Dynamic Spirometry

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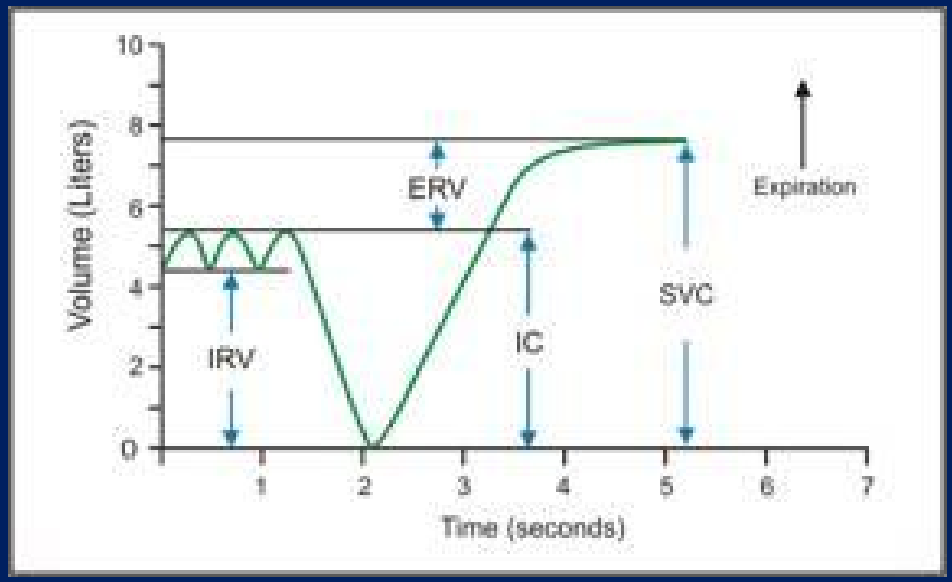
Spirometry

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

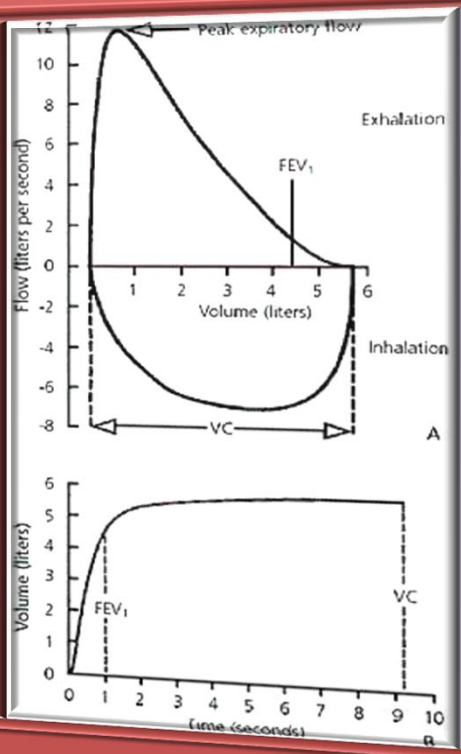
Measures the rate at which the lung changes volume during forced breathing.

