만성폐쇄성폐질환 환자의 호흡재활

전북대학교 재활의학과 원유희

COPD 환자의 특징

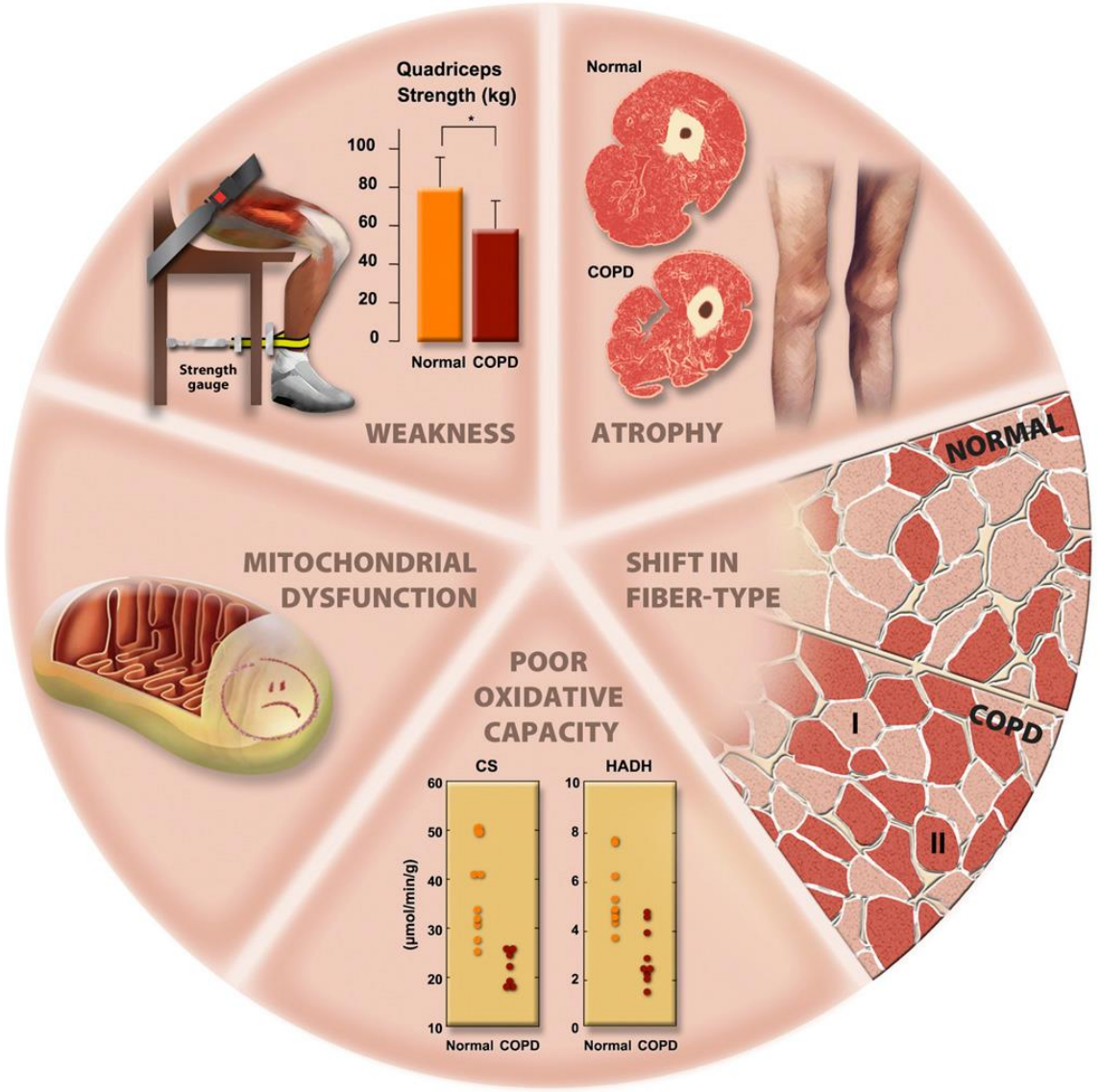
Respiratory symptoms

- Chronic & progressive
    - Cough
    - Sputum
    - Breathlessness

COPD 환자의 특징

Non-Respiratory symptoms

- Limb muscle dysfunction
  - Muscle atrophy
  - Thigh muscle weakness
  - Mitochondrial dysfunction
  - Poor oxidative capacity
  - Muscle fiber type shift to type II



