Multi-modal Peri-operative Pain Management – An Evidence-based Physiotherapy Perspective

Andrea LEUNG
DHSc (PT) – Candidate,
MSc Health Care (PT),
PD (PT), Dip (Acup)
Senior Physiotherapist
Queen Elizabeth Hospital

Stephen CHAN
DHSc (PT) – Candidate,
MSc Sports Science,
BSc (PT), Dip (Acup)
Physiotherapist I
Queen Elizabeth Hospital

18 May 2015

Contents

* Introduction
* Peri-operative Physiotherapy Management
  - From Past to Present: Illustration with Surgical Conditions
  - Physiotherapy Pain Management: Musculo-skeletal Conditions
* Summary

Physiotherapy in Hong Kong

Physiotherapy (PT) started in Hong Kong more than ½ century

Queen Elizabeth Hospital (QEH) opened 1963

HK PT Training School opened in 1960 & moved to QEH in 1963

Present

(Smith, 1978)

Service Demand in Peri-operative Physiotherapy

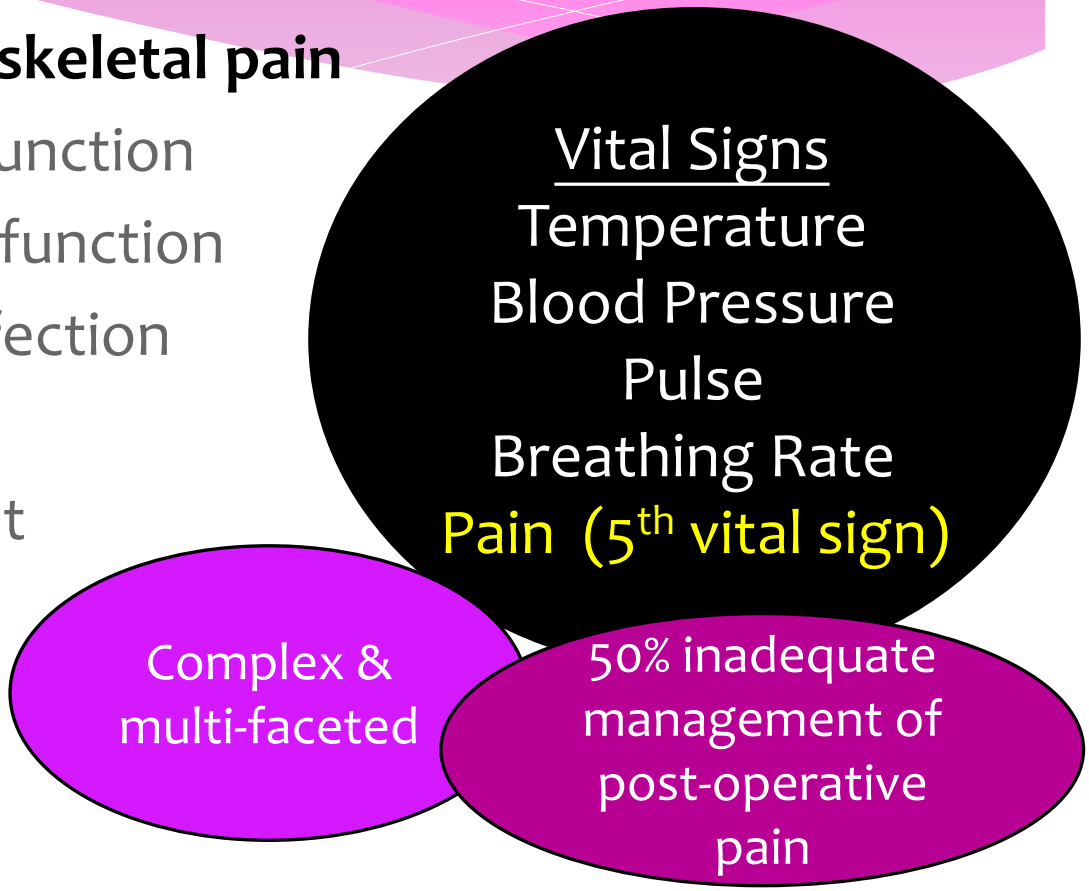
In 2012/13,

* 444,342 operations conducted at hospitals of Hong Kong Hospital Authority
  - Over 19,000 inter-mediate to ultra-major operations at QEH
* Peri-operative physiotherapy service provided

(Hospital Authority Statistical Report 2012-2013)