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

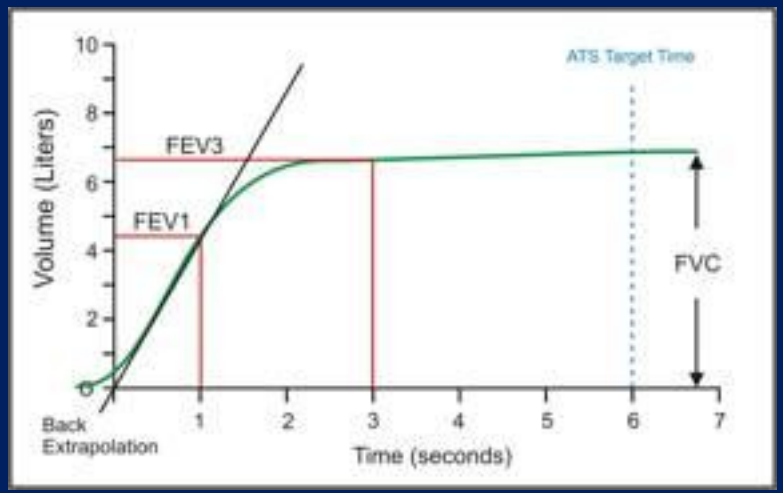
Forced expiratory curve



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

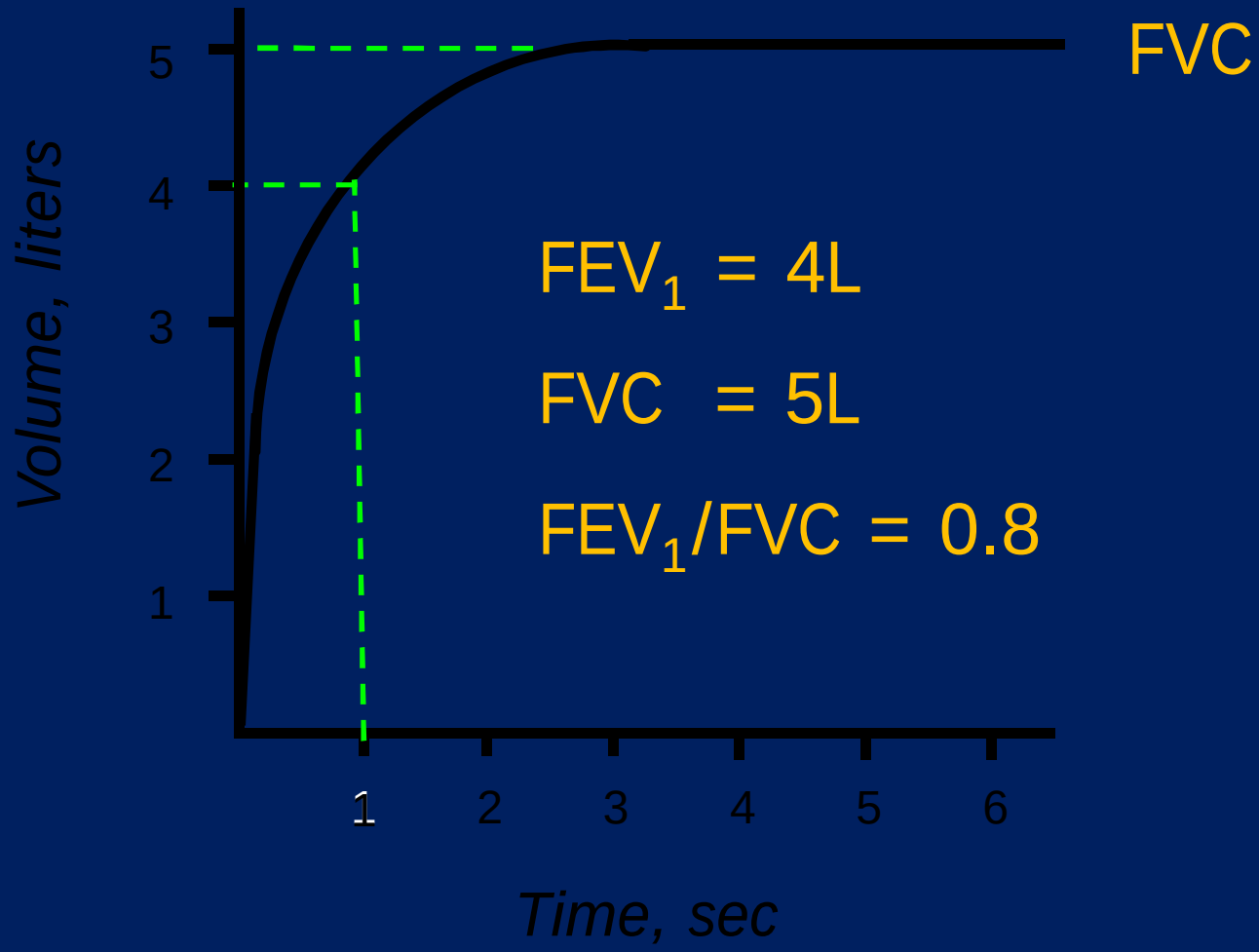
FEV_1 = 4l/sec

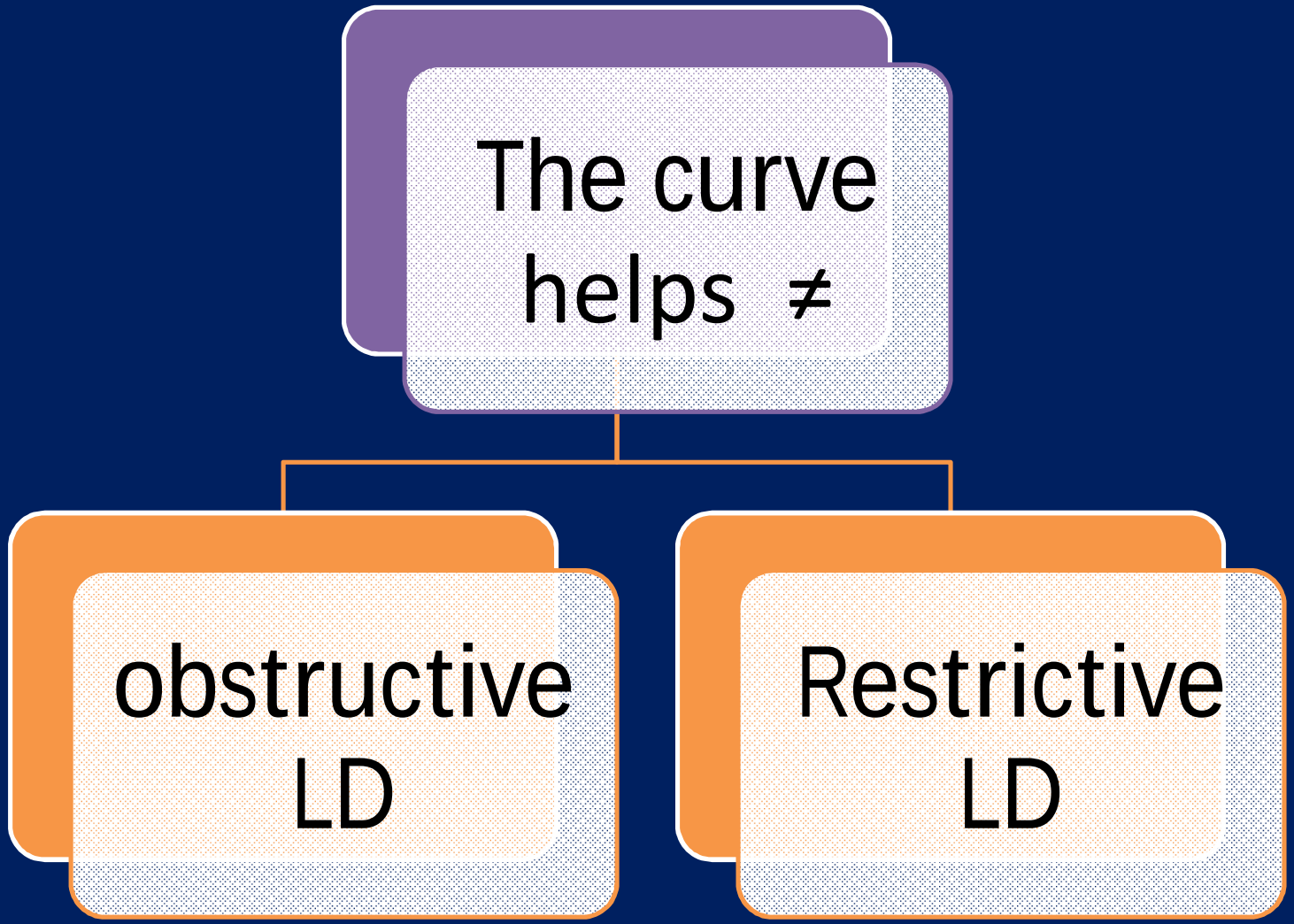
(plateau) **FVC = 5l/sec**

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

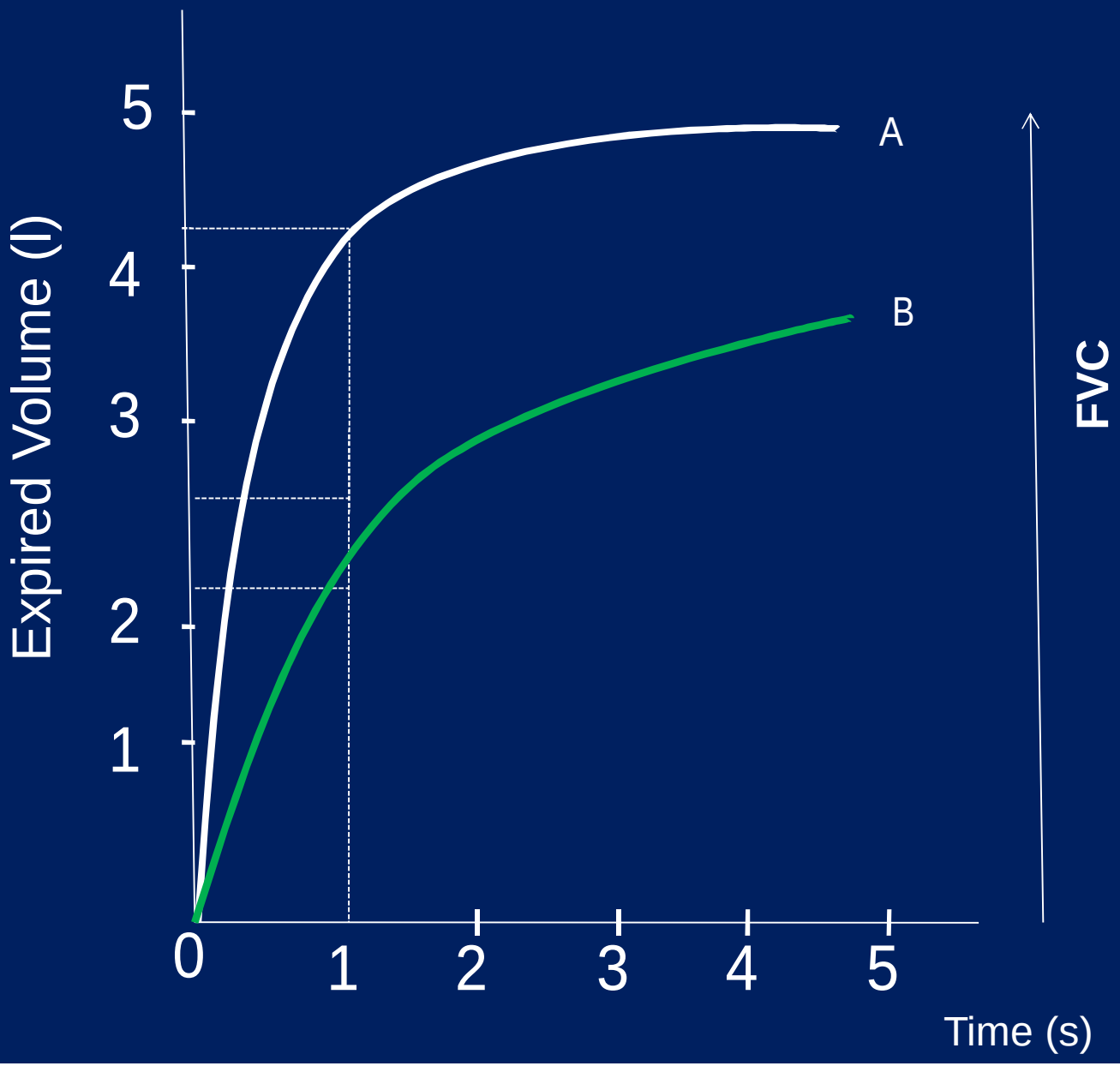
NL: able to exhale 80% from VC in the 1st sec

