictive LD

Miniature loop (elliptical)

All flow parameters ↓




Normal
R
O
Flow (l/s)
8
6
4
2
0
2
4
6
10
9
8
7
6
5
4
3
2
1
0
Volume (l)

Importance of spirometry

Assess physical fitness .

Helps in the diagnosis of certain pulmonary diseases (obstructive & restrictive).

Follow disease progression.

Thank You