# EFFECT OF VASTI ACTIVATION ON MEDIAL AND LATERAL TIBIOFEMORAL JOINT

Image Redacted

Presented by Brad Meccia

# Asymmetric loading of polyethylene leads to wear.

Videos Redacted

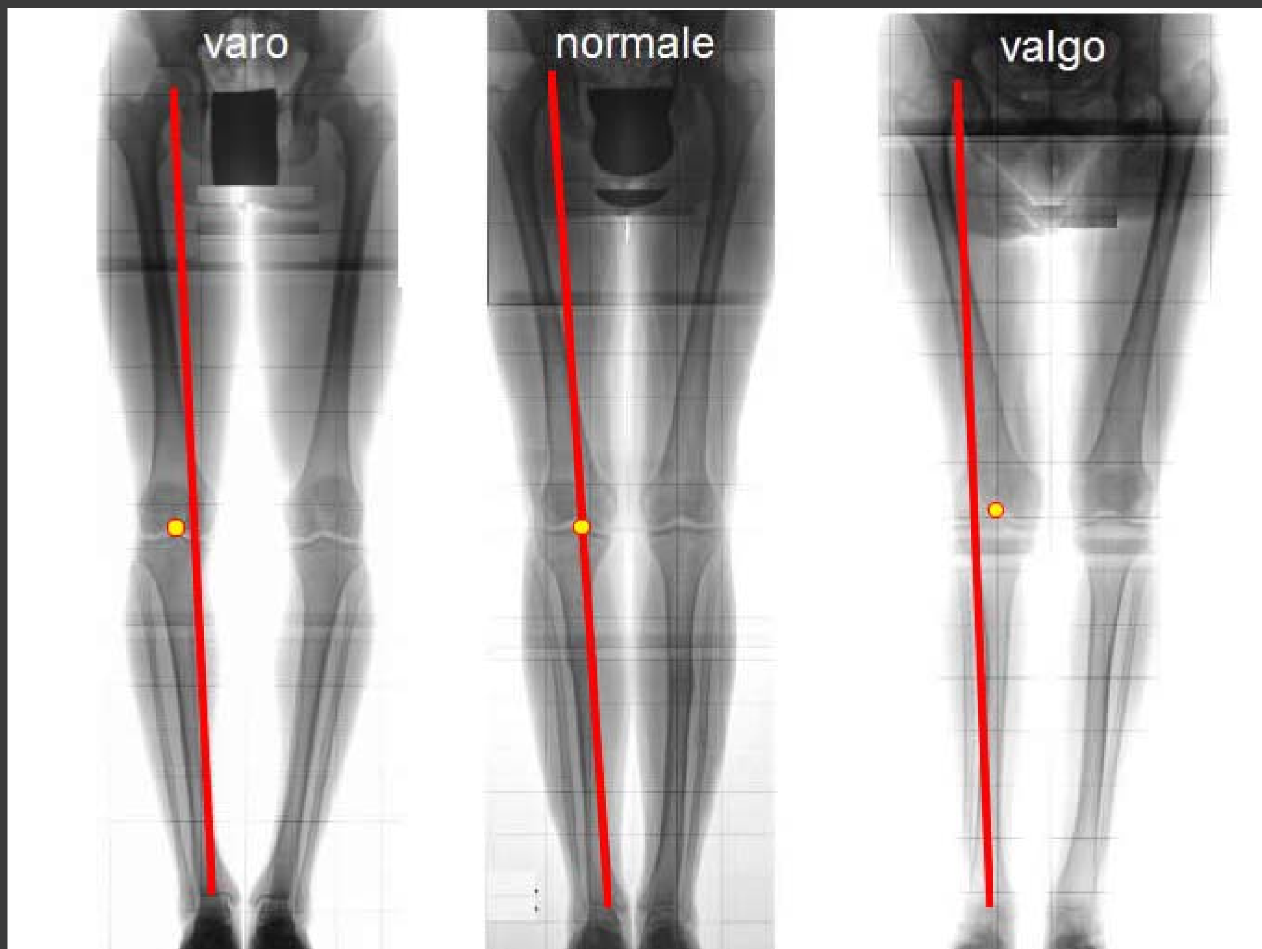
# RP implants help with this problem by allowing the cam and post to stay flush

Videos Redacted

