Pulmonary rehabilitation Program

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Our Most Successful Interventions for Improving Exercise Tolerance in COPD

- Pulmonary rehabilitation

  Improves peripheral muscle function

- Bronchodilator

  Improves lung function

Definition of pulmonary rehabilitation

- From the ATS in 2006
- Evidence-based, multidisciplinary, and comprehensive intervention for patients with chronic respiratory disease who are symptomatic and often have decreased daily life activities.
- Integrated into the individualized treatment of the patient, pulmonary rehabilitation is designed to reduce symptoms, optimize functional status, increase participation, and reduce health care costs through stabilizing or reversing systemic manifestations of the disease

Practice guidelines

1. A minimum of 20 sessions, three times per week
2. High-intensity exercise produces greater physiologic benefit

   however, low-intensity training is also effective
3. Both upper and lower extremity training should be utilized.
4. The combination of endurance and strength training generally has multiple beneficial effects
5. Interval training may be useful in more symptomatic patients

Benefits of pulmonary rehabilitation in COPD

Evidence A

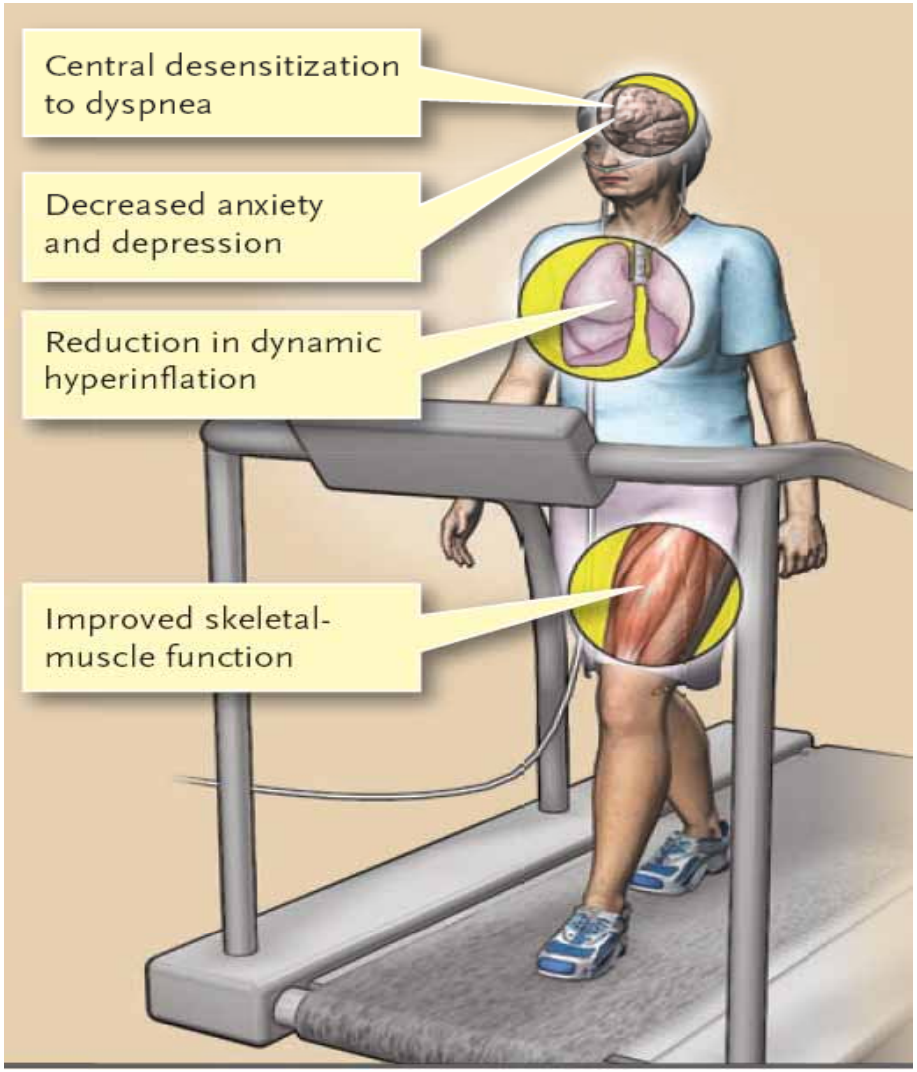
Improves exercise capacity

Reduces the perceived intensity of breathlessness

Improve health-related quality of life

Reduces the number of hospitalizations and days in the hospital

Reduces anxiety and depression associated with COPD



Benefits of pulmonary rehabilitation in COPD

Evidence B

Strength and endurance training of the upper limbs improves arm function

Benefits extend well beyond the immediate period of training

Improves survival

Benefits of pulmonary rehabilitation in COPD

Evidence C

Respiratory muscle training is beneficial, especially when combined with general exercise training.

Psychosocial intervention is helpful.

Evidence A ; Randomized controlled trials, rich body of data

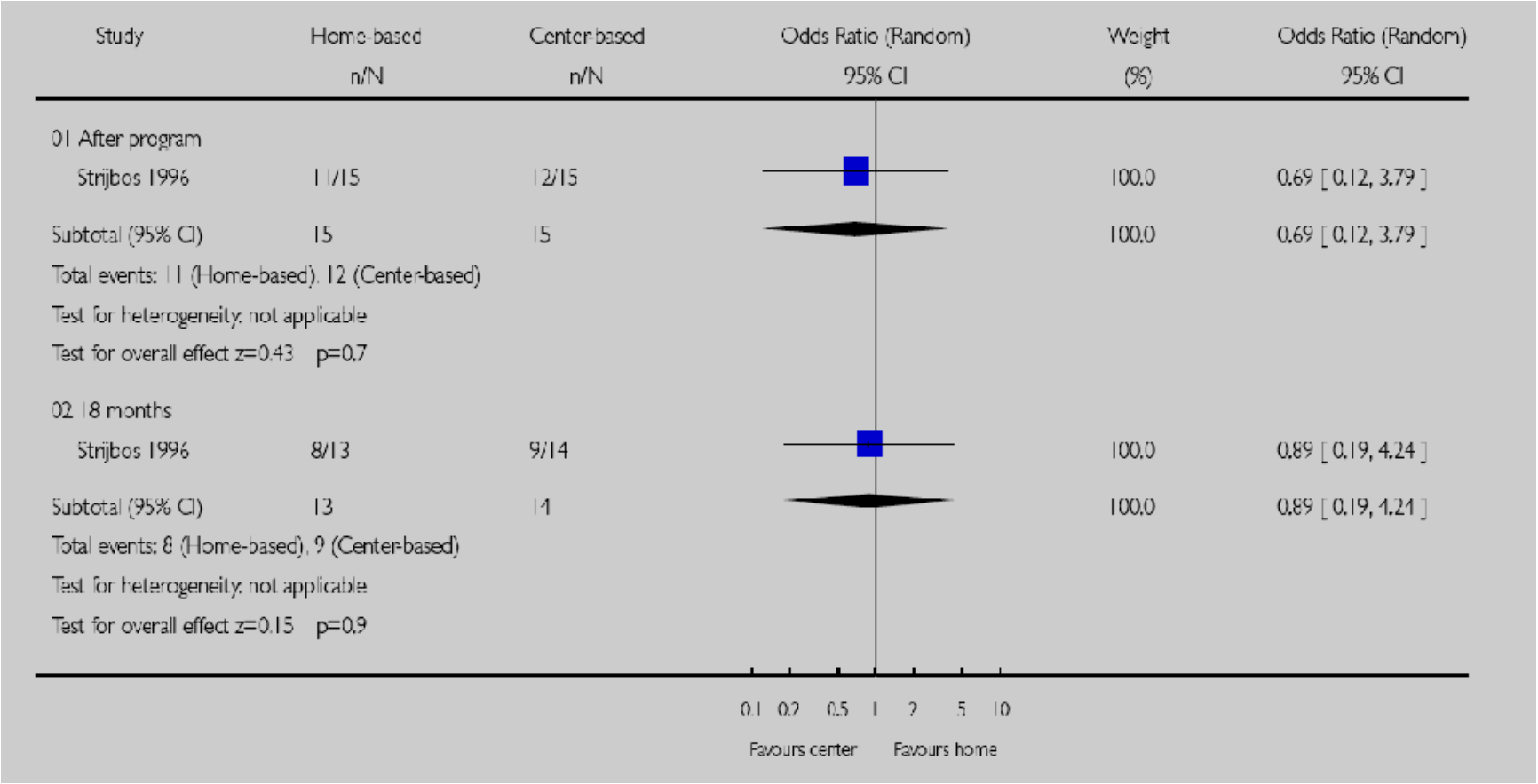
Evidence B ; Randomized controlled trials, limited body of data

