

## Preferred Motion Pathway Theory of Foot Biomechanics/Foot orthoses

Based on concepts of Beno Nigg

### **Purposes of foot orthoses:**

- 1) Reduce injury
- 2) Realign skeleton
- 3) Improve cushioning
- 4) Improve sensory feedback
- 5) Improve comfort

### Reduction of Injury

- Common reason
- evidence is that orthoses reduce injury
- no evidence as to which is best type of orthoses for which foot type or injury

### Aligning the skeleton

- effects are not systematic
- effects are subject specific
- are they an artifact of kinematic measurement

### Impact cushioning/shock absorption

- Typically reduction is 10-20%
- is this clinically significant?
- Does it alter impact moderating behaviour?
- Does it produce adjustments in muscular response?

### Improve sensory feedback

- Mechanoreceptors in sole of foot provide sensory input
- sensors detect input signals - at subject specific thresholds
- body responds mechanically by altering movement patterns

## Improve comfort

- Comfort --> may be related to fit, less need for muscle stabilising work, less fatigue, and damping of soft tissue vibrations

## Based on these 5 concepts, Nigg proposes that the purpose of foot orthoses are to

- minimise muscle work
- the body does this by following a preferred path for any given motion (eg running)
- if it moves outside this path --> extra muscular effort --> injury

## Basic steps of Nigg's concepts

- 1) Based on the chosen movement, a force signal acts as an input variable on the shoe
- 2) The shoe sole acts as a first filter for the force impact signal
- 3) The insert or orthotic acts as a second filter for the force input signal
- 4) The plantar surface of the foot with its soft tissue and mechanoreceptors acts as a third filter of the force input signal
- 5) The filtered information is transferred to the CNS that provides a dynamic response based on subject specific conditions
- 6) The subject performs the movement for the task at hand

## There fore, the function of the orthoses is:

- The skeleton has a preferred path for any given movement task
- if an intervention supports the preferred movement path, muscle activity is reduced. If an intervention counteracts the preferred movement path, muscle activity must be increased
- an optimal orthoses reduces muscle activity
- an optimal orthotic feels comfortable because muscle activity and the resulting fatigue are minimised
- since muscle activity is minimised, performance should increase with an optimal orthoses

## Muscle activity is minimised by

- 1) Stabilisation of joints
- 2) Minimising soft tissue vibration

## Summary

- Subject specific responses
- orthoses should support the preferred pattern of motion
- Not clear yet how to measure:
- subject specific responses
- preferred pathways