Content

• Pendulum Corridors
• Analyses FLEX-GTR variability
• Gage calibration and sensitivity calculation
• Additional data
• Inverse certification
Pendulum Corridors

- Humanetics agrees to keep pendulum corridors as they are
- Humanetics in-depth investigation on sources of variation
  - Reviewed tolerances, procedures, material control
  - Analyses of high response legs and low response legs
  - Reviewed data component tests: gages, tibia, femur and knee assy's
- Humanetics will refurbish any leg that is outside the GTR corridor
  - Our regional sales organisations will arrange with customers
- Bertrandt scatter investigation at Humanetics ongoing
  - Analyse and re-testing Bertrandt leg will take time
  - SN04 will be made available to Bertrandt for interim period
Review sources variation

- Geometrical tolerances
  - Segment (blue nylon)
  - Links
  - Shoulder bolt for links
  - Rubber buffer thickness
  - Bone thickness controlled by stiffness test

- Materials
  - Rubber Buffer Stiffness
  - Bone material
  - Neoprene foam wrap
  - Knee spring stiffness

- Procedures
  - Spring adjustment
  - Shimming
  - 400Nm gage calibration and sensitivity
Steps to tighten variations

• Correction of internal corridors to GTR spec
• Current part tolerances are in default ± 0.1 mm
  – Tighten the critical dimension tolerance to +/-0.05 mm for metal parts
  – Keep current tolerance for Polyamide parts
• Rubber buffer
  – Change dimension from 6.2±0.1 to 6.4±0.1? TEG AGREES?
  – Inspection of rubber block and inner segment total height before bonding
• Improve shimming procedure
  – Always apply the thickest shim to use the least number of shims
  – Internal inspection after assembly
• Inspection of the links to ensure no locking after assembly
Material Control

• Rubber buffer stiffness inspection procedure
  1. Check durometer and tolerance
  2. Drop bar fixture for dynamic test
  3. Collect data for analysis

• Flesh assembly test(s)
  1. Drop bar fixture testing on assembled flesh knee area
  2. Collect data for analysis (rubber/rubber/neoprene)
  3. Possible upper leg and lower leg area if applicable in the future
Effect of 400Nm gage calibration

• Largest effect
  – 400Nm full scale 0.9% up wrt 325
  – 400Nm linear regression 0.26% up

• Linear regression closer to 325 full scale in all cases

• TEG agrees apply linear regression?
Variation high and low legs

Tibia gauge 1

Tibia gauge 2

Tibia gauge 3

Tibia gauge 4
Variation high and low
Variation high and low legs

ACL

MCL

PCL
Variation high and low
Variation high and low legs

Femur gauge 1

Femur gauge 2

Femur gauge 3
Variation high and low
Inverse Testing

• Humanetics will deliver new product with Inverse certification report
  – In-house test equipment expected 1st quarter 2011
  – Outsource at BASt or JARI(?) intermediate period

• Humanetics willing to co-operate with TEG obtaining inverse data from all product
  – Humanetics will facilitate inverse tests at BASt
  – EU customers Bertrandt, Opel, PDB