Update on Diabetes Education & Management 2016

Exercise prescription for people with diabetes

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Content

- Exercise prescription for DM patients
  - Role of health care professionals
  - Evidence based practices
  - Safety precautions
  - Efficiency and effectiveness
  - Long term maintenance
- Case discussions

ROLE OF HEALTHCARE PROFESSIONALS



Role of health care professionals

- As a health care professionals, we should…
  - Recognize benefits of regular physical activities
  - Promote active lifestyle
  - Understand potential risks and prevent exercise related injuries



Role of health care professionals

- Points to note
  - Needs for Health and fitness screenings / Exercise testing
  - Contraindications to exercise
  - Concern of musculoskeletal, cardiovascular and metabolic conditions
  - Influence of environmental factors on physical performance
  - Skills of Behavior modifications for long term effects

SAFETY PRECAUTIONS



Highs Risk for physical training

- Acute orthopedic conditions
  - Acute inflammation
  - Post surgery
- Unstable cardiovascular conditions
  - Uncontrolled heart diseases, e.g. IHD, heart failure
  - Signs and symptoms indicating impaired cardiac ouput e.g. shortness of breath at rest or with mild exertion
  - Palpitations or tachycardia
  - Dizziness or syncope
  - Angina
- Systematic diseases
  - Uncontrolled Rheumatic diseases; fever

Exercise stress testing for DM patients

- NOT routinely recommended to detect ischaemia in asymptomatic individuals at low coronary heart disease (CHD) risk (<10 % in 10 yrs)
- Advised primarily for sedentary adults with DM who are at higher risk for CHD and who would like to undertake activities more intense than brisk walking
- Some Risk Factors for CHD include:
  - Age > 40,
  - Concomitant risk factors such as hypertension, microalbuminuria, etc.,
  - Presence of advanced cardiovascular or microvascular complications (e.g. retinopathy, nephropathy)

Exercise precaution for patients with Diabetes mellitus

- Monitoring of Blood glucose level
- Do not exercise during peak insulin action
- Avoid injection in exercising limbs
- Monitor BG at the beginning of training / when modifying program

Exercise precaution for patients with Diabetes mellitus

- Monitoring of Blood glucose level (con't)
  - Hyperglycaemia
    - T2DM patients generally do not have to postpone exercise simply because of high blood glucose as long as they feel well and are adequately hydrated
    - Should stop exercise with hyperglycemia (e.g. >15) + ketone

Exercise precaution for patients with Diabetes mellitus

- Monitoring of Blood glucose level (Con't)
  - Hypoglycaemia
  - Risk of exercise-induced hypoglycemia for those taking insulin and/or insulin secretagogues (e.g. Glicazide) if medication dose or carbohydrate consumption not altered
  - Rare in DM patients not treated with insulin or insulin secretagogues (e.g. metformin alone)
  - Added carbohydrate should be ingested if pre-exercise glucose levels are <5.6
  - Suggested amount = Around 20-30g carbohydrate with high glycaemic index, i.e. ~1 slice of bread

Exercise precaution for patients with Diabetes mellitus

- Environment considerations
  - Probability of impaired thermoregulation due to autonomic neuropathy
  - Not recommend to perform exercise in extreme weather
  - Wear suitable outfit to allow dissipation of heat





Exercise precaution for patients with Diabetes mellitus

- Foot care
  - Wear sport shoes that cover both the toes and heels and shock absorption
  - Wear socks to keep the feet dry and prevent blisters
  - Keep monitoring foot condition after exercise







Exercise precaution for patients with Diabetes mellitus

- Specific Long-term DM Complications
  - Retinopathy
    - vigorous aerobic or resistance exercise may be contraindicated in proliferative / severe non-proliferative DM retinopathy
    - Avoid exercise that will elevate blood pressure dramatically to prevent damage of retinal detachment

Exercise precaution for patients with Diabetes mellitus

- Specific Long-term DM Complications (con't)
  - Peripheral neuropathy
    - Individuals with peripheral neuropathy and without ulcer may participate in moderate weight-bearing exercise
    - Comprehensive foot care recommended for prevention and early detection of ulcers
    - Anyone with an open ulcer should confine themselves to non-weight-bearing activities

