

# 폐활량검사의 해석

서울대학교병원 폐기능검사실  
여계순

# 폐활량검사 측정 결과 해석 시 고려할 점

- 폐활량검사 해석전 정확하고 표준화된 검사방법에 따른 적합성, 재현성 확인
- 예측식 -검사에 대한 판독을 하기 전 적절한 예측식 선택  
(기관마다 다른 예측식 사용)

# 예측식

- ▶ 우리나라 예측식

임상 -Morris/Polgar식, 최정근식, ECCS식,GI식등

- ▶ 예측치에 영향을 미치는 요소  
성별 ,인종,신장 ,나이, 체중등

**\*예측식 사용에 따라 폐활량검사 해석 달라짐**

# 예측식 비교

Table 1. Reference equations<sup>3,4</sup>

Morris' equation		
FEV1	Males	$Ht^* \times 0.092 \times 0.3937^\dagger - Age^\ddagger \times 0.032 - 1.260$
	Females	$Ht \times 0.089 \times 0.3937 - Age \times 0.025 - 1.932$
FVC	Males	$Ht \times 0.148 \times 0.3937 - Age \times 0.025 - 4.241$
	Females	$Ht \times 0.115 \times 0.3937 - Age \times 0.024 - 2.852$
Korean equation		
FEV1	Males	$0.04578 \times Ht - 0.0002484 \times Age^2 - 3.4132$
	Females	$0.03558 \times Ht - 0.0001920 \times Age^2 - 2.4114$
FVC	Males	$0.05292 \times Ht + 0.010947 \times Wt^\S - 0.00008633 \times Age^2 - 4.8434$
	Females	$0.03951 \times Ht + 0.006892 \times Wt - 0.00012728 \times Age^2 - 3.0006$

\*Height in centimeters; † a conversion factor from inches to centimeters; ‡ Age in years; §Weight in kilograms

# 폐활량검사 해석 시 기본적인 변수

## FEV1/FVC%, FVC, FEV1

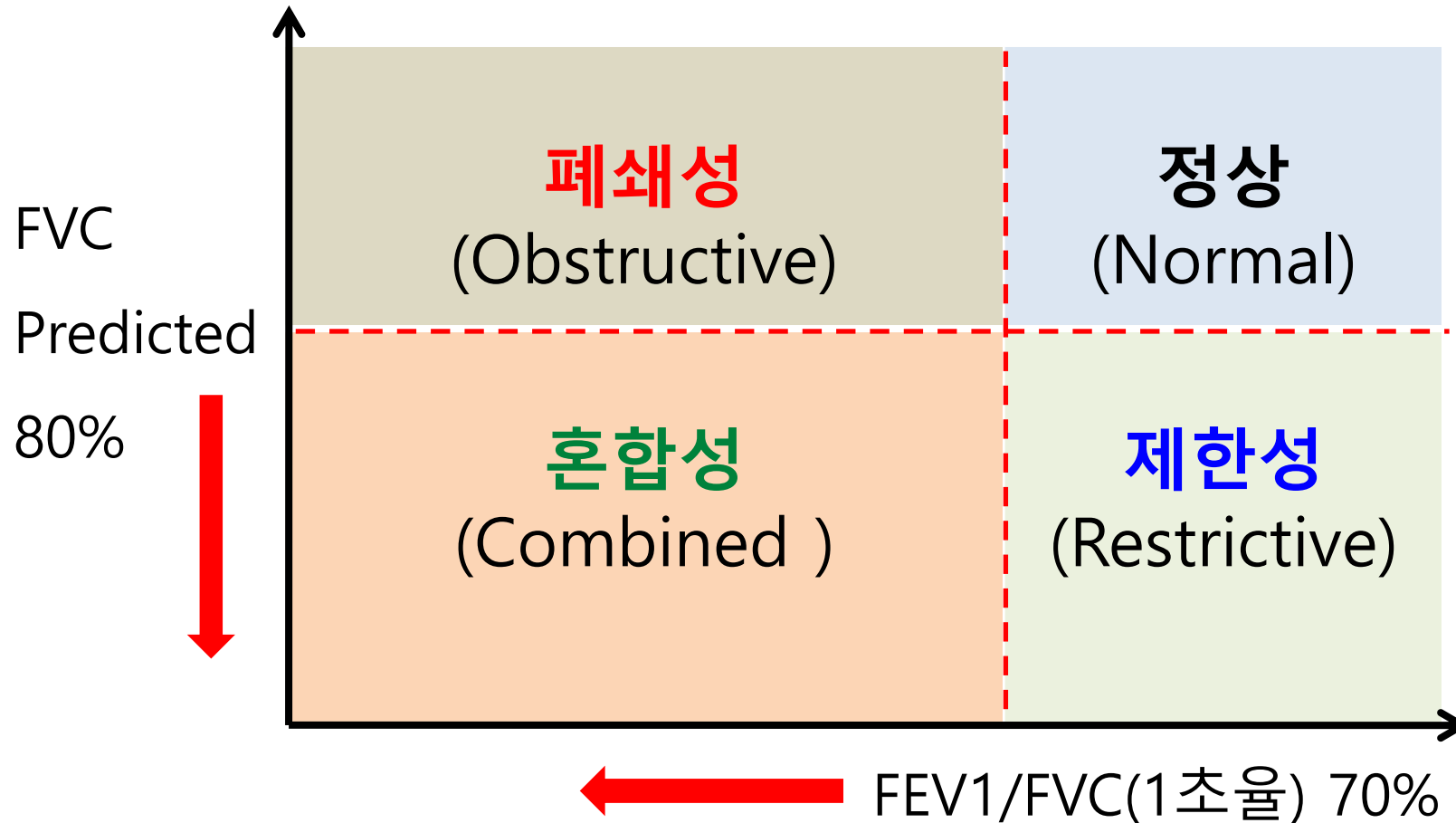
**FEV1/FVC%**- 폐쇄성 환기장애의 유무를 판단

**FEV1**- 폐쇄성 환기장애의 중증도 판단

**FVC** – 제한성 환기장애의 유무 판단

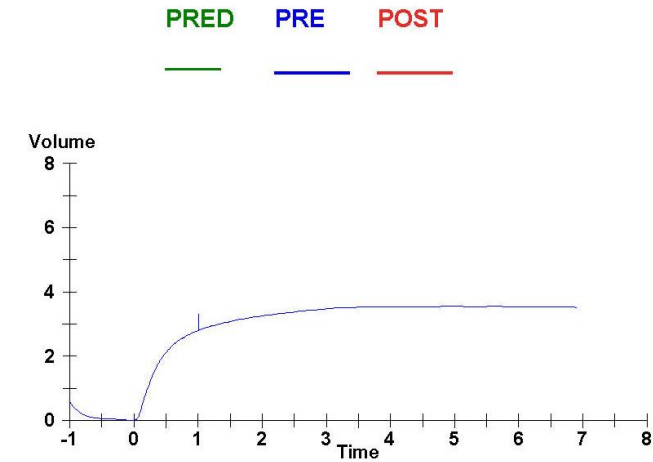
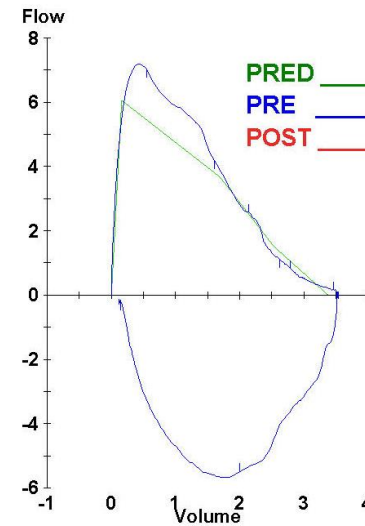
FEF25-75%-노력 비의존성 지표,  
말초 소기도 병변의 조기 진단  
변이성 해석에 주의

# 결과 해석-환기장애 유형



# 정상(Normal)

**FEV<sub>1</sub>/FVC %  $\geq$  70%**



**FVC % predicted  $\geq$  80%**

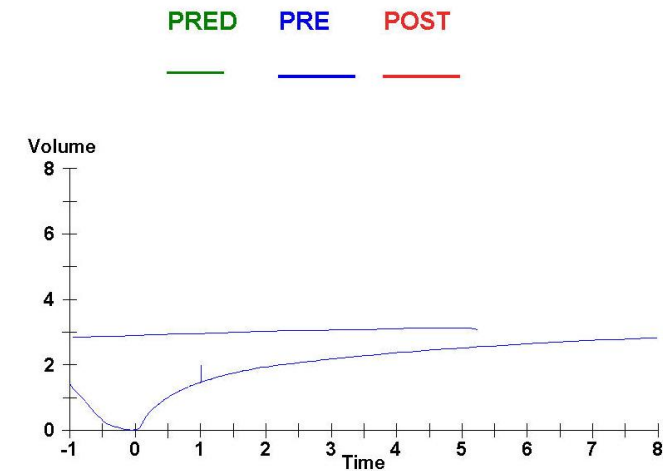
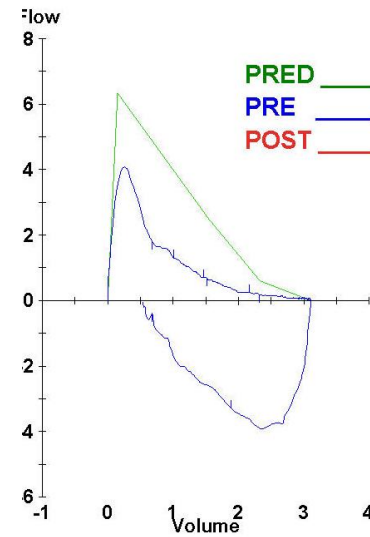
# 폐쇄성 환기장애