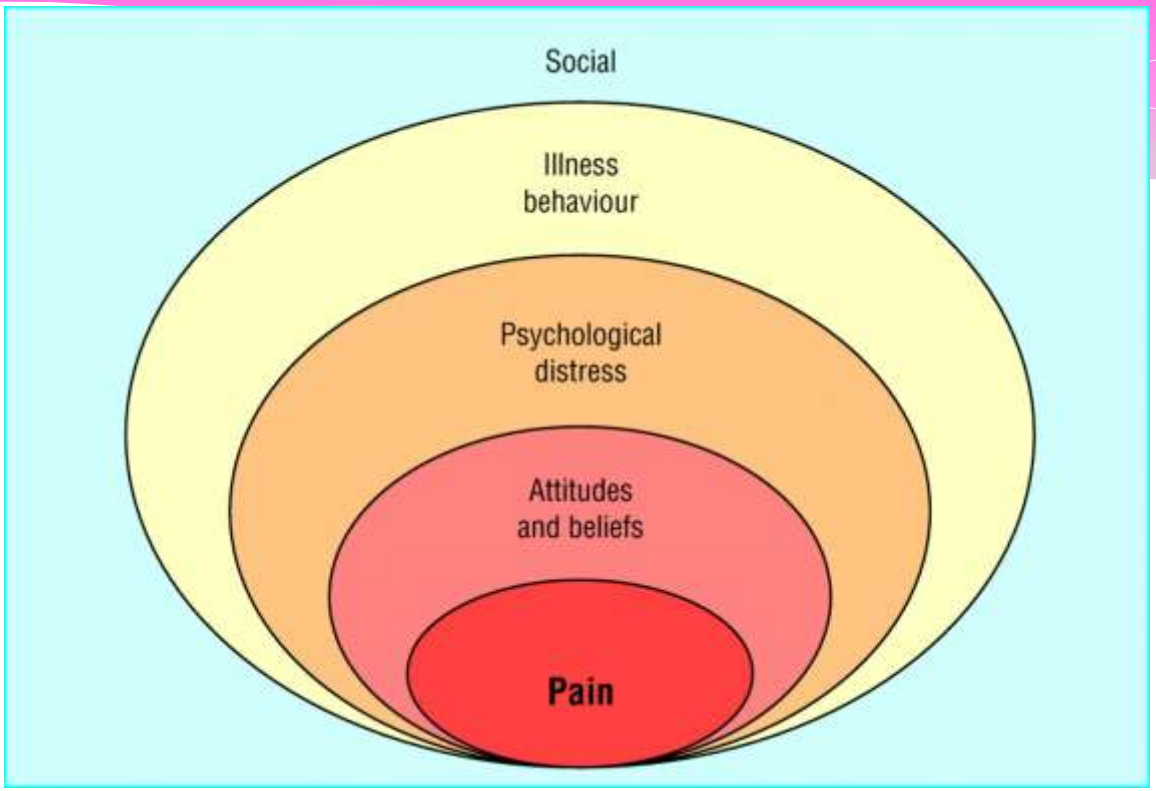
Common Problems after Surgery

* **Wound pain / musculoskeletal pain**
* Cardiorespiratory dysfunction
* Circulatory venous dysfunction
* Pneumonia & other infection
* Joint swelling
* Joint lack of movement
* Muscle atrophy
* Postural imbalance
* Pressure ulcer



(Chung & Lui, 2003; McCaffery & Pasero, 1997; Sinatra, 2010; Sivrikaya, 2012)

The Biopsychosocial Model of Pain



Pain Represents a Biopsychosocial Problem, with Maladaptive Changes in the Central Nervous System (CNS), Musculoskeletal System and the Cognitive Level

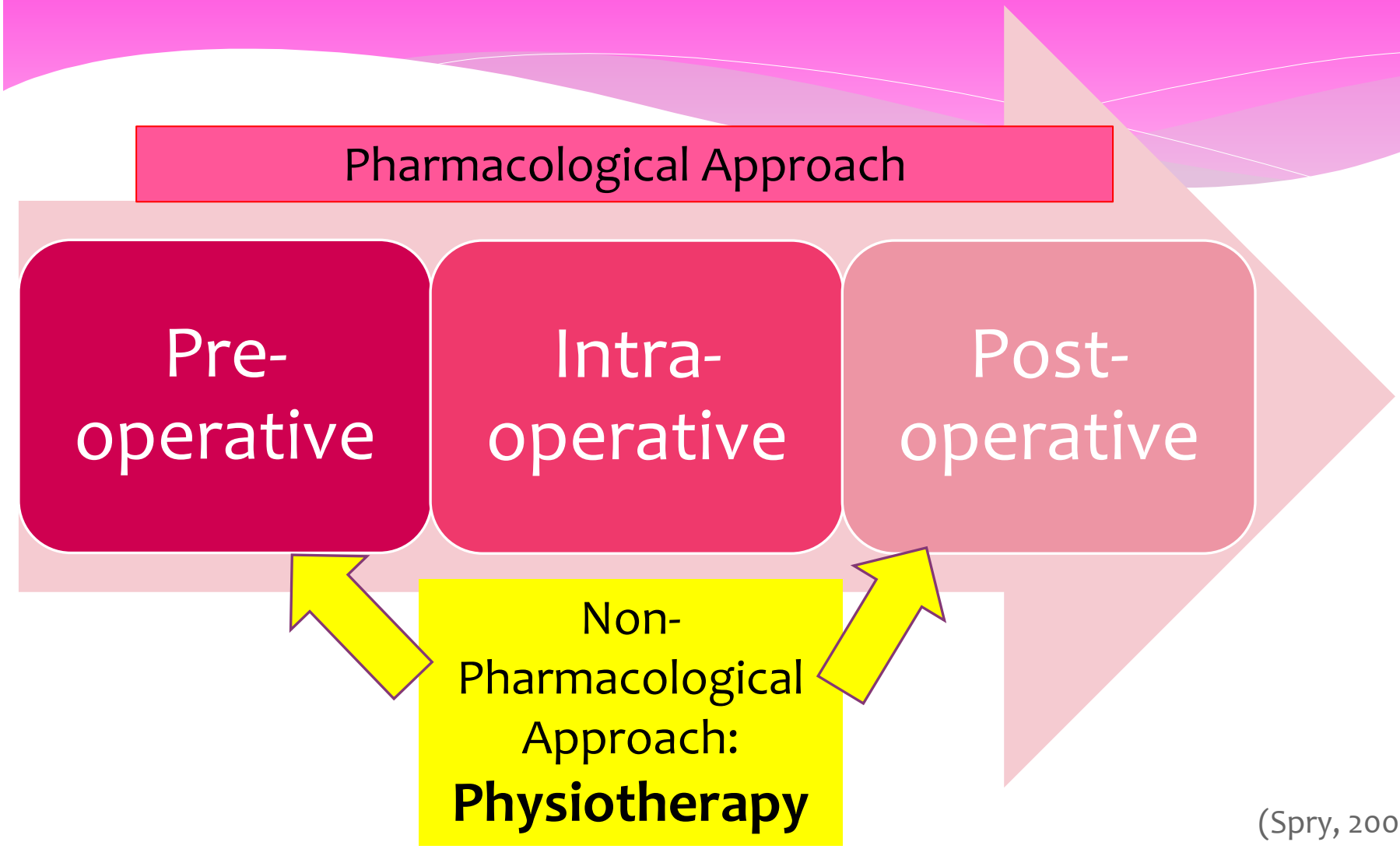
(Bastian et al., 2014; Main & Williams, 2002; Nijs et al., 2015)

The Pain Cycle :
Pain Affects Mobility & Functions

Multi-modal Peri-operative Pain Management & Fast-tracked Rehabilitation

(Meyr & Saffran, 2008)

Peri-operative Pain Management



(Spry, 2005)

Non-pharmacological Approach

* Multi-modal: Physical, cognitive, behavioral & others
* Enhance recovery & shorten hospital stay
* Prevent development of chronic pain
* Safe, effective & individualized care

Early mobilization

Early standing training with tilt table

Acupuncture for pain relief

Cryopneumatic therapy

(Gandhi & Viscusi, 2009; Hartrick, 2004; Sivrikaya, 2012)

Multi-modal PT Management for Surgical Pain

Education / Psychological Support

Tailored-Exercise Program

Graded Muscle Strengthening

Pain Relieving Modalities
(e.g. acupuncture, TENS, heat / cold therapy, IFT, US, MTP etc.)