Exercise precaution for patients with Diabetes mellitus

- Specific Long-term DM Complications (con't)
  - Autonomic neuropathy
    - Associated with decreased cardiac responsiveness to exercise, postural hypotension, impaired thermoregulation, and hypoglycaemia due to impaired gastroparesis
    - Should receive physician approval and possibly an exercise stress test before more intense PA
  - Uncomplicated albuminuria and nephropathy (i.e. without electrolyte imbalance or uraemia)
    - No PA contraindications unless with potential complications

Exercise precaution for patients with Diabetes mellitus

- Monitor self exertion level during exercise as exertion may not be reflected by heart rate
- Intermittent exercise (i.e. more frequent rest) is more desirable than a prolonged session of continuous exercise
- Encourage exercise with company
- Preferable exercise at the same time of a day



EVIDENCE BASED PRACTICE



Benefits of Exercise for DM Patients

- Structured exercise interventions can lower A1C by 0.7% in people with T2 DM
- In combination of diet therapy, exercises help in modifying lipids profile, lowering blood pressure and therefore lowering cardiovascular risks in diabetes by improving insulin sensitivity and loss of visceral fat

Benefits of Exercise for DM Patients

- Resistance exercise improves insulin sensitivity in older men with Type 2 DM to the same or even greater extent as aerobic exercise
- Blood glucose utilization by muscles usually rises and therefore blood glucose levels tend to decline
- Development and maintenance of muscular strength, endurance, and muscle mass
  - ↑ basal metabolic rate
  - ↑ functional capacity

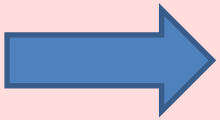
Exercise Physiology

- Carbohydrates and fats are primary energy substrates during exercise in healthy subjects
  - Anaerobic activities (**short duration / relatively high intensity**): **carbohydrates**
  - Aerobic activities (**long duration / relatively low to moderate intensity**): **fat**

→ Implications: **choice of exercises according to purpose**

Exercise physiology

- Aerobic exercise for weight reduction (fat burning)
  - High prevalence of obesity and overweight in T2 DM
  - Combination with diet control
  - Concept of Oxygen consumption
    - Reflects cardiorespiratory fitness



Implications: Level of Physical fitness



Level of physical exertion or muscle fatigue

Exercise physiology

- Oxygen consumption
  - Specific term describing energy expenditure in human
  - Highly variable in individuals (sedentary Vs athletes); higher value = higher aerobic fitness
  - The term MET (metabolic equivalents) commonly used in describing energy expenditure required for different exercises
  - 1 MET = 3.5 $mL \cdot kg^{-1} \cdot min^{-1}$
  - Calories (Kcal) = MET x Exercise time (min) x body weight (kg) /60

Exercise physiology

- Example of exercise in different MET level

Type of physical activities	MET level
Leisure walk 45min	3.0-3.5
Shopping 60min	2.5-3.0
Tai Chi 40min	3.5-4.0
Hiking 25min	5.5-6.5
Aerobic dance 30min (low impact)	4.5-5.5

EFFECTIVENESS AND EFFICIENCY



Recommendations for Prescribing Exercise to DM Patients

- Exercise prescription with the FITT principle
  - More or less the same as that recommended for Healthy Adults
- Basic principle for exercise prescription
  - **Frequency**
  - **Intensity**
  - **Time**
  - **Types**

Recommendations for Prescribing Aerobic Exercise to Patients with DM

- Frequency: Perform moderate-intensity aerobic PA on ≥ **5 days/wk**
- Intensity: At least at **moderate** intensity. Additional benefits may be gained from vigorous-intensity aerobic exercise
- Time: Perform 30-60min per day to a total of ≥ **150 min/wk**
- Type:
  - Exercise requires little skill to perform is preferable
  - Evidence showed that walking is an excellent choice