**FEV1/FVC % < 70%**

**FVC% ≥ 80%**

- 폐쇄성 중증도 지표 → FEV1  
(치료반응,예후)

폐기종, 만성기관지염, 천식

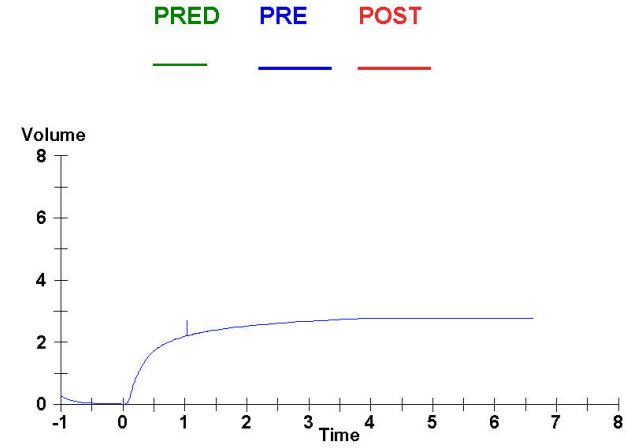
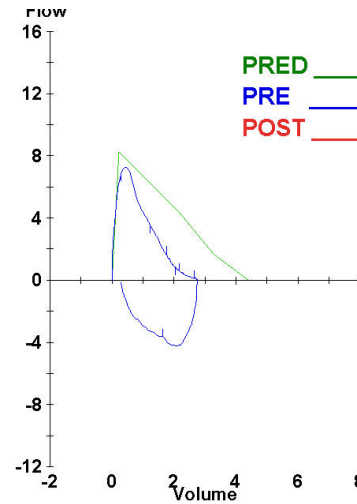


# 제한성 환기장애

**FEV1/FVC %  $\geq$  70%**

**FVC % < 80%**

**확진 - TLC 감소**

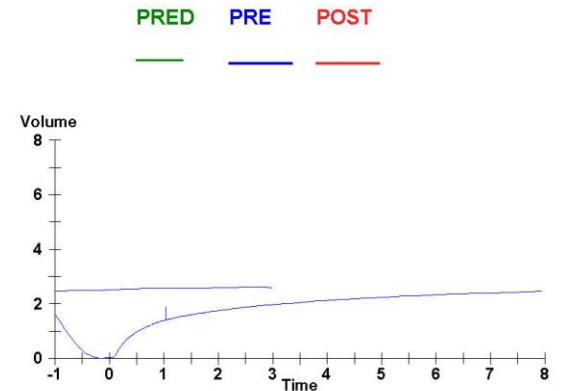
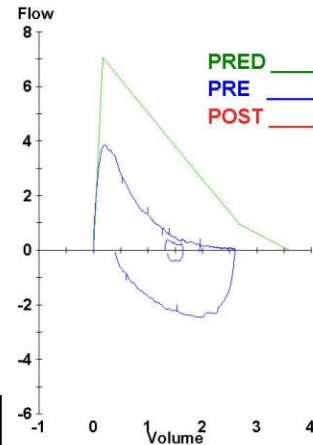


간질성 폐질환, 폐부종, 폐섬유증, 흉막 삼출액, 기흉, 흉부신경 및 근육질환  
횡격막 신경마비, 복수나 임신에 의한 횡격막의 운동 제한 등

# 혼합성 환기장애

**FEV1/FVC % < 70%**

**FVC % < 80%**



폐의 확장과 수축이 제한되어 폐용량도 적으며  
기도의 폐쇄 동반

-COPD동반폐섬유증,결핵휴유증

# COPD의 중증도 분류

- $FEV_1 / FVC \% < 70\%$
- 폐쇄성 중증도 →  $FEV_1 \% \text{ predicted}$   
( 천식, COPD의 중증도, 치료반응, 예후)

단계	$FEV_1$	$FEV_1 / FVC\%$	정도
I	$\geq 80\%$	$< 70\%$	Mild
II	$50\% \sim < 80\%$	$< 70\%$	Moderate
III	$30\% \sim < 50\%$	$< 70\%$	Severe
IV	$< 30\%$	$< 70\%$	Very severe

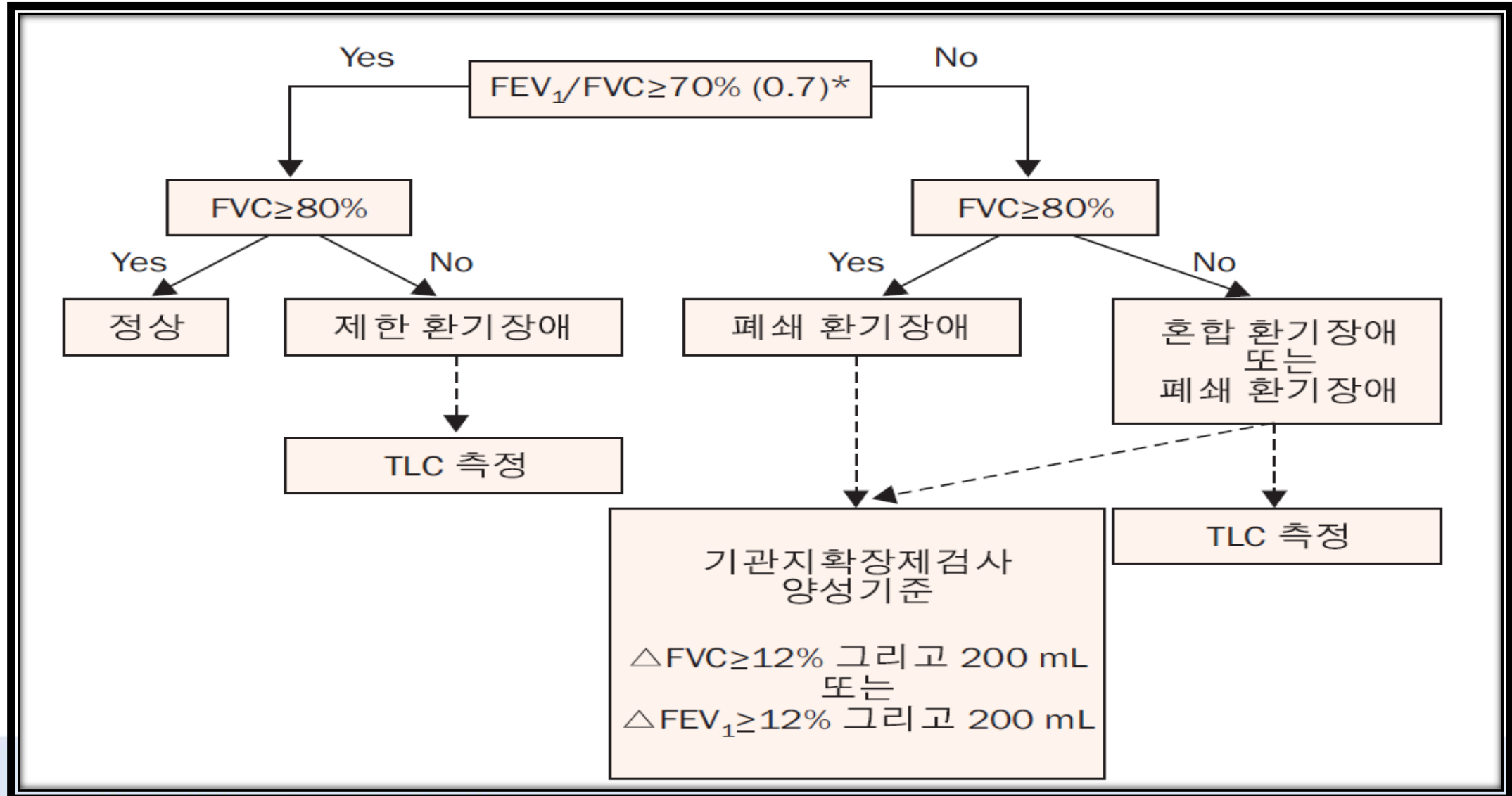
기관지확장제 흡입 후 검사 수치  
NHLBI/WHO.GOLD COPD Guidelines; 2012 Revised