Am J Respir Crit Care Med Vol 189, Iss 9, pp e15–e62

COPD 환자의 호흡재활치료의 목적

- Improving
  - Dyspnea
  - Health related quality of life
  - Exercise intolerance

- Reducing
  - Hospitalization among patients who had had a recent exacerbation (≤4 weeks from prior hospitalization)

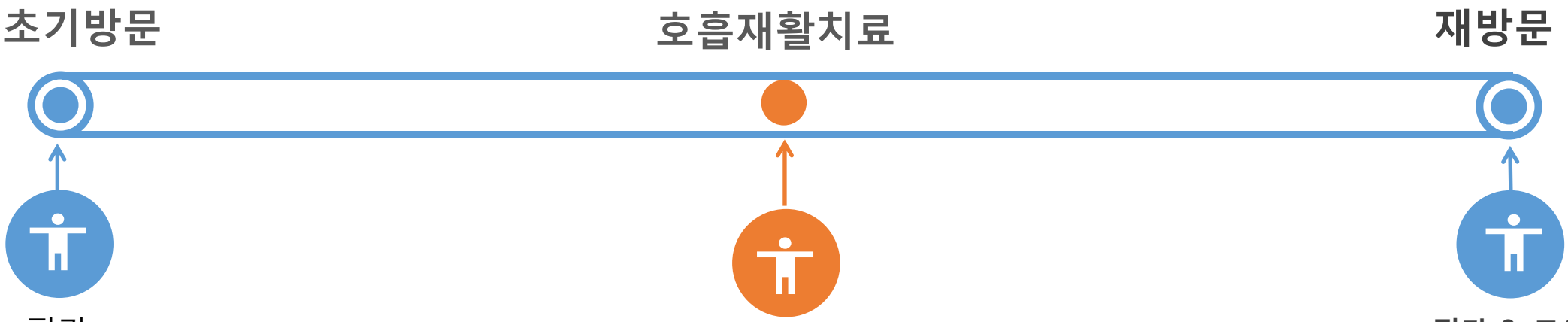
- Pulmonary function parameters, such as FEV1, did not significantly improve in most studies

호흡재활치료 Refer

- 가장 적절한 호흡재활치료 연계의 시기
  - 처음 진단받았을 때
  - 급성악화로 입원치료 후 퇴원할 때
  - 증상이 지속적으로 악화되고 있을 때

GOLD guideline 2019

호흡재활치료 timeline



평가

- 증상평가
- 근력
- 유산소운동능력평가
- 삶의 질 평가

Hospital based PR

Home based PR

6-8주, 주 3회

평가 & 교육

- 순응도 확인
- 재평가
- 결과 설명
- maintenance
- 교육 및 추적관찰

호흡재활치료 구성

필수	Optional
유산소운동	호흡법
근력운동 (상지, 하지)	객담배출물리치료
	흡기근운동
	유연성운동 (흉곽스트레칭)

GOLD 2021
Evidence based best practice for PR program

- Structured and supervised exercise training
- Smoking cessation
- Nutrition counseling
- Self management education

PR toolkit checklist

Essential requirements
☐Do I have staff with current basic life support training?
☐Exercise training staff such as Physiotherapist

Minimum equipment
☐Do I have access to a flat, straight or circular area for walking (preferably 30 metres long)?
☐Do I have a pulse oximeter?
☐Can I measure blood pressure?
☐Do I have an emergency plan (community and hospital) or ideally easy access to emergency support including a defibrillator and oxygen therapy (hospital)?
☐Do I have a telephone?
☐Do I have access to a breathlessness scale (ie modified Borg dyspnoea scale)?
☐Do I have tape or similar to mark out the walking track?
☐Do I have a stop watch/timer?
☐Do I have stable chairs?
☐Do I have pens and exercise recording sheets?
☐Do I have water and cups available for drinking?
☐Do I have tissues/cups available for secretion clearance?
☐Do I have alcoholic hand rub?
☐Do I have a controlled climate?