Wound Support & Transfer Technique

Early Supervised Mobilization

(Meyr & Saffran, 2008)

Usual Patient's Journey – PT Perspectives

* **Pre-operative**
  - Baseline **assessment** & physical conditioning
  - Psychological **preparation**
  - **Education**
* **Intra-operative**
* **Post-operative**
  - **Pain management**
  - Post-operative **rehabilitation**
  - **Home care** & advice

Objectives:

* Achieve the best possible physical condition
* Use the less time
* Diminish complication risks
* Facilitate further rehabilitation
* Early recovery / discharge & full social participation

(Varela et al., 2013)

Multi-modal Peri-operative PT Pain Management Delivery Model

Ward

Pre-operative **education** & **fast-tracked rehabilitation** to our needy patients

Day Care Centre

Enhanced **one-stop pre-admission service** (same day surgery, same day discharge)

OPD Clinic

Continuum of care**: timely referral** to PT **OPD** to enhance recovery

Community

Tailor-made home program / pain control; **patient empowerment**

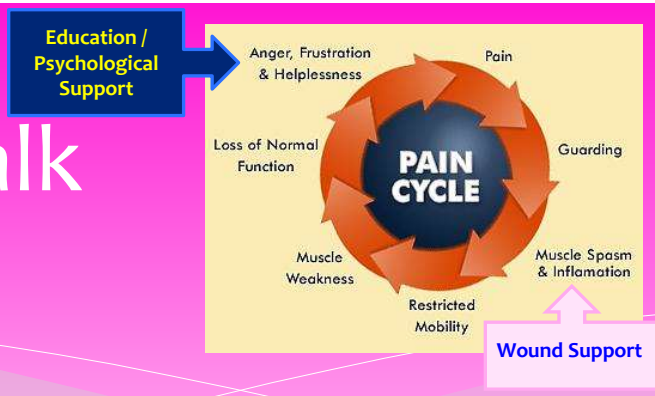
Summary of Effects of Physiotherapy for Patients Receiving Abdominal / Cardiothoracic Surgeries

Study	Subject Characteristic	Design	Treatment Regime	Measurement	Results
Cheifetz et al., 2010	Patients scheduled to undergo major abdominal surgery via laparotomy (n=75)	RCT	Intervention group wore abdominal binder	1. Preoperative measurements of 6-minute walk test (6MWT) distance 2. Perceived distress 3. Pain 4. Pulmonary function	The intervention group got improved 6MWT distance by day 5 was greater ($p < 0.05$). No blinder group got significantly increased pain and symptom-associated distress following surgery ($p < 0.05$)
Herdy et al., 2008					…on group got a shorter …acheal extubation (1054 …+/- 666 min, P = 0.05), a …e incidence of pleural …ve risk [RR] = 0.2; 95% …rval [CI]: 0.5-0.8), …= 0.15; 95% CI: 0.03-0.8), …s. 7 cases, p = 0.004), …ation or flutter (RR = 0.2; …) as well as a shorter …pital stay (p< 0.001)
Manzano et al., 2008				postoperative day 6. Incidence of postoperative pulmonary complications	…n group presented …en-hemoglobin …ng the immediate post-…od ($p < 0.03$)
Mackay et al., 2005	Patients undergoing open abdominal surgery, at high risk of developing postoperative pulmonary complications (n=56)	RCT	Intervention group received early mobilisation	1. Incidence of clinically significant postoperative pulmonary complications 2. Fever 3. Length of stay 4. Restoration of mobility	There was no significant difference between groups in the incidence of postoperative pulmonary complications (absolute risk reduction -3%, 95% C1 -22 to 19%), fever, physiotherapist time, or the number of treatments ($p>0.05$)

Conventional Physiotherapy (Chest Physiotherapy & mobilization exercises) had positive influence on reduction in pain, incidence of pulmonary complication & functional outcomes post-operatively for patients undergoing abdominal / cardiothoracic surgeries

Pre-operative Physiotherapy

Pre-operative Education Talk



* Pre-operative anxiety influences patients to experience more pain after surgery
* Pre-operative information
  - **Decrease** post-operative **pain**
  - **Reduce** pre-operative **anxiety**
  - **Improve** patients' **satisfaction** with post-operative **pain management**

(Irwin & Tecklin, 2004; Sjoling et al., 2003)

Wounds and lines of open heart surgery

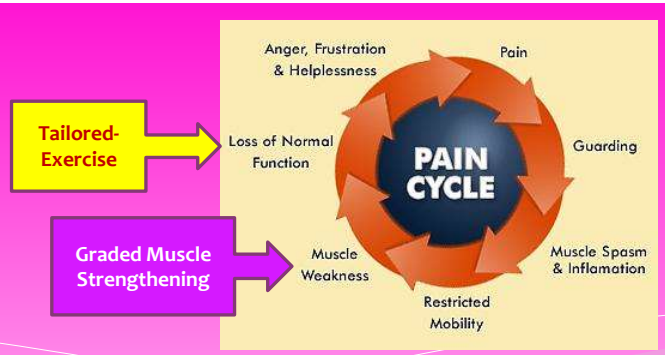
Wound support for open heart surgery

Educational Leaflet

Education / Psychological Support

* Educate wound support technique
* Reinforce breathing & coughing exercise
* Emphasize early mobilization

Pre-op Optimization



* Incentive spirometers
* Cardio-pulmonary fitness assessment & training for **optimizing surgical outcomes** (Irwin & Tecklin, 2004)

