Neuromuscular Exercise (NEMEX) - Key To Success In The Non-surgical Management Of Knee Osteoarthritis (KOA)

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Knee OA is the most common site for OA and affects 3.8% of the global population (Paula Rmss et. al 2012)

Systematic review:

On Patient

• Reduced activity and function
• Higher risk of comorbidities
• Increased mortality
• Higher health care use (L Murphy et. al 2012)

On Government

High financial burden in Hong Kong (U Woo et. al 2002)
Exercise in Knee OA
Evidence Based Practice

✓ Therapeutic exercise is effective
  ↓ Pain
  ↑ Physical functioning
  ↑ Health-related Quality Of Life

✓ Exercise is recommended as the First Line Of Choice in clinical guidelines for the management of Knee OA

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Exercise in Knee OA
Evidence Based Practice

• Various types of exercises, how to choose?

  • Conventional non-surgical management of knee OA stresses on improving knee muscle strength, range of motion and aerobic function (Pranita D G 2017, Clausen B 2017)

  • Recent studies show that Neuromuscular training is the key to enhance knee control and functional limitations in patients with OA (Ageberg E 2014, Clausen B 2017)
Why OA patients have poor functions

Patient has poor knee function because:

Sensorimotor deficiency

1. Reduced muscle strength (Difficult to climb up stairs, get up from squat…)
2. Altered muscle activation patterns (Crepitus, downstairs difficulties…)
3. Propriocetive deficiency (Poor walking gait…)
4. Impaired postural control (FFD, stress on joints) (Ageberg E 2014)
5. Fear avoidance (Bad experience vs good day ?)
6. Do not know proper control (No one taught them before)
7. Wrong belief (Should not do vs could not do)
8. Bad habit (Trick movement)
What is Neuromuscular exercise (NEMEX)?

The essential elements of neuromuscular exercise training:

- Emphasis on quality of movement with proper alignment
- Achieve dynamic stabilization
- Knee joint control with normal biomechanics
- Muscle activation and postural control to perform functional activities
With proper control of knee (timing and alignment), we have better confidence for our patients to try:

In daily activities
- Adapt stairs climbing with different strategies
- Kneel properly (to different degrees)
- Squat properly (to different degrees)
- Jog/jump properly (to different degrees)

To keep physical active in long run
- Adapt a proper (safe and effective) functional pattern
- To slow down degeneration
Correct (A) functional alignment ‘Knee over foot position’, and incorrect (B) functional alignment ‘Knee medial to foot position’ (Ageberg E 2014).

Exercises with an increasing level of difficulty (from A to C).
In all exercises, patients are encouraged to maintain a knee-over-foot position and to perform each exercise with good quality.
Overseas experiences

In September 2015:
• Team visit to Sweden “Better management of Osteoarthritis” (BOA)

In April 2016:
• Invited Professor Roos of “Good Life with Osteoarthritis in Denmark” (GLA:D) to give lecture in Hong Kong
  ➔ Stress on neuromuscular training and patient satisfaction rate 95%

In December 2015: we started our Comprehensive Osteoarthritis Management (Come) Programme
Comprehensive Osteoarthritis Management (COME) Programme

Prospective Intervention Programme

Inclusion Criteria
- Early–mid radiological stages of OA knee (Kellegren Lawrence grade I to III)
- Referred from orthopaedic specialist out–patient clinic
- Able to walk with stick or unaided for 15 minutes

Exclusion Criteria
- Severe knee deformities
- Late radiological stage (Kellegren Lawrence grade IV)
- Unstable medical conditions
Our programme in MMRC

Assessment
(OA knee patient referred by QMH doctor) – Individual visit PT

Comprehensive Osteoarthritis Management Programme

<table>
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<tr>
<th>Educational Talk</th>
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<tr>
<td>What is OA?</td>
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<td>Risk factors</td>
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<td>Symptoms</td>
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<td>Treatment</td>
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<tr>
<td>Importance of exercise</td>
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<td>Physical activity in daily living</td>
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<td>Coping techniques</td>
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<td>Self management</td>
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<td>OA communicator</td>
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<td>To live with OA</td>
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</tbody>
</table>

Group exercise (6 weeks)
Supervised exercise using individualised programme

3 month FU
Individual PT visit

1 year FU
Telephone

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Our programme in MMRC

- 12 sessions of exercise programme, supervised by physiotherapist
- 1.5 hour each, 2 sessions per week x 6 weeks
- 6 – 8 patients each class
- Contents are individually designed to meet patient’s need
## Our programme—content

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<th>Contents / Session</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
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<th>9</th>
<th>10</th>
<th>11</th>
<th>12</th>
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</thead>
<tbody>
<tr>
<td><strong>Function</strong></td>
<td>Floor</td>
<td>Kneel</td>
<td>Stairs</td>
<td>Sit to stand (diff height)</td>
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<td><strong>Stretching</strong></td>
<td>Gp</td>
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<td><strong>Strengthening</strong></td>
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<tr>
<td><strong>Neuromuscular</strong></td>
<td>Posture</td>
<td>Dynamic</td>
<td>Multi-dimensional</td>
<td>Different height</td>
<td>Different speed</td>
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<td><strong>Cardiopulmonary</strong></td>
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<td>Fast walking</td>
<td>Aerobic dance</td>
<td>Equipment</td>
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<tr>
<td>Knowledge Sharing</td>
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<td>Knowledge and experience</td>
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Examples of Neuromuscular exercise (NEMEX)

• With proper (NEMEX) training, patient can and willing to try: squat, kneel, jump, manage stairs, carry heavy objects and jogging.