# 기관지 확장제 검사 양성 기준

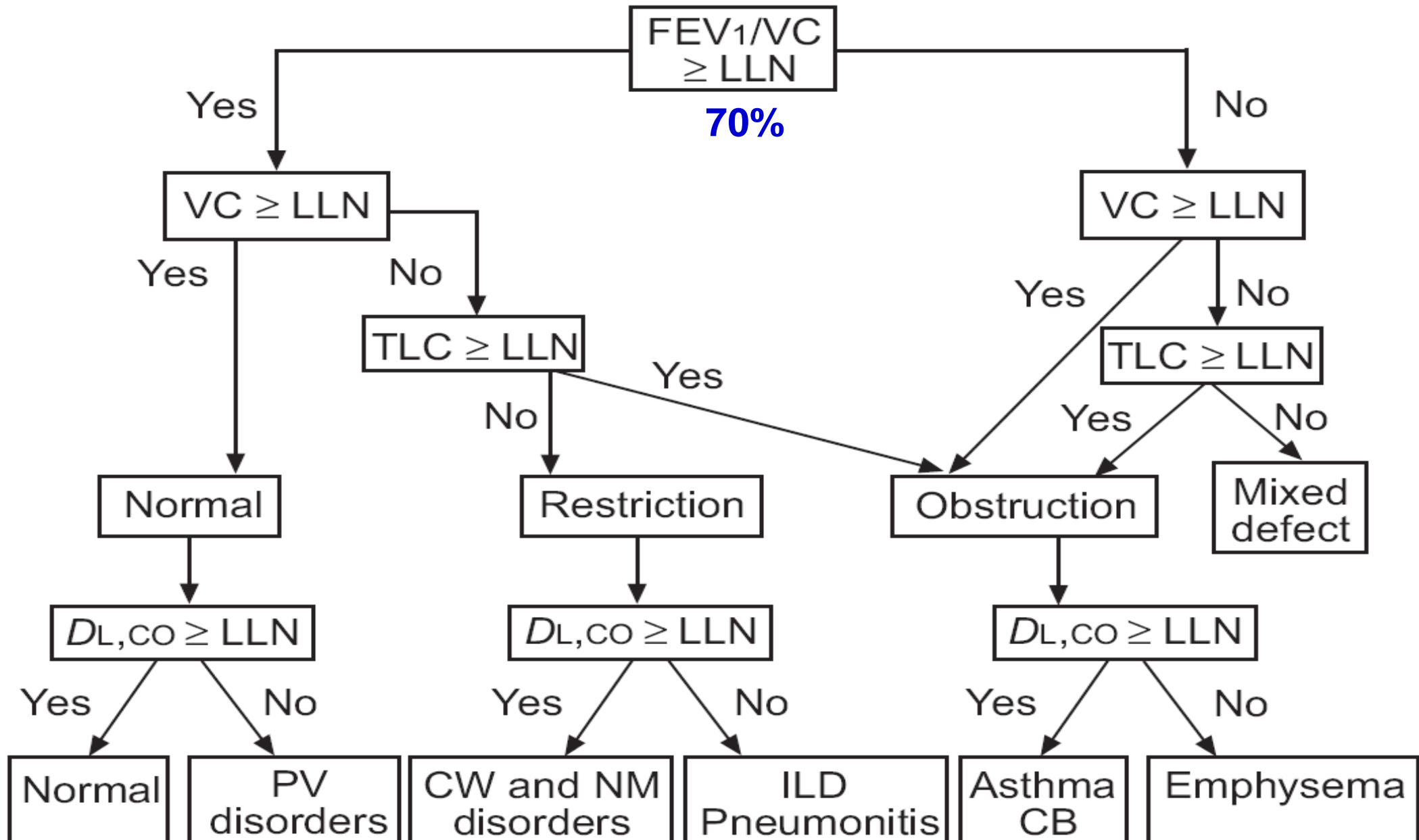
Positive bronchodilator response

FVC or  $FEV_1 \geq 12\%$  and 200mL

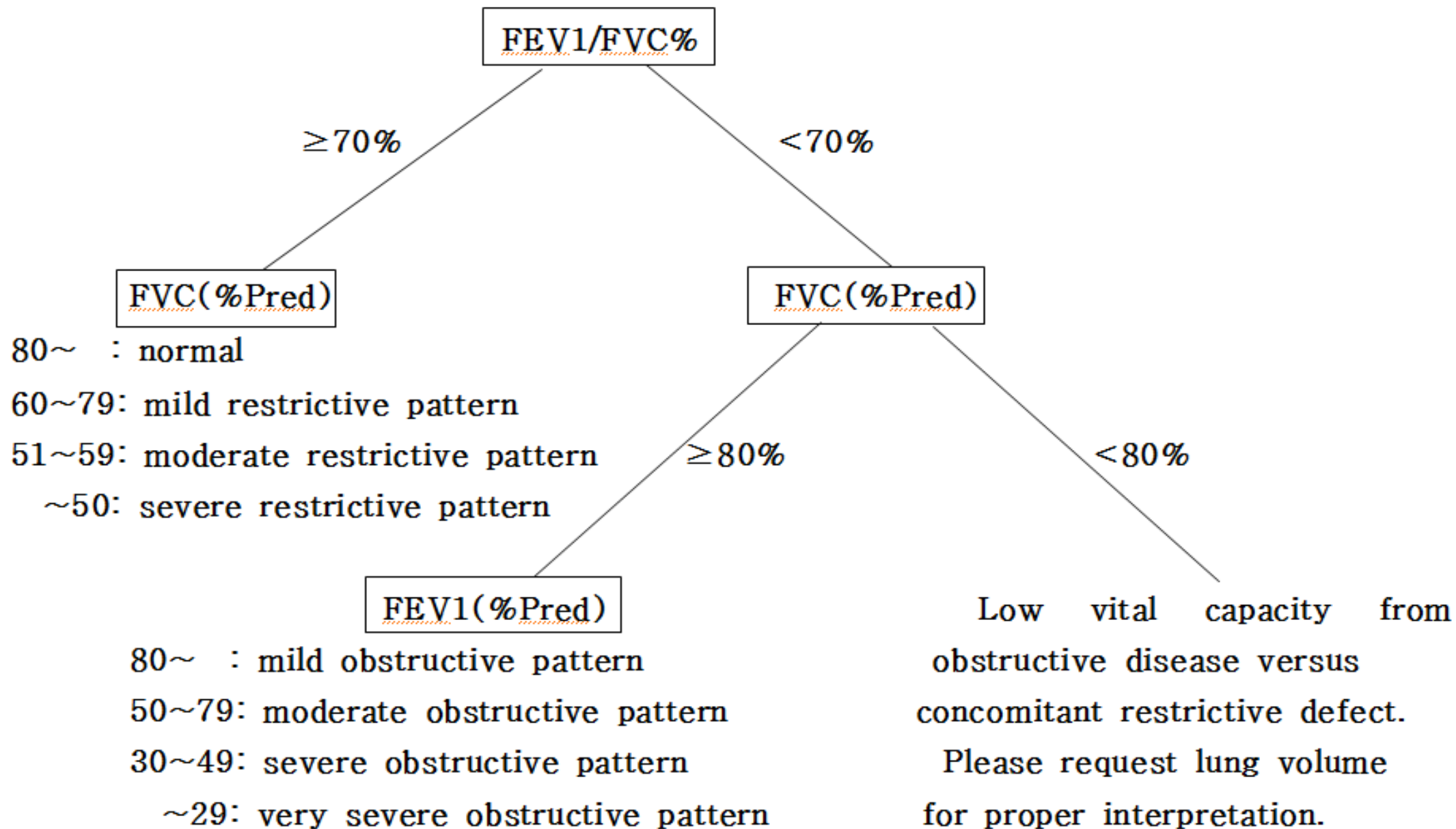
# 폐활량검사 해석 흐름도



# Interpretation of PFT



# 폐활량검사 해석흐름도 (SNUH)



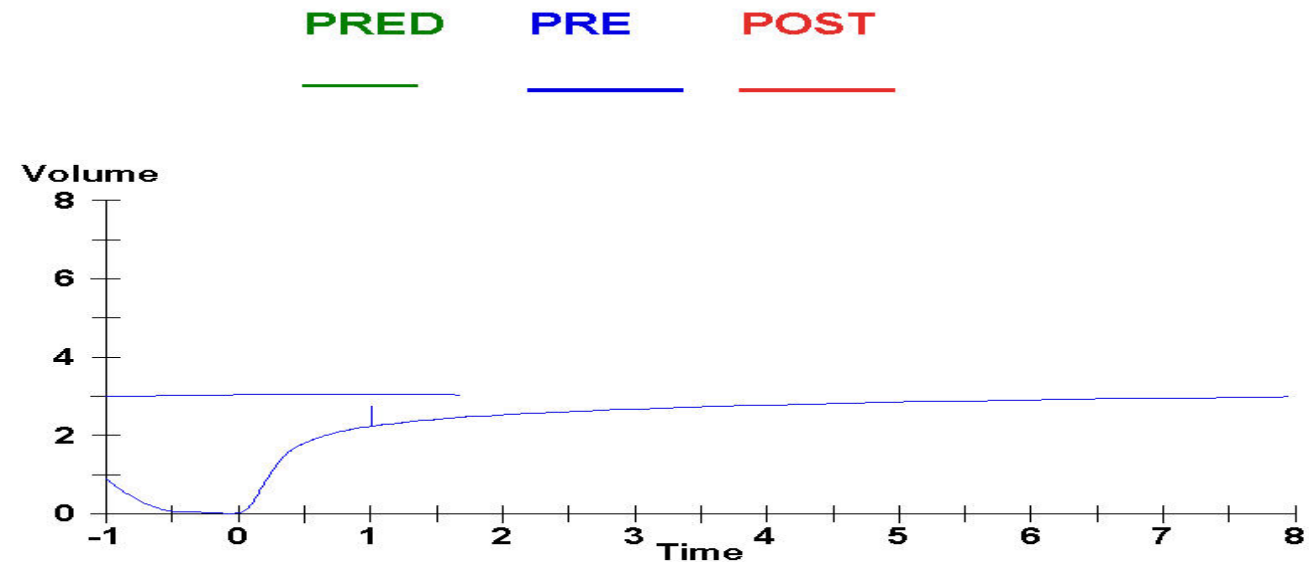
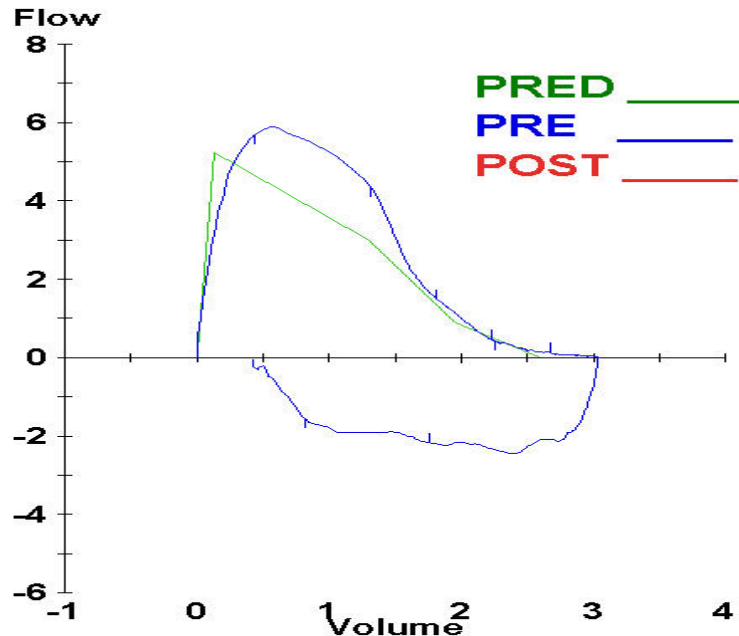
# 판독실습