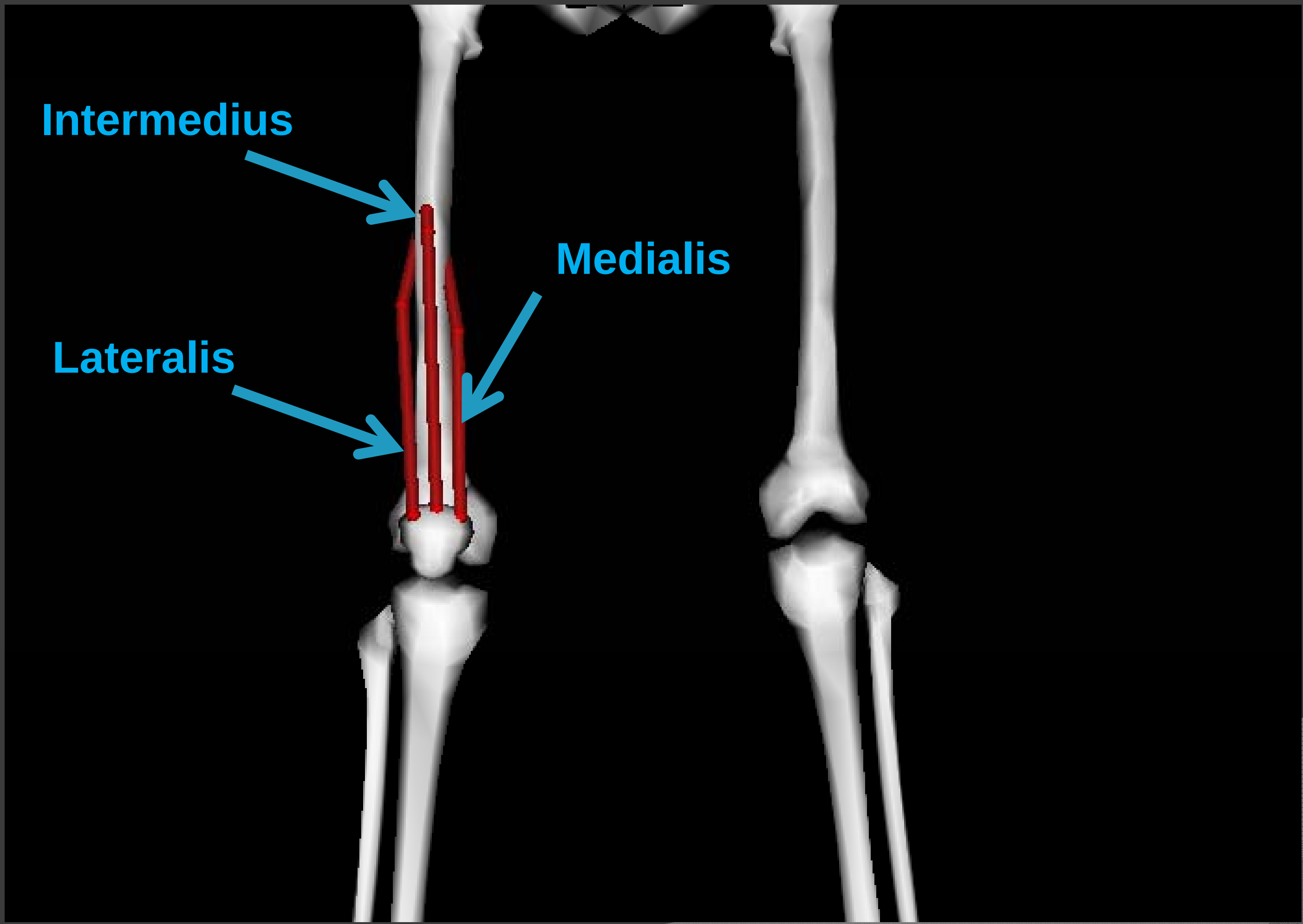
# The rotation of the polyethylene is driven by the medial and lateral normal and sheer forces.

Videos Redacted

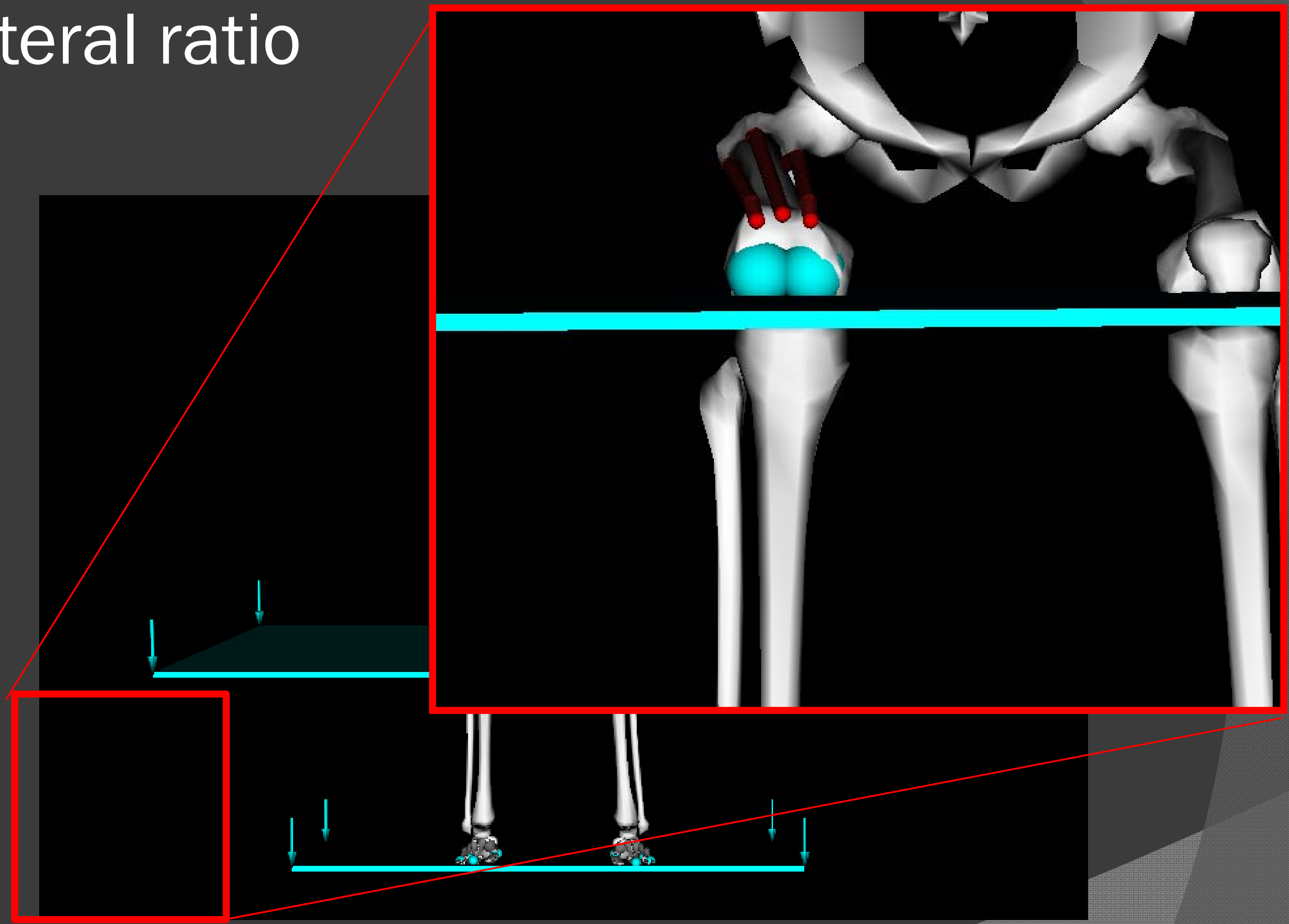
# Traditionally, the mechanical axis used to control medial/lateral force ratio.



Hypothesized that vasti activation also influences medial/lateral ratio



# OPENSIM must be modified to find medial/lateral ratio



# Implemented with two Hunt Crossley Forces in the XML code

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   <objects>
    <HuntCrossleyForce::ContactParameters name="">
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            <stiffness> 100000000.00000000000000000000 </stiffness>
