**Effects of neuromuscular gait modification strategies on indicators of medial knee joint load in people with medial knee osteoarthritis: Systematic review and a meta-analysis**

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**Research question**
- What are the effects of neuromuscular gait modifications on indicators* of medial knee joint load in people with medial knee osteoarthritis?

(*Definitions are in box 1)

Box 1: Medial knee joint load indicators included:
- Knee adduction Moment (KAM) and Knee Flexion Moment (KFM), which were further divided into KAM1, KAM impulse, KAM2, KFM1, KFM2 (Definitions are given below)
  - KAM1: early stance peak KAM, KAM2: late stance peak KAM, KAM impulse: integration of the KAM over stance time, KFM1: early stance peak KFM, KFM2: late stance peak KFM

**Method**
- **Study design:** Systematic review and a Meta-analysis
- **Databases:** Embase, MEDLINE, Cochrane, CINAHL, PubMed
- **Eligibility:** Studies of gait interventions aimed at reducing medial knee joint load for adults with medial knee OA were included. Studies of gait aids or orthoses were excluded.
- **Risk of bias of studies:** Downs and Black scale (Downs and Black, 1998)
- **Data analysis:** Quality-adjusted meta-analysis models
- **Certainty-evidence:** GRADE approach (Schünemann, 2013)

**Results**

<table>
<thead>
<tr>
<th>Walking modification</th>
<th>Outcomes</th>
<th>Overall effects</th>
<th>Dose-response</th>
<th>Evidence certainty (GRADE)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Trunk lean</td>
<td>KAM1 reduction</td>
<td>medium</td>
<td>Yes</td>
<td>LOW</td>
</tr>
<tr>
<td></td>
<td>KAM impulse</td>
<td>small</td>
<td>No</td>
<td>VERY LOW</td>
</tr>
<tr>
<td>Toe-out</td>
<td>KAM2 reduction</td>
<td>small</td>
<td>No</td>
<td>VERY LOW</td>
</tr>
<tr>
<td>Toe-in</td>
<td>KAM1 reduction</td>
<td>medium</td>
<td>No</td>
<td>VERY LOW</td>
</tr>
<tr>
<td></td>
<td>KAM2 increase</td>
<td>small</td>
<td>Yes</td>
<td>LOW</td>
</tr>
</tbody>
</table>

**Discussion**
- Feedback included visual, verbal and haptic feedback.
- No adverse events were reported and there was no evidence of increased joint load on the hip, ankle and spine by gait modifications.
- Participants achieved peak trunk lean of 12°, toe-out of 20°, and toe-in of 10°.
- However, these findings are based on short-term effects.

**Conclusion**
- Ipsilateral trunk lean, toe-out and toe-in all reduce medial knee joint load.
- To develop clinical recommendations, we need to know the best intervention, the best angle for trunk lean and toe out.
- Future studies need to use stronger research designs, evaluate longer-term programs and how many degrees produce an optimal effect.