# 정상 (Normal)

## Spirometry

(BTPS)

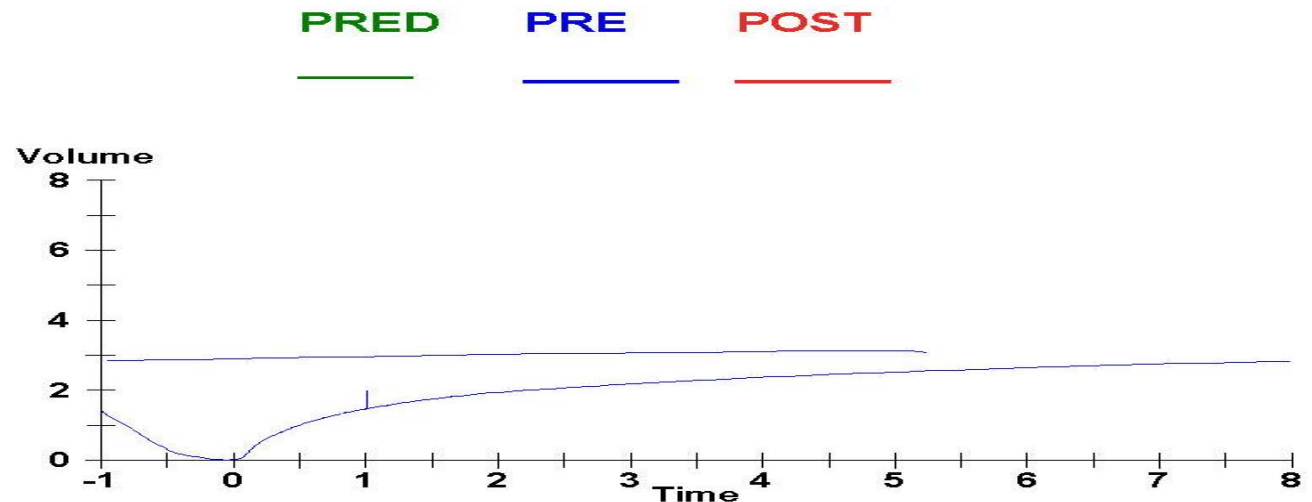
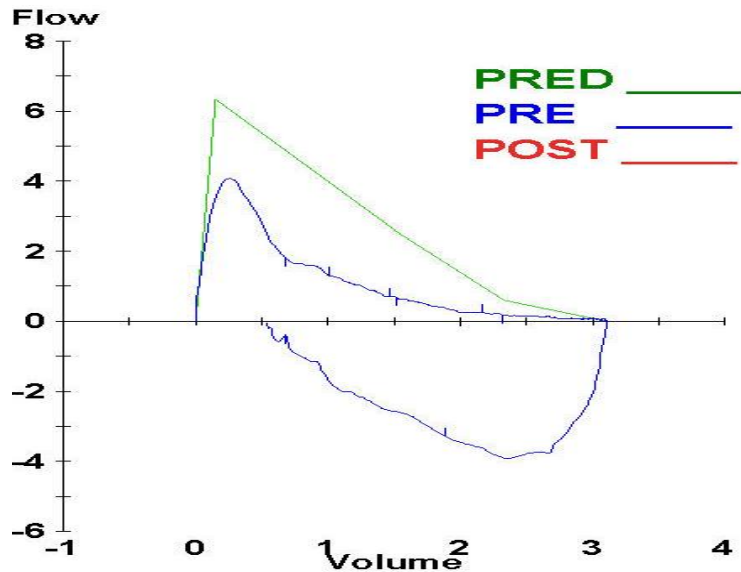
		Ref	PRE-RX Meas	%Ref
FVC	Liters	2.61	3.04	117
FEV1	Liters	1.89	2.26	120
FEV1/FVC	%	73	74	
FEV3/FVC	%	97	88	
FEF25-75%	L/sec	2.30	1.64	71



# 폐쇄성 환기장애(Obstructive pattern)

## Spirometry

		Ref	PRE-RX		POST-RX		% CHG
(BTPS)			Meas	%Ref	Meas	%Ref	
FVC	Liters	3.11	3.12	100			
FEV1	Liters	1.89	1.56	83			
FEV1/FVC	%	66	50				
FEV3/FVC	%	97	70				
FEF25-75%	L/sec	1.66	0.45	27			

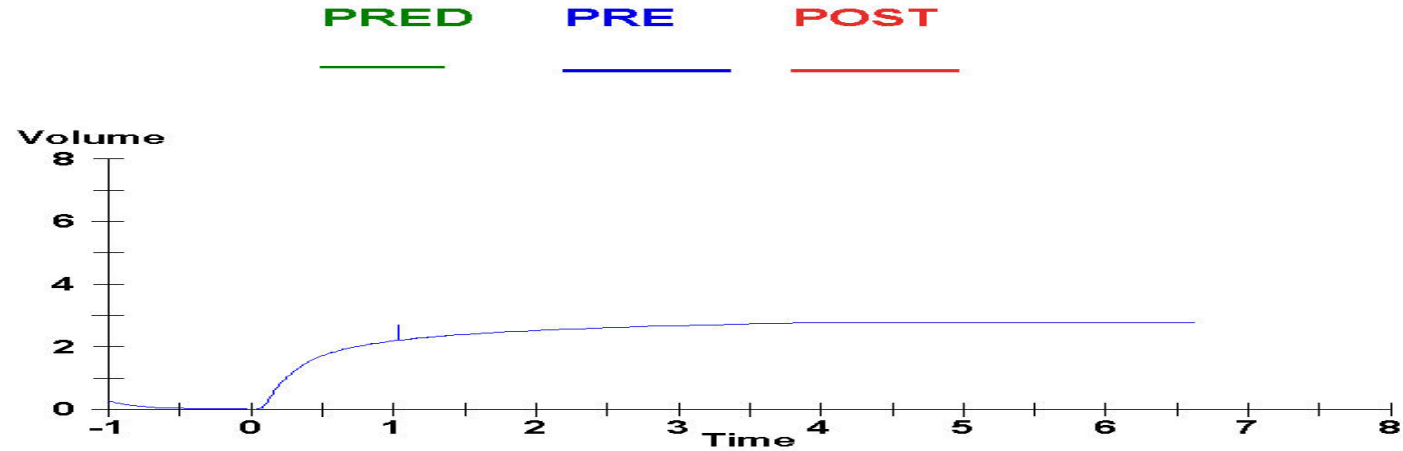
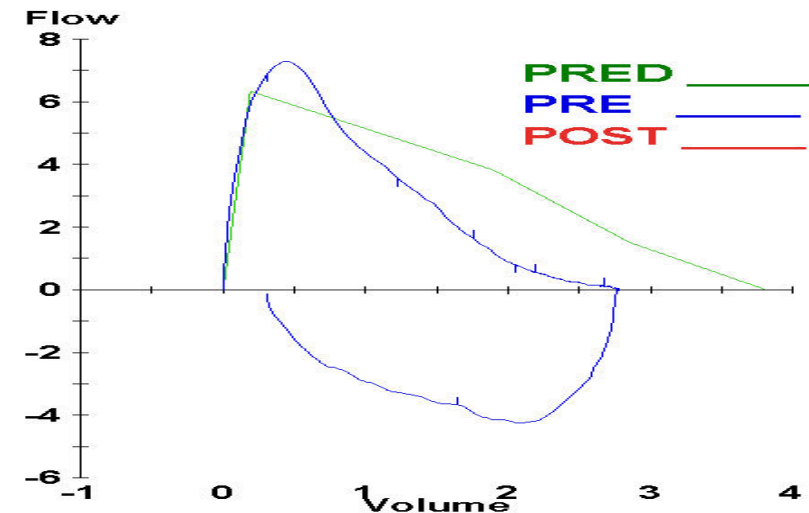


# 제한성 환기장애( Restrictive pattern)

## Spirometry

(BTPS)