            <dissipation>       0.50000000000000000000 </dissipation>
            <static_friction>       0.90000000000000002000 </static_friction>
            <dynamic_friction>       0.90000000000000002000 </dynamic_friction>
            <viscous_friction>       0.59999999999999998000 </viscous_friction>
    </HuntCrossleyForce::ContactParameters>
   </objects>
   <groups/>
 </HuntCrossleyForce::ContactParametersSet>
 <transition_velocity>       0.10000000000000001000 </transition_velocity>
</HuntCrossleyForce>

<HuntCrossleyForce name="knee_lat">
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 <HuntCrossleyForce::ContactParametersSet name="">
   <objects>
    <HuntCrossleyForce::ContactParameters name="">
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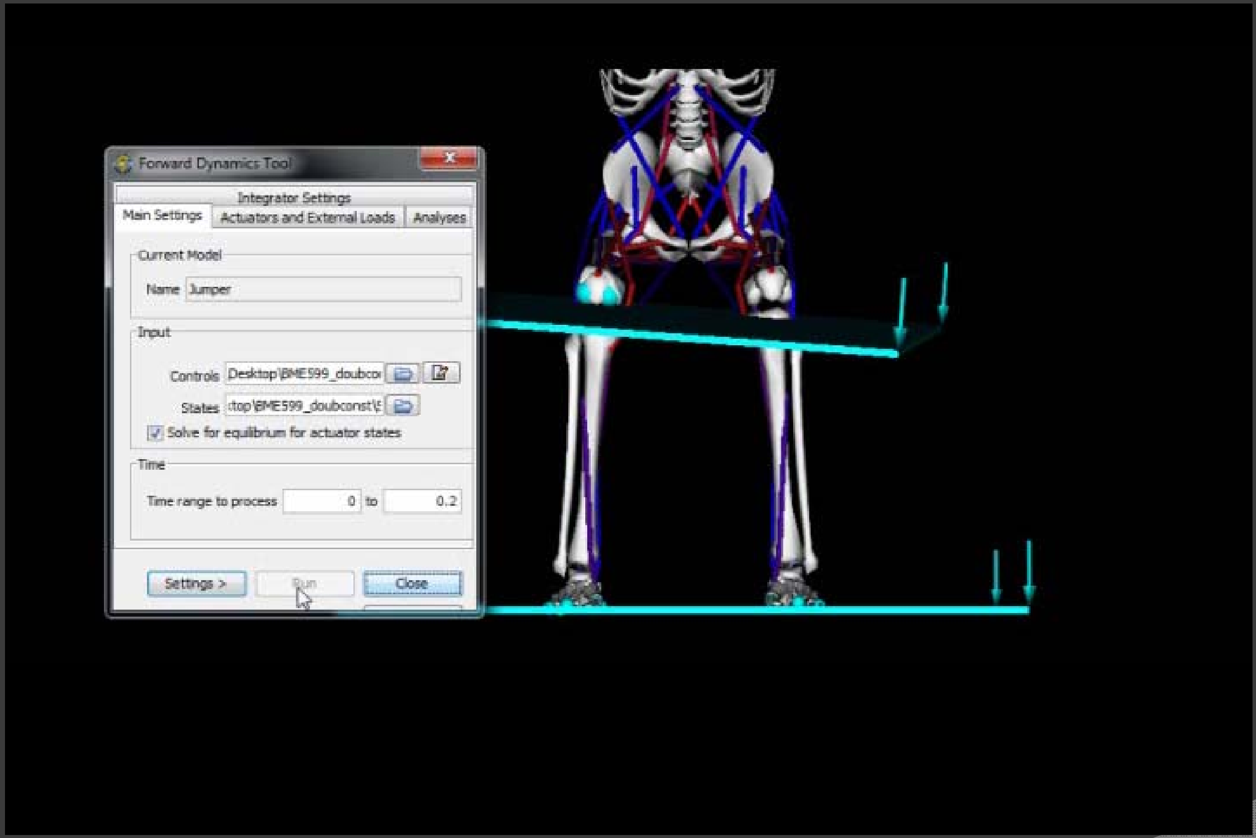
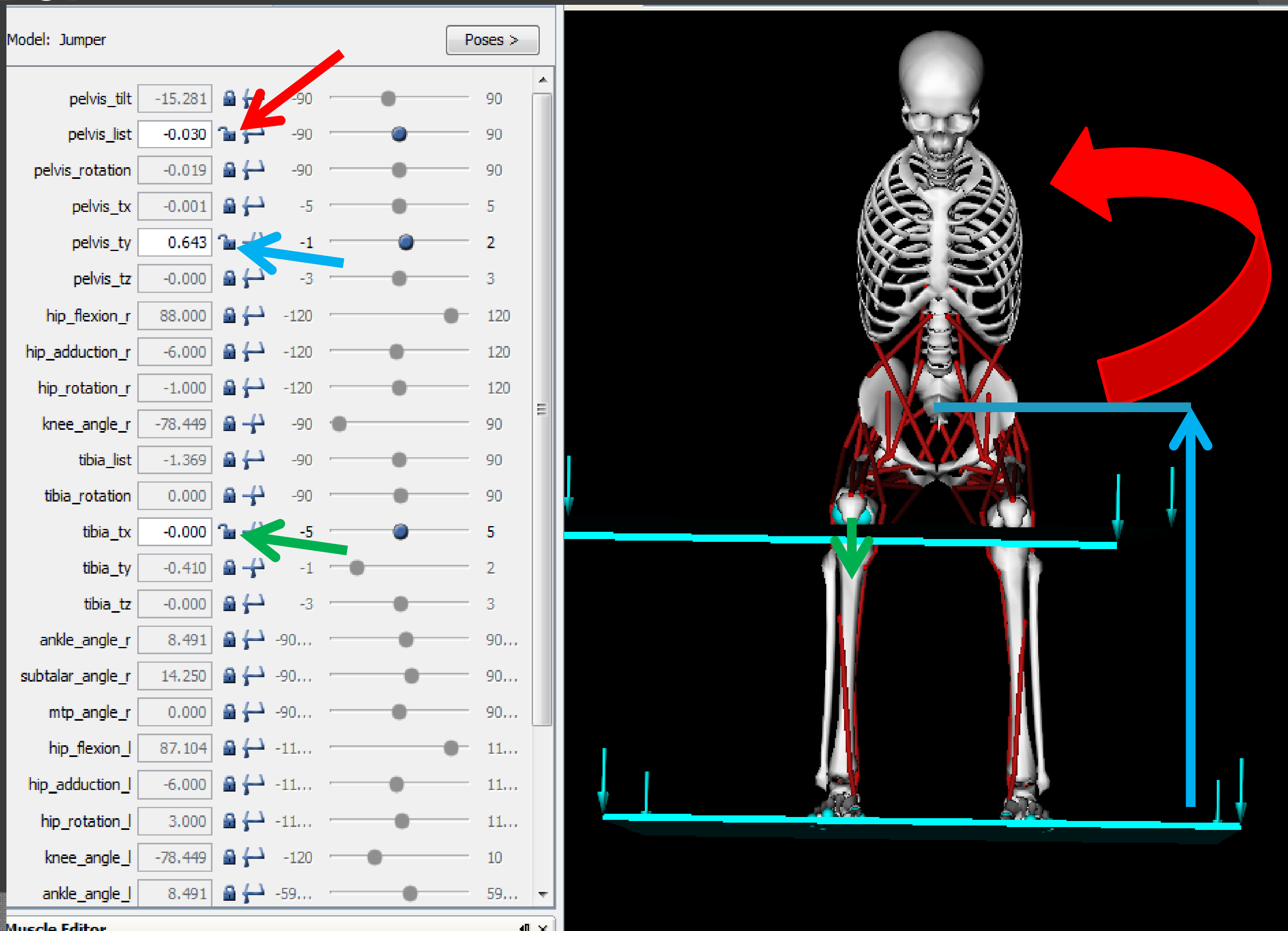
            <stiffness> 100000000.00000000000000000000 </stiffness>
            <dissipation>       0.50000000000000000000 </dissipation>
            <static_friction>       0.90000000000000002000 </static_friction>
            <dynamic_friction>       0.90000000000000002000 </dynamic_friction>
            <viscous_friction>       0.59999999999999998000 </viscous_friction>
    </HuntCrossleyForce::ContactParameters>
   </objects>
   <groups/>
 </HuntCrossleyForce::ContactParametersSet>
