Walking Poles: Exploring use for older adults

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Objectives

1. Describe evidence of the cardiovascular benefit of using walking poles (WP) for healthy young and middle age adults.
2. Describe evidence for the potential benefits of using WP for adults with various chronic health conditions.
3. Discuss exclusion and inclusion factors to be considered prior to conducting a trial of WP for the older adult.
4. Adjust WP height appropriately (lab).
5. Demonstrate beginning skill in instruction and use of WP (lab).

Summary of Clinical Points

1. Consider continuum: Mobility ↔ Stability
2. Consider pt/client preference & motivation:
   - Physical activity (WP provide aerobic boost)
   - Balance (WP provide proprioceptive input)
   - Low Back Pain (WP engage dynamic muscles)
3. Gait pattern:
   - 2-point is the standard (all the research)
   - Consider using 4-point (e.g. balance, LBP)
4. Improved posture (compared to other Amb. Aids)

Terminology

1. Nordic Walking (NW) is the standard method
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Japanese style NW

- 2-point gait pattern
- Vertical poles

European style NW

- 2-point gait pattern
- Diagonal poles
- Uses wrist strap & releases grip at end of shoulder extension

(Homma, Jigami, & Sato, 2016)
**Literature Review**

1. Healthy, young adults:
   - Aerobic ([Church](#))
   - Knee: 3D motion analysis (level) ([Jensen](#), [Hansen](#), [Willson](#))
   - EMG core muscles (level, incline) ([Zoffoli](#), [Pellegrini](#))
   - Knee: 3D motion analysis (downhill) ([Schwameder](#))

2. Healthy older adults ([Dalton](#))

3. Chronic diseases:
   - CHF ([Keast](#))
   - COPD ([Barberan-Garcia](#))
   - Peripheral Arterial Disease ([Oakley](#))
   - Parkinson Disease ([Reuter](#))
   - Knee OA, and s/p TKA ([Bechard](#), [Fregley](#))
   - s/p THA ([Homma](#))

**Healthy, young adult – Aerobic** ([Church, 2002](#))

- n=22, av. age 30, moderately fit
- Subjects walked 1 mile at “Fairly Light” intensity, i.e. Borg RPE: 9/20
  - NW
  - Typical walking
- NW increased (compared to regular walking)
  - Oxygen consumption
  - Caloric expenditure
- However, Borg RPE NOT significantly different

**3D Motion Capture**

8 infrared **video cameras**, retroreflective markers ([Vicon®](#))

... synchronized with

3 **force plates** embedded in the floor ([AMTI®](#))
Retroreflective marker placement

3D Motion Capture

3 Force Plates, embedded in floor

Healthy, young adults: Knee Jt. Loading
Do WP ↓ knee Jt. compression, on level ground?

- Jensen (2011): no difference (WP vs. no WP)
- Hansen (2008): no difference (NW vs. no WP)
- Willson (2001):
  - ↓ JRF with WP (vs. no WP)
  - ↓ knee extensor impulse with NW (vs. no WP)

EMG sensors

Ascending inclines

https://www.delsys.com/Attachments_pdf/EMG%20sensors%20web-1-0.pdf

http://cort.ucsf.edu/capabilities

www.escardio.org

nordicwalkingstepbystep.com
Healthy, young adults: Core muscle EMG
(Zoffoli, 2016)
- n=10, males, av. age 30
- 4 Conditions (all done at Fast speed, Preferred speed)
  - Treadmill at 0% grade: WP, typical gait
  - Treadmill at 7% grade: WP, typical gait
- Abdom (RA, EO): WP ↑ EMG activity (vs. no WP)
- Multifidus: WP ↑ EMG at fast speed (vs. no WP)
- Erector Sp. (ES): no difference (WP vs. no WP)
- ↑ Co-activation: Abdom, Multif, ES (% of gait cycle)
  - for fast speed at 0% grade
  - for fast and slow speeds at 7% grade