Normal Trace Showing FEV_1 and FVC

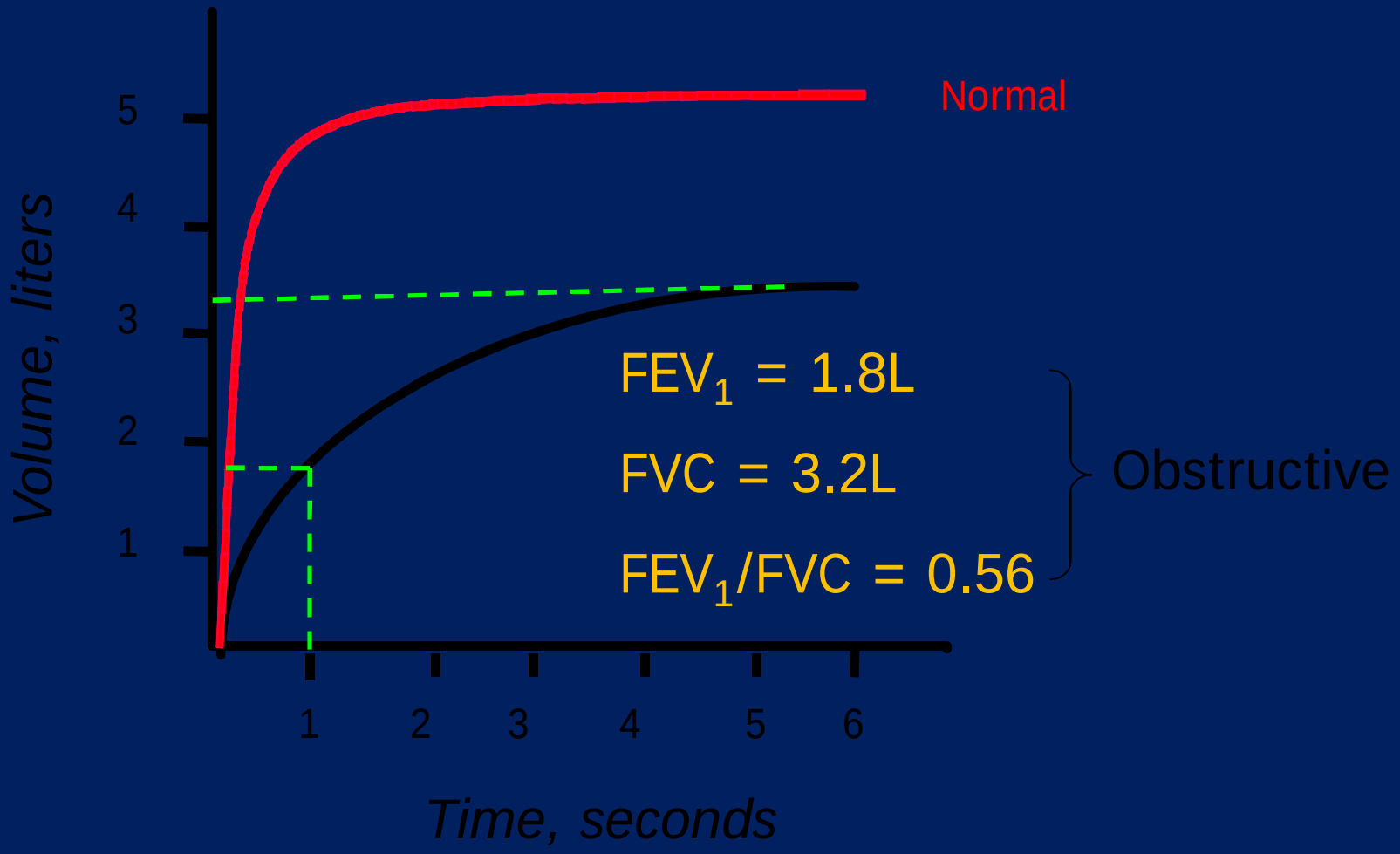



The curve helps ≠
obstructive LD
Restrictive LD

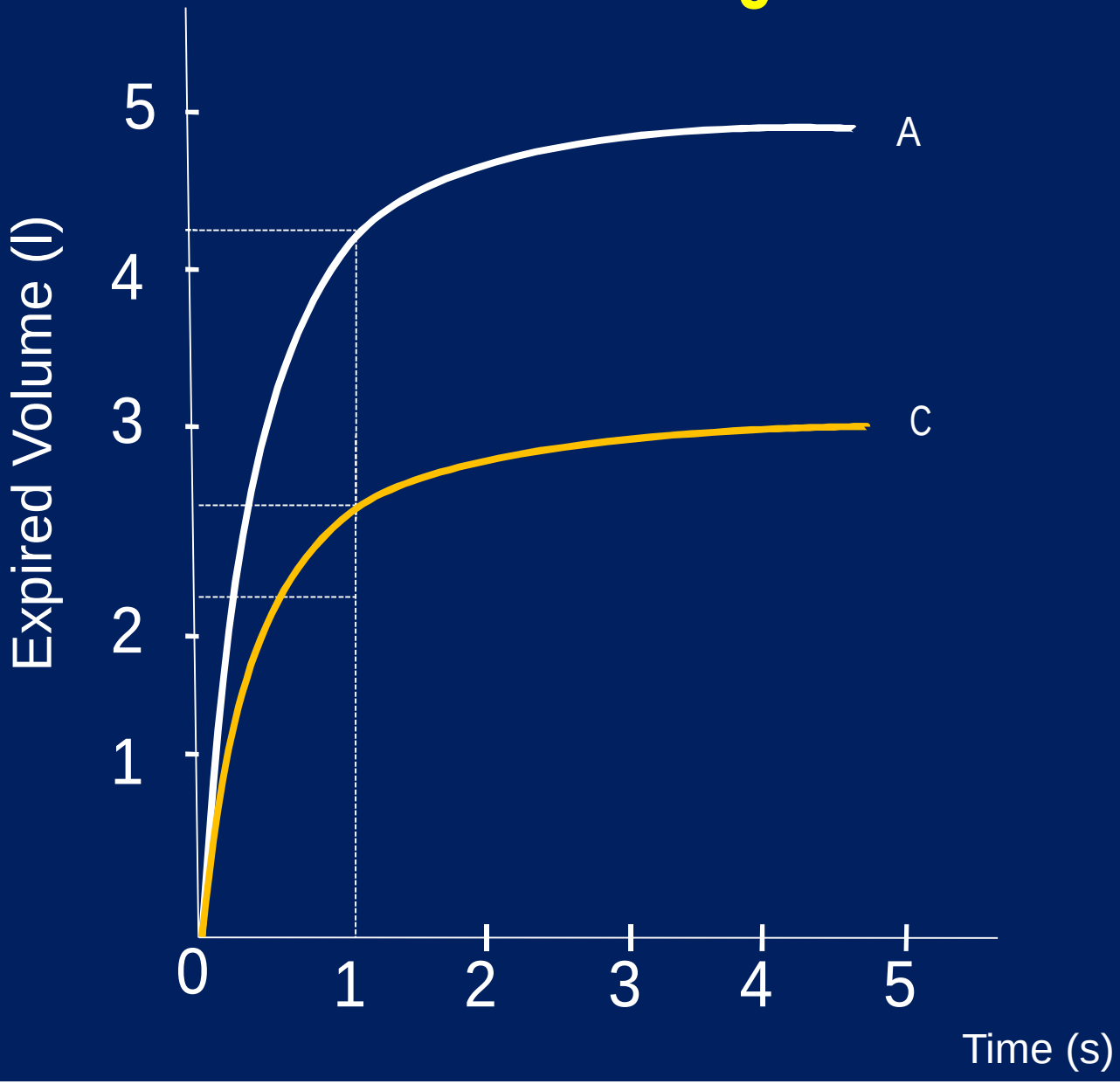