Incentive spirometers for adult and children

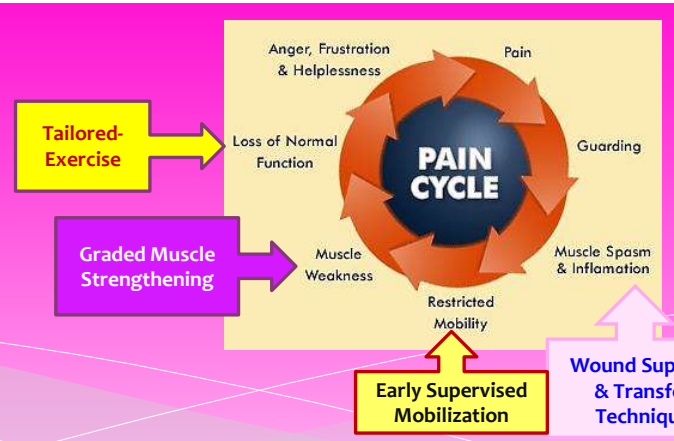
Lung function test

Cardio pulmonary exercise test

Aerobic exercise training

Post-operative Physiotherapy

Post-op PT Care



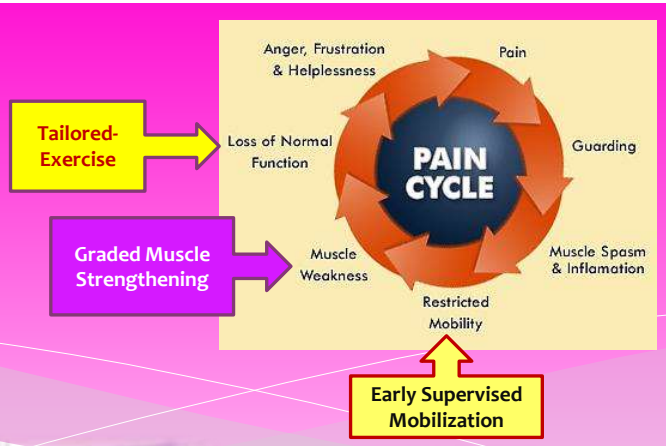
Post-operative chest physiotherapy & breathing exercises

Huffing is a forced expiratory technique with exhaling through an open mouth & throat – less painful!

Wound support coughing / huffing

Augmented transfer technique & bedside mobility training

Early Limb Mobilization & Training



Ankle & toes mobilizing exercise (ankle pump), & anti-embolism stocking prevent deep vein thrombosis

Wound support vest , early ambulation & exercise training

Fast-tracked Rehabilitation & Early Mobilization : Enhance Recovery & Reduce Morbidity

Fast-tracked Rehabilitation

* Multi-modal approach incorporates surgeons, anesthesiologists, physical therapists & nurses, with:
  - Comprehensive pre-operative assessment & education
  - Evidence based practice in anesthesia
  - Minimally invasive procedures and analgesia
  - Early feeding & ambulation
* Early physiotherapy – early extubation, sitting in a chair for > 1 hour on the post-operative day, & ambulation by post-operative day one

(Ambrosino & Gabbrielli, 2010; Makhabah et al., 2013; Patel & Hall, 2013)

Summary of Effects of Fast-tracked Rehabilitation on Post-operative Patients

Study	Subject Characteristic	Design	Treatment Regime	Measurement	Results
Barker et al., 2013	Patients undergoing metal-on-metal hip resurfacing arthroplasty (n=80)	RCT	Intervention group consisted of accelerated post-operative physiotherapy programme	1. Oxford Hip Score (OHS) 2. Hip disability and Osteoarthritis Outcome Score (HOOS) 3. EuroQol (EQ-5D) 4. UCLA activity score 5. Hip range of motion 6. Hip muscle strength	Intervention group led a higher one year the mean OHS ($p < 0.001$) as well as statistically significant increase in HOOS ($p < 0.0005$) and UCLA activity score ($p < 0.019$) and improved EQ 5D ($p < 0.0005$) 80% of the intervention group fully met their self-selected goal Increased hip range of motion in terms of d abduction ($p < 0.05$)
Wang et al., 2011	Patients after rese of colorectal canc (n=106)				to faster restoration functions ($p < 0.01$) lications ($p < 0.05$) ive hospital stay time e was observed in d after both groups
Serclova et al., 2009	Patients schedule open intestinal res (n=105)		the emphasis on an interdisciplinary approach	functions 3. Post-operative complications 4. Post-operative length of stay (LOS)	to significantly better e pain and faster ctions ($p<0.001$), better food tolerance, shorter hospital stay ($p<0.001$) and significant lower postoperative complications within 30 postoperative days ($p=0.003$)
Larsen et al., 2008	Patients scheduled to undergo elective primary total hip replacement, total knee replacement or unicompartmental knee arthroplasty (n= 87)	RCT	Intervention group consisted of a new accelerated perioperative care and rehabilitation procedure	1. LOS in hospital 2. EQ-5D from baseline to 3-month follow-up	Intervention group reduced mean LOS ($p < 0.001$); was accompanied by a greater gain in QOL ($p = 0.03$)

Fast-tracked rehabilitation program reduced incidence of pulmonary complications, enhanced recovery & reduced length of stay in post-operative patients

Recent Advances in Multi-modal Peri-operative PT Management

Recent Advances in Multi-modal Peri-operative PT Management - 1

* Facilitate patient recovery & reduce morbidity with advanced equipment
* Promote early mobilization on bed / in upright position for patients with stable acute condition (Patel & Hall, 2013)

Active / Passive Limb Mobilizer – at bed's end for early lower limb mobilization (cycling in bed)

Recent Advances in Multi-modal Peri-operative PT Management - 2

Neuromuscular Electrical Stimulation with Graded Muscle Strengthening Exercise – prevent disuse muscle atrophy & muscle weakness

Acupuncture & Acu-TENS – provide pain relief & facilitate mobilization

Recent Advances in Multi-modal Peri-operative PT Management - 3

Tilt-table – graded weight bearing exercise & vaso-motor training

Tilt-table with In-built Computerized Stepper – additional benefit of stepping exercise to strengthen very weak lower limb muscles for fragile patient

Recent Advances in Multi-modal Peri-operative PT Management - 4

Present

Past

Off ventilator; multiple pieces of accessories carried for ambulatory training; labour-intensive

Portable ventilator & monitor incorporated to mobility aid – facilitate early mobilization; adequate support; less effort & reduce pain

Various walking aids to facilitate ambulation

Multi-modal Peri-operative PT Pain Management in Musculoskeletal Conditions

Peri-operative PT Management for Orthopaedic Surgery

Common problems encountered by patients

* Musculoskeletal pain upon movement

* Kinesiophobia (Fear to move)
* Joint swelling
* Joint stiffness
* Muscle atrophy
* Postural imbalance

Significantly affect mobility, leading to more symptoms of depression, low self-efficacy and quality of life

(Svensson et al., 2011)

Emphasis of physiotherapy program for patients after orthopaedic surgery

* Early pain relief for better pain management
* Early rehabilitation for physical optimization

Literatures on Benefits of Physiotherapy Program for Patients Receiving Orthopaedic Surgery

