COMPARISION OF FAILURE

SINGLE vs. INTEGRATED DUAL SCREW FIXATION FOR INTERTROCHANTERIC FXS

USING A NOVEL CHAIR RISE BIOMECHANICAL MODEL

fore

FLORIDA ORTHOPAEDIC INSTITUTE

USF ORTHOPEDICS

DISCLOSURES

Ian Smithson, MD	USF	NONE
Seth Cooper, MD	USF	NONE
Jacob Cox, MD	USF	NONE
Scott Marberry, MD	USF	NONE
Aniruddh Nayak	FORE	NONE
Brandon Santoni, PhD	FORE	NIH-NIBIB
Roy Sanders, MD	OTS/FOI	SEE PROGRAM

BACKGROUND

UNSTABLE INTERTROCH FXS

- MORBIDITY
- COMPLICATIONS

BACKGROUND

FIXATION FAILURE

=

"CUT – OUT"

BACKGROUND

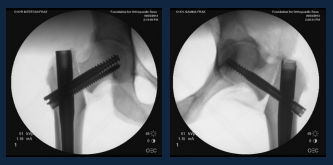
RECENTLY CMNs WITH DUAL SCREWS WERE DEVELOPED TO DECREASE "CUT-OUT"

GOAL OF STUDY

TO COMPARE THE STABILITY OF A DUAL vs. SINGLE LAG SCREW CMN IN AN UNSTABLE INTERTROCH FX

HYPOTHESIS

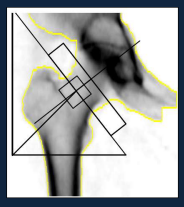
The dual screw design **will have better rotational control and stability in an unstable intertrochanteric fracture** ***compared to a single screw device*****.**



METHODS

Specimens

- Procured n=11 female cadaveric pelves w/ intact sacrum and bilateral femurs
- Age: 72.8 yrs. (range: 64-79);
- BMD & T-Score measured
- in femoral neck using DEXA.
  - *BMD: 0.81 ± 0.07 g/cm²*
  - *T-Score: -1.6 ± 0.5 (range: -1.0 to -2.4)*

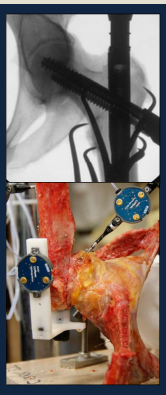


"Fracture" Creation

Specimen dissection maintained competency of hip capsule

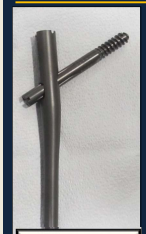
Oscillating saw used to create an osteotomy meeting criteria for OTA 31-A2 fracture

Right & left femurs randomized to receive single- or dual-screw intramedullary fixation



METHODS

Test Devices



GAMMA 3

10.5 mm

- SINGLE LAG SCREW
- SHORT IM NAIL (18 CM)
- FIXED NECK SHAFT ANGLE (125 °)

METHODS

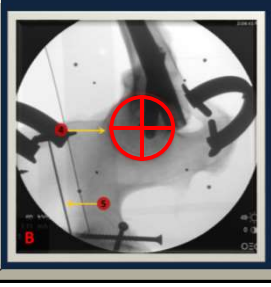
Test Devices

INTERTAN

15.5 mm

- LAG SCREW
- INTEGRATED COMPRESSION SCREW
- SHORT IM NAIL (18 CM),
- FIXED NECK SHAFT ANGLE (125˚).

Specimen Potting & Alignment



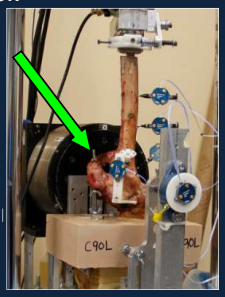
SPECIMEN HIP JOINT CENTER ALIGNED WITH SPATIAL POSITION OF TORQUE MOTOR

ALIGNMENT CONFIRMED WITH IMAGE

SPECIMEN POTTED IN BONDO BODY FILLER.

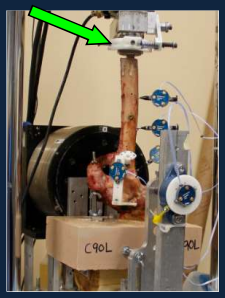
Chair Rise Biomechanical Test Model

- INVERTED HEMI-PELVIS ATTACHED TO SWING ARM ATTACHED TO TORQUE MOTOR



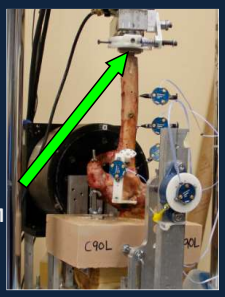
Chair Rise Biomechanical Test Model

- DISTAL FEMUR ATTACHED VIA BALL JOINT AND PIVOTING ARM TO 5 KN LOAD CELL



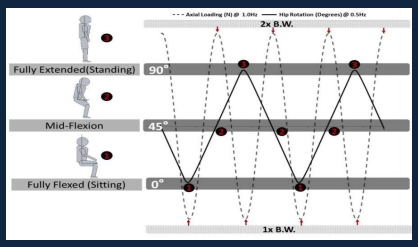
Chair Rise Biomechanical Test Model

- SPRING LOADED SWING ARM ALLOWED FOR PASSIVE IR/ER OF FEMUR.