Obstructive lung disease



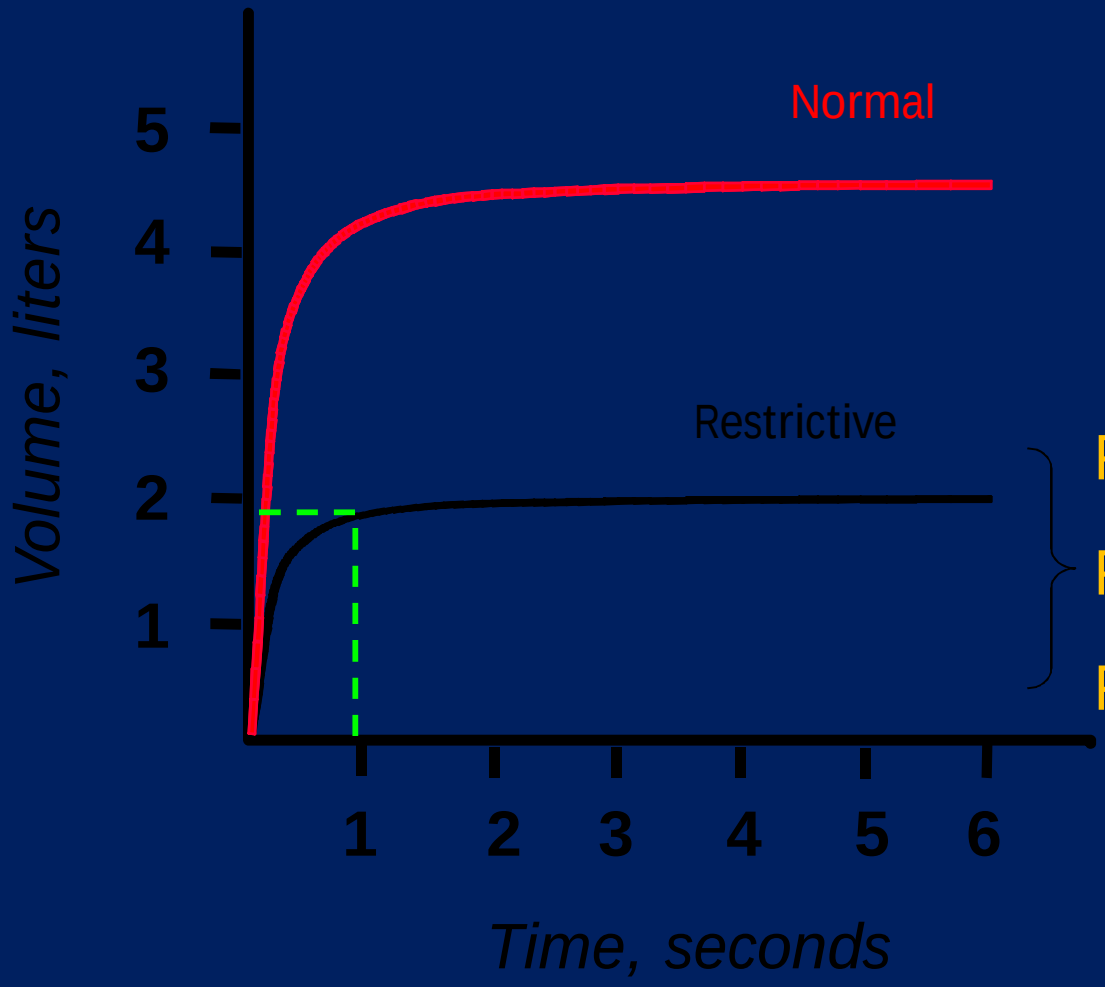
Obstructive Disease



Restrictive lung disease



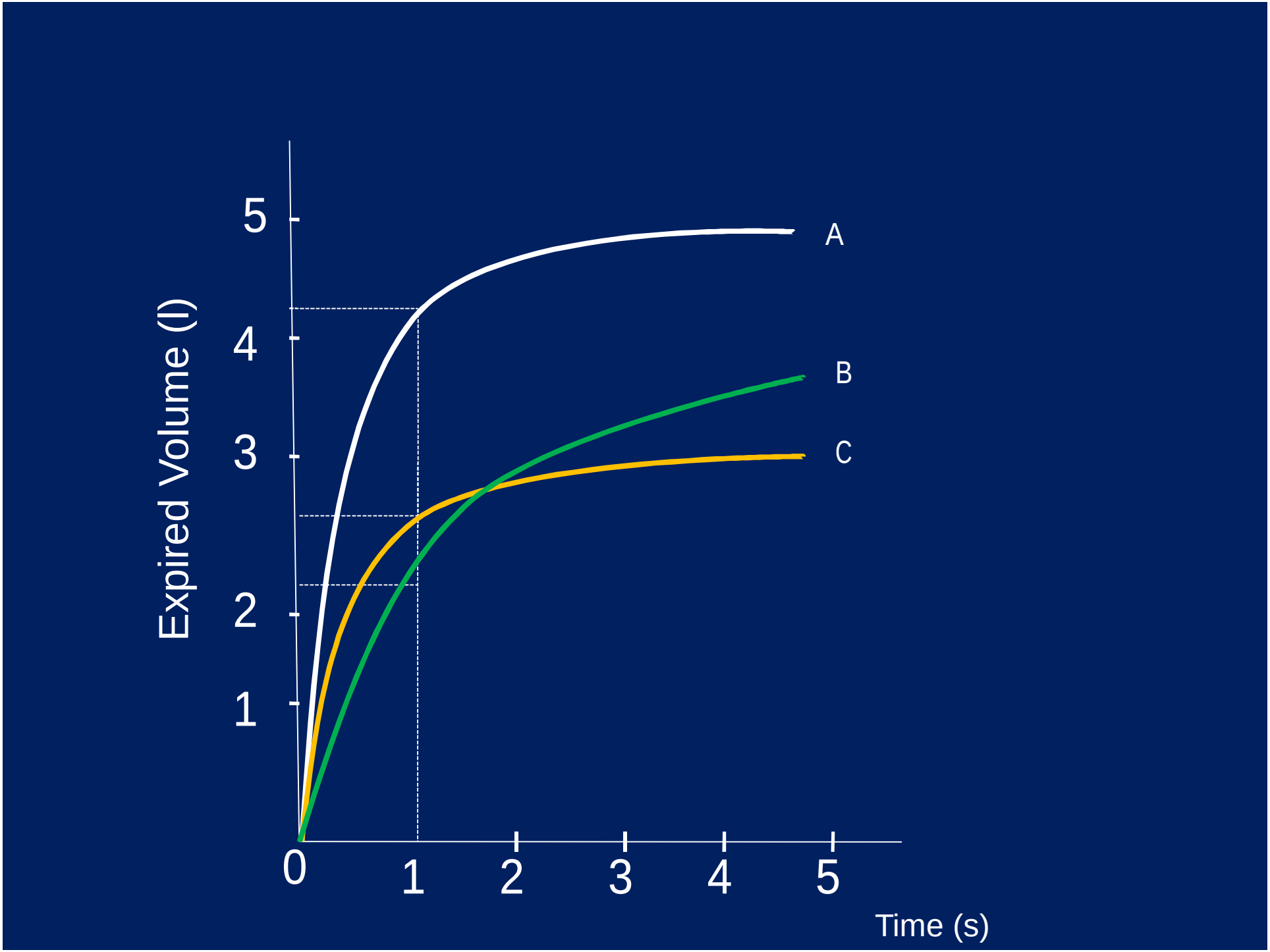
Restrictive Disease