 <transition_velocity>       0.10000000000000001000 </transition_velocity>
</HuntCrossleyForce>
```

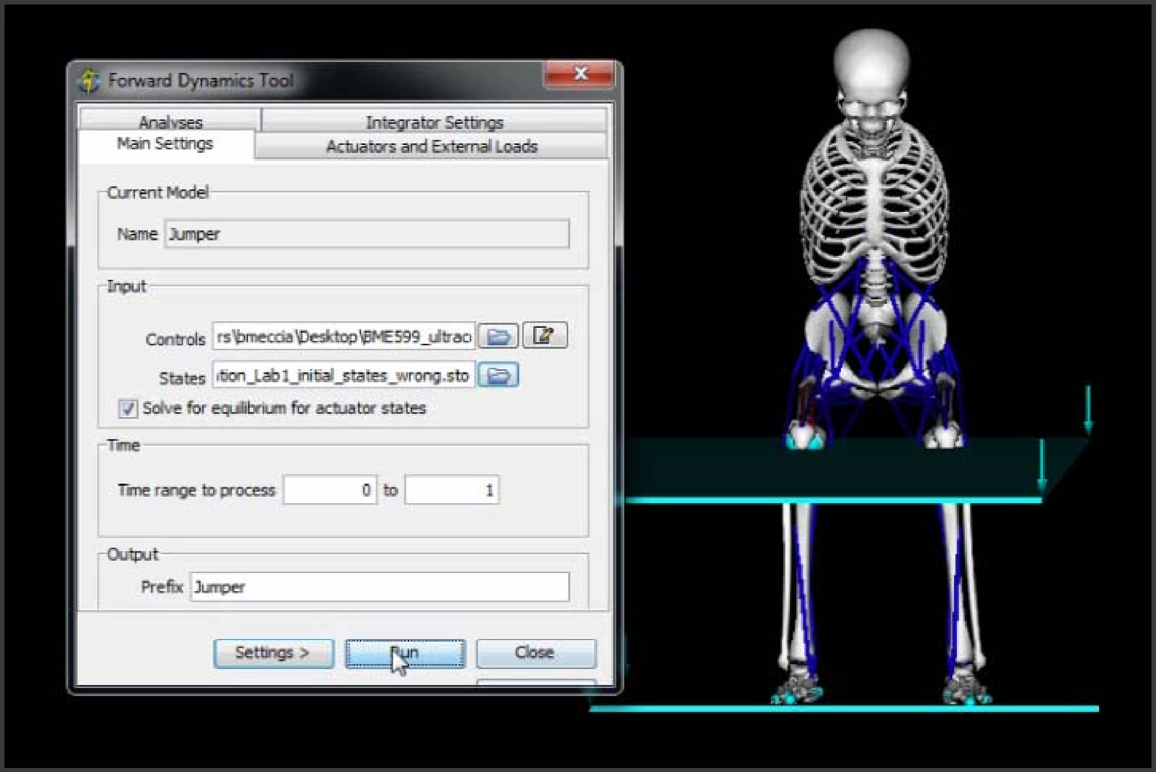
# Contact bodies are extremely sensitive to initial positions

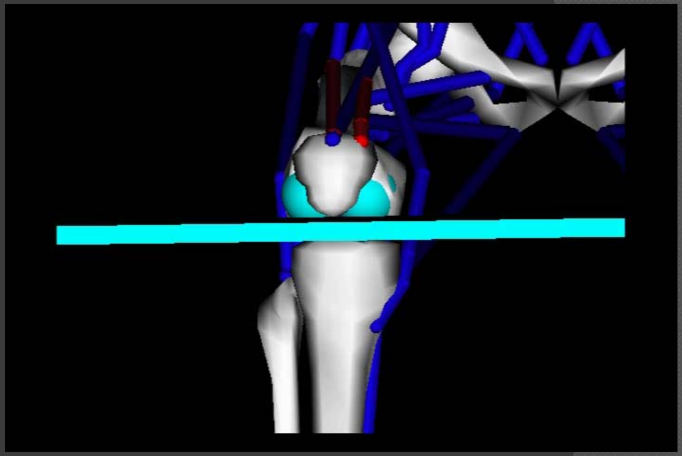


# Develop a settler to detect initial positions with 3 DOF

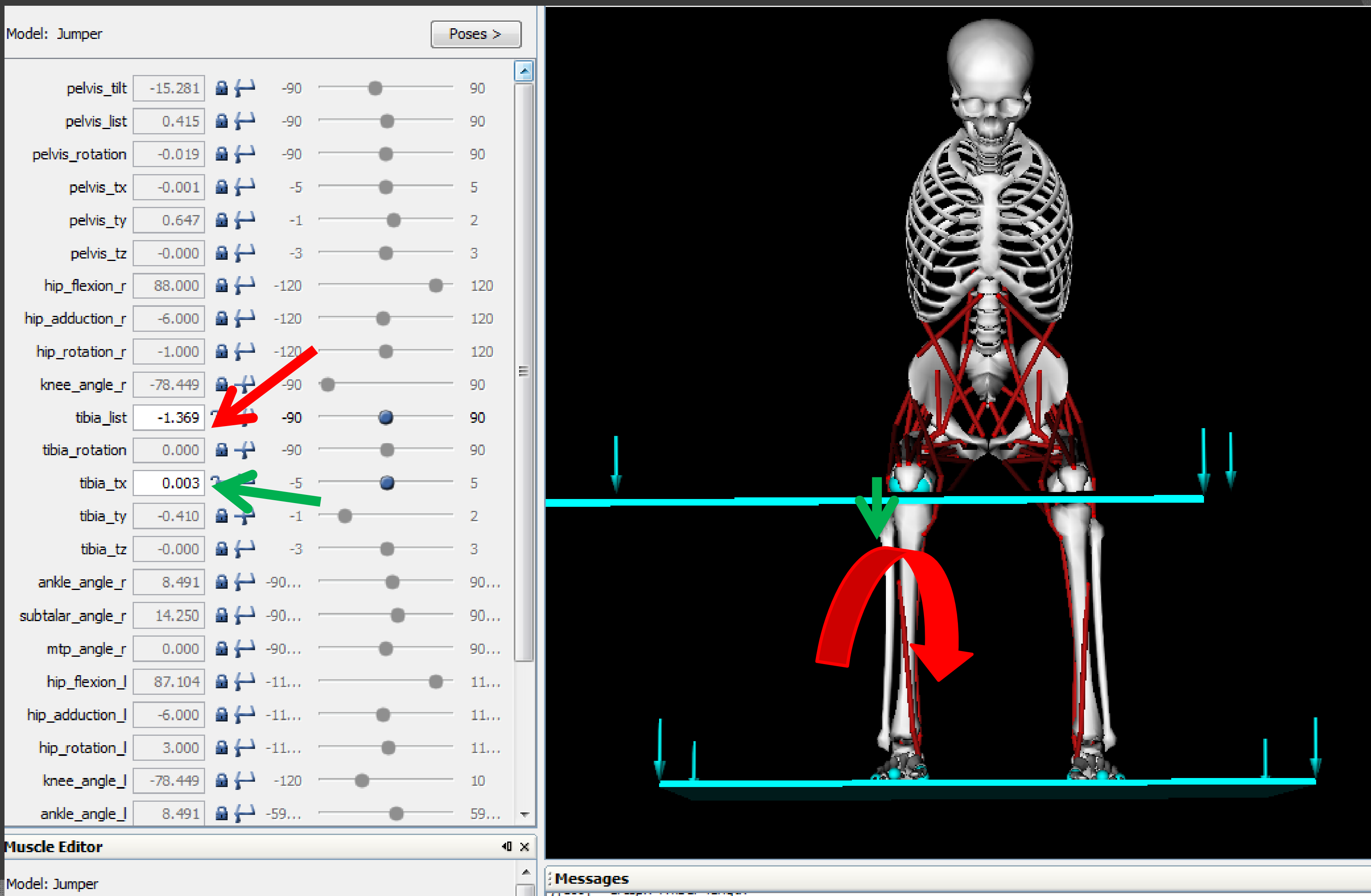


# Final settler position is used as model initial position

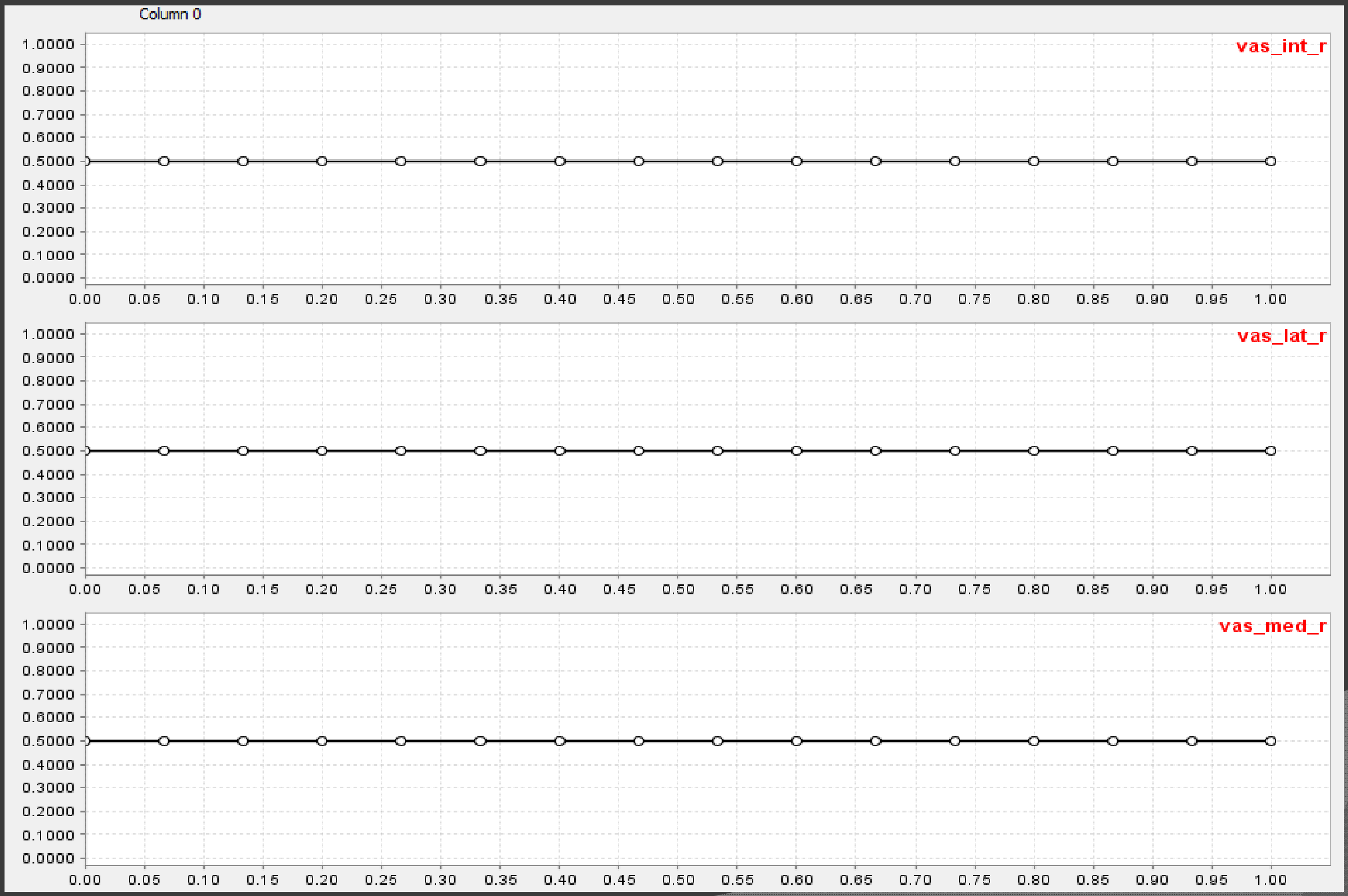


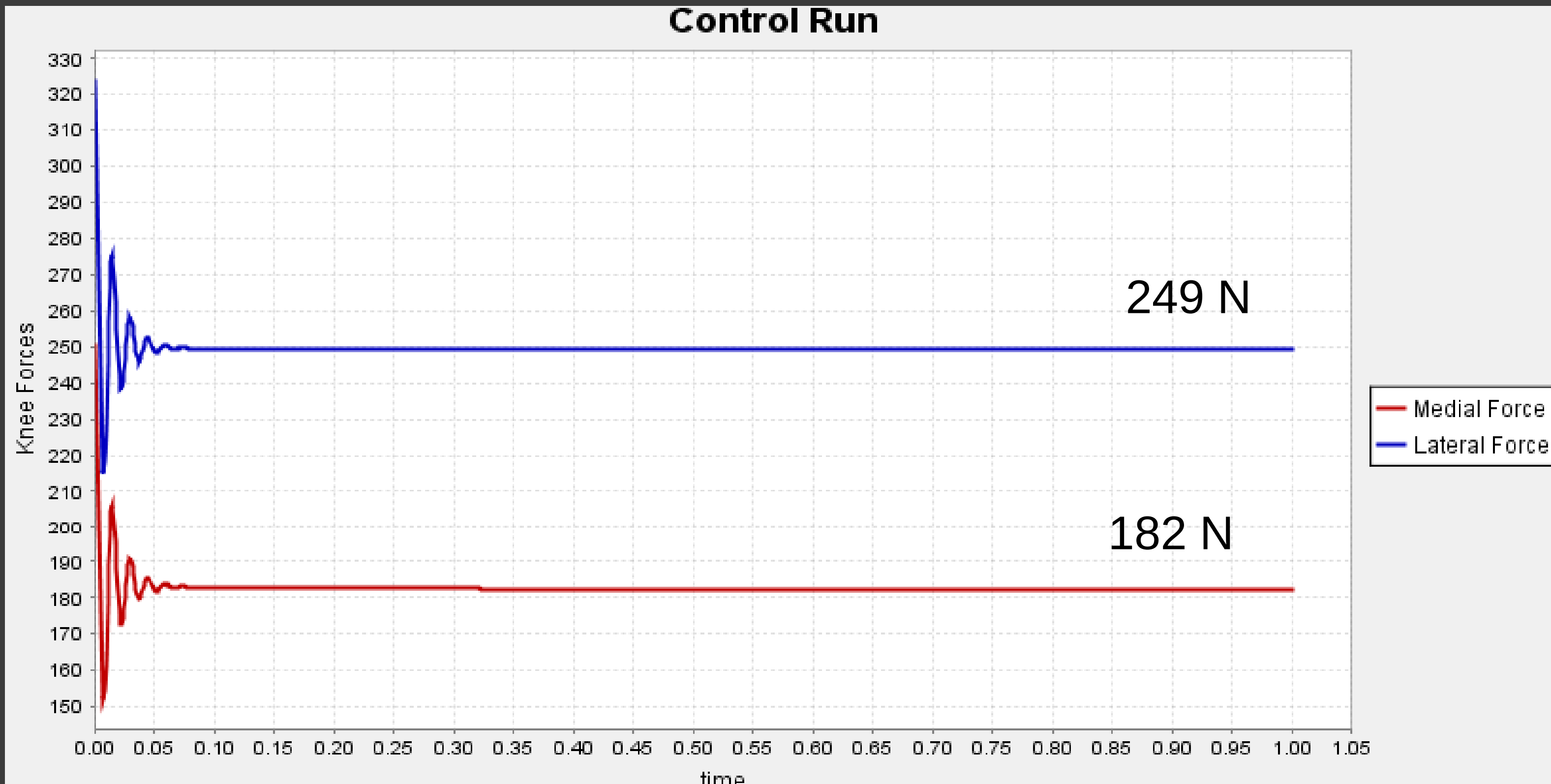
# Inputting settled initial positions and including constrains completes the model



# Forces were determined from the model in four scenarios: 1) Control 2) Max Lateralis 3) Max Intermedius 4) Max Medialis

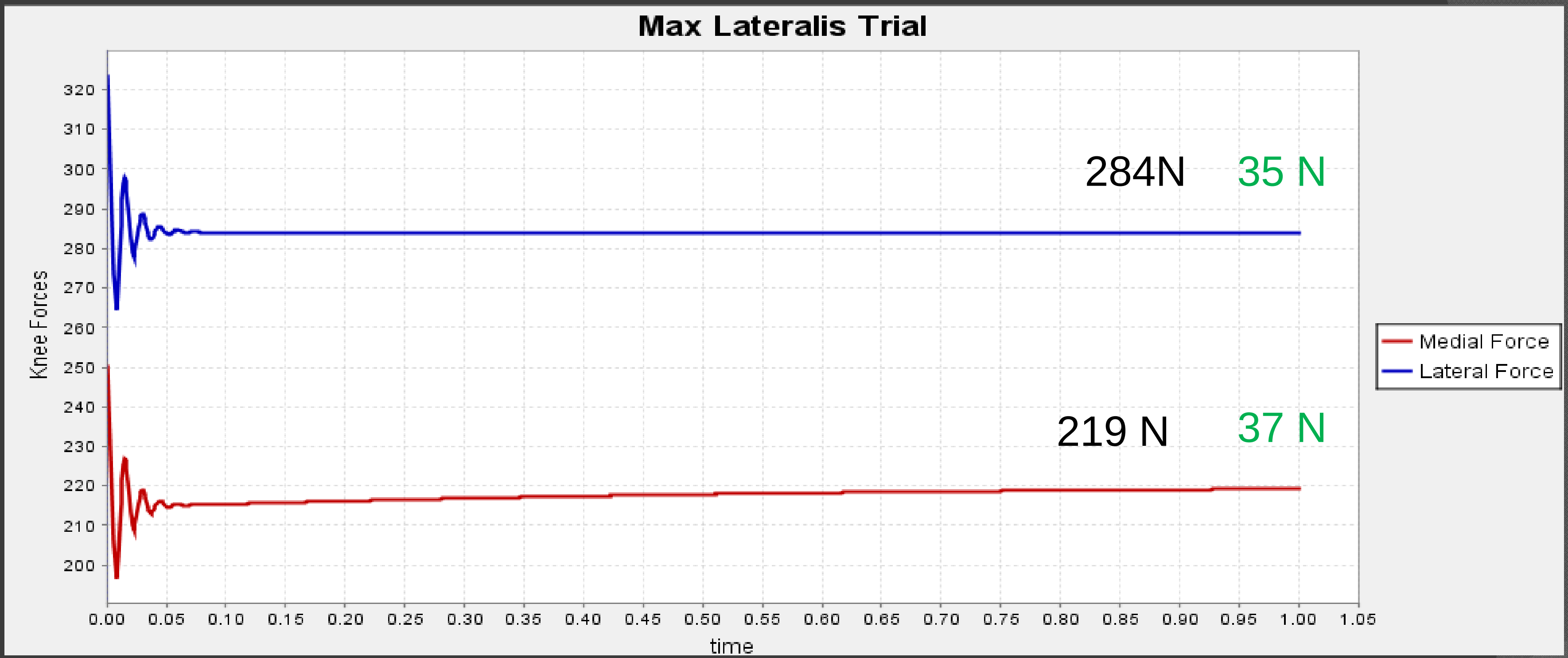