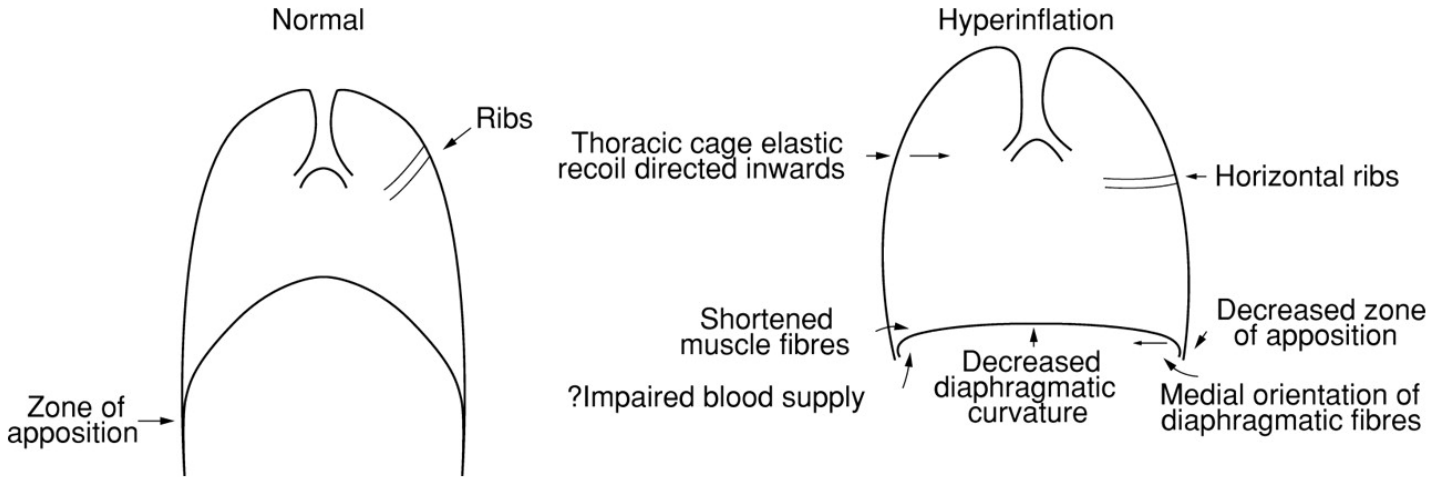
Additional equipment if available
Do I have a stationary bicycle?
Do I have access to stairs or a step/step box?
Do I have access to hand weights and/or theraband resistive exercise bands?
Do I have an incremental shuttle walk test, including cones, tape measure, CD or tape player?
Do I have a treadmill?
Do I have weights machines?
Do I have an arm crank ergometer?

호흡재활치료 구성-호흡법

- Altered pattern of ventilatory muscle recruitment by use of rib-cage inspiratory muscles instead of diaphragm in patients with COPD

→ Lung hyperinflation, diaphragm flattening

Diaphragmatic breathing : ***focusing on diaphragm movement*** not using rib cage muscles
Pursed lip breathing : ***breathing out slowly with the lips in a whistling position***



호흡재활치료 구성-객담배출

- COPD
  - Chronic cough and sputum

  → independent risks of premature **COPD related death** & related to frequent **exacerbation**

호흡재활치료 구성-객담배출

- No specific guideline of airway clearance technique for COPD
  - ACBT (active cycle of breathing technique)
  - Huffing
  - Postural drainage and percussion, vibration
  - PEP therapy
  - Mechanical chest wall oscillation

- Choice of technique is most commonly determined by therapist considering of patients' individual needs