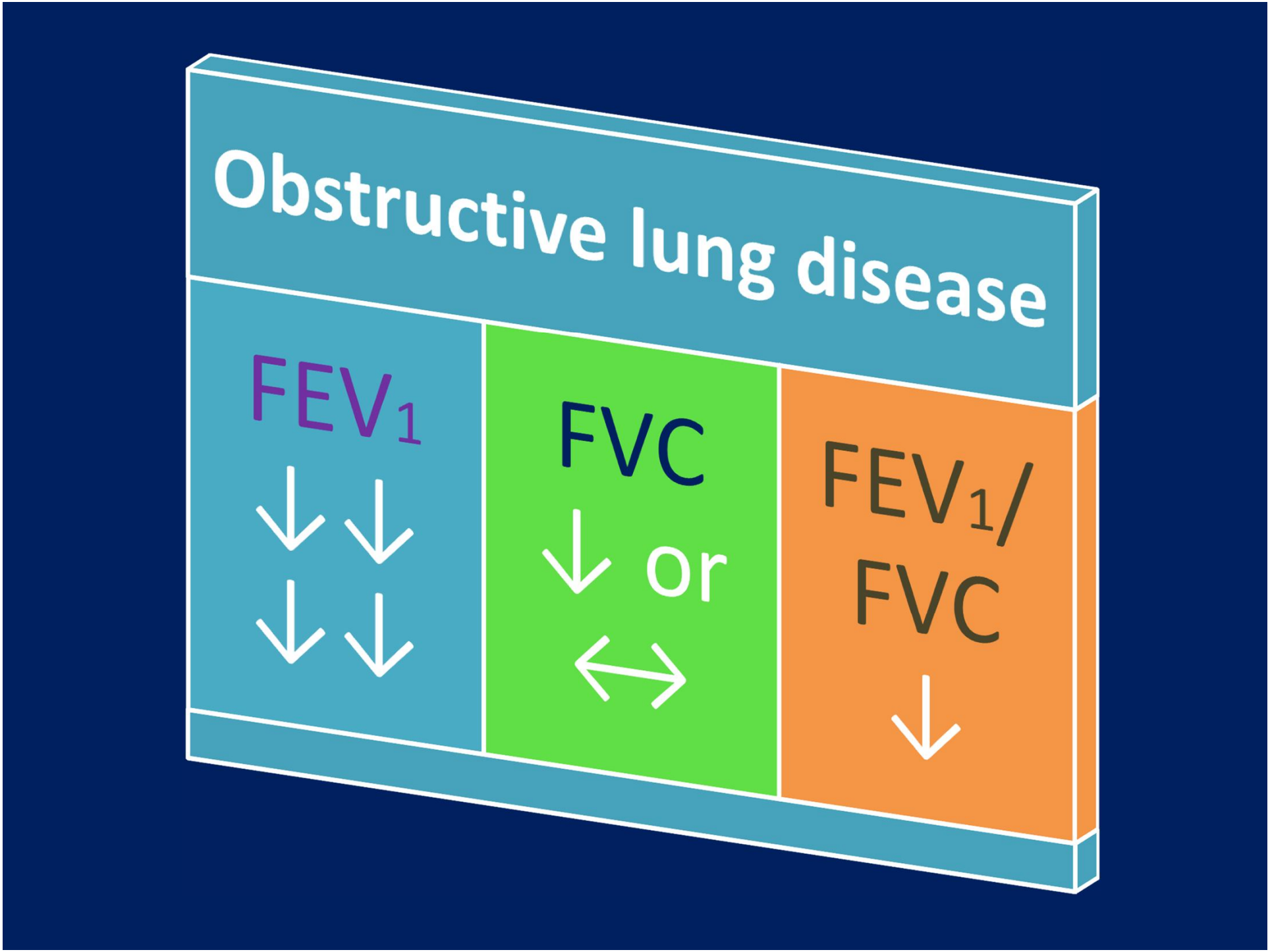


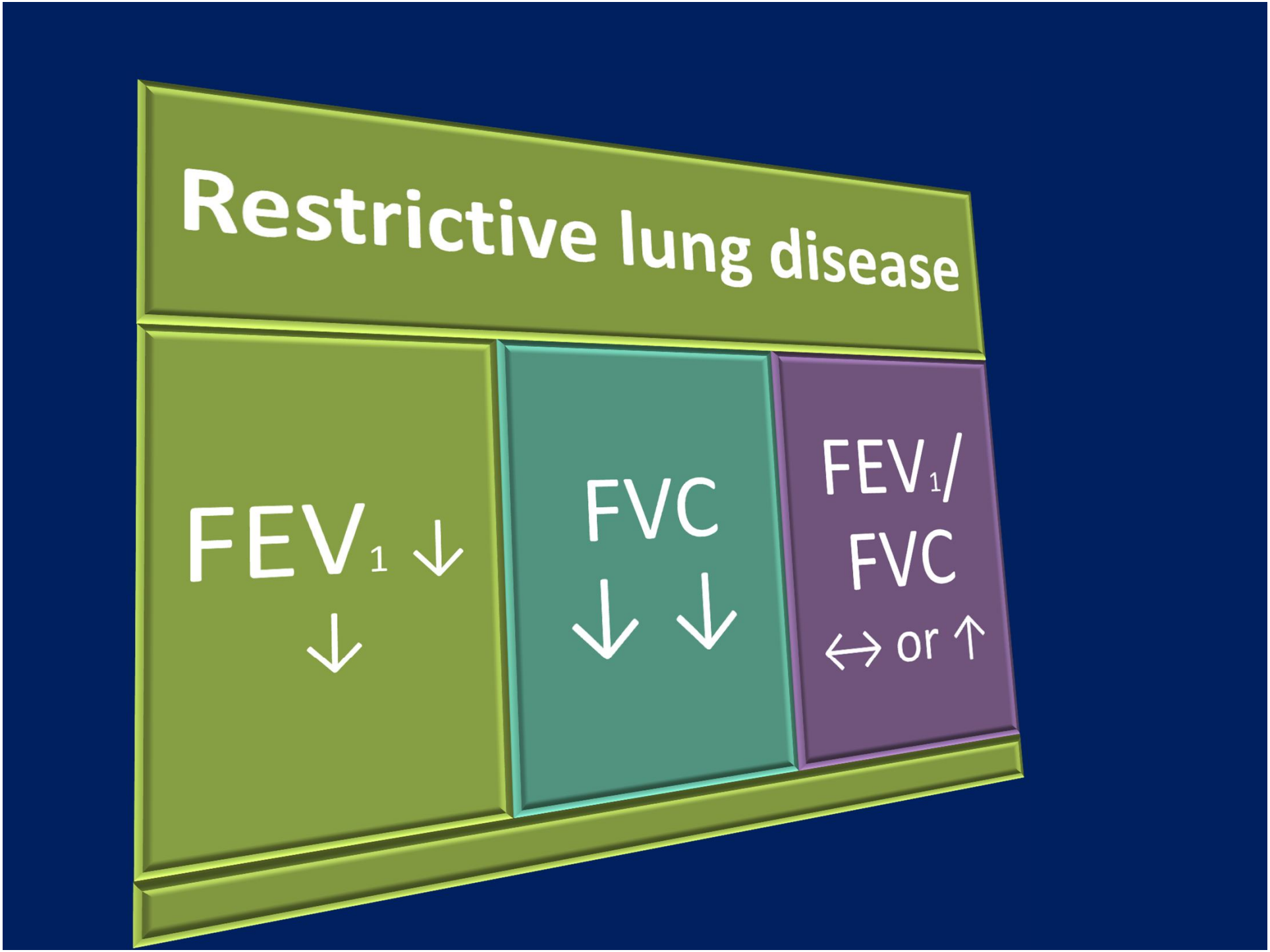
FEV_1 = 1.9L

FVC = 2.0L

FEV_1/FVC = 0.95


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"