# Higher lateral forces were seen with all muscles partially activated



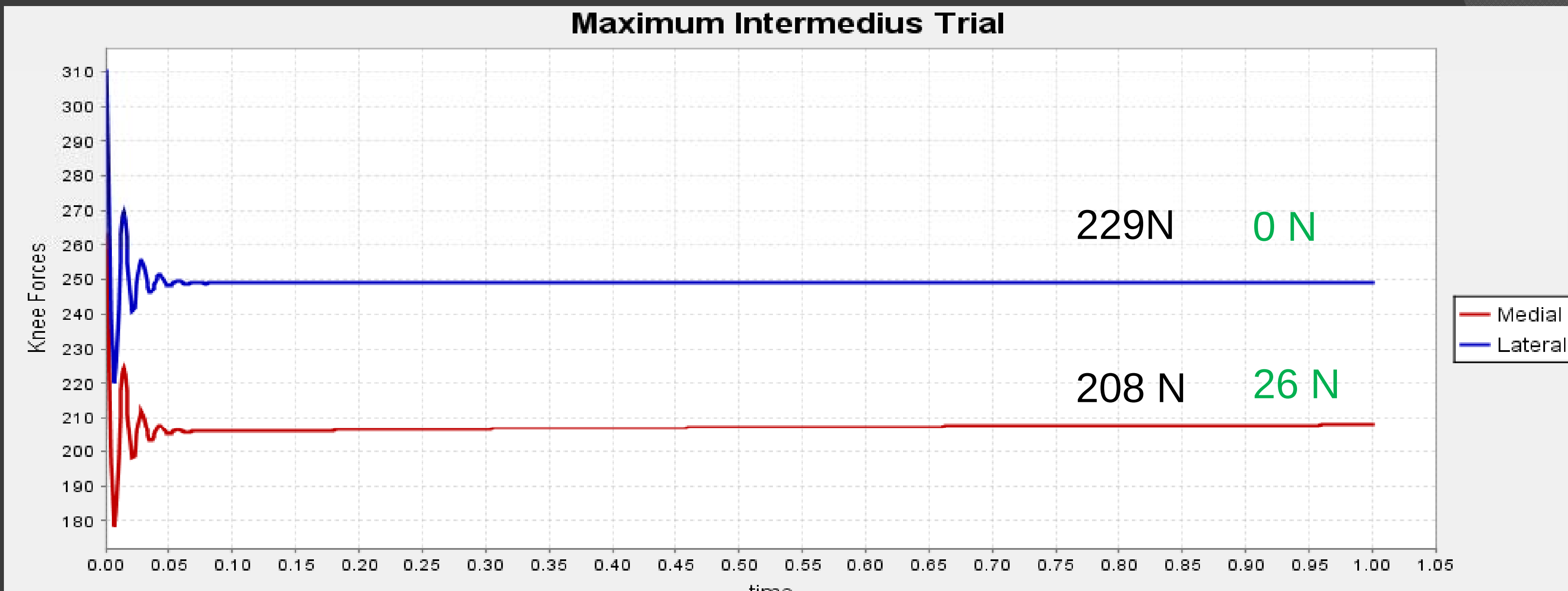

| Scenario | Medial Force (N) | Lateral Force (N) | Medial Percentage |
|---|---|---|---|
| Control | 182 | 249 | 42.2% |
| Lateralis | | | |
| Intermedius | | | |
| Medialis | | | |

# Activating the lateralis increased both contact forces evenly



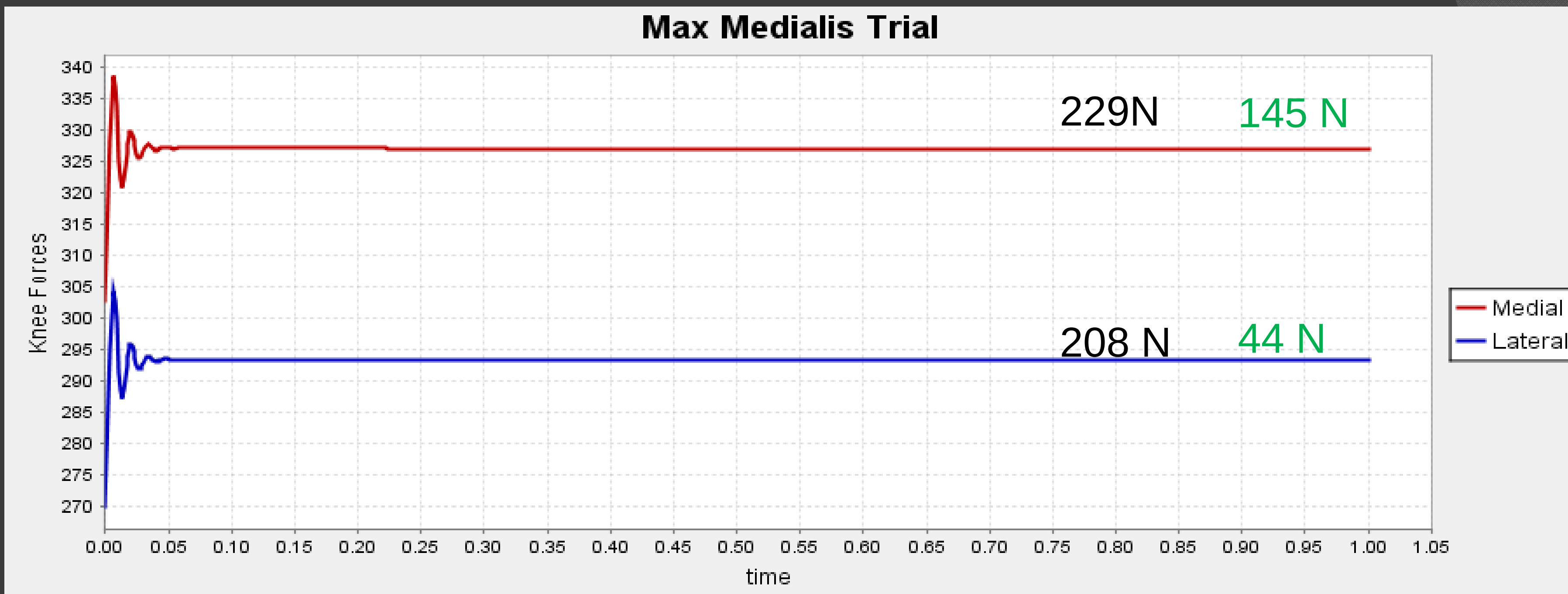

| Scenario | Medial Force (N) | Lateral Force (N) | Medial Percentage |
|---|---|---|---|
| Control | 182 | 249 | 42.2% |
| Lateralis | 219 | 284 | 43.5% |
| Intermedius | | | |
| Medialis | | | |