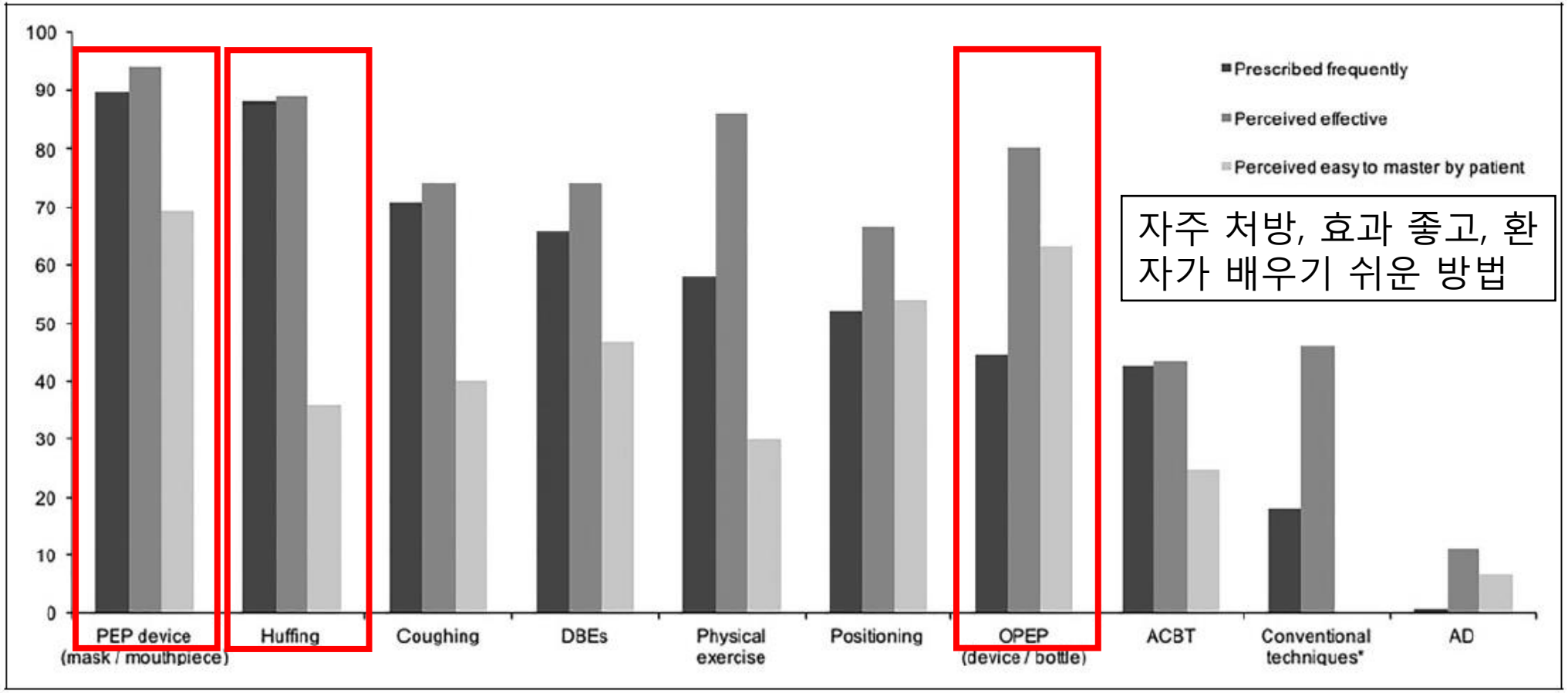


Figure 1. Frequency of prescription, perceived effectiveness and perceived ease to master airway clearance techniques by physical therapists in Sweden. Data represent percentages (%) of overall respondents. Conventional techniques comprise postural drainage, percussions and vibrations. ACBT: active cycle of breathing technique; AD: autogenic drainage; DBEs: deep breathing exercises; PEP: positive expiratory pressure.

호흡재활치료 구성-근력운동

Recommendation	Older and very deconditioned individuals	Purpose of improving endurance
2-4 sets rest interval 2-3 min		fewer sets (1-2 sets) shorter rest interval
8-12 repetitions/set		higher number (15-25)
60-70% of 1 RM (beginner) ≥80% (experienced)	60-70% 1RM RPE of 5-6 (severe breathlessness) on 10 point scale	lower intensity of resistance (<50% 1RM)

호흡재활치료 구성-근력운동

- Chest press
- Shoulder press
- Lateral pull-down
- Mid low
- Biceps curl/Triceps curl
- Leg press/leg curl
- Hip abduction/adduction
- Low back extension/abdominal crunch

호흡재활치료 구성-근력운동

- 근력운동의 원칙
  - 상지/하지/체간근육의 강화를 고르게
  - 큰 근육운동은 작은 근육운동 전에
  - 다관절 운동은 단관절 운동 전에
  - 고강도 운동은 저강도 운동 전에
  - 작용근과 길항근 운동을 번갈아

- COPD specific strengthening protocol은 없음.
- 일반적인 근력운동 원칙에 따르되 근력운동 강도는 환자의 능력과 상태를 고려하여 결정

호흡재활치료 구성-근력운동

- Progressive overload principle
  - 강도나 자극을 근력 증진을 위해 지속적으로 증가시켜야 함.
  - 저항정도/세트수/치료횟수 증가

- 일상생활동작수행시 상지사용을 통해 호흡곤란이 심해지는 경우
  - 특히 shoulder girdle 근육의 운동을 통한 이득이 있음.