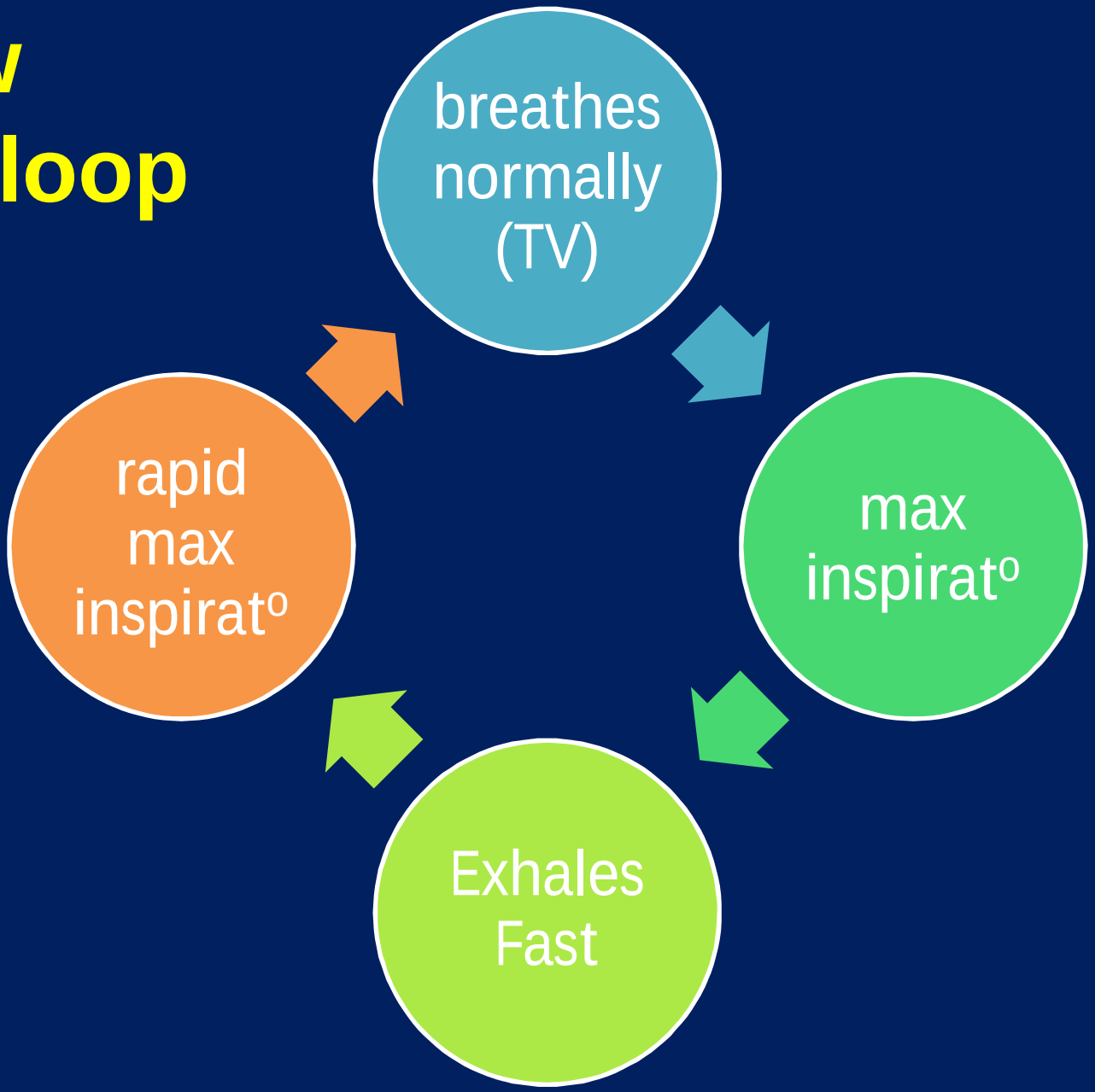
$$FEV_1 \quad \text{Reading } 1.43 \;/\; \text{Predicted value } 2.60 \times 100\% = 55\% \text{ of predicted normal}$$

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

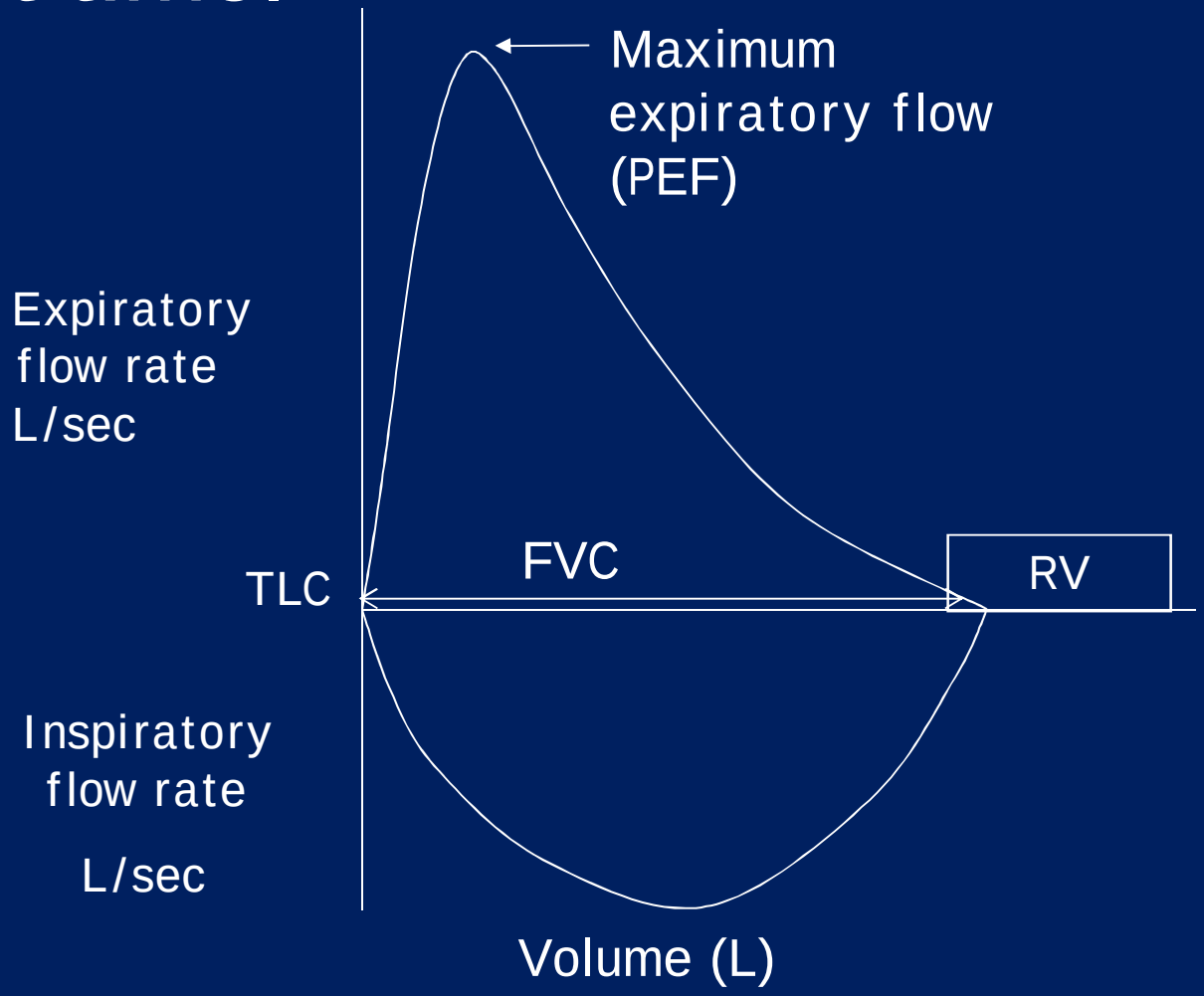
$$\frac{FEV_1}{FVC} \quad \frac{\text{Reading } 1.43}{\text{Reading } 2.5} = 0.57$$

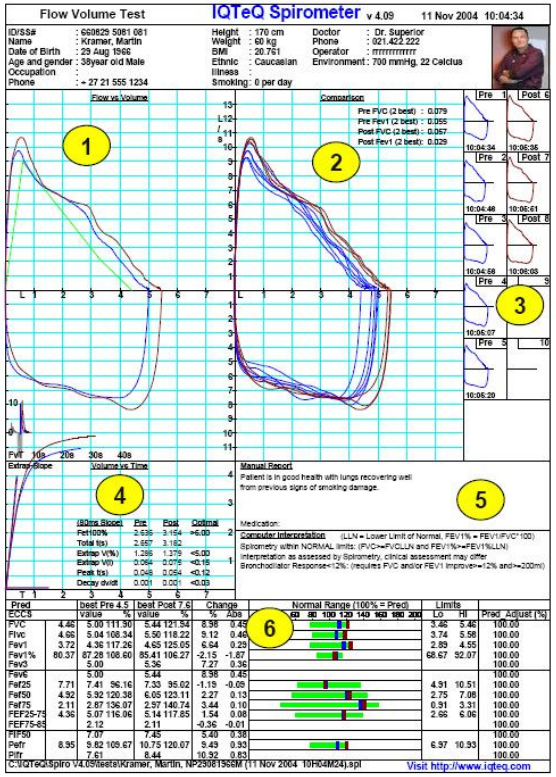
Interpretation: patient has mild airflow obstruction as FEV_1 is between 50% and 80% of predicted normal and FEV_1/FVC is <0.7.

