EFFECTS OF FIXED AND VARIABLE DAMPING ENVIRONMENTS ON ANKLE AGILITY AND STABILITY

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Importance of the Ankle

- Ankle is the primary joint responsible for transferring energy between the lower extremity (leg) and the environment.
  - Postural maintenance (standing).
  - Locomotion (walking).
  - Reacting to sudden changes in environment (balance).
- Proper control of ankle is vital to maintaining stability of the lower extremity.
This Study:

- Quantified ankle agility/stability trade off across a range of damping-defined environmental conditions.
Experimental Setup

- Damping = [-1.0, 0.0, +1.0] Nm*sec-rad
Agility Aggregate Results

**Plantarflexion**

- **Active**
- **Passive**
- **Dissipative**

**Dorsiflexion**

- **Active**
- **Passive**
- **Dissipative**
Stability Aggregate Results

**Plantarflexion**
- Active
- Passive
- Dissipative

**Dorsiflexion**
- Active
- Passive
- Dissipative

Max Overhost (deg)
Takeaway?

- Negative damping increases agility *but* decreases stability.
- Positive damping decreases agility *but* increases stability.
- There is a trade-off, but can we have the best of both?
  - Variable damping environments.
Agility Aggregate Results

**Plantarflexion**

- Dissapative
- Active
- Variable

**Dorsiflexion**

- Dissapative
- Active
- Variable
Stability Aggregate Results

**Plantarflexion**
- Dissapative
- Active
- Variable

**Dorsiflexion**
- Dissapative
- Active
- Variable
Conclusions

- Constant damping environments offer either enhanced agility or stability.
- Variable damping environment offers most of the agility boost of negative damping without as much instability.
- Variable damping shows potential as a control scheme for assistive devices—several factors must be tuned for each individual.
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