- Dumbbell, theraband, machine

호흡재활치료 구성-유산소운동

- FITT-VP
  - Frequency (how often)
  - Intensity (how hard)
  - Time (duration or how long)
  - Type (mode or what kind)
  - Total volume (amount)
  - Progression (advancement)

호흡재활치료 구성-유산소운동

- Methods of estimating the intensity of exercise
  - % HRR
  - % HRmax
  - % VO_2R
  - % VO_2
  - % METs
  - Rating of perceived exertion (RPE)
  - Talk test

	Cardiorespiratory endurance exercise intensity							Resistance exercise
	Relative intensity				**Absolute** intensity (MET) by age			
Intensity	%HRR or %VO2R	%HRmax	%VO_2max	RPE (6-20)	Young(20-39)	Middle (40-64)	Older (≥65)	%1RM
Very light	<30	<57	<37	Very light (<9)	<2.4	<2.0	<1.6	<30
Light	30-39	57-63	37-45	Very light to fairly light (9-11)	2.4-4.7	2.0-3.9	1.6-3.1	30-49
Moderate	40-59	64-76	46-63	Fairly light to somewhat hard (12-13)	4.8-7.1	4.0-5.9	3.2-4.7	50-69
Vigorous	60-89	77-95	64-90	Somewhat hard to very hard (14-17)	7.2-10.1	6.0-8.4	4.8-6.7	70-84
Near to maximal to maximal	≥90	≥96	≥91	≥very hard (≥18)	≥10.2	≥8.5	≥6.8	≥85

ACSM 10th edition

Endurance training

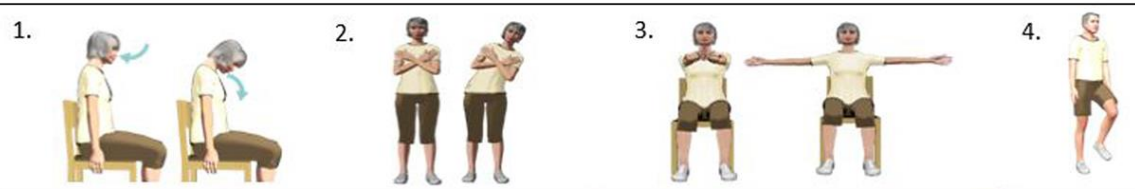
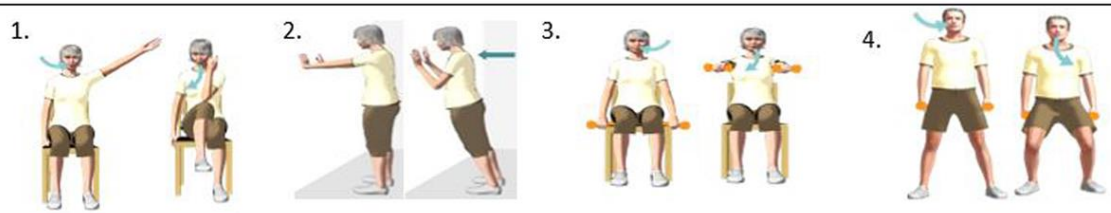
mode	intensity	duration	frequency	type
Walking (ground or treadmill) • Preferred for greatest functional capacity	Walking • 80% of 6WMT • 64-76% of HRmax	Recommendation of 30-50 minutes	Supervised exercise training: 3 times/ week	Continuous training
Stationary bicycling • Less desaturation	Cycling • 60% of peak work rate • Dyspnea 3-4 of BORG	Walking for debilitated Initial session of 10 minutes Built up 30 minutes during first 2 weeks	Home exercise training: 1-2 times / week for integrating into home life	Circuit training • Flexibility, stretching, balancing exercise • Should not replace endurance training
Severe dyspnea → wheeled walker use (fixing shoulder girdle and leaning forward)		Split into 15 minutes of cycling + 15 minutes of walking program		Warm-up Cool-down