Healthy, young adults: Core muscles EMG
(Pellegrini, 2015)
- n=9, av. age 36, expert NW instructors
- 4 Conditions (speed was constant)
  - Treadmill 0% grade: NW, typical gait
  - Treadmill 15% grade: NW, typical gait
- Rectus Abd: ↑ EMG on flat, and incline (vs. no WP)
- Erector Sp:
  - ↓ activity for 15% grade with NW
  - ↑ activity for 15% grade w/o WP

Healthy, young adults: Downhill walking
(Schwameder, 1999)
- EMG & 3D motion analysis: descending ramp
- “3-by-1” technique: double pole plant ... 3 steps
- Results:
  - ↓ ground reaction force
  - ↓ TF compression & shear
- Mechanism:
  - Forces applied through WP
  - Forward leaning upper body posture

Healthy Older Adults
(Dalton, 2016)
- n=12, av. age 68
- Prior activity level: 2 vigorous, 7 mod., 3 light
- 2x/wk., 8 weeks NW supervised instruction
- Results of 3D motion analysis:
  - longer stride
  - faster gait
  - ↑ power generation at the hip
  - ↑ power absorption at the knee
Chronic Diseases

CHF (Keast, 2013)
- 42 participants, av. age 62
- RCT Groups: NW or std. Cardiac Rehab (CR)
- 200-400 min exercise/week
- NW Group:
  - greater distance in 6MW (vs. CR)
  - greater self-reported physical activity (vs. CR)
  - fewer depressive symptoms (vs. CR)
  - no difference: VO₂ Max, or body weight

COPD (Barberan-Garcia, 2014)
- n=15, av. age 67
- Each subject tested (6MWT), both conditions: NW, typical walking
- NW increased:
  - VO₂
  - Ventilation (Vₑ)
  - HR
  - but not a higher Dyspnea rating

Peripheral Arterial Disease (Oakley, 2008)
- 20 males, av. age 70, intermittent claudication
- Treadmill (each subject performed both)
  - NW
  - Typical Walking
- NW (compared to regular walking):
  - ↑ distance before pain onset (by 69%)
  - ↑ total walking distance (by 38%)
  - ↑ oxygen consumption, HR
  - No significant increase in Borg RPE

Chronic LBP (Hartvigsen, 2010)
- 126 patients, av age 48
  - pain >3 on 11 point scale
  - had been treated for 4 weeks
- RCT - 3 Groups:
  1. NW: supervised (2x/wk, 8 weeks)
  2. NW: instructed once, then left to perform “as much as they wanted to at home on their own”
  3. Education on active living, maintaining function
- No significant between group difference
- Supervised NW group: significant within group improvement: pain & function (up through 52 wks.)

Parkinson’s Disease (Reuter, 2011)
- 90 PD patients in otherwise good health
- RCT groups: NW, Walking, or Flexibility/Relaxation
- Supervised 3x/wk. for 6 mo.
- Improved postural stability, gait pattern, stride length, stride variability, stride time in NW group compared to other groups
- 100% NW patients were continuing at 6 mo. post, compared to 60% for Walking group (30% of Walking group subsequently took up NW)
- Exercise programs NOT associated with increased risk of falls/injuries
Knee OA (Bechard, 2001)
- n=34, av. age 54, medial compartment OA, Varus.
- 2 Conditions: level walking with WP vs. without
- Results: WP did not decrease knee add. moment, ... does not decrease medial compartment load

s/p THA (Homma, 2016)
- n=9, av. age 63. THA: 6 bilateral, 3 unilateral
- All subjects walked under 3 conditions:
  1. NW “European style” (ES) – poles more diagonal
  2. NW “Japanese style” (JS) – poles more vertical
  3. Typical gait without WP
- Swing phase EMG:
  - Rectus Abd: incr. for ES & JS (vs. no WP)
  - Erector Spin: decr for JS (vs. no WP)
- Stance phase EMG: Glut med: decr for ES & JS