Methods of Monitor exercise intensity during aerobic training

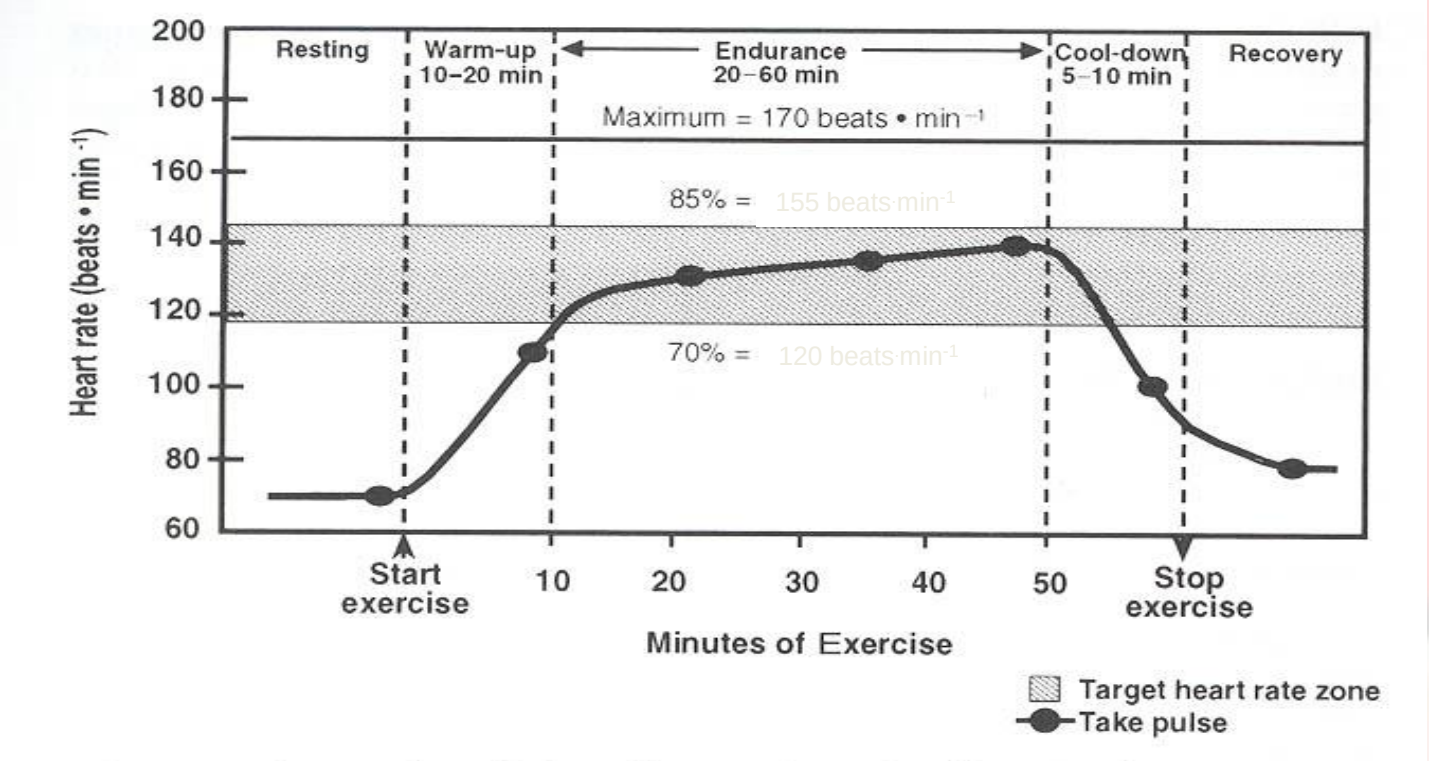
- Methods to guide intensity
  1. % of heart rate (HR) achieved
  2. Rate Perceived Exertion (RPE)
  3. Talk test