Study	Subject Characteristic	Design	Treatment Regime	Measurement	Results
Villadsen et al., 2014	Patients scheduled for hip or knee arthroplasty due to severe osteoarthritis (n=153)	RCT	The intervention group consisted of an 8-week preoperative supervised exercise program twice a week for 1 h as adjunct treatment to the standard arthroplasty procedure	1. Pain scale 2. Self-reported physical function measured on the activities of daily living (ADL) subscale in the Hip disability and Osteoarthritis Outcome Score (HOOS) 3. The Knee injury and Osteoarthritis	There was no statistically significant difference in effects between hip or knee patients (p=0.7370) Three months postoperatively, no difference was found between groups for ADL or pain (p>0.05) Intervention group got a statistically significant effect of exercise over the entire period (baseline to 3-months postoperatively)
Stevens-Lapsley et al., 2012	Patients scheduled undergo a primary unilateral total knee replacement (TKA) (n=66)		stimulation (NMES) applied to the quadriceps muscle (initiated 48 hours after surgery; twice per day at the maximum tolerable intensity for 15 contractions)	2. Knee range of motion 3. Timed up and go test 4. Stair-climbing Test 5. Six-minute walk test 6. Self-report measures	significant riceps and hamstring nal performance, and knee extension active range of motion (p<0.05) at 3.5 week At 52 weeks, improvements with NMES were still significant for quadriceps and hamstring muscle strength, functional performance, and some self-report measures
Rahmann, Brauer & Nit, 2009	Patients undergoing primary hip or knee arthroplasty (n=65)	RCT	Participants were randomly assigned to receive supplementary inpatient Physiotherapy, beginning on day 4: aquatic physiotherapy, nonspecific water exercise, or additional ward physiotherapy	1. Strength 2. Gait speed 3. Functional ability	Hip abductor strength was significantly greater after aquatic physiotherapy intervention than additional ward treatment (P.001) or water exercise (P.011). No other outcome measures were significantly different at any time point in the trial, but relative differences favored the aquatic physiotherapy intervention at day 14

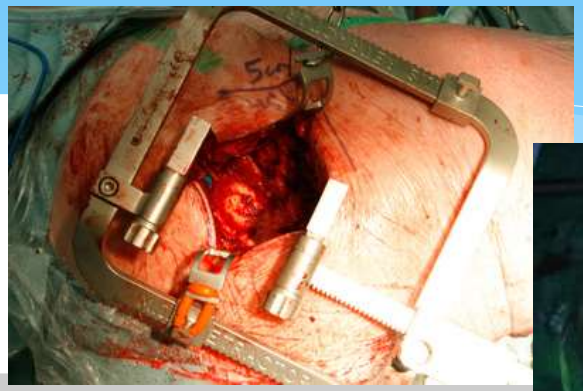
Supervised Physiotherapy program reduced pain, improved muscle strength and functional performances for patients after orthopaedic surgery

Literatures on Effectiveness of Physiotherapy Pain Relieving Modalities in Orthopaedic Conditions

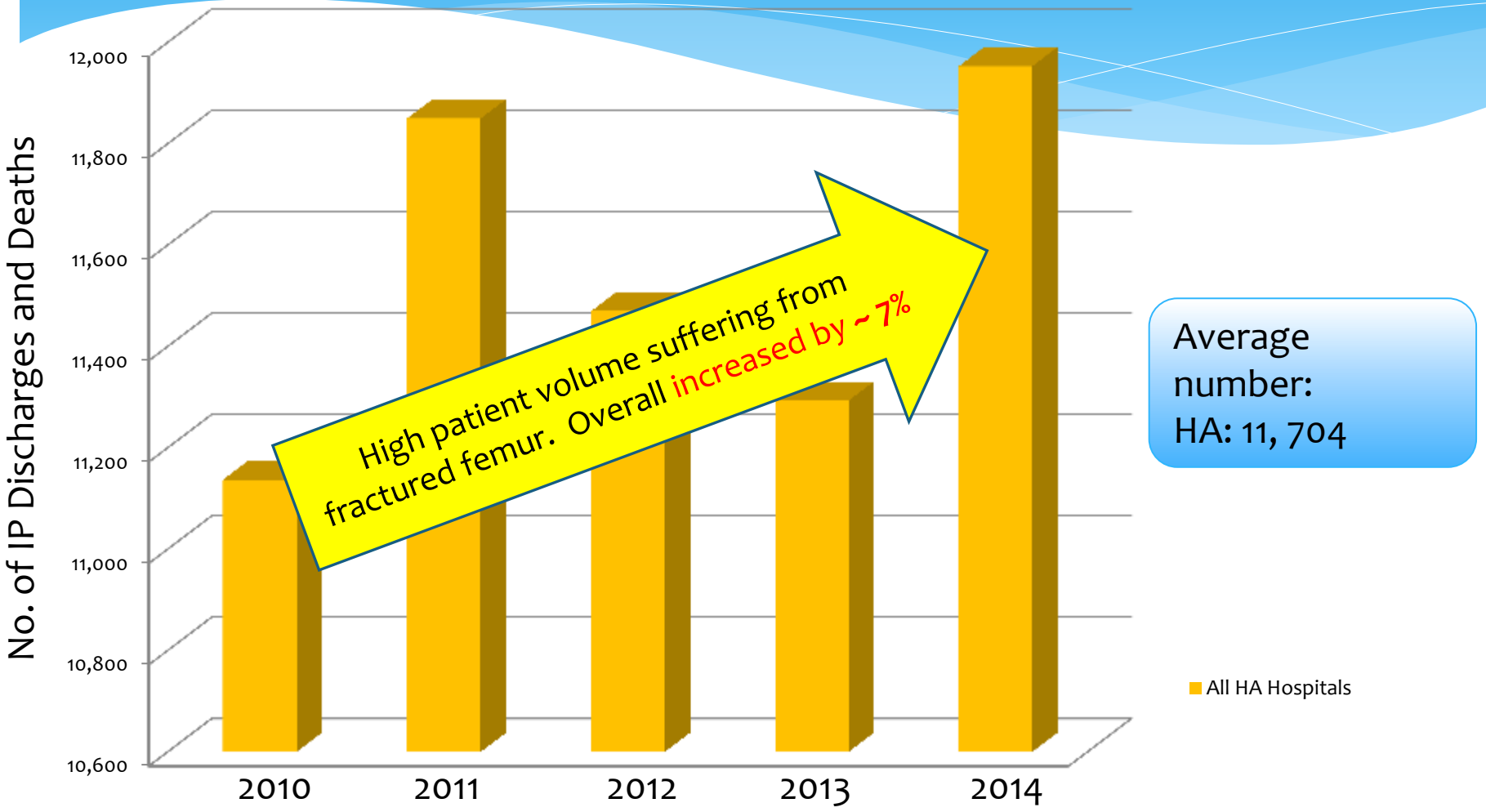
Study	Subject Characteristic	Design	Modalities	Measurement	Results
Ebadi et al., 2012	Non-specific chronic low back pain	RCT	1) Continuous US (1 MHz &1.5 W/cm) plus exercise 2) Placebo US plus exercise	1. Functional disability, measured by Functional Rating Index 2. Visual analog scale. 3. Lumbar flexion and extension range of motion (ROM)	Both groups had improved regarding function (FRI) and global pain (VAS) (P < .001). Lumbar ROM as well as holding time during the Sorensen test and median frequency slope of all measured paravertebral muscles did not change significantly in either group (P > .05). Improvement in function and lumbar. ROM was significantly greater in the group receiving continuous US (P < .05)
Nelson & Zvirbulis, 2013	Early OA knee	RCT	1) Pulsed electromagnetic field (PEMF), for 15 min twice daily 2) Placebo PEMF	1. VAS pain score	Results showed VAS pain score decreased in the active cohort by 50 ± 11 % versus baseline starting at day 1 and persisting to day 42 (P=0.001). The overall decrease in mean VAS score for the active cohort was nearly threefold
Cramer et al., 2014	chro neck				red for pain intensity (P . Group differences for e of maximal pain (P =
Waterman et al., 2012	Pati ACL			numerical evaluation (SANE). 5. Circumferential measurements of the knee	nt 27-point decrease in for the Lysholm, SF-36, rmore, no significant differences were noted for any of thecircumferential measurements either between groups or time points
Dailey et al., 2013	People with fibromyalgia	RCT	1) Active TENS, 2) Placebo TENS 3) No TENS	1. Pain and fatigue at rest 2. Movement pressure pain thresholds (PPTs) 3. 6 minute walk test (6MWT) 4. Range of motion (ROM), 5. Five time sit to stand test (FTSTS) 6. Single leg stance (SLS).	Pain with movement (during the 6MWT) was significantly less during active TENS (4.0 ± 0.4) when compared to placebo (4.7 ± 0.4) (p<0.05) or no TENS (5.0 ± 0.4)(p<0.05) Fatigue with movement (during the 6MWT) was significantly different after treatment between active TENS (4.4 ± 2.3) and placebo TENS (5.5 ± 2.6)(p<0.05), and between active TENS and no TENS (5.0 ± 2.7)(p<0.01) PPTs over the anterior tibialis muscle were significantly increased during active TENS when compared to no TENS (p<0.05). There were no significant differences in ROM, FTSTS , SLS and 6MWT