Jumping

Kneeling

Squatting

Jogging

Carry 20 lbs and walk

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Our programme in MMRC

Outcome measures:

**Objective Measures**
1. One Minute Chair Rise Test
2. Quadriceps Strength
3. Stairs Climbing

**Self Reported Measures**
1. Pain of knee
2. Self efficacy for exercise (SEE)
3. Weekly training time
4. Patient specific functional score
5. Health VAS assessment
Results

• Come programme commenced in January 2016
• In February 2019, 100 patient had completed a 3 month & 1 year evaluation
• 100 Patients Recruited, male: female 30:70
• Age: male $65.3 \pm 7.7$, female $64.4 \pm 7.4$ years old
• Prospective intervention study
• Results analysed with IBM SPSS 23, paired sample t-test, the level of significance was set at $p<0.05$. 
Results: Objective Measures

One minute chair rise test for COME patient

<table>
<thead>
<tr>
<th></th>
<th>Repetitions</th>
</tr>
</thead>
<tbody>
<tr>
<td>adm</td>
<td>30.2</td>
</tr>
<tr>
<td>six weeks</td>
<td>40.5</td>
</tr>
<tr>
<td>3 months</td>
<td>43.3</td>
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Assessment interval p < 0.05

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3 Months Results
Results: Objective Measures

3 Months Results

Quadriceps strength of COME patient

<table>
<thead>
<tr>
<th></th>
<th>Right</th>
<th>Left</th>
</tr>
</thead>
<tbody>
<tr>
<td>Admission</td>
<td>30.8</td>
<td>30.1</td>
</tr>
<tr>
<td>Six weeks</td>
<td>35.2</td>
<td>33.1</td>
</tr>
<tr>
<td>3 months</td>
<td>37.2</td>
<td>36.9</td>
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</tbody>
</table>

Assessment interval p < 0.05
Results: Objective Measures

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3 Months Results
Results: Pain Of Knee

Pain over knee

<table>
<thead>
<tr>
<th>Assessment Interval</th>
<th>Numeric Pain Rating Scale (Scores)</th>
</tr>
</thead>
<tbody>
<tr>
<td>adm</td>
<td>4.2</td>
</tr>
<tr>
<td>six weeks</td>
<td>2.9</td>
</tr>
<tr>
<td>3 months</td>
<td>3</td>
</tr>
<tr>
<td>1 year</td>
<td>3.2</td>
</tr>
</tbody>
</table>

Assessment interval p<0.05

3 Months Results
Results: Specific Function

Patient specific function score of COME patient

<table>
<thead>
<tr>
<th>Time</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>adm</td>
<td>3.11</td>
</tr>
<tr>
<td>six weeks</td>
<td>6.6</td>
</tr>
<tr>
<td>3 months</td>
<td>7.0</td>
</tr>
<tr>
<td>1 year</td>
<td>6.9</td>
</tr>
</tbody>
</table>

Assessment interval p < 0.05

1-year Results
Results: Self Efficacy of Exercise
(Willing to do ex oneself)

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Self efficacy of exercise of COME patient

1–year Results
Results: Training time per week

Time spent on training per week of COME patient

<table>
<thead>
<tr>
<th>Time (minutes)</th>
<th>adm</th>
<th>six weeks</th>
<th>3 months</th>
<th>1 year</th>
</tr>
</thead>
<tbody>
<tr>
<td>62.7</td>
<td>74.4</td>
<td>82.8</td>
<td>106.2</td>
<td></td>
</tr>
</tbody>
</table>

Assessment interval p < 0.05

1-year Results
Results: Health

Health of COME patient

<table>
<thead>
<tr>
<th>Time</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>adm</td>
<td>64.6</td>
</tr>
<tr>
<td>six weeks</td>
<td>70.4</td>
</tr>
<tr>
<td>3 months</td>
<td>72.2</td>
</tr>
<tr>
<td>1 year</td>
<td>74</td>
</tr>
</tbody>
</table>

Assessment interval p < 0.05

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1-year Results
Conclusion

Patients in COME programme had improvement in:

- Pain
- Physical function
- Time spent in training

✓ For short and long-term results compared to baseline
Sincere thanks to:

Mr. Raymond Tsang (MMRC physiotherapy DM)
Dr. Lewis Chan (Team leader of COME program)
Dr. CH Yan and Professor Peter Chiu (QMH)

Those patients participated in COME for their trust toward us and their hard work
Discussion

• Our knee OA programme is feasible & effective
• The NEMEX training as a component of programme seems beneficial for control improvement and daily functions with no adverse effects observed
• If funding available, a RCT with control group would give a definitive conclusion on intervention efficacy


• Mcalindon TE, Bannuru RR, Sullivan MC, Arden NK, Berenbaum F, Bierma–zeinstra SM. OARSI Guidelines for the non-surgical management of knee


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Thank You

Q&A

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