Adapting physical activity and exercise to comorbid conditions

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Exercise therapy

- Effective in a wide range of diseases
Number of chronic disorders by age-group

Barnett et al., Lancet, 2012
Comorbidity and exercise therapy

- Patients with comorbidity excluded from trials
  - Comorbid diabetes: patients excluded due to concerns related to hypoglycemia

- Comorbidity
  - Therapists reduce the intensity of exercise therapy to an ineffective level
  - Patients exercise at a low level of intensity

Holden et al, Arthritis Rheum, 2009
Holden et al, Arthritis Care Res, 2012
Comorbidity and exercise therapy

- Current guidelines
  - Exercise therapy in the index disease
    - Osteoarthritis or diabetes as index disease

- No proper guidance on adaptations required because of the presence of comorbidity
  - Osteoarthritis and diabetes as comorbid disease
Strategy

- Strategy for the development of comorbidity-related adaptations to exercise therapy in index disease
Overview of my presentation

- Strategy
- Application to exercise therapy in osteoarthritis and comorbid disease
- Randomized clinical trial
- Broadening the scope
Index disease

Step 1. Inventory of comorbid diseases

Step 2. Inventory of restrictions and contraindications

Step 3. Inventory of potential adaptations to exercise therapy

Step 4. Synthesis
- Starting point is regular exercise therapy for the index disease
- Adaptations to diagnostic phase, intervention phase, and evaluation phase
- Emphasis on clinical reasoning
Osteoarthritis

- High prevalence of comorbidity
  - Estimates range from 68% to 85%
  - Coronary artery disease, heart failure, hypertension
  - Diabetes, obesity
  - COPD
  - Depression
  - Chronic pain
Index disease

**Knee osteoarthritis (OA)**

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Synthesis

- Regular exercise therapy in knee OA
  - Adaptations to
    - Diagnostic phase
    - Intervention phase
    - Evaluation phase

- Source of adaptations
  - Guidelines on regular exercise therapy in each comorbid disease (e.g. COPD)
  - General guidelines on exercise (e.g. American College of Sports Medicine)
  - General medical guidelines
  - Expert opinion

- Emphasis on clinical reasoning
Clinical reasoning

- Anamnestic interview
  - *e.g.* Neuropathy, cardiac problems? Contraindication for physical examination? Need to consult physician?

- Physical examination
  - *e.g.* Blood pressure? Lesions of the foot?

- Treatment plan
  - *e.g.* Risk of hypoglycemia, loss of protective sensation in feet

- Monitoring treatment
  - *e.g.* Monitoring blood glucose level, feet inspection
RCT

- **P:** Patients with knee OA and comorbidity (cardiac disease, diabetes, COPD, obesity)

- **I:** Comorbidity–adapted exercise protocol

- **C:** In comparison to control group (usual care, waiting list)

- **O:** Efficacy and safety
Method

- Primary outcome
  - WOMAC Physical Functioning
  - 6 Minute Walk Test

- Secondary outcomes
  - Adverse events
  - Pain
  - .......

- Measurements

<table>
<thead>
<tr>
<th>Wk 0</th>
<th>Wk 10</th>
<th>Wk 20</th>
<th>Follow up 3 months</th>
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<tbody>
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Table 1. Patient characteristics

<table>
<thead>
<tr>
<th></th>
<th>Exp. group n=63 Mean ± sd</th>
<th>Con. group n=63 Mean ± sd</th>
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</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>63.2 ± 8.4</td>
<td>63.9 ± 12.4</td>
</tr>
<tr>
<td>BMI</td>
<td>36.0 ± 6.8</td>
<td>35.0 ± 7.6</td>
</tr>
<tr>
<td>Total number of comorbidities (CIRS score ≥2) range 0-12</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>31 (49.2)</td>
<td>24 (38.1)</td>
</tr>
<tr>
<td>2</td>
<td>17 (27.6)</td>
<td>21 (33.3)</td>
</tr>
<tr>
<td>≥3</td>
<td>15 (23.8)</td>
<td>18 (28.9)</td>
</tr>
<tr>
<td>Comorbidities of inclusion</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cardiac diseases</td>
<td>24 (38)</td>
<td>21 (33)</td>
</tr>
<tr>
<td>Diabetes type 2</td>
<td>10 (15)</td>
<td>9 (14)</td>
</tr>
<tr>
<td>COPD</td>
<td>20 (31)</td>
<td>19 (30)</td>
</tr>
<tr>
<td>Obesity</td>
<td>41 (65)</td>
<td>36 (57)</td>
</tr>
<tr>
<td>Six minute walking test (meters)</td>
<td>406.3 ± 107.6</td>
<td>406.4 ± 116.9</td>
</tr>
<tr>
<td>WOMAC physical functioning (0-68)</td>
<td>35.1 ± 11.9</td>
<td>31.0 ± 12.3</td>
</tr>
<tr>
<td>NRS knee pain severity (0-10)</td>
<td>6.4 ± 1.8</td>
<td>5.9 ± 2.1</td>
</tr>
</tbody>
</table>
Figure 2. WOMAC physical functioning (PF) and Six Minute Walk Test outcome at week 10 (T1 mid-treatment), week 20 (T2 directly post-treatment), and week 32 (T3 3 months post-treatment)
Secondary outcomes