Physiotherapy electro-physical modalities (i.e. ultrasound, electromagnetic therapy, cryotherapy and transcutaneous electrical nerve stimulation etc.) were all effective for pain management in various orthopaedic conditions

Multi-modal Peri-operative PT Pain Management in Open Surgery: Patients with Fractured Femur



No. of IP Discharges and Deaths in **Fractured Femur** in HA Hospitals (2010-2014)



(Clinical Data Analysis and Reporting System, Hospital Authority, accessed 14 April 2015)

Pre-operative Education: Lower Anxiety & Pain Level

Education / Psychological Support

* Education of positioning & activity modification to reduce patients' pain level
* Promote concept of self pain management

Cochrane Database of Systematic Reviews (2014): Pre-operative education lowered post-operative anxiety & pain level after surgery

(McDonald et al., 2014)

Pamphlets / booklets to enhance self pain management

Individualized & tailor-made education

Positioning to reduce pain

Multi-modal Peri-operative Pain Management in Patients with Fractured Femur

Acute Pre-operative and Post-operative Pain Management

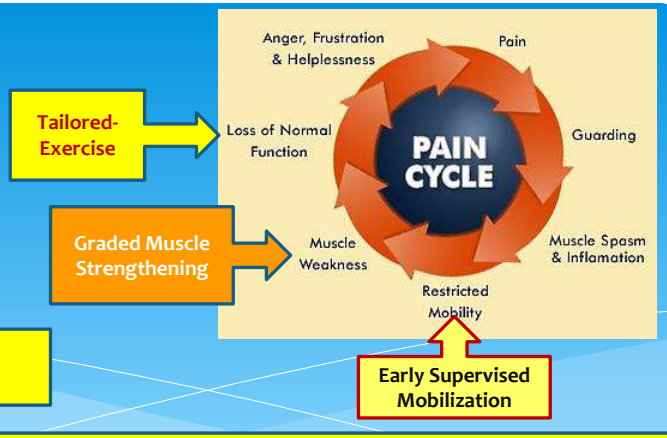
Cryotherapy / Cryopneumatic therapy
– ↓ pain, swelling & stiffness

Transcutaneous electrical nerve stimulation (TENS)
– ↓ pain, user friendly and portable

Heat therapy
– ↓ pain & muscle spasm

Magnetic therapy & ultrasound
– enhance soft tissue healing

Early Ambulatory Training: ↓ Post-operative Pain Level



Patients after surgery: Pain ↑ upon movement, reluctant to move

ELSEVIER MASSON

Available online at SciVerse ScienceDirect www.sciencedirect.com

Elsevier Masson France EM|consulte www.em-consulte.com/en

ORIGINAL ARTICLE

Rehabilitation implications during the development of the Norwich Enhanced Recovery Programme (NERP) for patients following total knee and total hip arthroplasty☆

T.O. Smith[a,*], C. McCabe[b], S. Lister[b], S.P. Christie[b], J. Cross[a]

[a] Queen's Building, Faculty of Medicine and Health Sciences, University of East Anglia, Norwich, NR4 7TJ, UK
[b] Physiotherapy Department, Norfolk and Norwich University Hospital, Colney Lane, Norwich, NR4 7UY, UK

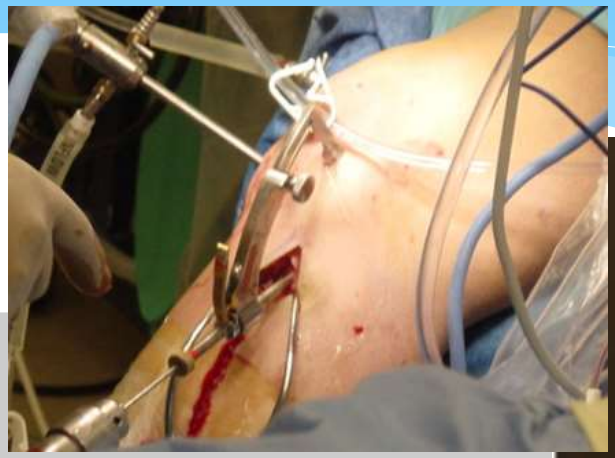
Accepted: 6 March 2012

Protocol: Approximately four hours post-operatively, with the local anaesthetic still effective, each patient was assessed by a physiotherapist and commencing full weight-bearing exercises using walking aids, and gait reeducation (Smith et al., 2012)

