Physiotherapy ‘SmartMove Programme’ – A Revolutionary Intervention for Elderly with Early Cognitive Impairment in Hospital Authority

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Content

• Scientific Background - Exercise and Cognition
• Physiotherapy ‘Smart Move Programme’
• Result and Limitation
• Conclusion
Scientific Background of SmartMove Exercise Program for patients with cognitive impairment
Facing Challenges –
Increase in dementia population

↑ in the no. of dementia sufferers in HK

70,000 (2011)

280,000 (2036)

↑ Socioeconomic / health care burden
Maintenance and reversibility of early cognitive impairment

- Researches are exploring factors/predictors for cognitive decline and to provide early intervention in maintaining cognitive function of MCI, or even reversion to normal.

Clinical dementia

Patients with Early cognitive impairment

Therapeutic window for intervention

Sustained MCI or Reverse to normal
Associated side-effects from pharmacological intervention in cognitive impairment

- Headache
- Fatigue
- Dizziness
- Constipation
- Diarrhoea
- Nausea
- Fall

Effectiveness

Pharmacological treatments not yet clearly found to be effective on patient with early cognitive impairment

(Curr Alzheimer Res, 2009)
Revolutionary findings suggested that Exercise intervention not just treating the symptoms but also reverse the disease progression.

- **Sig. ↑ hippocampal volume (2%) and improved cognitive outcome measures** after 1 year of aerobic ex. in elderly (Erickson 2011)

- **↑ cortical volume and neural connectivity** in 6 months aerobic ex. (Cocombe 2006; Ruscheweyh 2009)

Strong Evidence with Meta-analysis and RCTs showed exercise intervention helps to sustain and improve cognitive function of patients with MCI or Dementia.
## Effects mechanism – Direct Pathway

<table>
<thead>
<tr>
<th>Mechanism</th>
<th>Effects of Exercise</th>
<th>Results</th>
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</thead>
</table>
• ↑ Small vessel grows  
• ↑ Blood volume | • Brings O2, glucose, nutrients to brain cells, vital for cell health  
• Cell growth: supports new connections  
• Blood washes away metabolic wastes e.g amyloid beta protein |
| **2. Neuroplasticity**                        | • ↑ Production and secretion of BDNF (Brain-derived neurotrophic factor) and other growth factors  
• ↑ Cortical connectivity and activation (Colcombe, 2004, Voss, 2010) | • Easier grow of new neural connections and nerve cells bind more easily and stronger.  
• ↑ neurotransmitter activity and producing Brain Growth Factors |
| **3. Selective ↑ brain cell grow in Hippocampus** | • ↑ Gray matter volume | • Sig. larger hippocampal volume (Erickson 2011) and cortical volume which helps in memory function(Cocombe 2006; Ruscheweyh 2009) |
Effects mechanism - Indirect pathway

<table>
<thead>
<tr>
<th>Proposed Mechanism</th>
<th>Effects of Exercise</th>
<th>Results</th>
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</table>
| **1. Improved Mood improves Cognition** (Lindgren, 2011) | • **↓** Stress Hormones (e.g. cortisol)  
• **↑** BDNF (Brain-derived Neurotrophic Factors) | • Fertilization of brain’s neuron for better nerve connection and development |
| 2. **↓** Cardiovascular risk factors for developing dementia | • E.g. Stroke / Type 2 DM / Obesity / Cardiac diseases / Hypertension |                                                                         |

What kinds of exercise are good for the brain?
### Studies on Multicomponent Ex.

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<tbody>
<tr>
<td></td>
<td>25 aMCI (mean age: 75)</td>
<td>24 aMCI (mean age: 75)</td>
<td>33 aMCI (mean age: 70)</td>
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#### Training Program

<table>
<thead>
<tr>
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<tbody>
<tr>
<td>Aerobic ex.</td>
<td></td>
<td></td>
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<tr>
<td>Warm-up</td>
<td></td>
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<tr>
<td>Muscle strength ex.</td>
<td><strong>Bold</strong></td>
<td><strong>Bold</strong></td>
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<tr>
<td>Postural balance retraining</td>
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<tr>
<td>Dual-task training</td>
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<tr>
<td>Aerobic exercise</td>
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<tr>
<td>Endurance walking</td>
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<tr>
<td>Muscle strength training</td>
<td><strong>Bold</strong></td>
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<td>Postural balance retraining</td>
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<tr>
<td>Dual-task walking</td>
<td><strong>Bold</strong></td>
<td><strong>Bold</strong></td>
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#### Dosage

