

Potential advantages
 Maximizes removal of excess bronchial secretions when combined with ACBT
 Allows accurate treatment of specific bronchopulmonary segments
 Self-treatment can be included in a home programme

Potential complication
 Positions need modification when used in the presence of cardiovascular/neurological instability, haemoptysis or gastric reflux

gravity assisted positioning

Potential advantages
 Decreases the work of breathing by reducing the use of accessory muscles of respiration, improving lung volumes and decreasing airway resistance
 Improved ABGs

Potential complication
 Positions may need modification in the presence of other existing pathology

positioning

positioning can be used to achieve several different goals:
 (i) drainage of secretions (ii) reduced work of breathing / breathlessness (iii) maximising V/Q ratio

- in self ventilating adults V/Q matching increased from non-dependent to dependent areas of the lung; however, in adults receiving positive pressure ventilation, lung mechanics are altered producing V/Q inequality. In this situation, non-dependent areas of lung are preferentially ventilated while dependent regions are optimally perfused

- (i) optimisation of ventilation & cardiopulmonary function
- (ii) assistance in the weaning process, utilising ventilatory support & oxygen therapy
- (iii) advice on positioning to optimise ventilation / perfusion matching & oxygenation
- (iv) advice on positioning to protect joints and to minimise potential muscle & soft tissue shortening / injury & nerve damage
- (v) optimisation of body position to effect muscle tone in the brain injured patient
- (vi) instigation of an early rehabilitation / mobilisation to assist in preventing consequences of enforced immobility & optimise voluntary movement to promote function independence & improve exercise tolerance
- (vii) assessment / treatment / advice on presenting musculoskeletal pathology
- (viii) enlisting other appropriate specialist physiotherapists to optimise patient care
- (ix) liaison with medical and nursing staff on continuation and monitoring of ongoing physiotherapy careplans

roles of physiotherapy

Table 4.4 Potential advantages and complications of chest shaking and vibrations, compression, chest clapping and NPF

Potential advantages
 Stimulation of a cough reflex facilitates movement of secretions
 Improved arterial blood gases (ABGs) when clapping, shaking and vibrations are combined with ACBT^{1,2}
 Slow one-handed clapping may reduce intracranial pressure in head injured patients
 NPF may improve ventilation and sputum clearance in self-ventilating neurologically impaired adults^{1,3}
 Effectiveness may be increased when used in conjunction with gravity assisted positioning and ACBT

Potential complications
 Arterial oxygen de-saturation³ and cardiac arrhythmias
 Bronchospasm in patients with reactive airways¹⁴
 Reduced pulmonary compliance
 Patient discomfort

chest physio

mobilisation

Potential advantages	
Positioning supine to upright	Mobilization
↑ Lung volumes	↑ Ventilation
↑ Lung compliance	↑ V/Q matching
↓ Airway closure	↑ Recruitment of lung units
↑ PaO ₂	↑ Surfactant production/distribution
↓ Work of breathing	↓ Mobilization of secretions
↑ Mobilization of secretions	

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Increased cardiopulmonary fitness and exercise capacity

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Potential complications

Cardiovascular/neurological/haematological instability
 Increased oxygen/ventilatory requirement

Potential advantages
 Stimulation of a cough when reflex is impaired by mechanical stimulation of the larynx, trachea or large bronchi¹⁰
 Removal of secretions from central airways when cough is ineffective or absent

Potential complications
 Tracheal suction is an invasive procedure and should only be undertaken when there is a clear indication to do so
 Absolute contraindications to suctioning are unexplained haemoptysis, severe coagulopathies, severe bronchospasm, laryngeal stridor, base of skull fracture and a compromised cardiovascular system
 Hypoxaemia can be induced secondary to suctioning. This can be limited by pre- and post-oxygenation
 Cardiac arrhythmias may be more common in the presence of hypoxia
 Tracheal stimulation may produce increased sympathetic nervous system activity or a vasovagal reflex producing cardiac arrhythmias and hypotension

suctioning

physiotherapy

Invasively ventilated patients	Non-invasive/self-ventilating patients
Manual hyperinflation (MHI)	Active Cycle of Breathing Technique (ACBT)
Suction	Manual techniques
Manual techniques	Positioning
Positioning	Intermittent Positive Pressure Breathing (IPPB)
Mobilization/rehabilitation	Continuous Positive Airways Pressure (CPAP)
	Bi-level non-invasive ventilation
	Nasopharyngeal/oral suction
	PEP mask, flutter valve, cornet
	Autogenic drainage
	Mobilization/rehabilitation

physio techniques to optimise cardioresp function

Table 4.10 Potential advantages and complications of IPPB, CPAP and bi-level non-invasive ventilation

Potential advantages
 Improves lung volumes
 Improves gaseous exchange
 Decreases the work of breathing
 IPPB and bi-level non-invasive ventilation can mobilize excess bronchial secretions by improving V_T
 IPPB and bi-level non-invasive ventilation can improve lung and chest wall compliance
 CPAP reduces left ventricular afterload by reducing the transmural pressure gradient
 Patients can be mobilized while on CPAP and some modes of bi-level non-invasive ventilation. Alteration of ventilator settings might be indicated to maximize patient potential/exercise tolerance during treatment
 Settings can be adjusted to augment physiotherapy intervention e.g. increased IPAP to assist removal of secretions

Potential complications
 Absolute contraindications include severe bronchospasm, undrained pneumothorax, pneumomediastinum, unexplained haemoptysis and facial fractures. Use with care in pre-existing bullous lung disease.
 Haemodynamic/neurological instability
 Risk of decreased urine output with CPAP and bi-level non-invasive ventilation
 Risk of carbon dioxide retention with CPAP
 Risk of aspiration

CPAP & BIPAP for physio

manual hyperinflation

Potential advantages
 Reversal of acute lobar atelectasis²
 Alveolar recruitment via channels of collateral ventilation
 Improvement in arterial oxygen saturation² and gaseous exchange
 Mobilization of secretions and contents of aspiration
 Improved static lung compliance⁴
 Effectiveness may be increased when combined with appropriate positioning and manual techniques^{5,6}

Potential complications
 Absolute contraindications include undrained pneumothorax and unexplained haemoptysis
 Cardiovascular and haemodynamic instability⁷
 Loss of positive and expiratory pressure (PEEP), inducing hypoxia and potential lung damage. This can be minimized by incorporating a PEEP valve into the circuit of a 'PEEP dependent' patient
 Risk of volutrauma, barotrauma and pneumothorax⁸, which can be reduced by including a manometer in the circuit⁹
 Risk of increased intracranial pressure (ICP)
 Increased patient stress and anxiety

Potential advantages
 Mobilizes and clears excess bronchial secretions^{4,17}
 Improves lung function¹⁸
 Minimizes the work of breathing
 Individual components of the cycle can be utilized/emphasized to target specific problems
 Can be used in combination with other manual techniques, GAP, V/Q matching, positioning to reduce breathlessness, and during activities such as walking
 Self-treatment can be included in a home programme

Potential complications
 Without adequate periods of breathing control, bronchospasm and de-saturation can occur.
 Poor technique can lead to ineffective treatment and unnecessary energy expenditure

active cycle breathing technique

consists of:
 (i) breathing controlling minimising accessory muscle use
 (ii) thoracic expansion emphasising inspiration
 (iii) forced expiration emphasizing 'huff'