Monitoring exercise intensity by measuring heart rate

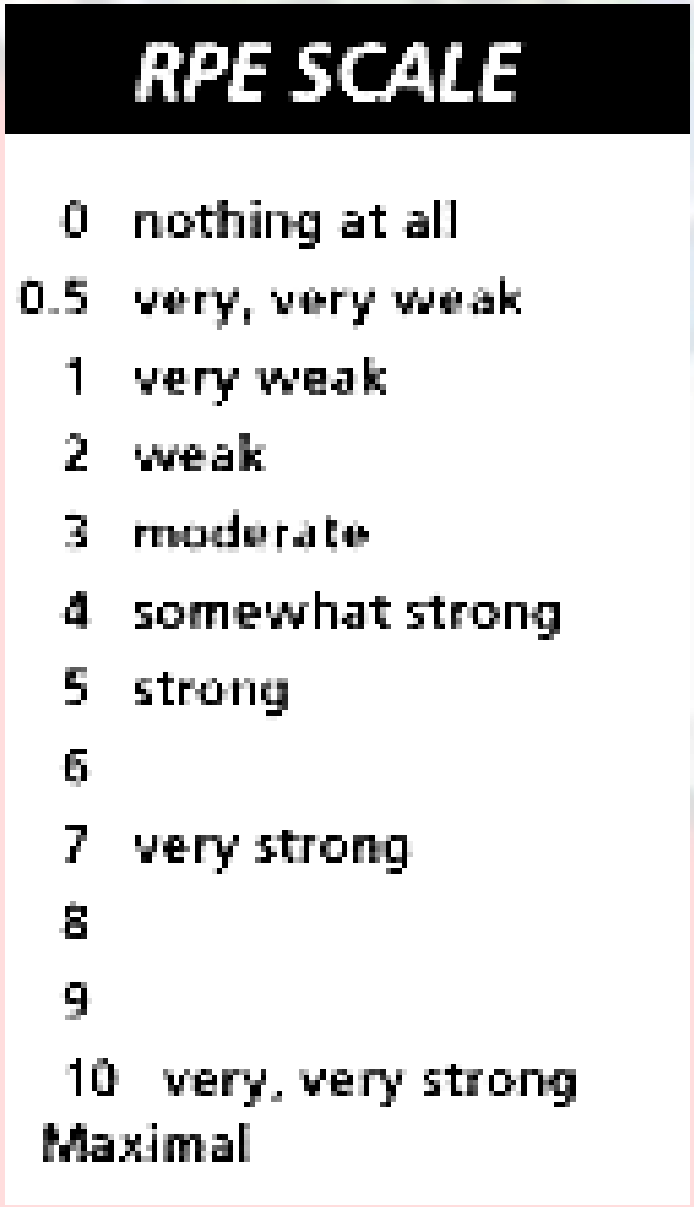


- % of maximal heart rate
  - (220 – age) x target training %
  - E.g. (220 – 50) x 70% = 119 beat per minute
  - Moderate intensity = 65-75% of maximal heart rate
- Heart rate reserve method
  - (Resting heart rate) + (maximal heart rate – resting heart rate) x training %
  - E.g. 80 + (220-50-80) x 70% = 143 beat per minute

Heart rates responses during Aerobic Exercise



Heart Rate Reserve Method Resting HR = 70 beat·min^{-1}



RPE Scale

- Light Intensity
  = RPE < 3
- Moderate Intensity
  = RPE 3-5
- High Intensity
  = RPE > 7

Talk test method



- Talk Test
  - Low intensity exercise <50%HRmax
    - ‘**You can still sing during the exercise**.’
  - Moderate intensity exercise-50-70% HRmax
    - ‘**You can complete a full sentence during the exercise**.’
  - High intensity exercise-70-85%HRmax
    - ‘**You cannot talk normally during the exercise**.’

Factors Influencing Intensity Levels

- Individual fitness level
- Medical conditions & Medications
  - Some medications may affect cardiac output -> aerobic capacity
- Orthopedic conditions e.g. joints problems may limit physical performance
- Individual preferences
  - Patients own goals?