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<tr>
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<tbody>
<tr>
<td>12 months, 2 d/wk, 90min</td>
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<tr>
<td>6 months, 2 d/wk, 90min</td>
<td></td>
<td></td>
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<tr>
<td>45 to 60 min/d, 4 d/wk for 6 months</td>
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</table>

#### Results

<table>
<thead>
<tr>
<th>Results</th>
<th>Suzuki et al, 2012</th>
<th>Doi et al, 2013</th>
<th>Baker et al. 2010</th>
</tr>
</thead>
<tbody>
<tr>
<td>Improvements of cognitive function were superior at treatment end (MMSE: p=0.04; logical memory of immediate recall: p=0.03)</td>
<td></td>
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<tr>
<td>Both groups had improved Stroop test result (p=0.02)</td>
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<tr>
<td>Sig. effect on gait speed &amp; stride length in simple task (p=0.037 &amp; 0.011)</td>
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</table>

### Conclusion:
Multicomponent ex. program has positive effects in patients with early cognitive impairment.
Exercise Protocol

Aerobic Exercise

Cognitive Ex. (Brain Gym/Dual Task)

Sedentary Activities

Daily Physical Activities
Physiotherapy ‘Smart Move Program’
- Exercise Class Pioneered for patients with cognitive impairment
This programme is unique in focusing:

• (1) Multi-component exercise
  (Aerobic ex./ Cognitive-targeted ex./ Dual task ex.)

• (2) Lifestyle modification

• (3) Patient and carer empowerment
Core components in SmartMove exercise programme

- Aerobic Exercise
- Daily Physical Activity
- Cognitive Targeted Exercise

Daily Physical Activity

Core components in SmartMove exercise programme
Aerobic Exercise
Cognitive Targeted Exercise
Daily Physical Activity
SMP service collaboration with community partners – exercise continuity

Patients who completed 8 weeks SmartMove programme

Continuation with cognitive exercise programme in Cheng Tak Yim Day Rehabilitation & Care Centre
觀塘香港復康會- 藍田綜合中心
Physiotherapy SMP Study

Aim and objective

- To investigate the effectiveness of “SmartMove” exercise programme on patients with early cognitive impairment.

Hypothesis

1. Multicomponent exercise program is effective in improving the cognitive function, mood, and quality of life of elders with MCI

2. Home based exercise program can be performed on MCI elders with the support from their carers
Physiotherapy Smart Move Programme Study

Cognitive/Memory Clinic in UCH/YFS

Patients diagnosed with MCI

Screening done by physiotherapist for individual risk factor identification

Patient fulfilled inclusion criteria to study group

Intervention group (n=26)
Physiotherapy SMP (8 Weeks self empowerment Programme)

Control Group (n=17)
Patient on waitlist for SMP

Re-Ax (8 weeks)

Re-Ax (8 weeks)

Home programme

(pending)

Re-Ax 16 weeks
Inclusion Criteria

• Community dwelling elders, ≥ 60 years old, attending UCH cognitive clinic

• All patient participants were examined by well-experienced geriatrician

- A standard assessment battery, which included an interview with patients and informants, general and neurological examinations, mental state examination, laboratory tests (complete blood count, liver and renal function tests, thyroid function tests, serum vitamin B12 and folate level, and syphilis serology) and brain imaging (MRI or CT).

- Diagnoses of MCI were made according to Peterson’s criteria for MCI (Petersen, 2004) and core clinical criteria for the diagnosis of MCI of The National Institute on Aging and the Alzheimer’s Association (Albert et al., 2011)

- Each patient was staged functionally by the Global Deterioration Scale (GDS), the GDS should be <4

• Walk unaided or with stick

• Good family support with a least one carer able to accompany

Exclusion Criteria

• Unstable physical condition, admission for major medical or (e.g. stroke, acute ischemic cardiac events) surgical conditions within 3 months, active musculoskeletal disease that restricted the ability to perform physical exercise

• Active depression or other mental illness that require medication

• Currently on medications for dementia
Method

• All subjects diagnosed with mild cognitive impairment (MCI)

(1) Intervention group:
   26 patients (age: 57-87, mean 76.4, SD=7.01)

(2) Control group:
   17 patients (age: 57-85, mean 74.8, SD=7.50) on waitlist for SMP

• Data collection from September to February 2014

• Data collected from the two groups was analyzed by SPSS with Mann-Whitney U Test.
Outcome assessment

• **Primary outcome**—cognitive function
  – C-ACER (Cantonese version)
  – Stroop color word test
  – Dual task gait speed (Normal, naming, calculation)
  – Physical activity-- International physical activity questionnaire (IPAQ) (short, self administered format)