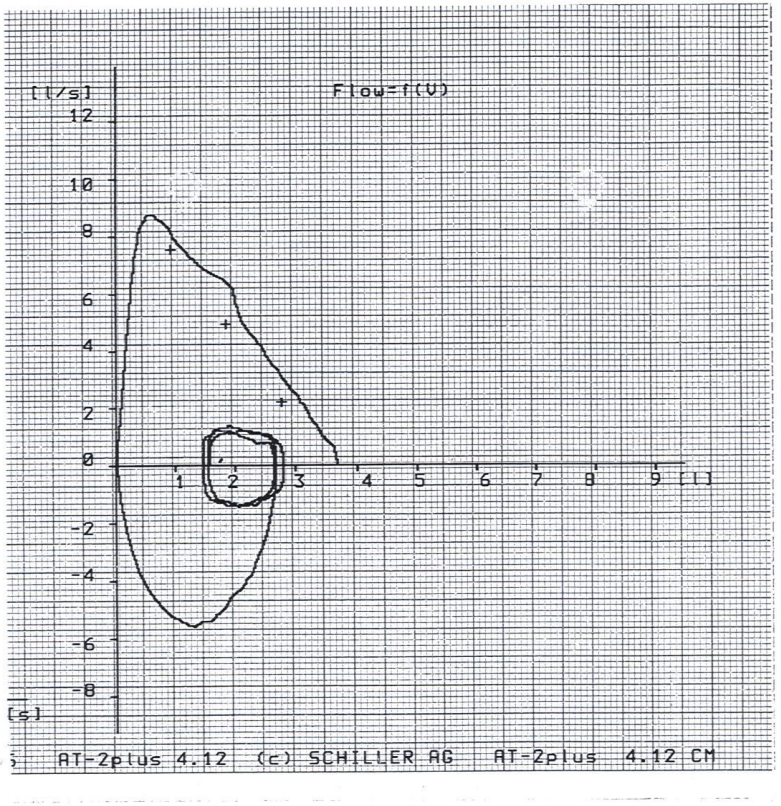
Flow Volume loop



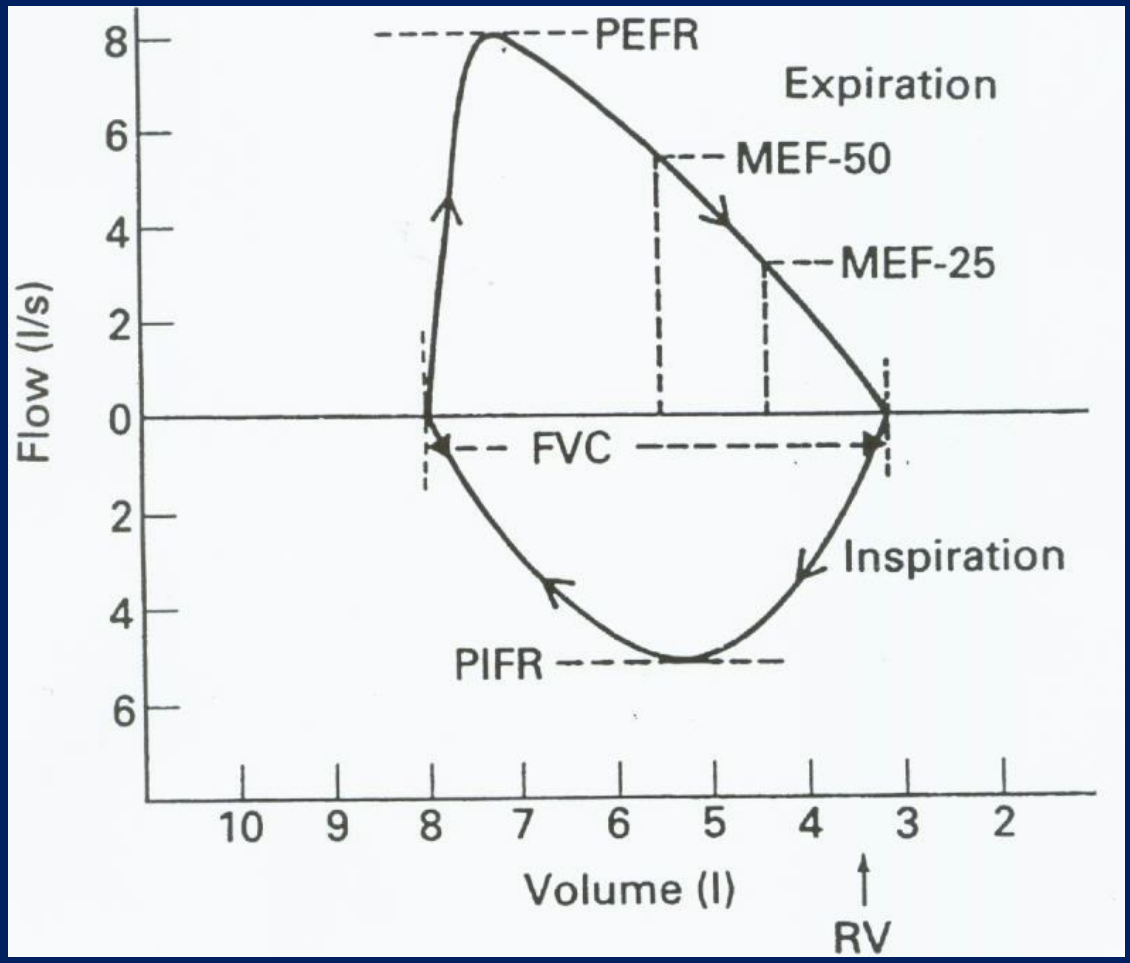
This measures exp & insp flow as a function of exhaled volume rather then against time.




Flow Volume Test
IQTeQ Spirometer v 4.09
11 Nov 2004 10:04:34
ID/SS# : 680825 5081 081
Name : Kramer, Martin
Date of Birth : 29 Aug 1966
Age and gender : 38year old Male
Occupation :
Phone : + 27 21 555 1234
Height : 170 cm
Weight : 60 kg
BMI : 20.761
Ethnic : Caucasian
Illness :
Smoking: 0 per day
Doctor : Dr. Superior
Phone : 021.422.222
Operator : rrrrrrrrrrrr
Environment : 700 mmHg, 22 Celcius
Flow vs Volume
Comparison
Pre FVC (2 best) : 0.079
Pre Fev1 (2 best) : 0.055
Post FVC (2 best) : 0.057
Post Fev1 (2 best) : 0.029
Extrap Slope
Volume vs Time
Manual Report
Patient is in good health with lungs recovering well from previous signs of smoking damage.
Medication:
Computer Interpretation
Spirometry within NORMAL limits: (FVC>=FVCLLN and FEV1%>=FEV1%LLN)
Interpretation as assessed by Spirometry, clinical assessment may differ
Bronchodilator Response<12%: (requires FVC and/or FEV1 improve>=12% and>=200ml)
Pred
best Pre 4.5
best Post 7.6
Change
Normal Range (100% = Pred)
Limits
Visit http://www.iqteq.com


