INCREASED MUSCLE CO-CONTRACTION IS ASSOCIATED WITH INCREASED VARUS THRUST IN PATIENTS WITH KNEE OSTEOARTHRITIS

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**Introduction**

**Background**
- Varus thrust is the lateral “bowing out” of the knee during weight acceptance in the frontal plane.
- Varus thrust occurs in 37% of patients with knee osteoarthritis (OA) when ambulating.¹
- Varus thrust is a risk factor for knee OA progression (odds ratio = 1.49 to 3.96).²

**Knowledge Gap**
- Varus thrust is often assessed subjectively, few studies use objective measures.
- How do the muscles respond or compensate for varus thrust?
- Does varus thrust vary between different knee OA subgroups?

**Objective**
- To determine the relationship between muscular co-contraction and objective measures of varus thrust in patients with knee OA.
- Do OA subgroups (non-traumatic vs. post-traumatic OA) and disease severity modulate this relationship?
Methods

Participants
- Participants with non-traumatic (n=23; mean age 60 y) and post-traumatic (n=19; mean age 56 y) knee OA were recruited.
- History of knee ligament injury was confirmed on magnetic resonance imaging.
- Radiographic disease severity was assessed with Kellgren-Lawrence scores.

Gait Analysis
- 8 camera motion capture system with reflective markers measured varus thrust.
- 16-channel surface electromyography system measured muscle activity of quadriceps, hamstring, and gastrocnemius.
- Participants ambulated at self-selected speeds over an 8 meter walkway for five trials.

Variables
- Varus thrust: Change in adduction angle from heel strike to maximum angle.3
- Muscle pair co-contraction ratios:4
  - Vastus medialis-medial hamstrings
  - Vastus lateralis-lateral hamstrings
  - Vastus medialis-medial gastrocs
  - Vastus lateralis-lateral gastrocs

Statistical Analysis
- Linear regression examined if varus thrust was predicted by co-contraction ratios after controlling for disease severity and OA subgroup.
**Results**

**Vastus Lateralis-Lateral Hamstring (VL-LH)**
- OA severity: Not significant
- OA subgroup: Not significant
- VL-LH Co-contraction: $b=0.08$, $p<0.01$
- $R^2=0.35$
- Greater varus thrust associated with greater VL-LH co-contraction

**Vastus Medialis-Medial Hamstring (VM-MH)**
- OA severity: Not significant
- OA subgroup: Not significant
- VM-MH Co-contraction: $b=0.06$, $p=0.03$
- $R^2=0.17$
- Greater varus thrust associated with greater VM-MH co-contraction
Discussion

• Greater varus thrust was related to greater quadriceps-hamstring co-contraction.
  • Muscles might be providing increased frontal plane stability.
  • Alternatively, it could be a proprioceptive reflex that is independent of stability.

• There was no relationship between varus thrust and quadriceps-gastrocnemius co-contraction ratios.

• Relationships did not depend on OA subgroup or severity.

Clinical Impact

• Muscular co-contraction likely increases joint loading and has been linked to cartilage loss in patients with knee OA.5

• Thus, muscular co-contraction for varus thrust might not represent an appropriate long term strategy.

References