병원호흡재활 vs 가정호흡재활

- Home or community based PR
- 주로 education session 후 home or community center 에서 PR program 수행
- 내원이 어려운 환자, motivation 이 높아 교육 후에 충분히 가정 운동을 수행할 수 있는 환자, 경제적 어려움이 있는 환자 등

- 많은 systematic review 에서 home based PR이 hospital based PR과 유사한 정도의 호전이 있다고 발표

Home exercise sample

Exercise Type	Modality	Frequency, duration and intensity	Exercises
Warm-up	Global range of motion exercises; breathing control.	**Daily, 5 minutes** 4 exercises: 1 set of 8 to 15 repetitions	
Aerobic training	Walking; cycling; stepping.	**Daily, 30 minutes continuous or 3 bouts of 10 minutes** 4-6 in the modified Borg scale	
Resistance training	Free weights (major muscle groups of upper and lower limbs and trunk).	**Daily, 15 minutes** 4 exercises: 2 set of 10 to 12 repetitions 4-6 in the modified Borg scale	
Balance training	Upright positions; adjustments of the centre of gravity in static and dynamic postures; dual cognitive and motor task.	**Daily, 5 - 10 minutes** Progression with eyes closed	
Cool-down	Breathing control; stretching exercises.	**5 minutes** 4 exercises: 2 to 4 repetitions maintaining 20 seconds each	

Flyers available at http://3r.web.ua.pt/[81].

Marques et al. BMC Public Health (2019) 19:676

Home based PR clinical tip

- 병원 호흡재활이 아닌 가정호흡재활인 경우 정확한 프로그램 구현이 어려운 경우가 많음.

- 고령이고 motivation이 높지 않은 환자들의 경우 walking 만으로도 효과가 있다는 것을 강조하거나 physical activity를 올리는 간단한 지침을 주는 것으로도 효과가 있음

- 환자들이 가장 크게 느끼는 호흡재활의 효과는 호흡곤란 호전인 경우가 많으며 유산소 운동을 통해 기대할 수 있음.

호흡재활치료 기간

- Optimum benefits from programs lasting 6 to 8 weeks

- Maintenance
  - lack of evidence evaluating whether programmes of longer duration are more effective than the standard 8-week programmes
  - No additional benefits from extending PR to 12 weeks
  - Insufficient evidence for continuation of exercise programs, but if programs are available they should target health behavior taking into account patient's own preferences, needs and personal goals.

호흡재활치료의 BARRIER

환자요인	의료기관
• 환자의 순응도 & 이해도 & 의지 • 중증도 & 증상의 중증 정도 • Frailty • 가족의 지지 • 경제적 능력 • 병원까지의 접근성, 교통편	• 호흡기 내과 의사의 협조, 이해도 • 호흡재활 전문 치료사 부재 • 호흡재활치료시설 및 기구 부재

COPD 환자의 급성악화

- GOLD 2021
  - PR reduces hospitalization among patients who have had a recent exacerbation (≤ 4 weeks from prior hospitalization)

- Management of COPD exacerbation : ATS/ERS guideline 2017
  - Conditional recommendations of initiation of PR within 3 weeks after hospital discharge
  - Conditional recommendation against the initiation of PR during hospitalization

Acute exacerbation of COPD

European respiratory review, systematic review, 2020

TABLE 2 Most frequently used and effective designs for delivering pulmonary rehabilitation during acute exacerbations of COPD

Outcome	Most effective intervention	Pooled effects (95% CI)
Exercise capacity: 6MWT	Exercise + breathing techniques	WMD −41.06 (−131.70–49.58)
Dyspnoea symptoms: modified Borg scale	Breathing techniques	WMD 1.90 (0.53–3.27)
Health-related quality of life: SGRQ	Exercise + breathing techniques	WMD 14.64 (8.73–20.54)
Length of hospitalisation: number of days	Breathing techniques	ES 0.15 (−0.28–0.57)

Inpatient setting within 24–48 h of hospital admission. Components are exercise training, education and psychosocial support and breathing techniques. 6MWT: 6-min walk test; WMD: weighted mean difference; ES: effect size; SGRQ: St George's Respiratory Questionnaire.