Flow=f(V)
[l/s]
[s]
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

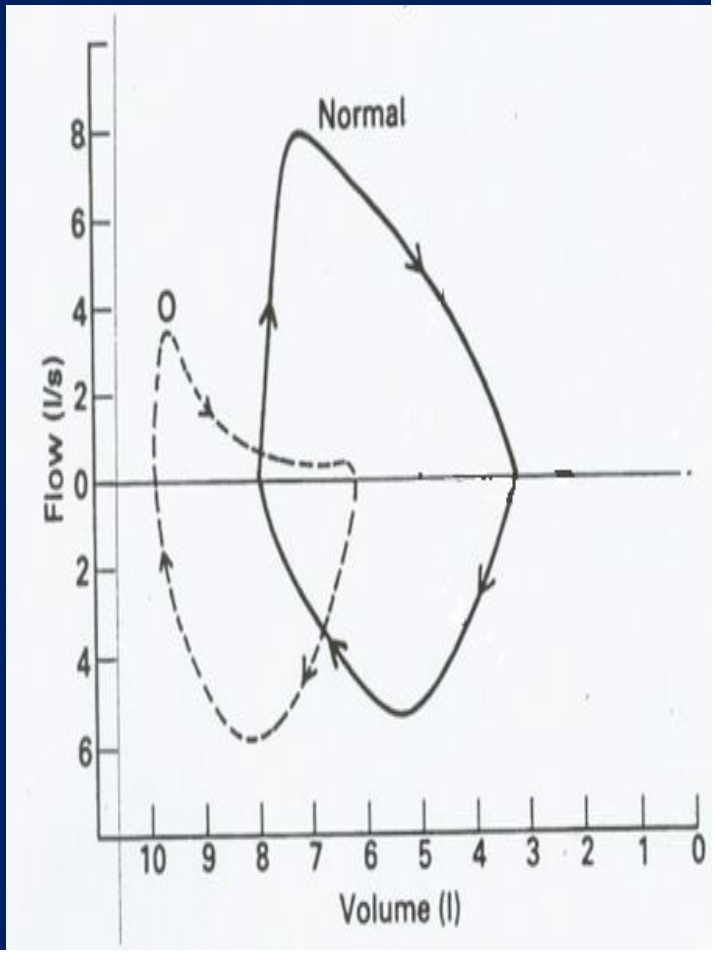
Obstructive LD

MEF50↓

Effort independent part of curve: concave

PEFR↓

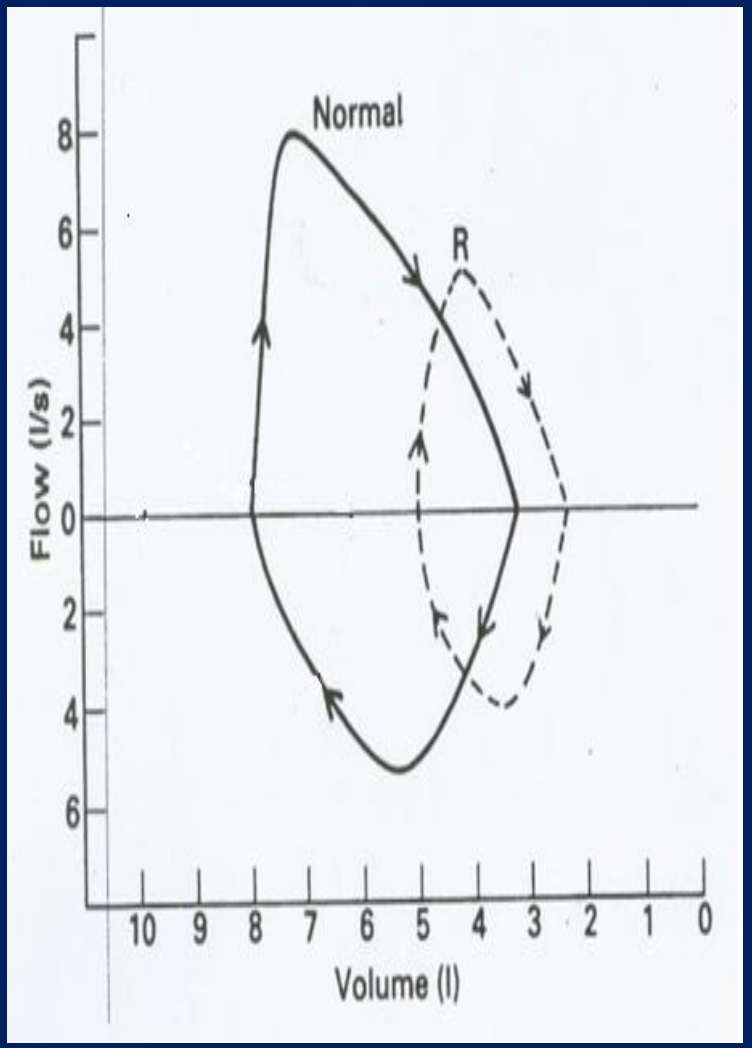
Inspiratory loop Normal

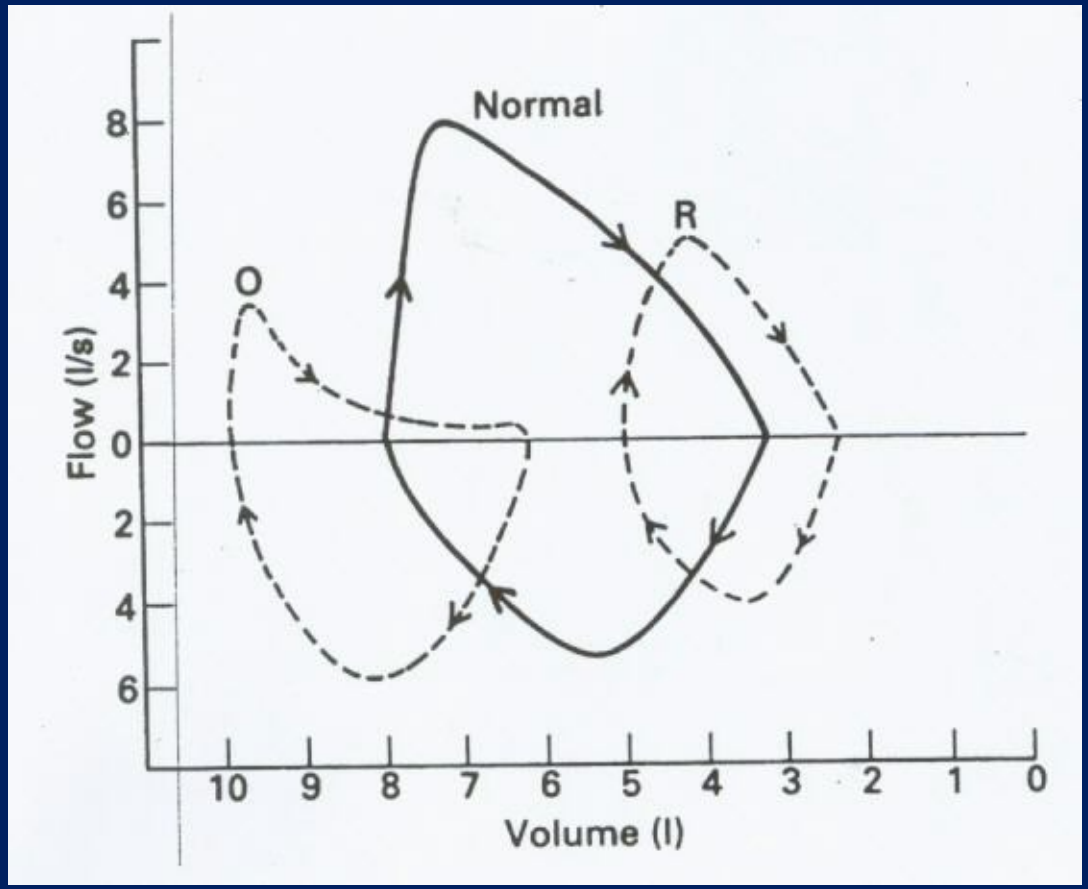


Restrictive LD

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