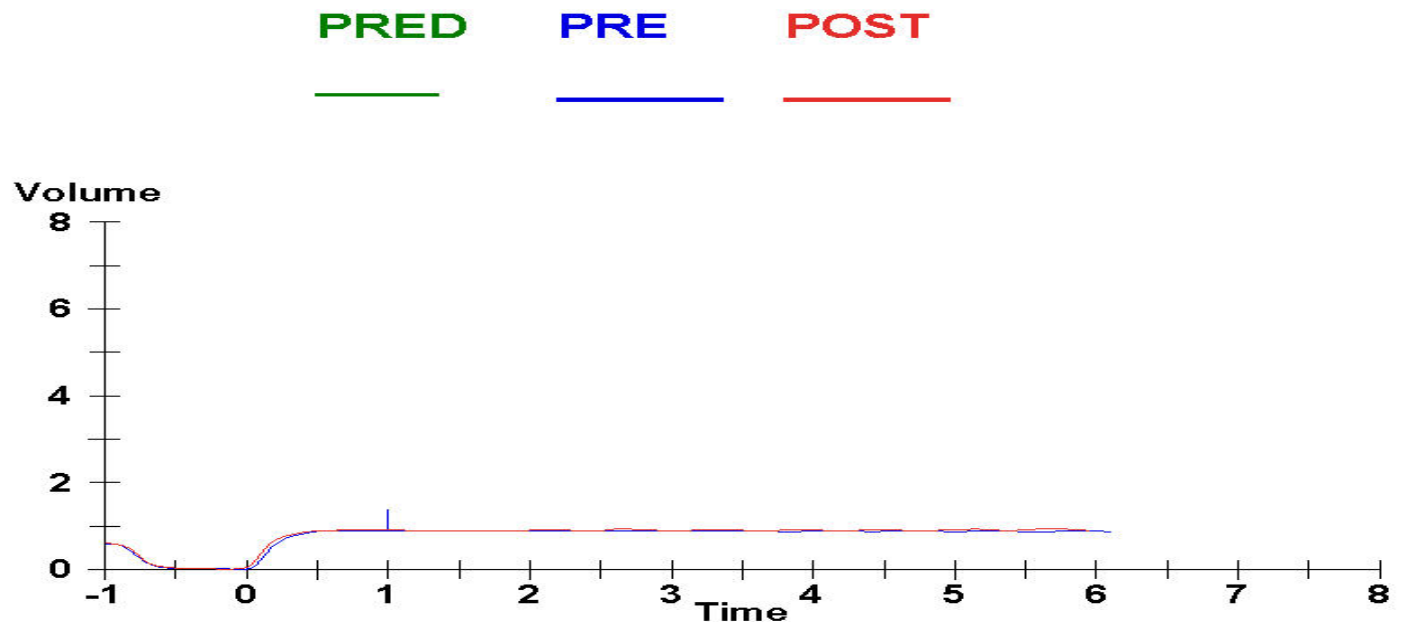
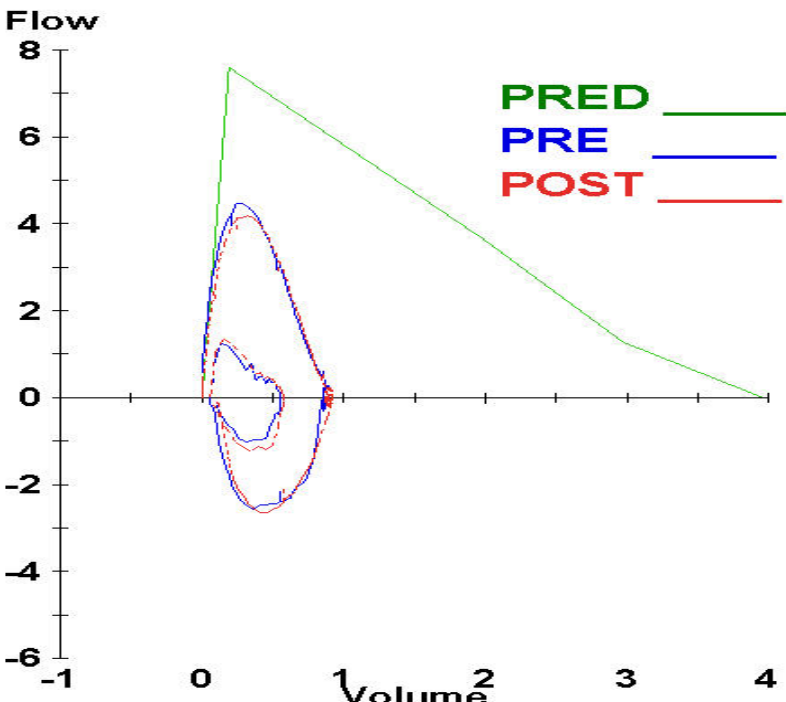
		Ref	PRE-RX		POST-RX		% CHG
			Meas	%Ref	Meas	%Ref	
FVC	Liters	3.81	2.78	73			
FEV1	Liters	3.16	2.22	70			
FEV1/FVC	%	81	80				
FEV3/FVC	%	97	96				
FEF25-75%	L/sec	3.07	2.13	69			



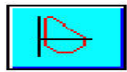
# 제한성 환기장애( Restrictive pattern)

## Spirometry

		Ref	PRE-RX Meas	%Ref
FVC	Liters	3.97	0.90	23
FEV1	Liters	2.81	0.89	32
FEV1/FVC	%	71	98	
FEV3/FVC	%	97	100	
FEF25-75%	L/sec	2.78	3.60	129
FEF50%	L/sec	3.64	4.07	112
PEF	L/sec	7.58	4.56	60



# 제한성 환기장애( Restrictive pattern)



## Spirometry

		Ref	Pre Meas	Pre % Ref	Post Meas	Post % Ref	Post % Chg
FVC	Liters	3.64	2.03	56	2.02	56	-0
FEV1	Liters	2.57	1.53	60	1.58	62	3
FEV1/FVC	%	71	76		78		
FEV3/FVC	%	97	91		92		
FEF25-75%	L/sec	2.61	1.20	46	1.32	51	10
PEF	L/sec	7.06	6.67	94	6.95	98	4
FIVC	Liters	3.64	1.81	50	1.65	45	-9
FEV3	Liters		1.84		1.85		1
FEV6	Liters		2.00		1.99		-1



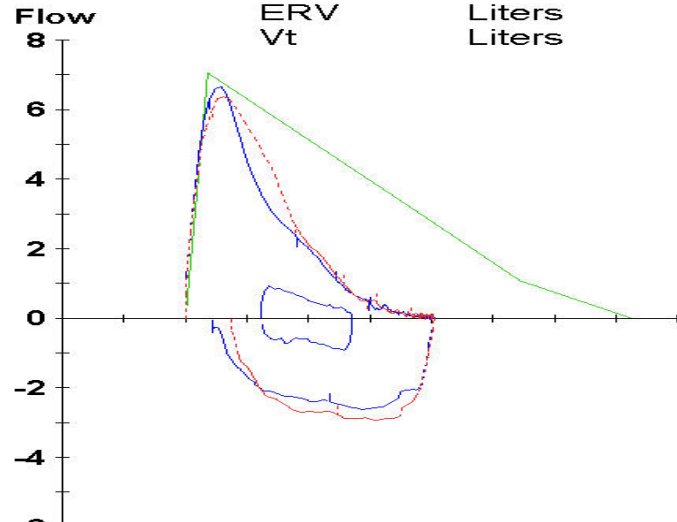
## Diffusion

		Ref	Pre	Post
DLCO	mL/min/mmHg	18.3	8.4	46
DL Adj	mL/min/mmHg	18.3	9.5	52
DLCO/VA	mL/min/mHg/L	3.81	3.26	85
DL/VA Adj	mL/min/mHg/L		3.70	
VA	Liters	5.94	2.56	43
IVC	Liters		1.82	

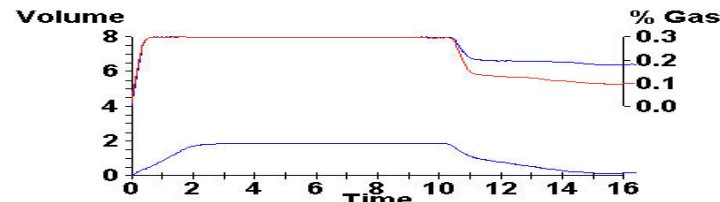
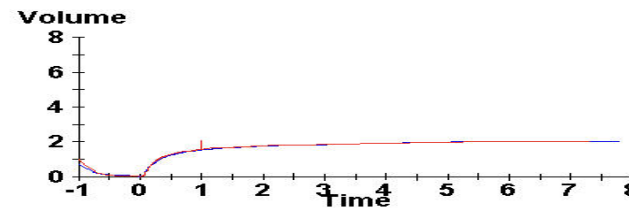


## Lung Volumes

		Ref	Pre	Post
TLC	Liters	5.20	3.30	63
RV	Liters	2.06	1.21	59
RV/TLC	%	39	37	
FRC PL	Liters	2.99	2.00	67
VC	Liters	3.64	2.09	57
IC	Liters	2.47	1.30	53
ERV	Liters	1.23	0.74	60
Vt	Liters		0.62	



Ref — Pre — Post —



# 혼합성 환기장애 (Mixed pattern)

## Spirometry

(BTPS)

