The difference in biomechanics and physiology between synchronous and asynchronous handcycling in dependence of practice in able-bodied men

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Handcycling for commuting

• More efficient than hand-rim wheelchair
  Dallmeijer 2004; Arnet 2013

• Participation in society

• Stay active and independent
  ICF, WHO 2001
Explore the handcycle settings: Crank mode

• Handcycle mechanics from bicycle technology → asynchronous
• Nowadays, western world → synchronous

• Synchronous is more efficient as asynchronous  
  
  van der Woude 2008; Dallmeijer
Outcomes

Handcycle kinetics

- Distance on treadmill
- Front to Back
- Left to Right
- Energy Expenditure (internal work) Garby 1987
- Ventilation
- Breathing Frequency
- Heart rate

Kinematics and Physiology

Krämer 2009
Pre test 4th min. asynchronous vs. synchronous
Post test 12th min. asynchronous vs. synchronous
## Conclusions

<table>
<thead>
<tr>
<th></th>
<th>Without practice</th>
<th>Practice</th>
<th>After practice</th>
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</thead>
<tbody>
<tr>
<td><strong>Force effectiveness</strong></td>
<td>ASYN &lt; SYN</td>
<td>ASYN ↑ / SYN ↑</td>
<td>ASYN &lt; SYN</td>
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<tr>
<td><strong>Power production</strong></td>
<td>ASYN &lt; SYN</td>
<td>ASYN ↑ / SYN =</td>
<td>ASYN &lt; SYN</td>
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<tr>
<td><strong>Crank rotation velocity</strong></td>
<td>ASYN &gt; SYN</td>
<td>ASYN = / SYN ↑</td>
<td>ASYN &gt; SYN</td>
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<tr>
<td><strong>Movement on treadmill</strong></td>
<td>ASYN &lt; SYN</td>
<td>ASYN = / SYN =</td>
<td>ASYN &lt; SYN</td>
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<tr>
<td><strong>Physiological strain</strong></td>
<td>ASYN &gt; SYN</td>
<td>ASYN ↓ / SYN =</td>
<td>ASYN = SYN</td>
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</tbody>
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Take home message

• For research
  • Improvements with practice > have a practice period before comparing both modes

• For handcycle users
  • Use a synchronous set-up for daily use
  • Speed fluctuations → solutions needed
Thank for your attention

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