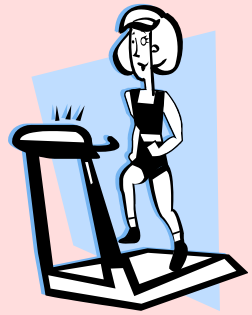


Common types of Aerobic Training exercise





- Free or treadmill walking/jogging/running
- Cycle ergometer
- Rower
- Stair master (standing and seated)
- Water aerobics
- Various group aerobics (dance, pool exercise)



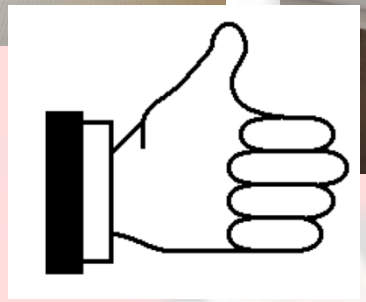


DM aerobics created by Association of Diabetes Nurses and Hong Kong Physiotherapy Association



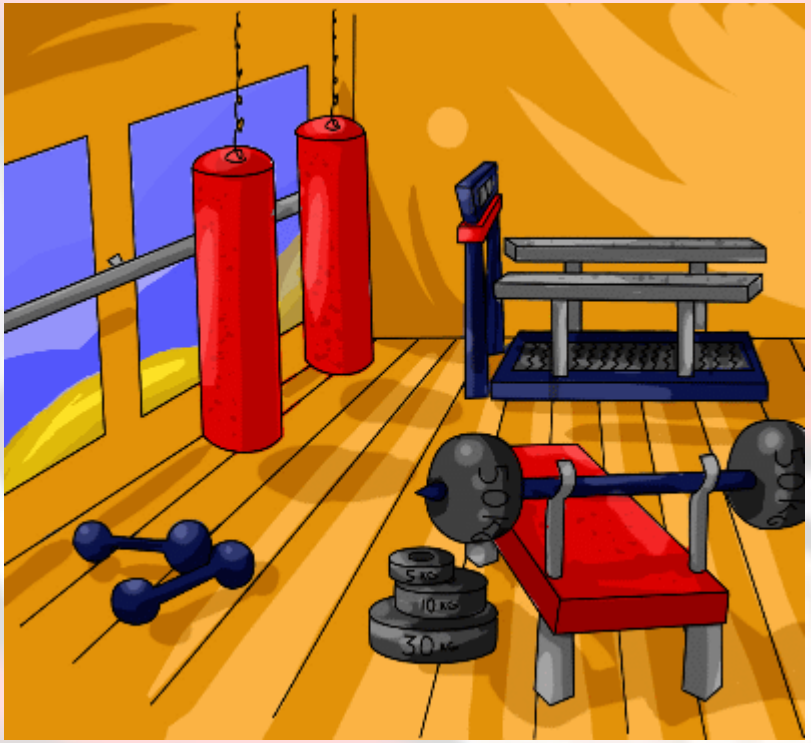
-《舞動健康 2》



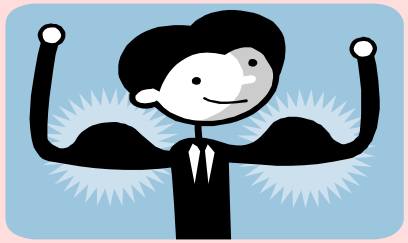


Resistance Training
Position Stand

- To make activities of daily living e.g. stair climbing, less stressful physiologically
- To effectively manage, attenuate, and prevent chronic diseases such as osteoporosis, Type 2 DM, and obesity



General principle of Resistance Training



- General principles
  - 60-80% of one repetition maximum
  - 2 to 4 sets; 8-12 repetitions/set
- Modification for Older adults / deconditioned persons
  - 50% of one repetition maximum
  - 2 to 4 sets; 10 – 15 repetitions/ set

General principle of Resistance Training

- Perform 2-3 days/week with at least 48 hours separating the exercise training sessions for the same muscle group (prevent fatigue)
- Positioning and correct use of desired muscles groups



General principle of Resistance Training Resistance Training

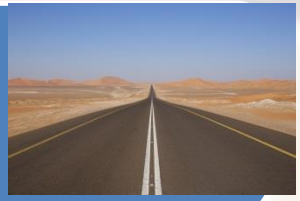
- Exercise major muscle groups by using
  - Resistance bands
  - Machine weights
  - Free weights
  - Other: balance balls etc.