FVC	Liters
FEV1	Liters
FEV1/FVC	%
FEV3/FVC	%
FEF25-75%	L/sec

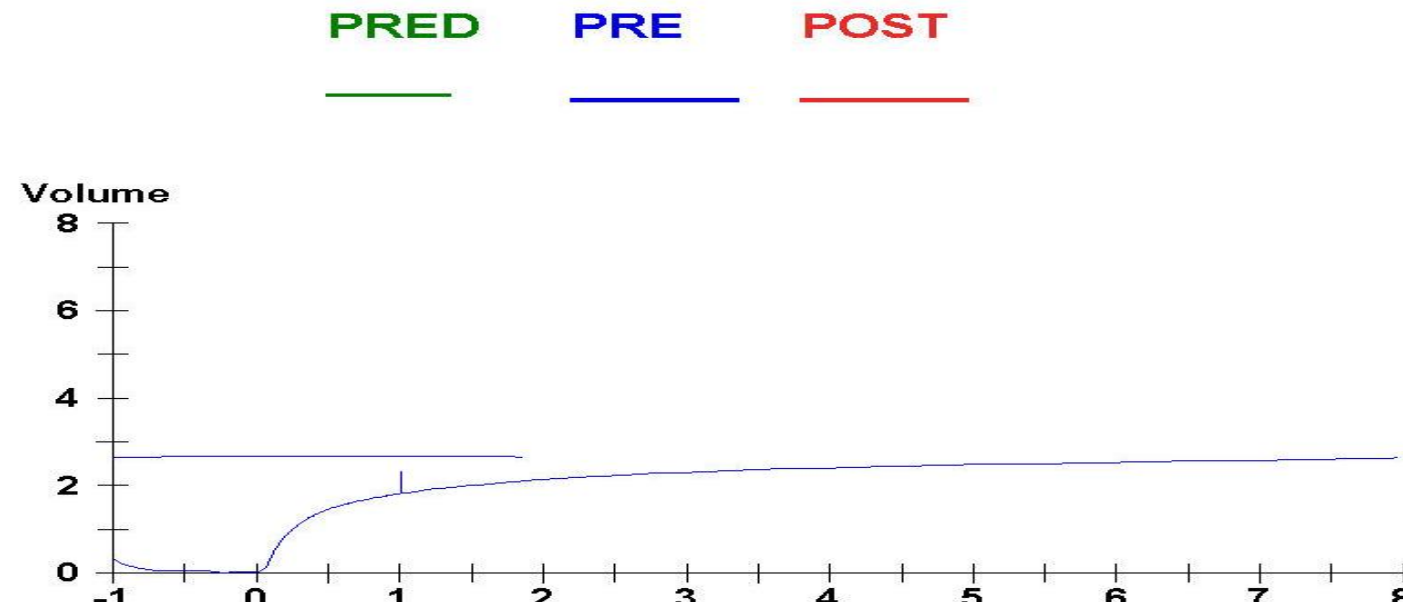
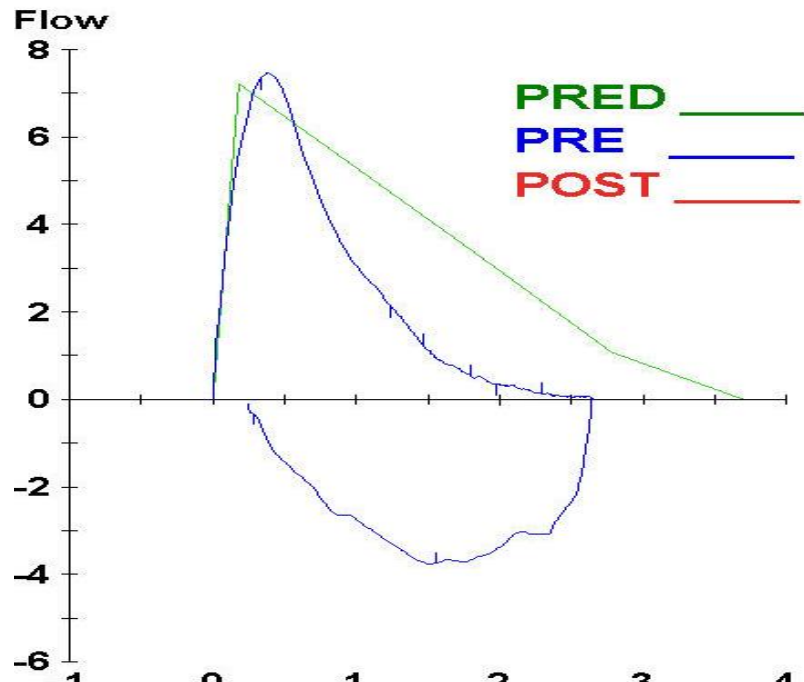
Ref

PRE-RX  
Meas %Ref

3.71  
2.51  
69  
97  
2.41

2.65  
1.83  
69  
87  
1.00

72  
73  
  
42



# PRISm ( Preserved Ratio Impaired Spirometry )

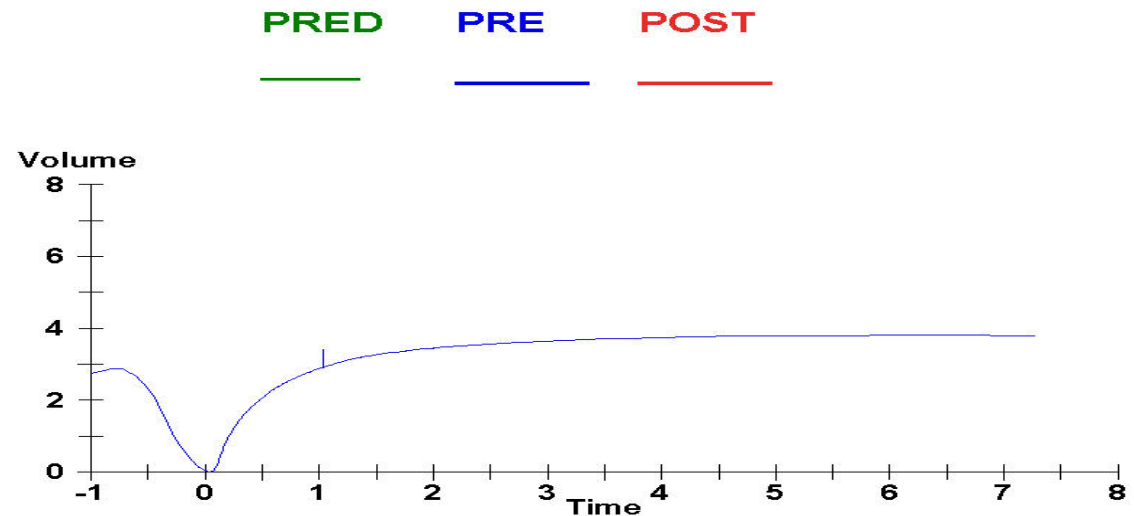
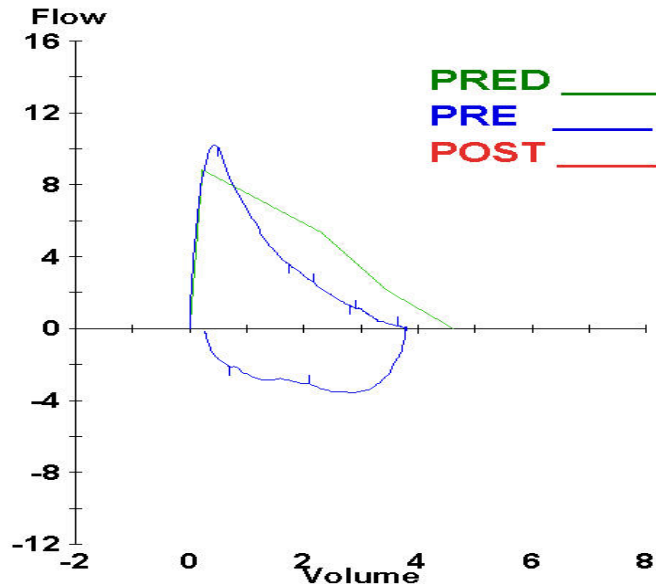
Gender: Male  
 Age: 25  
 Height(cm): 163