Pulmonary rehabilitation is a safe intervention during AECOPD.
The combination of exercise, breathing techniques and education and psychosocial support seems to be the most effective for improvements on dyspnoea, knowledge about the disease, exercise capacity, HRQoL and length of hospitalisation, and thus all these components might be considered as core components to implement pulmonary rehabilitation during AECOPD

Eur Respir Rev 2020; 29: 200039

급성악화 환자의 호흡재활치료

- 2020 Australian PT practice

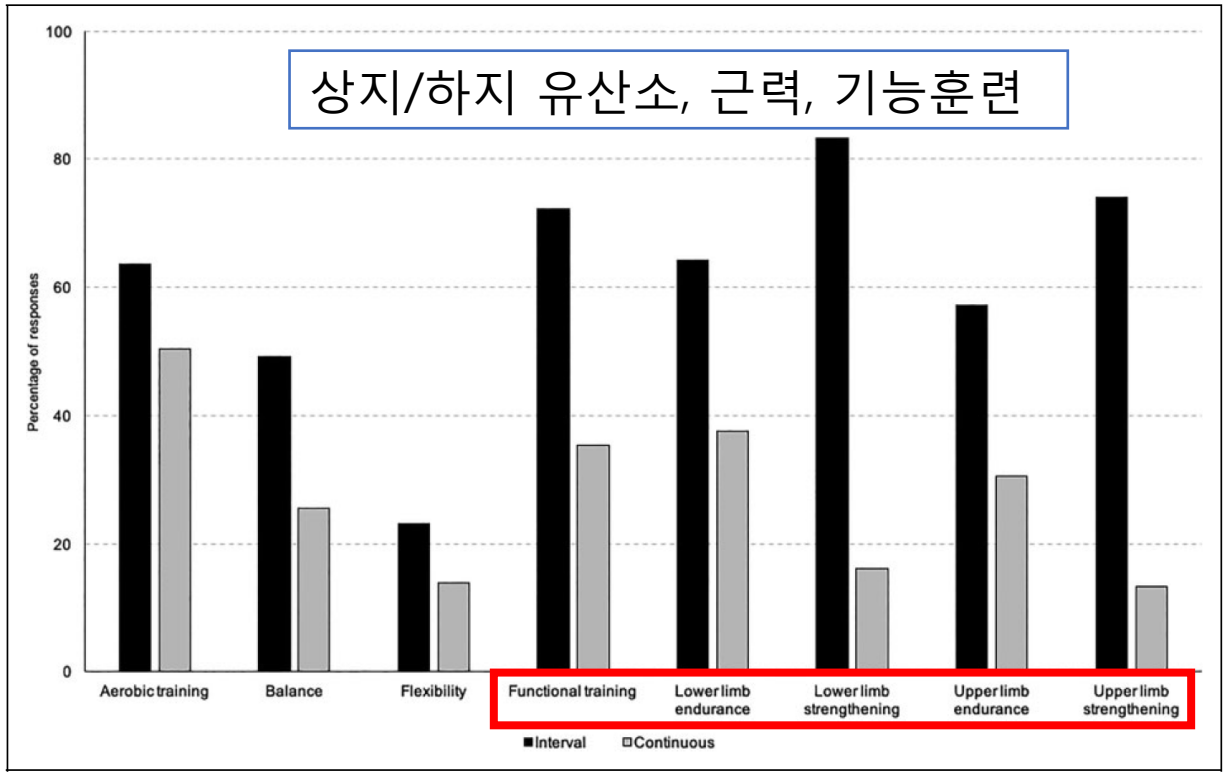


Figure 1. Types of exercise training prescribed for patients with acute exacerbations of chronic obstructive pulmonary disease.