Early ambulatory training for patients with THR / TKR could ↓ pain level, ↓ length of stay and improved functional performances overall

Different mobile pain relieving devices & walking aids for early ambulation on level ground & stairs

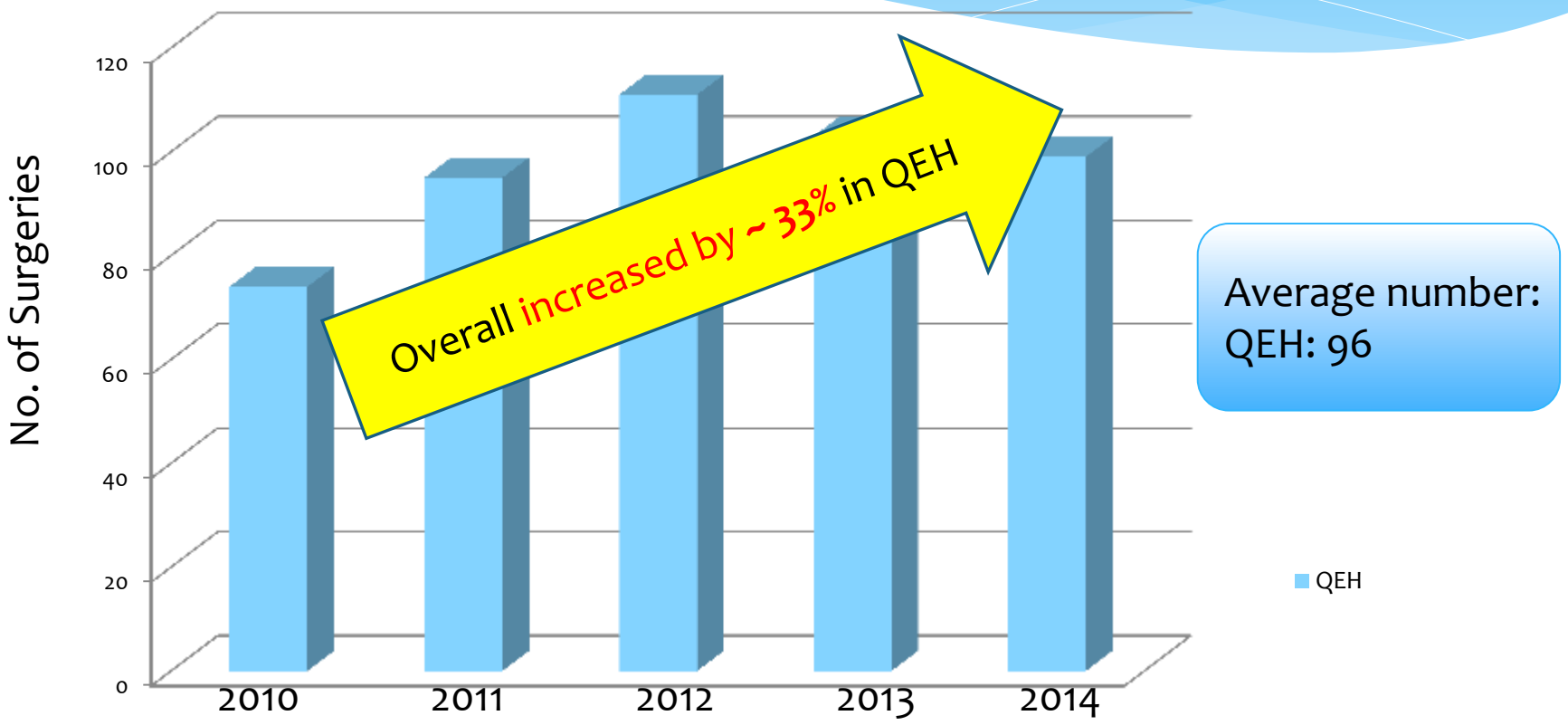
Multi-modal
Peri-operative PT Pain Management in Day Surgery Patients / Patients with Minimally Invasive Surgery



Patients with **Day Surgery or Same Day Surgery** in HA Hospitals (2010-2014)

(Clinical Data Analysis and Reporting System, Hospital Authority, accessed 14 April 2015)

Patients with **Knee Arthroscopic Surgery** in QEH (2010-2014)



(Clinical Data Analysis and Reporting System, Hospital Authority, accessed 14 April 2015)

Overview of Multi-modal Peri-operative PT Pain Management in Day Surgery Centre

* Relatively young, better physical ability
* One-stop peri-operative service
* Early & timely PT response & services
* Pain relief and functional training to facilitate same day discharge and earlier return to work / sports

Functional training to facilitate same day discharge

A set of pre-prepared package of home-based pain management & exercises program for patient empowerment