Evidence C ; Nonrandomized trials, observational studies

Location of Pulmonary Rehabilitation

1) Inpatient PR
2) Out-patient based PR
3) **Home-based PR**

Home vs center based physical activity programs in older adults Quality of life



Cochrane database 2005, CD004017

Home-based PR

만성기도폐쇄성질환 임상연구센터

- Indication :

  Stable COPD without exacerbation within 3 months

- PR program :

  12 weeks, Home-based exercise training

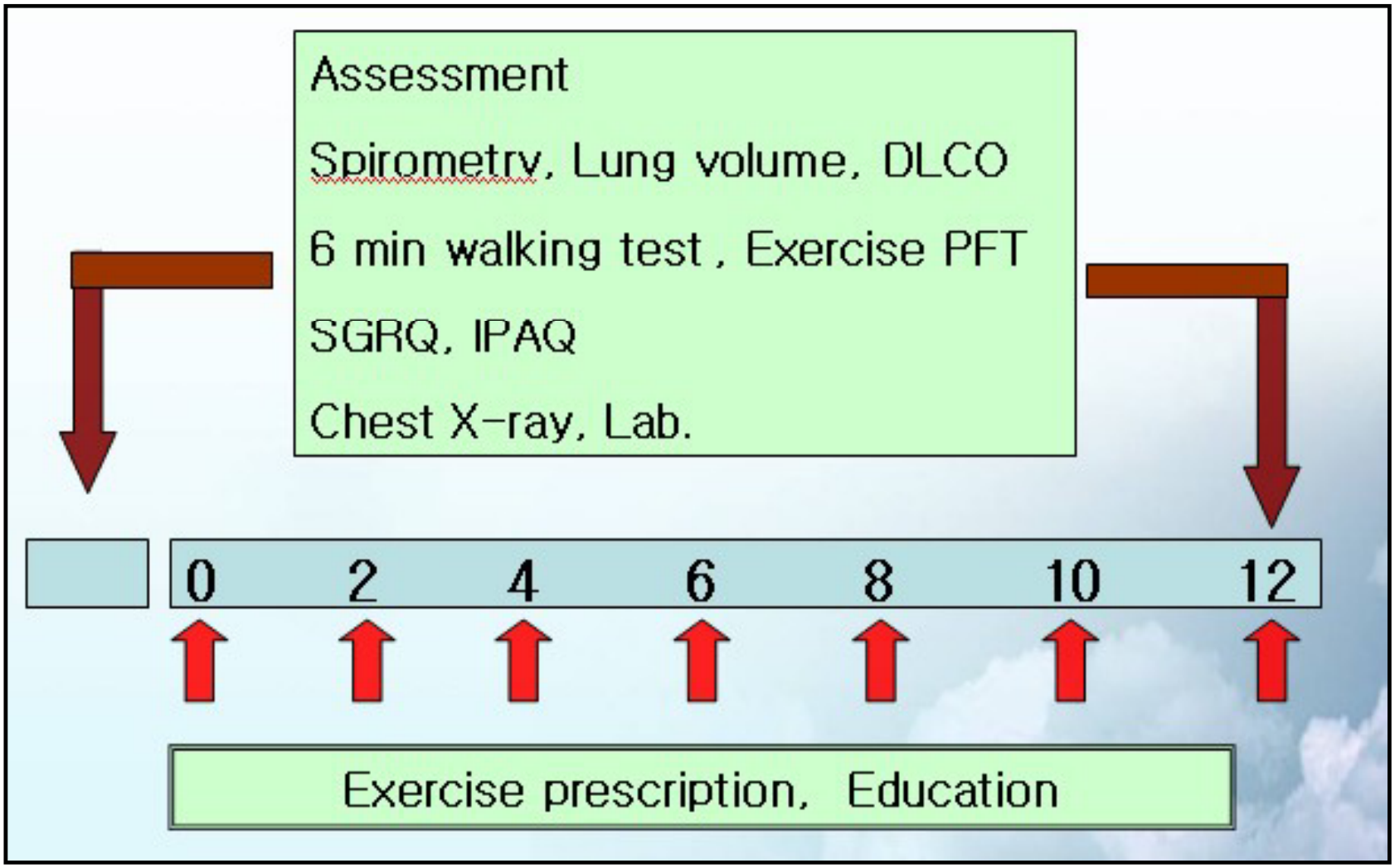
  Visit sport medicine clinic ; every 2 weeks