LONG TERM MAINTAINENCE



Principle of exercise progression

- Following the FITT mode
  - Increase duration; then consider increasing frequency until the recommended level by ACSM
- Gradual changes to prevent muscle soreness and injury
- Monitor the response to the changes, prepare for downward adjustments

Principle of exercise progression



- Decide 'the optimal level'
  - Functional capacity
  - Medical and health status
  - Age
  - Individual activity preference & goals
  - Individual’s tolerance to current level of training

Exercise prescription for patients with Obesity

- Obesity = Energy intake > energy expenditure
- Losing weight relies on Lifestyle modification and diet control
- Physical activity appears to have **little impact on magnitude of weight loss in the initial 6 months** but **important for sustaining significant weight loss** and **to prevent weight regain**
- Involves behavioral modification

Exercise prescription for patients with Obesity

- Effective weight loss through lifestyle modification program by multidisciplinary approach
  - Maintained 61% of weight lost at 1 year
  - Maintained 48% of weight lost at 2 years



Aerobic training for patients with Obesity



- High Frequency and long duration
  - > 5 days / week
  - 30-60 min/day

    = 150 min/ week, progress to 300 min
- Moderate to vigorous intensity
- Same recommendations as healthy subjects but beware musculoskeletal and orthopaedic conditions e.g. ergometer instead of treadmill

Resistance Training for patients with Obesity

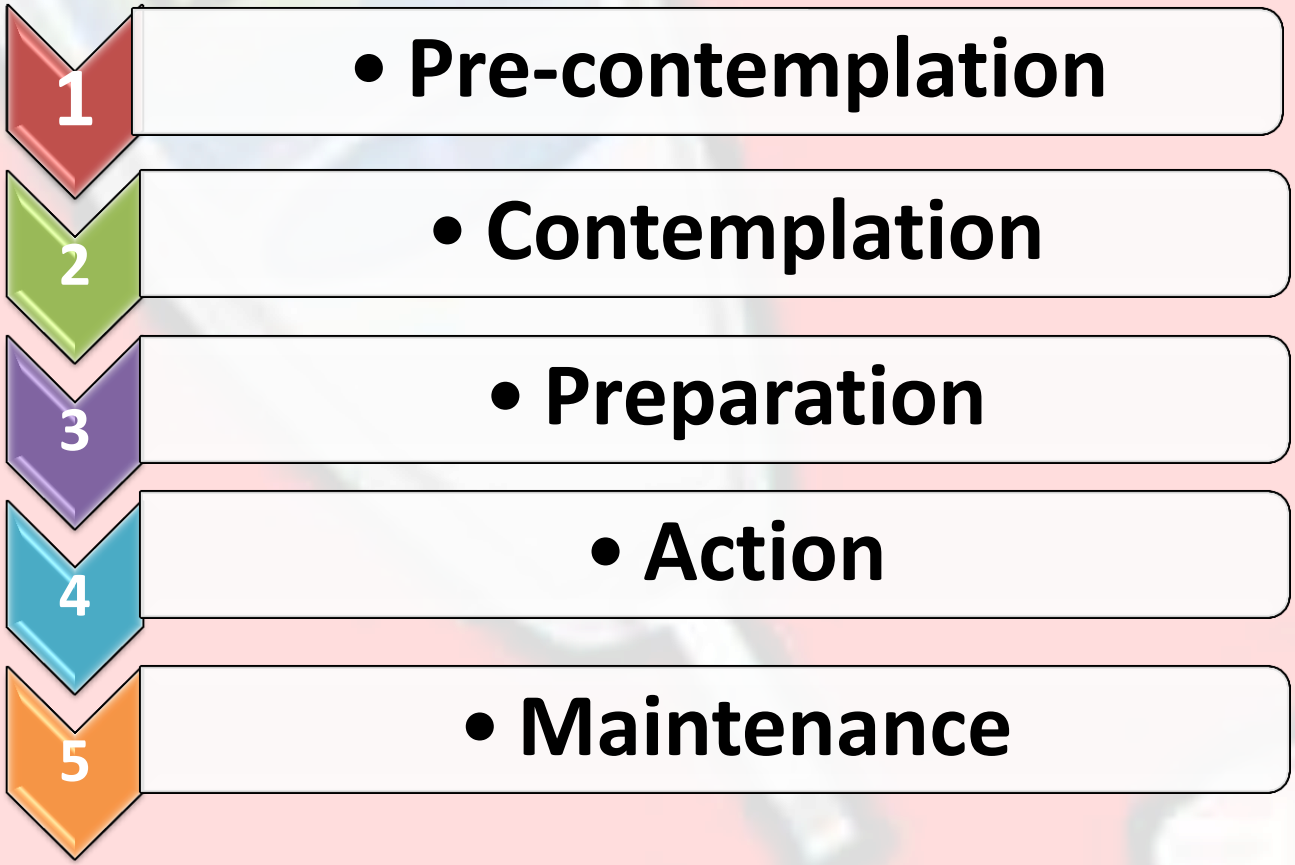
- Prescription same as healthy subjects if no other co-morbidities
- May need to modify based on body size and equipment
- More focus of Lower limbs strengthening in order to sustain longer duration of aerobic training