# Intermedius activation increased only the medial force.



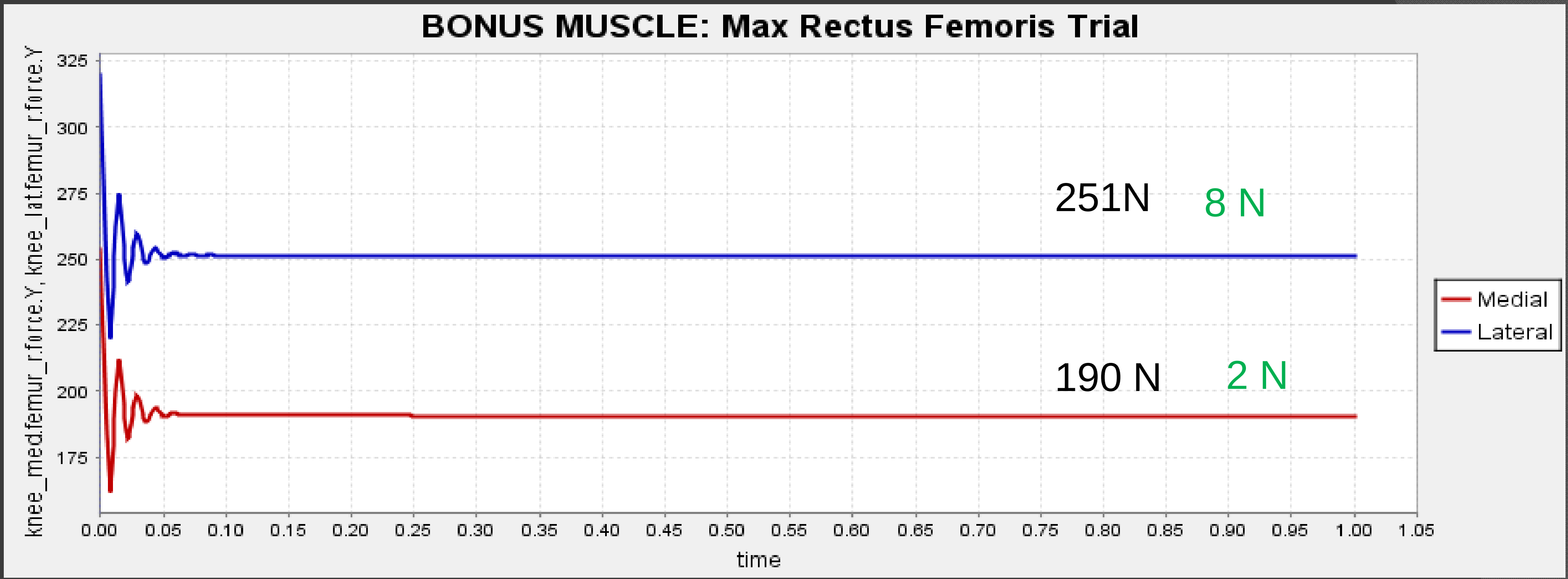

| Scenario | Medial Force (N) | Lateral Force (N) | Medial Percentage |
|---|---|---|---|
| Control | 182 | 249 | 42.2% |
| Lateralis | 219 | 284 | 43.5% |
| Intermedius | 208 | 249 | 45.5% |
| Medialis | | | |

# Medialis activation actually made the medial force higher than the lateral.




| Scenario | Medial Force (N) | Lateral Force (N) | Medial Percentage |
|---|---|---|---|
| Control | 182 | 249 | 42.2% |
| Lateralis | 219 | 284 | 43.5% |
| Intermedius | 208 | 249 | 45.5% |
| Medialis | 327 | 293 | 52.7% |