  Education, Self management

- Outcome

  Exercise capacity, QOL

Home-based pulmonary rehabilitation protocol



만성기도폐쇄성질환
임상연구센터

VO2 max

Exercise program

- VO_2 max : 결정 21 ml/kg/min
- METs : VO_2max/3.5 6 METs

표 3. Treadmilll 걷기 속도 설정표

등급	최대 METs	속도(Km/h)	100m 당 걸리는 시간
1	3.4 이하	1.6	3' 45"
2	3.5-4.4	2.9	2' 4"
3	4.5-5.4	4.2	1' 25"
4	5.5-6.4	5.4	1' 7"
5	6.5 이상	6.4	56"

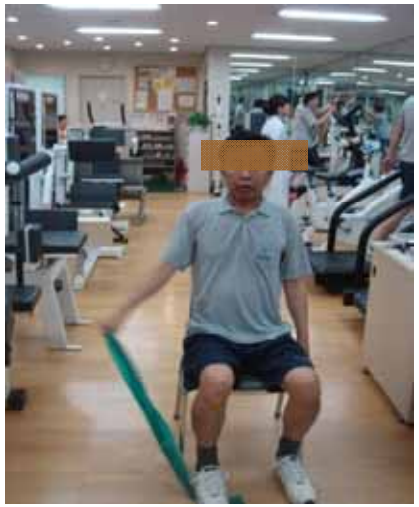
Metronome : 환자가 집에서 걷기 운동할 때 속도 control

운동 강도 control

Metronome beeps at pre-set interval. Patient walk with metronome in hands and synchronize steps with metronome beep.

걷기 운동프로그램			
단계	일회 운동시간(분)	하루 운동 횟수	일주당 운동 횟수
1	2.5	10	5
2	5	6	5
3	7.5	4	5
4	10	3	5
5	12.5	3	5
6	15	2	5
7	20	2	5
8	25	2	5
9	30	1	5
10	35	1	5
11	40	1	5
12	45	1	5

Muscle Strength Exercise



Respiratory Muscle Exercise

Actical® Physical Activity Monitoring

Twenty two patients data were included in analysis.
Male: female = 20:2
Mean age : 69.3± 7.2

1) Six minute walking distance was increased
2) Quality of life, as assessed by SGRQ, was improved.

	Pre-HBPR	Post-HBPR	*p*-value
6 MWD (m)	502±54	558±51	0.03
SGRQ score	54.1±17.1	44.1±15.1	0.04