Lab #1

Terminology
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Technique: NW (ES)
- Sizing: elbow at 90d, w/pole tip close to toe
- Walking Technique:
  - Start w/ relaxed arm swing, dragging poles behind
  - Gradually swing arms a little more to the front (this makes the tips start to “plant” more firmly). Grip handles a little more firmly.
  - Axis of motion is from the shoulder (don’t need lots of elbow motion; don’t need to grip tightly)

Clinical Application & Questions
- As an ambulation aid, how do WP fit into the continuum of Mobility ↔ Stability?
- When would it be appropriate/safe to attempt a trial of using WP with a patient? (study criteria)
- Wrist straps: Boost propulsion. Fracture risk?
- Compare posture using a cane vs. WP (shoulder girdle, trunk)
After Lab #1 ...

Your Observations?

MU Research
WP & Balance
• n=20, av. age 74, community dwelling
• Exclusion: use walker or cane; however allowed intermittent cane use (terrain, distance)
• Description:
  – # Diagnoses: 3.5 (0-9)
  – TUG: 10.3 sec (6-15)
  – Gait Speed: 1.1 m/s (0.8-1.7)
  – ABC: 81% (39-99)
  – LEFS: 74.6 (44-99)

MU Research
WP & Balance
• 3 one-hour classes, instruction on using WP
• Survey: Perception of Benefit of using WP
  – “Increase physical activity” = 6
  – “Improve balance” = 11
  – “Decrease pain” = 3
• Correlation: ABC with “Improve Balance” (as the primary perceived benefit)
• Community dwelling older adults not dependent on an ambulation aid, who lack balance confidence, may perceive WP as beneficial to improve balance.
MU Research, case study:
Spondylolisthesis, Chronic LBP

- 65 yof, MVA in 2002: Gr. 1 Spondylolisthesis L4-5
- 3 one-hour classes, instruction on using WP
- Follow up: 1,4,8,10 weeks
- Completed at 10 wks. (retrospectively)
  - Activity Log
  - Lower Extremity Function Scale (LEFS)
- Planning 6 mo. and 12 mo. follow up

Activity Log
(Chronic LBP)

<table>
<thead>
<tr>
<th>Prior to WP Class</th>
<th>WP: April-June</th>
</tr>
</thead>
<tbody>
<tr>
<td>Distance</td>
<td>0.6 miles</td>
</tr>
<tr>
<td>Duration</td>
<td>15 minutes</td>
</tr>
<tr>
<td>Frequency</td>
<td>1-2 / week</td>
</tr>
<tr>
<td>Pain</td>
<td>10/10</td>
</tr>
<tr>
<td>Borg RPE</td>
<td>17/20 “Very Hard”</td>
</tr>
<tr>
<td>LEFS</td>
<td>50/80</td>
</tr>
</tbody>
</table>

* (MDC=9, MCID=9)

Video: Chronic LBP & WP

Lab #2

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Technique: Japanese-style (JS)

- Emphasize Japanese style (poles more vertical, more action in the elbows)
- Poles might be sized 1-2” lower than ES, because they are more vertical than diagonal
- Challenge! Go 10 strides with JS, then 10 strides with ES, switch back. Notice what happens to core muscles.
- Alternative rubber tips for WP:
  - Bootie (boost)
  - Bell bottom (stability)
After Lab #2 …

Your Observations?

MU Study: other observations

Variations of 4-point gait: the increased amount of time that a pole is in ground contact relative to the amount of time that the limb is in swing phase might be a strategy adopted to provide:

1. increased stability for persons with low balance confidence
   (mechanism: greater % of gait cycle receiving proprioceptive input)
2. increased dynamic core muscle facilitation for persons with chronic low back pain
   (mechanism: extended % of gait cycle that UEs are able to bear weight through the WP)

Note: these 4-point gait variations were not instructed, rather some participants adopted them as their preferred gait pattern.

Future research questions

1. For persons with chronic LBP does using WP:
   — Decrease or eliminate pain while walking?
   — Increase (pain free) walking distance?
   — Improve overall function, QOL?

2. For persons with chronic LBP, is there an optimal WP method, i.e. 2-point vs. 4-point?

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References