# Bonus Muscle: Rectus Femoris had very little effect.

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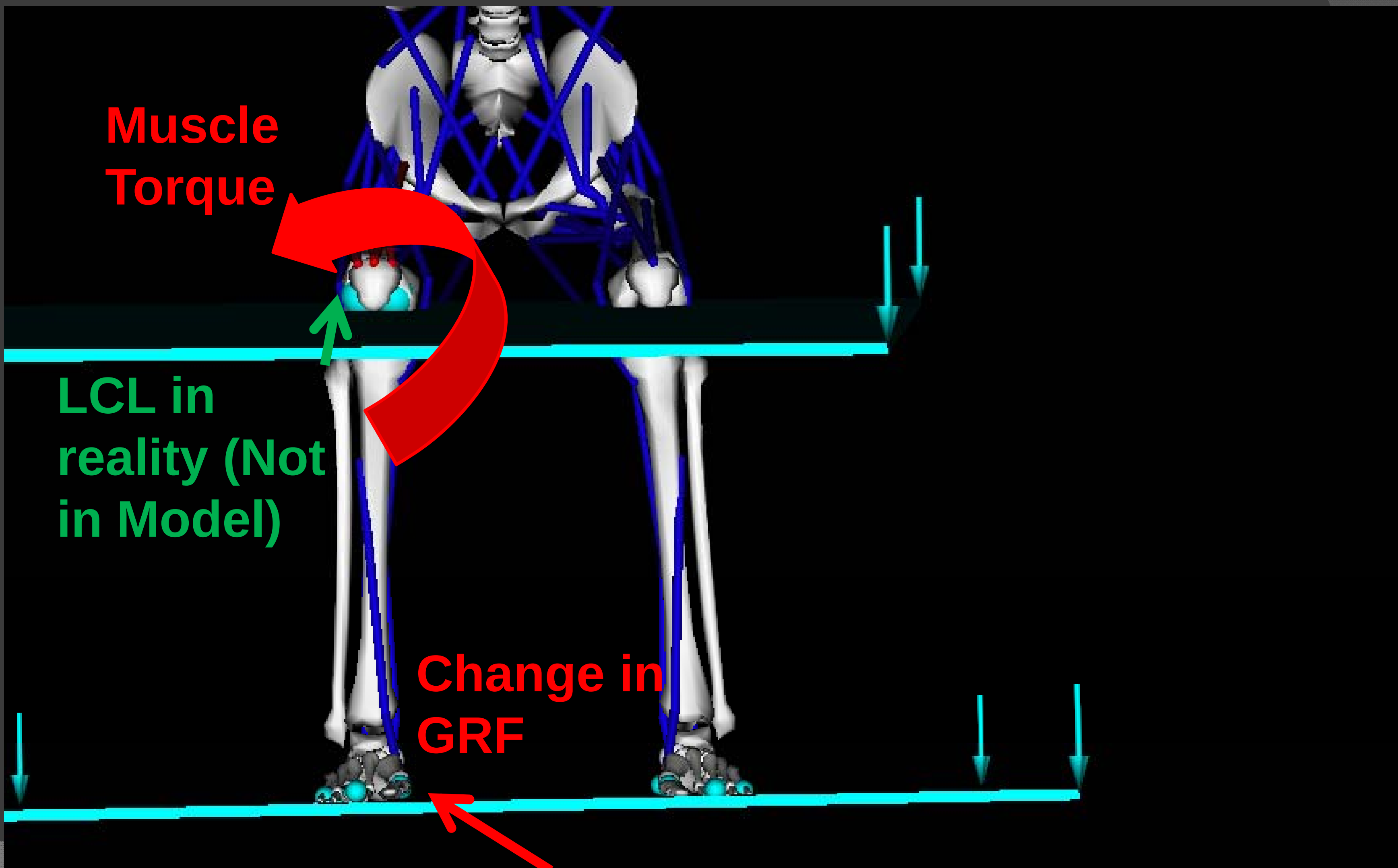
| R. Femoris | 190 | 251 | 43.1% |

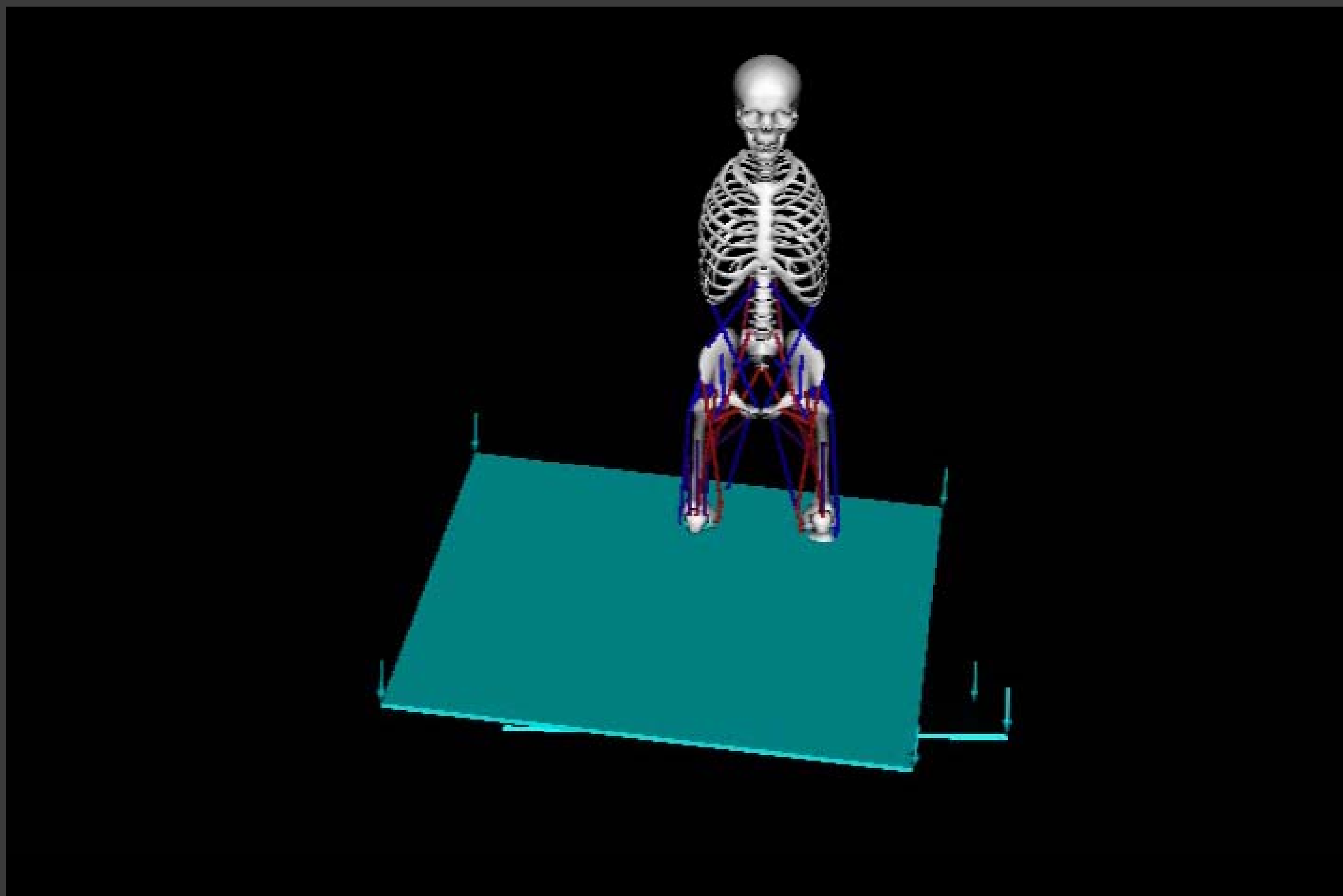
# The medialis was the only muscle to have a substantial effect in total force or force ratio.

| Scenario | Medial Change (N) | Lateral Change (N) | Medial Percentage Change |
|---|---|---|---|
| Control | NA | NA | NA |
| Lateralis | 37 | 35 | 1.3% |
| Intermedius | 26 | 0 | 3.3% |
| Medialis | 145 | 44 | 10.5% |
| R. Femoris | 8 | 2 | 0.9% |

Ligaments should be added because currently the ground is acting like a ligament.



# Can this model be expanded to dynamic activities?



# Conclusions

| Scenario | Medial Force (N) | Lateral Force (N) | Medial Percentage |
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| Intermedius | 208 | 249 | 45.5% |
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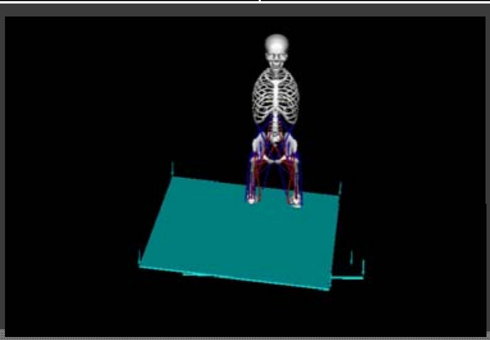

# Thank you!

# Questions?