Cryotherapy

Heat therapy

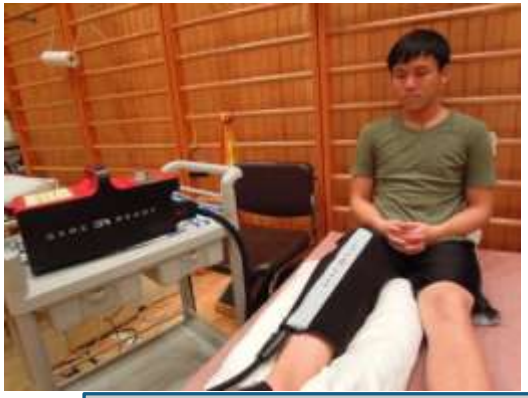
Manual therapy and home-based exercises

Sports taping

Patients with Anterior Cruciate Ligament (ACL) Surgery

Arrange Timely FU at PT OPD upon D/C from Day Surgery Centre

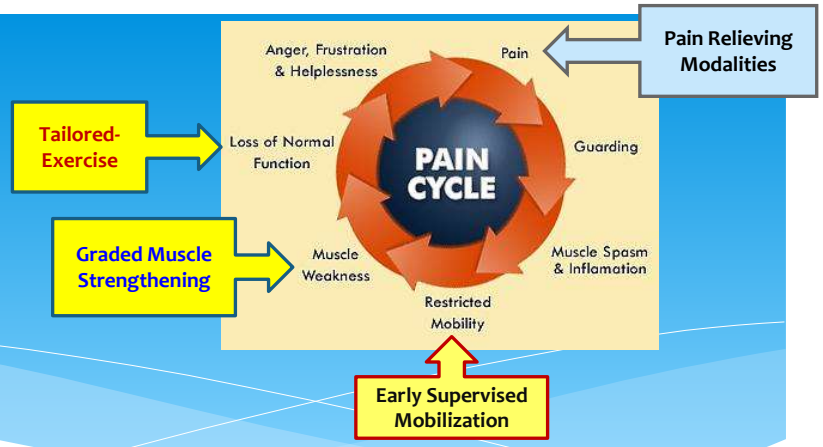
Pain Management Program



Magnetic therapy

Cryotherapy & cryopneumatic therapy

Structural Training Program after ACL Surgery



Accelerated rehabilitation program

Working specific muscles at a constant rate with accommodating resistance

Protect vulnerable soft tissue while training → more safe & less pain

Supervised strengthening exercises

Agility & speed training

Computerized assessment & isokinetic training

Education Materials Designed for Patients with ACL Surgery

Education / Psychological Support

Pamphlets, booklets & display boards

Comprehensive & easily accessible information for patients to learn about pain management & home exercises

Hydrotherapy for Pain Relief in Orthopaedic Conditions

Underwater gymnasium for orthopaedic clients

Hydrotherapy class and individualized exercise

Hydrotherapy: thermal treatment using water as a media with temp ranged from 28 – 35°C

By using different water properties (buoyancy, viscosity, hydrostatic pressure etc.) to achieve various therapeutic purposes (i.e. ↑ROM, ↑strength and ↓pain) (Becker, 2009)

Hydrotherapy for Pain Relief in Orthopaedic Conditions

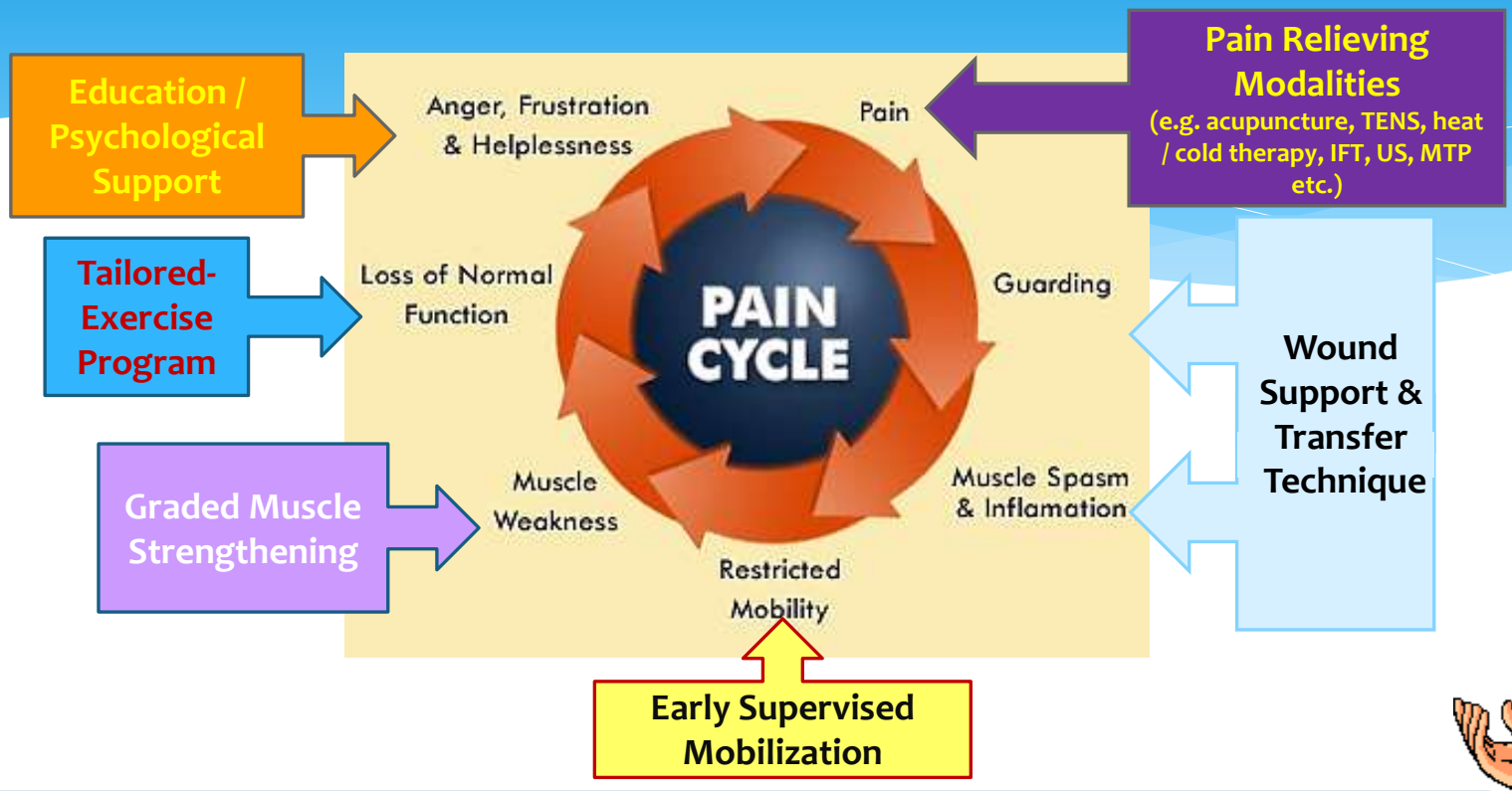
Hydrotherapy for patients with OA knee had a **better pain relief** & functional improvement with possible mechanism of **decreased kinesiophobia** (fear to move) & concurrent improvement in symptom & quality of life measures

(Lau, Chung & Cheung, 2013)

Under-water exercise was a better **starting media** for rehabilitation than land exercise for OA patients because of **less joint loading**

(Cochrane Database of Systematic Reviews 2009; Roper et al., 2013)

Bring Home Messages



Physiotherapy multi-modal interventions tackle different elements of pain cycle at various time points of peri-operative phases

Tackling multiple elements of pain cycle
→ achieve a **synergistic effects** and hence a **better outcome** in our multi-modal peri-operative pain management

Thank You