Behavioral Weight Loss Recommendations

- Aim at reducing energy intake and increasing energy expenditure
- Changing of eating and exercise habits
- Prevent sedentary lifestyle
- Behavioral modification strategies to facilitate adoption and maintenance of desired changes in behavior
- Realistic goal
  - Target to lose 5-10% of initial body weight over 3-6 months

Stage of change theory



- *Maintenance stage – long term effect more obvious

Stage of change theory

- Early Stage (Stage 1-3)
  - Cognitive processes to improve motivation
    - Warning of risks
    - Increasing knowledge (e.g. exercise pamphlets)
    - Comprehending benefits
- Later stage (Stage 4-5)
  - Behavioral processes
    - Substituting alternatives
    - Rewarding
    - Reminding (e.g. exercise log book)

Exercise log book

慢性疾病病人家居運動指引





九龍西聯網家庭及基層醫療部　物理治療

2016 年 4 月修訂版

個人運動記錄

日期 /血壓	辛苦程度	運動種類			

Exercise pamphlets



CASE DISCUSSIONS



Case 1

- Age 62
- Sex M
- DM Dx in 2008, controlled by lifestyle modification
- Started metformin 250mg in 2014 – self off medication due to ? Side effect
- 01/16 HbA1c 7.0
- BW 96.8 / BMI 38.8

- Refer PT for Weight reduction
- FU KWH Ortho / YCH TJR centre; pending TKR in Sep 2016
- Known Cervical Spondylotic myelopathy – C3/4, C4/5 PID with stenosis, cord signal change at C4/5 to C5, also PID at C5/6 & C6/7
- Walk with stick

Case discussion - 1

- What can / should we do?
  - Physical capacity limited by multiple joint problems
  - Realistic goal: maintenance / maximize physical condition instead of weight reduction
  - Safety precaution for exercise: avoid high impact sports / heavy lifting / closely monitor joint signs
  - Plan – stepping ex in sitting / leisure walk with intermittent rests

Case 2

- Age 66
- DM since 2010; on insulin since 06/15; metformin 1000mg bd
- 10/15 HbA1c 6.8%
- LDL 1.9
- Urine OK
- No known HT; pending ABPM
- Dietitian consulted in 2011 -> refused

- Refer PT for DM / weight management
- BMI 26.9 BW75
- SHx retired
- Mild knee pain; not affecting ADL
- Occ limbs mob ex only
- Occ episodes of hypoglycemia, claimed not related to physical exertion

Case 2

- What can / should we do?
  - Exercise precaution – on insulin, risk of exercise induced hypoglycemia; monitor other complications
  - SOC ? Contemplation
  - Goal: establish habit of regular aerobic / resistance training for weight management and DM control
  - Plan: moderate intensity aerobic ex e.g brisk walk in park; home base resistance training ex

Conclusion

- As a health care professionals, we should…
  - Recognize benefits of regular physical activities
  - Promote active lifestyle (Part 2)
  - Understand potential risks and prevent exercise related injuries

Role of health care professionals

- Points to note
  - Needs for Health and fitness screenings / Exercise testing
  - Contraindications to exercise
  - Concern of musculoskeletal, cardiovascular and metabolic conditions
  - Influence of environmental factors on physical performance
  - Skills of Behavior modifications for long term effects


Q & A ?

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Thank You