Room: OS  
 Race: Asian  
 Weight(kg): 89.0

PF Reference: Morris/Polgar

Technician: 이난희3

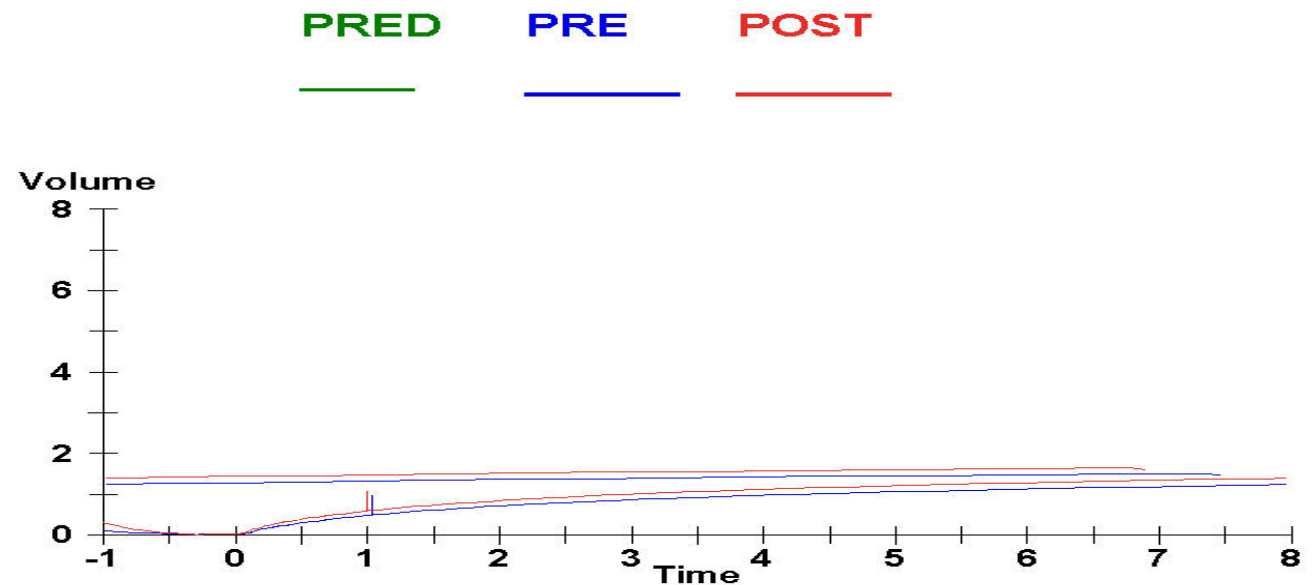
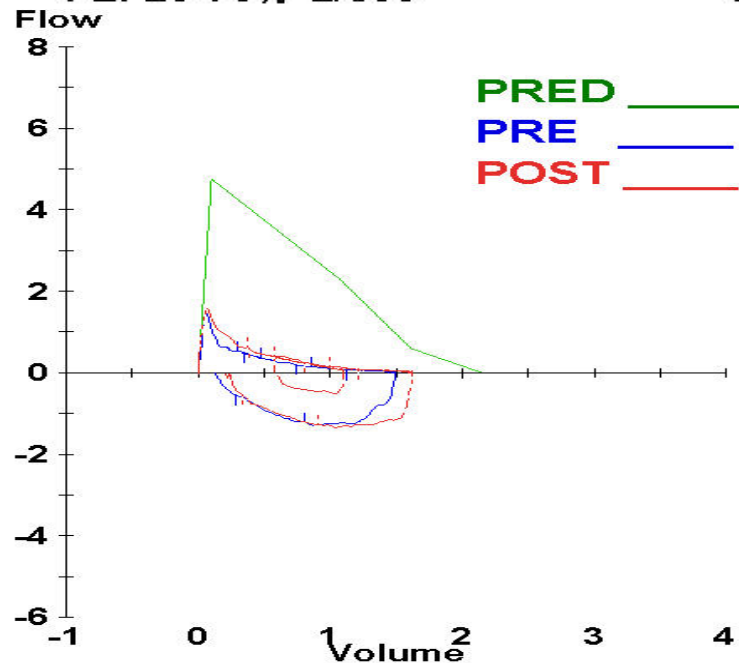
Spirometry	(BTPS)	Ref	PRE-RX		POST-RX		% CHG
			Meas	%Ref	Meas	%Ref	
FVC	Liters	4.64	3.82	82			
FEV1	Liters	3.85	2.95	77			
FEV1/FVC	%	81	77				
FEV3/FVC	%	97	95				
FEF25-75%	L/sec	4.41	2.40	55			
FEF50%	L/sec	5.34	3.10	58			
PEF	L/sec	8.80	10.23	116			
FIVC	Liters	4.64	3.54	76			
FEV3	Liters		3.65				
FEV6	Liters		3.81				
FET100%	Sec		7.22				
FEF/FIF50		<1.00	1.03				
Vol Extrap	Liters		0.02				



# Negative BDR

## Spirometry

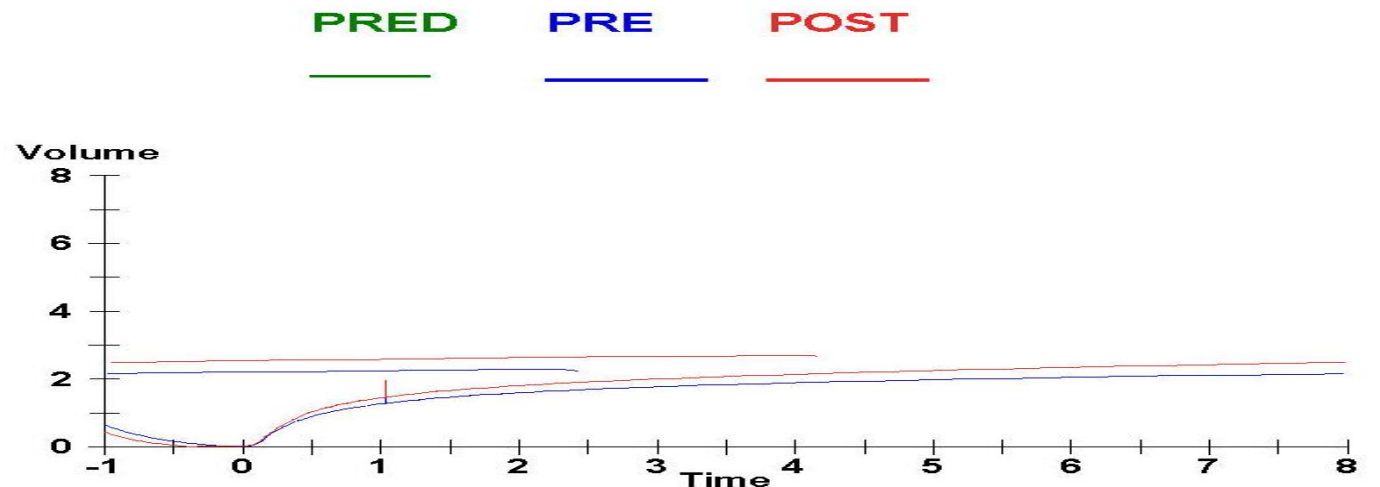
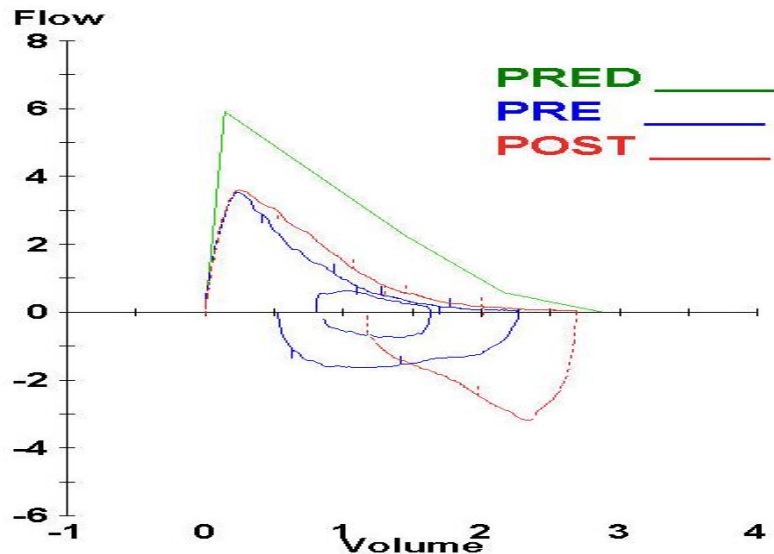
		Ref	PRE-RX		POST-RX		% CHG
(BTPS)			Meas	%Ref	Meas	%Ref	
FVC	Liters	2.16	1.50	70	1.63	76	9
FEV1	Liters	1.45	0.49	34	0.60	41	20
FEV1/FVC	%	71	33	37			
FEV3/FVC	%	97	58	62			
FEF25-75%	L/sec	1.83	0.14	8	0.17	9	23