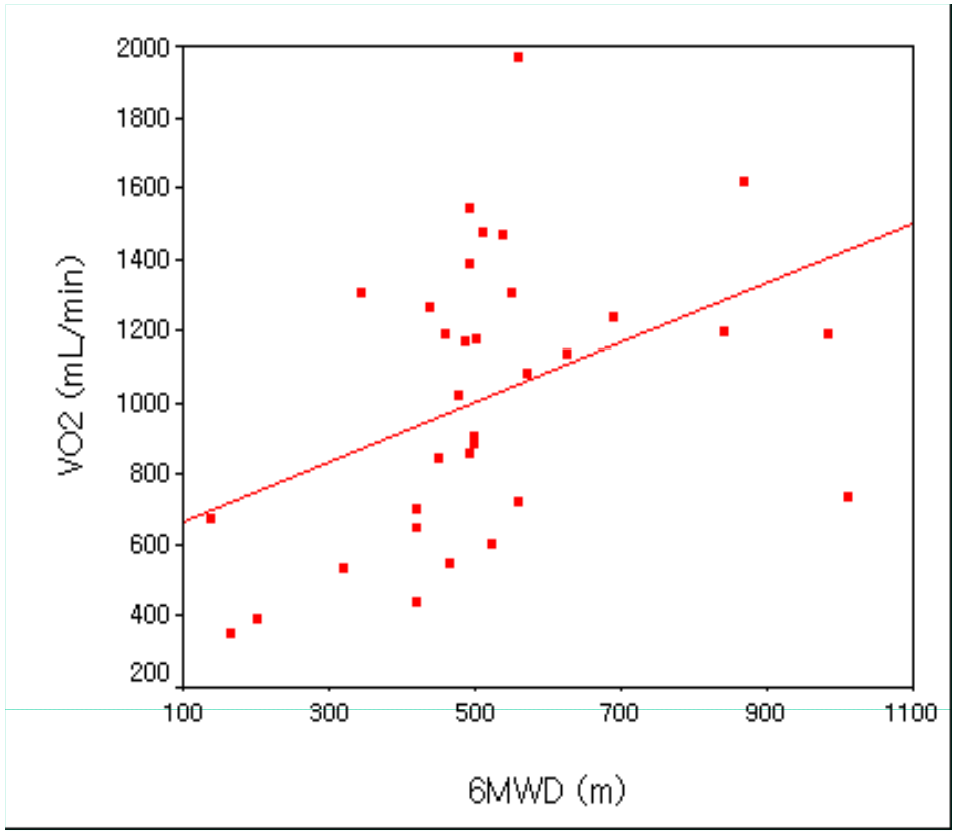
6MWD: 6 minute walking distance

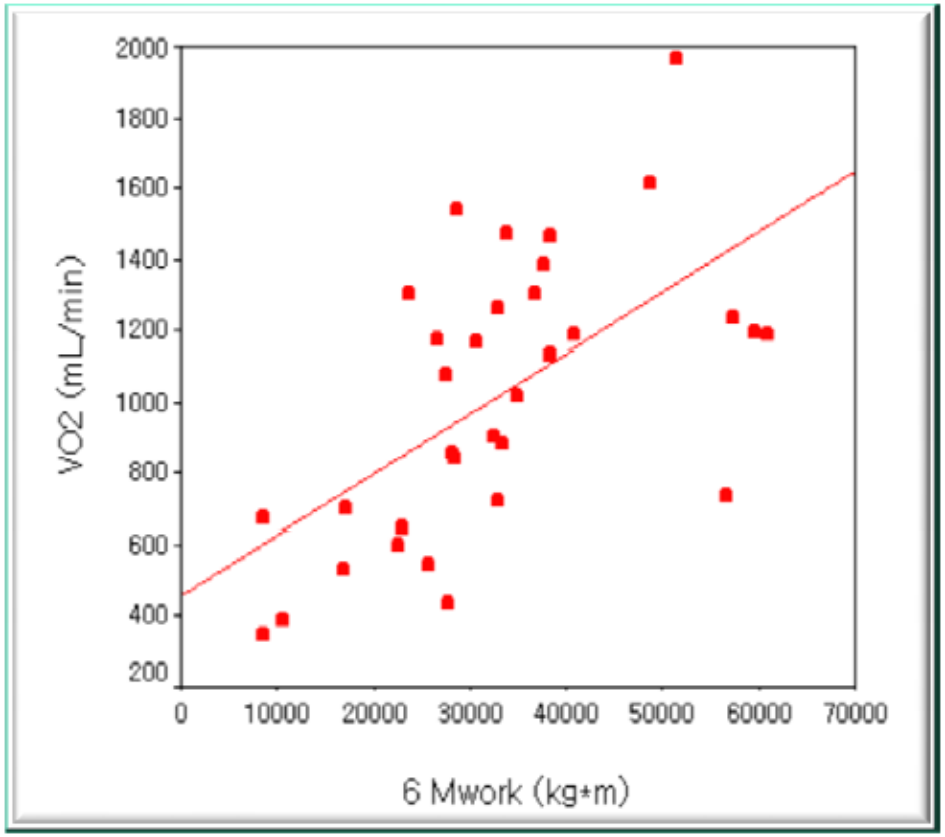
3) Daily activity (measured by Actical calorimeter) increased after home-based pulmonary rehabilitation.
4) Daily activity was correlated with the total and activity score of SGRQ, not FEV1, FVC.