• **Secondary outcome**
  – Mood—depression, anxiety and irritability subset of neuropsychiatric inventory (home version)
  – Carer stress-- The Chinese Version of the Zarit Burden Interview
Result – Significant increase in IPAQ score

C-ACER

ZBI - Carer burden

IPAQ

Test Statistics

<table>
<thead>
<tr>
<th>Test Statistics</th>
<th>ACER_Difference</th>
<th>ZBI_difference</th>
<th>IPAQ_difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mann-Whitney U</td>
<td>136.500</td>
<td>132.500</td>
<td>107.000</td>
</tr>
<tr>
<td>Wilcoxon W</td>
<td>307.500</td>
<td>285.500</td>
<td>227.000</td>
</tr>
<tr>
<td>Z</td>
<td>-.546</td>
<td>-.126</td>
<td>-.2.507</td>
</tr>
<tr>
<td>Asymp. Siq. (2-tailed)</td>
<td>.585</td>
<td>.899</td>
<td>.012</td>
</tr>
<tr>
<td>Exact Siq. [2*(1-tailed Siq.)]</td>
<td>.590a</td>
<td>.901b</td>
<td></td>
</tr>
</tbody>
</table>

a. Not corrected for ties.
b. Grouping Variable: Grouping

No sig. change

Sig. increase in daily physical activities

*C-ACER - The Addenbrooke's Cognitive Examination Revised (Cantonese version)
ZBI - Zarit Burden Interview for Chinese Canadian caregivers
IPAQ - The International Physical Activity Questionnaire –short form
Result - Significant decrease in dual task gait time

**No task**

- Mann-Whitney U: 66.000
- Wilcoxon W: 144.000
- Z: -2.921
- Asymp. Sig. (2-tailed): .003
- Exact Sig. [2*(1-tailed Sig.)]: .003

**Naming**

- Mann-Whitney U: 63.000
- Wilcoxon W: 108.000
- Z: -2.137
- Asymp. Sig. (2-tailed): .033
- Exact Sig. [2*(1-tailed Sig.)]: .032

**Calculation**

- Mann-Whitney U: 73.000
- Wilcoxon W: 151.000
- Z: -2.708
- Asymp. Sig. (2-tailed): .007
- Exact Sig. [2*(1-tailed Sig.)]: .006

### Test Statistics

- Walking time difference_No task
- Walking time difference_Naming
- Walking time difference_Calculation

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*Note: Grouping Variable: Grouping.*

*a. Not corrected for ties.*

*b. Grouping Variable: Grouping*
Result – Significant improvement in Stroop color-word Test

**Test Statistics**

<table>
<thead>
<tr>
<th></th>
<th>Stroop_TEST_Difference_Test1</th>
<th>Stroop_TEST_Difference_Test2</th>
<th>Stroop_TEST_Difference_Test3</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mann-Whitney U</td>
<td>114.000</td>
<td>91.000</td>
<td>98.000</td>
</tr>
<tr>
<td>Wilcoxon W</td>
<td>285.000</td>
<td>262.000</td>
<td>269.000</td>
</tr>
<tr>
<td>Z</td>
<td>-2.864</td>
<td>-3.413</td>
<td>-3.246</td>
</tr>
<tr>
<td>Asymp. Sig. (2-tailed)</td>
<td>.004</td>
<td>.001</td>
<td>.001</td>
</tr>
</tbody>
</table>

*a. Grouping Variable: Grouping*
In summary

- Client was able to adhere to exercise and active lifestyles through the programme.

- A sig. improvement was found in dual task gait speed of naming and calculation (p<0.05),

- A sig. improvement executive function via computerized stroop color-word test (p<0.05)

- A sig. increase in client’s health related physical activity via IPAQ (p<0.05).

- No sig. change was found in cognitive assessment from C-ACER and Carer burden from ZBI after eight weeks training.
Limitation

• Short duration (8 weeks) to detect a significant cognitive change and reduction in carer burden

  - Further data collection is pending after completion of exercise class (post exercise class 3-6 months)
In conclusion

Physiotherapy SmartMove programme

- Low Cost
- High Efficacy
- High Knowledge
- Simple Intervention
SmartMove - SMARTER Patients!
Let’s Get started and move!
Acknowledgement

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Physiotherapist II, Haven of Hope Hospital
Ms. Ho Kit Ming
Physiotherapist II, United Christian Hospital
References


Suzuki T.; Shimada H, Makizako H., Doi, T, Yoshida, D. (2013) A Randomized Controlled Trial of Multicomponent Exercise in Older Adults with Mild Cognitive Impairment PLOS One, 8(4)e61483