- No adverse events

- Beneficial effects
  - Pain
  - Get Up and Go test
  - Stairclimbing test, up and down
  - Physical Component Summary score of SF36
  - Fatigue
  - Upper leg muscle strength
  - Physical activity
  - Frailty index
  - Patient Specific Symptoms
Table 2. Comorbidity-related adaptations to the exercise program

<table>
<thead>
<tr>
<th>General comorbidity-related adaptations</th>
<th>100%</th>
</tr>
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<tbody>
<tr>
<td>• extended intake procedure: identification of comorbidity related contraindication and restrictions for exercise therapy by history taken and physical examination</td>
<td></td>
</tr>
<tr>
<td>• extended training program of 20 weeks</td>
<td></td>
</tr>
<tr>
<td>• during and after every training session therapists monitored symptoms and clinical parameters related to comorbidity and adapted the exercise program when required</td>
<td></td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Exercise program: adaptations of FITT factors</th>
<th>76%</th>
</tr>
</thead>
<tbody>
<tr>
<td>• frequency (number of repetition per exercise set)</td>
<td>15%</td>
</tr>
<tr>
<td>• intensity of exercises (exercise load)</td>
<td>76%</td>
</tr>
<tr>
<td>• time (duration of exercise session)</td>
<td>17%</td>
</tr>
<tr>
<td>• type of exercises</td>
<td>52%</td>
</tr>
</tbody>
</table>

FITT factors: Frequency, Intensity, Time, Type
Table 2. Comorbidity-related adaptations to the exercise program – *cont’d*

<table>
<thead>
<tr>
<th>Additions to exercise program</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>• coaching on body weight reduction</td>
<td>76%</td>
</tr>
<tr>
<td>• coaching on fear of exertion</td>
<td>20%</td>
</tr>
<tr>
<td>• education related to the comorbid disease and exercise</td>
<td>69%</td>
</tr>
</tbody>
</table>

Other adaptations

- consulting a medical specialist or GP about the comorbid disease (e.g. medication or high blood pressure or trainability of the patient) 24%
- monitoring blood glucose levels before and after the training and in the evening in patients with diabetes 7.4%
- postponement of the training session (e.g. high blood pressure, pain on the chest, dyspnea) 17%
- referred to a dietician 13%
Conclusion of RCT

- Tailored exercise therapy for patients with knee OA and comorbidity
  - Effective in improving physical functioning and pain
  - Safe

- Clinicians
  - Consider exercise therapy as a treatment option in knee OA, also in the presence of comorbidity
Broadening the scope

- Systematic review
  - Strategies for the development of comorbidity-related adaptations to exercise therapy in an index disease
    - Dekker et al, Disability and Rehabilitation, 2016

- Three studies
  - COPD + comorbid diseases
  - HIV + comorbid diseases
  - OA + comorbid diseases
    - Camp et al, Can Resp J, 2013
    - O’Brien et al, BMJ Open, 2014
    - de Rooij et al, Clin Interv Aging, 2014
Broadening the scope

- Very similar approaches
  - Inventory of comorbidities
  - Inventory of comorbidity–related restrictions and contraindications for exercise (de Rooij et al only)
  - Inventory of potential adaptations
    - Derived from guidelines on specific comorbidities
  - Synthesis
    - Expert knowledge and advice
    - Various approaches to elicit this advise
Conclusion

- Strategy for the development of comorbidity-related adaptations to physical activity and exercise therapy in index disease

- In line with approach of two other groups

- Resulting in effective and safe exercise for patients with knee OA and comorbidity
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