Correlation analysis between physical activity (measured by Actical calorimeter) and SGRQ score, pulmonary function test

	r	P-value
Actical vs SGRQ total score	0.55	0.04
Actical vs SGRQ activity score	0.56	0.045
Actical vs FVC	0.04	0.88
Actical vs FEV1/FVC	0.20	0.49

Scatterplot of peak VO_2 to total 6MWT distance and 6MWT work

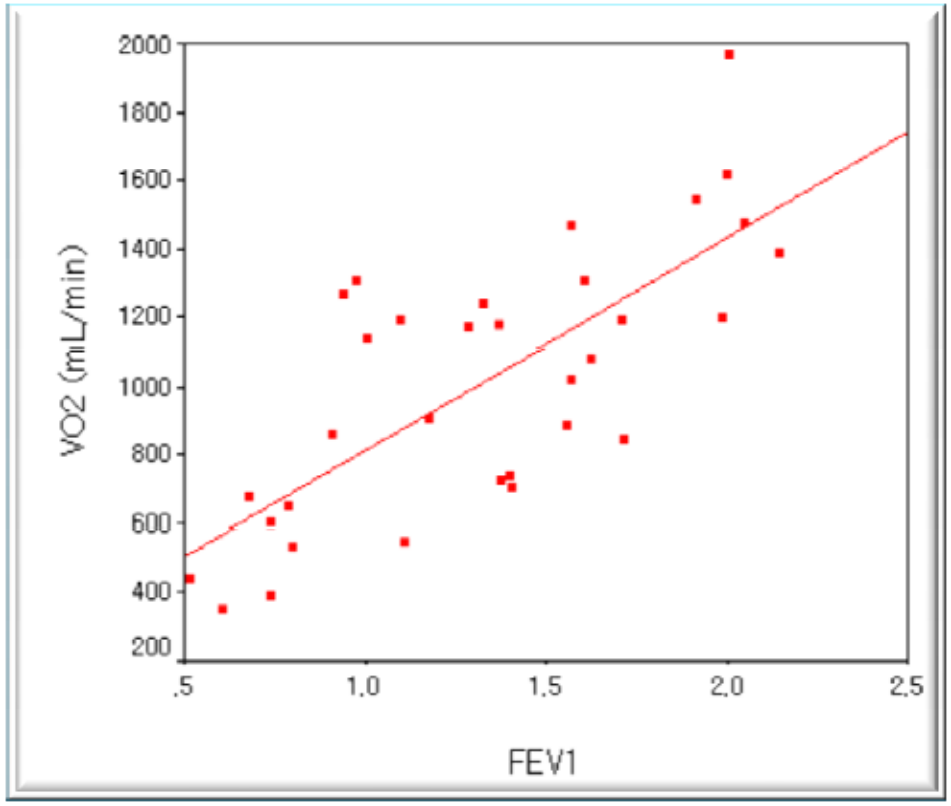


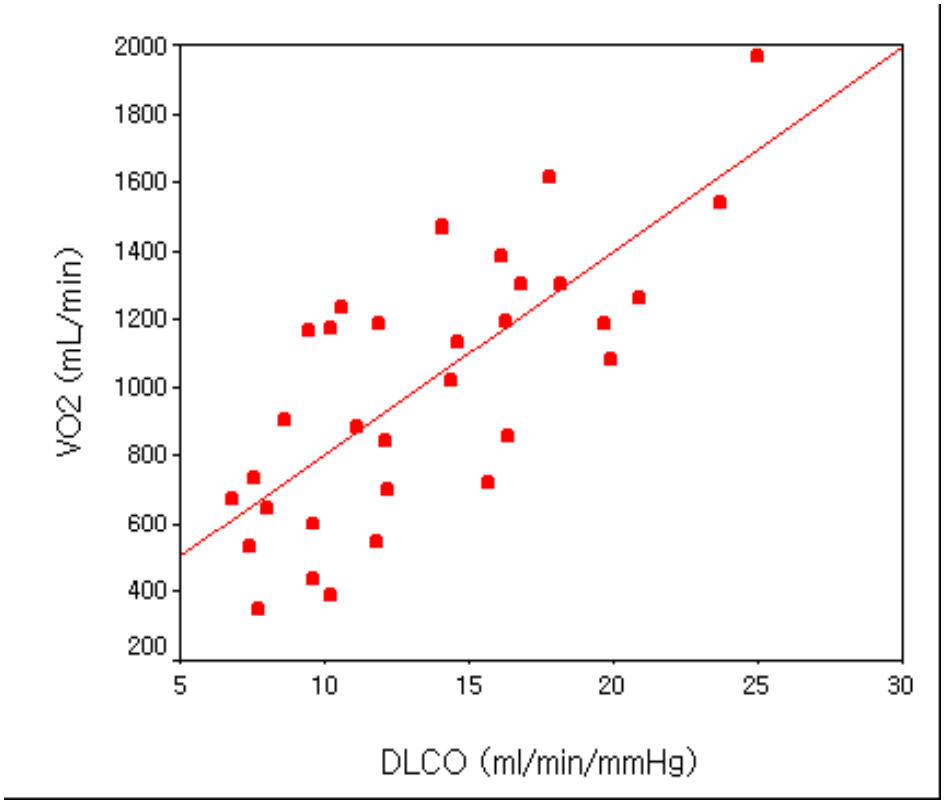


R=0.415, P=0.016

R=0.597, P < 0.001

Scatterplot of peak VO_2 to FEV_1 and DLco





r=0.679, p<0.001

r=0.742, p<0.001

Regression Models for estimating Peak VO2 From the 6MWT

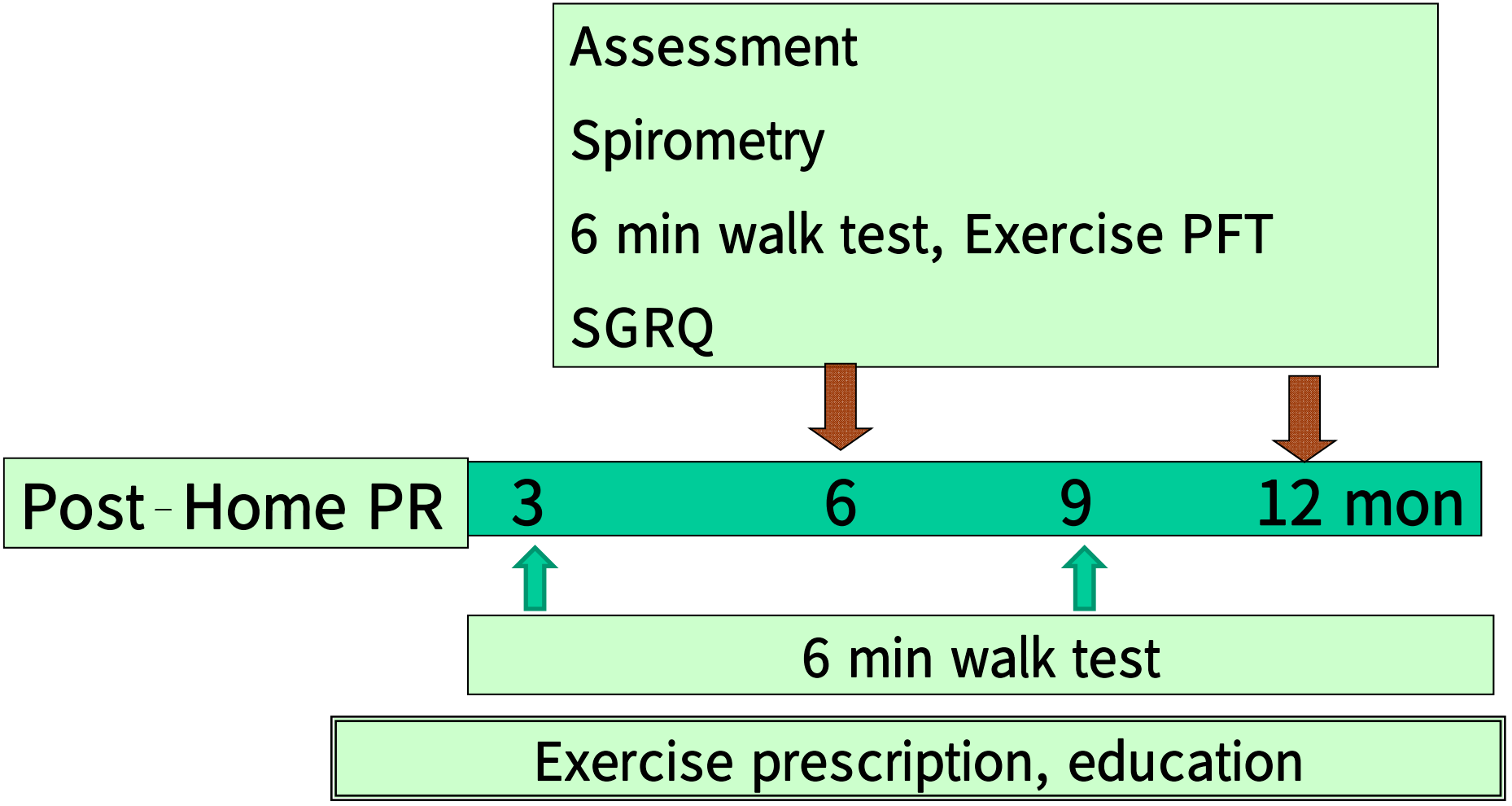
- VO_2 (mL/min)
  = 0.007(6Mwork)