# Positive BDR

## Spirometry (BTPS)

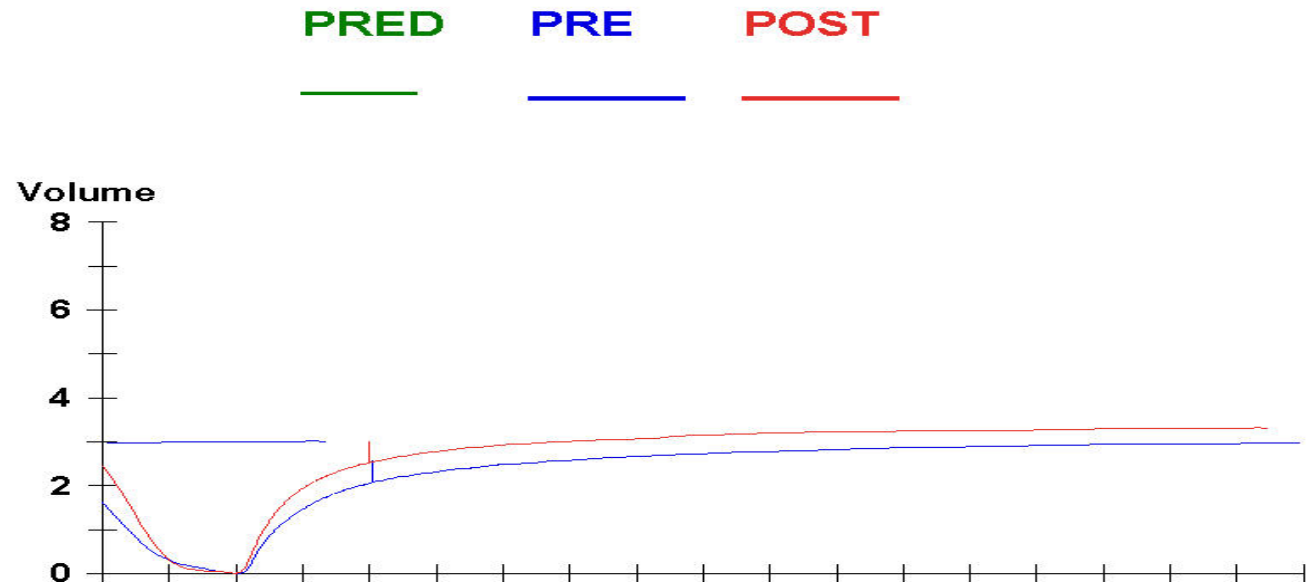
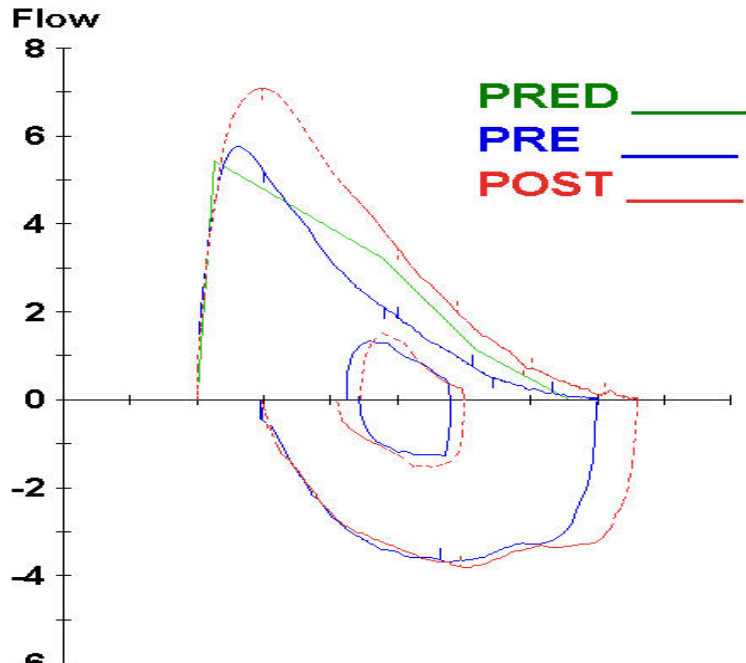
		Ref	PRE-RX Meas %Ref	POST-RX Meas %Ref	% CHG
FVC	Liters	2.89	2.27 79	2.70 93	19
FEV1	Liters	1.92	1.30 68	1.48 77	14
FEV1/FVC	%	70	57	55	
FEV3/FVC	%	97	78	74	
FEF25-75%	L/sec	1.96	0.49 25	0.47 24	-5



# Positive BDR

## Spirometry

		Ref	PRE-RX		POST-RX		% CHG
(BTPS)			Meas	%Ref	Meas	%Ref	
FVC	Liters	2.80	3.06	109	3.30	118	8
FEV1	Liters	2.10	2.09	100	2.54	121	21
FEV1/FVC	%	75	68		77		
FEV3/FVC	%	97	87		93		
FEF25-75%	L/sec	2.57	1.32	51	2.15	83	62

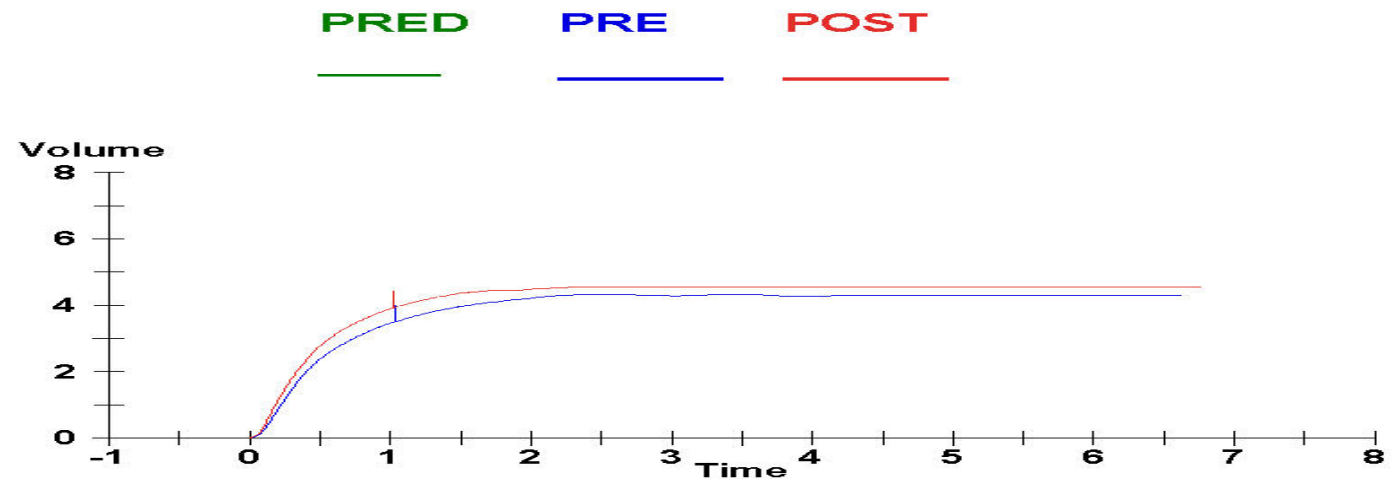
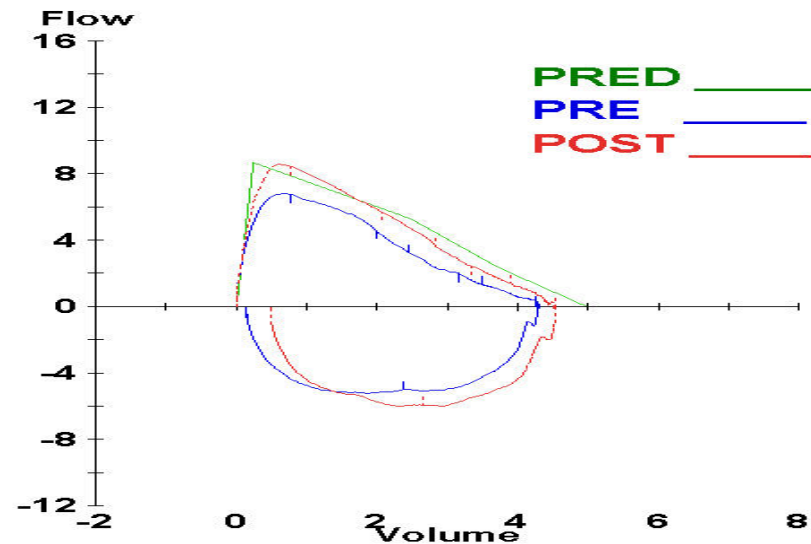


# Negative BDR

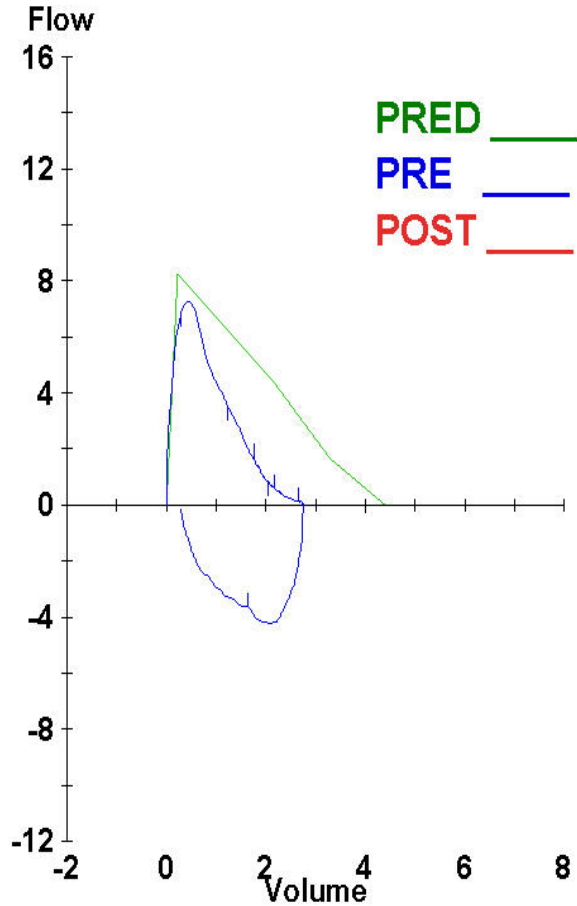
## Spirometry

(BTPS)

		Ref	PRE-RX		POST-RX		% CHG
			Meas	%Ref	Meas	%Ref	
FVC	Liters	4.99	4.32	86	4.56	91	6
FEV1	Liters	4.12	3.65	89	3.94	96	8
FEV1/FVC	%	81	85		86		
FEV3/FVC	%	97	99		100		
FEF25-75%	L/sec	4.63	3.37	73	4.16	90	24



# Morris/최정근식 비교



50세 ,남자 ,170cm,60kg

	최정근식 (Ref)	Morris식 (Ref)	측정값	% Ref	
FVC	4.59	4.41	2.78	60	63
FEV1	3.75	3.29	2.22	59	67
FEV1/FVC			80	80	80

# 검사 결과 보고(Comment )

- 검사 협조가 잘 안될 때 - 사유 기록 (cough, sputum)
- 흡입기 사용 유무 기록(검사 시간 전 흡입기 사용)
- 검사 자세 필요 시 기록 (supine position)
- Exhalation time is too short
- Facial palsy

# 참고문헌

- 2016 폐기능검사 지침( 대한결핵 및 호흡기학회)
- <https://respiratory-research.biomedcentral.com/articles/10.1186/s12931-018-0896-7>

감사합니다.