Chronic Respiratory Disease Volume 17: 1–8

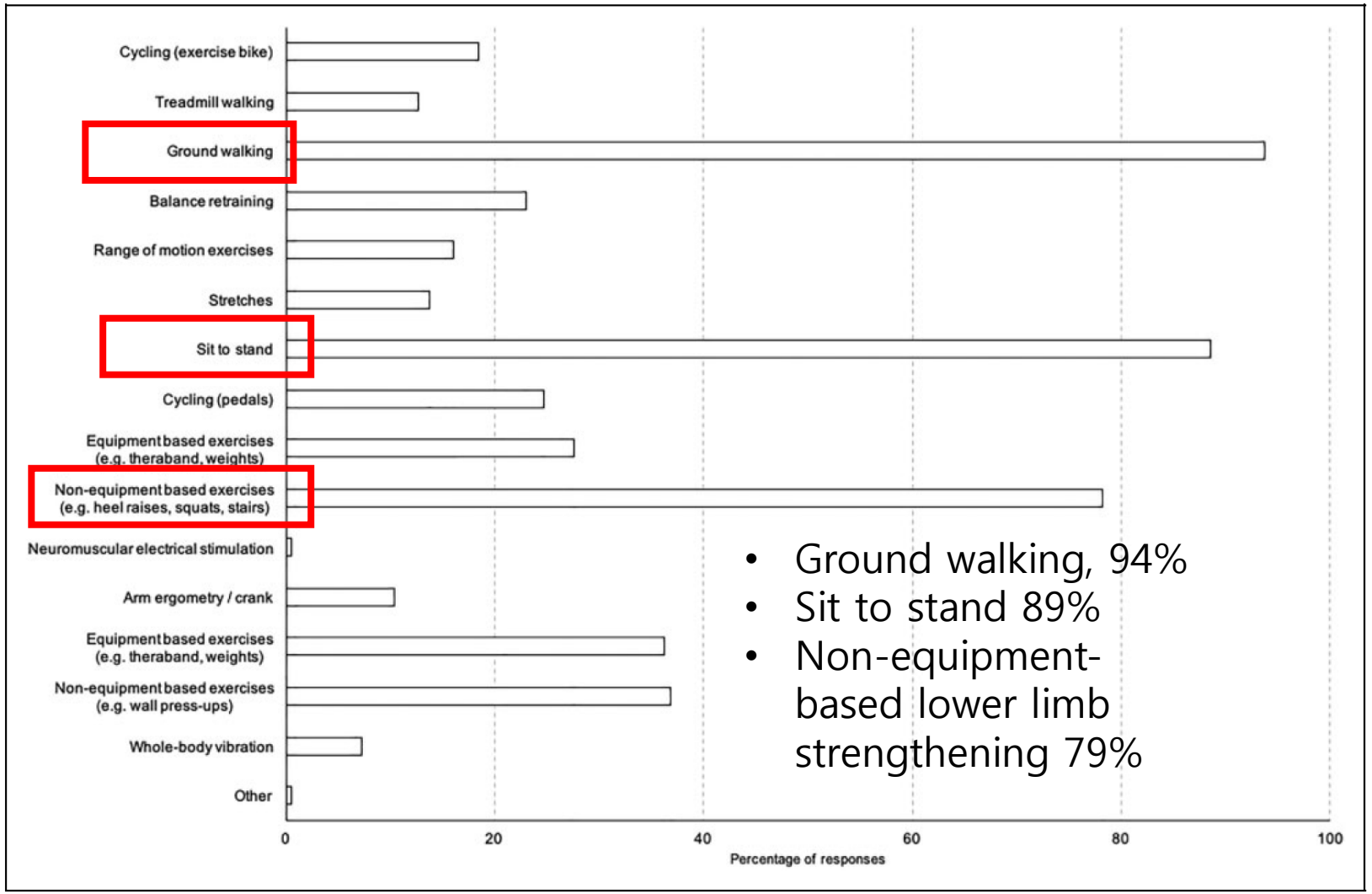


Figure 2. Specific exercise training modalities for patients with acute exacerbations of chronic obstructive pulmonary disease.

Acute exacerbation of COPD

어려운 점	장점
• 완전한 PR 프로그램으로 진행하기 어려움 • 입원기간이 다양하여 제한적임	• 입원기간 중 deterioration을 예방 • Physical activity의 중요성에 대한 경험 및 motivation 증진, PR 프로그램 경험하여 퇴원 후 외래에서 시행하는 standard PR program으로의 연계에 유용함