  + 274.306(FEV1)
  + 36.242(DLCO1)
  – 84.867

R^2 = 0.729, Adjusted R^2 = 0.700

6Mwork만을 사용한 모델에 비해 약 **36%**정도 설명도가 높다.

Long-term Maintenance Effects of Home-based Pulmonary rehabilitation of COPD

To determine the 12-months effectiveness after a 12 weeks home-based pulmonary rehabilitation program for COPD patients on exercise performance.


Assessment
Spirometry
6 min walk test, Exercise PFT
SGRQ
Post-Home PR
3
6
9
12 mon
6 min walk test
Exercise prescription, education

Variable	
Age(y)	65.5 ± 7
Weight (kg)	61.7 ± 14
Height(cm)	165.8 ± 8
BMI (kg/m^2)	22.2 ± 3.6

	Pre-HBPR (n=18)	Post-HBPR (n=18)	After 6 months (n=18)	After 12 months (n=18)
6MWD (m)	521 ± 135	554 ± 141*	558 ± 138*	564 ± 163*
MIP (cmH_2o)	82.8 ± 25	92.5 ± 25*	95.8 ± 29*	101.8 ± 21*
VO_2max (L/min)	1.09 ± 0.37	1.06 ± 0.33	1.08 ± 0.34	1.06 ± 0.40
FVC	3.04 ± 0.89	3.19 ± 0.83	3.24 ± 0.97	3.12 ± 0.84
FEV_1	1.37 ± 0.49	1.39± 0.47	1.40 ± 0.47	1.31 ± 0.49
FEV_1 per	52 ± 18	54 ± 21	54 ± 20	50 ± 21

Conclusion

- HB-PR had improved exercise endurance, QOL, and actual physical activity.
- Measured physical activity correlated well with the SGRQ score.
- The applicability of the 6MWT is expanded as an alternative when formal tests of exercise capacity are unavailable or impractical.
- Training effects obtained from home based PR can be maintained in patients with moderate to severe COPD.