Chair Rise Biomechanical Test Model

- Compressive load distal femur @ 0.5 Hz



- Based on in vivo hip joint load data measured during chair rise published by Bergmann et al.

Goal : Simulate 3 months of Chair Rise Loading

- ***SPECIMENS CYCLED 13,500 @ 1-2 X BW***
- ***IF STILL INTACT AFTER 13,500 > 4X BW TO 15,500 max***

Biomechanical Parameters of Interest

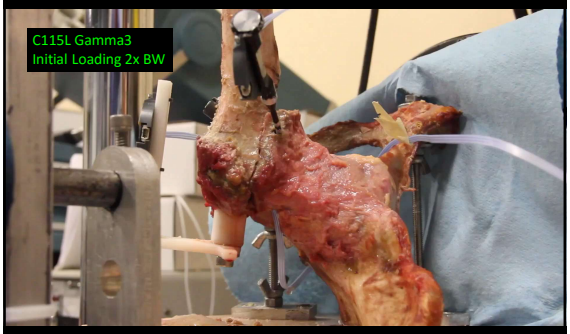
α NECK

- **ROTATION**

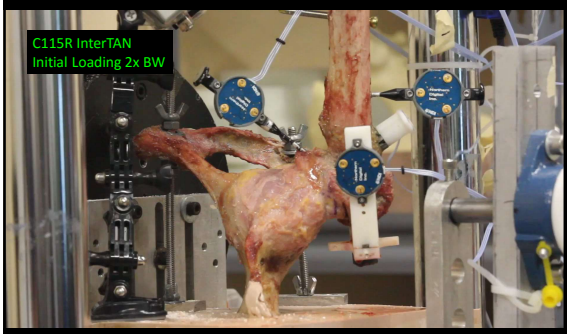
α VARUS

- **COLLAPSE**

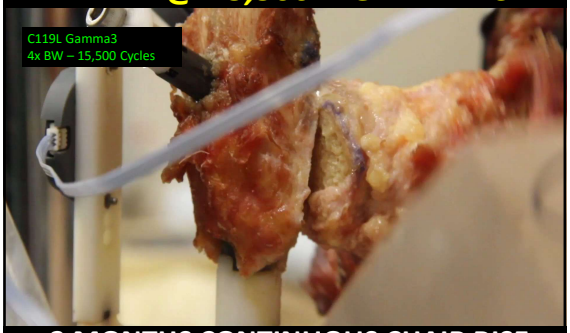
INITIAL LOADING GAMMA 3



INITIAL LOADING INTERTAN



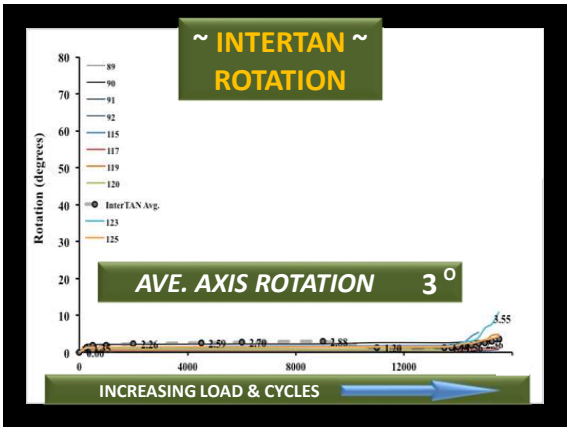
4X BW @ 15,500 - GAMMA 3

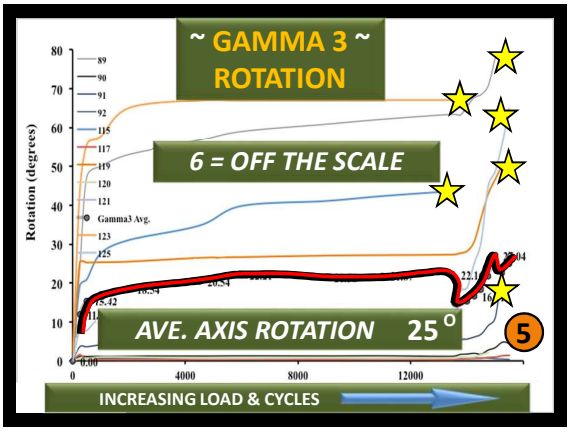


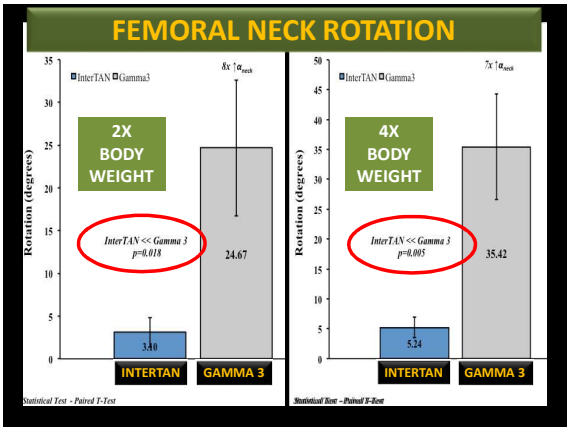
> 3 MONTHS CONTINUOUS CHAIR RISE

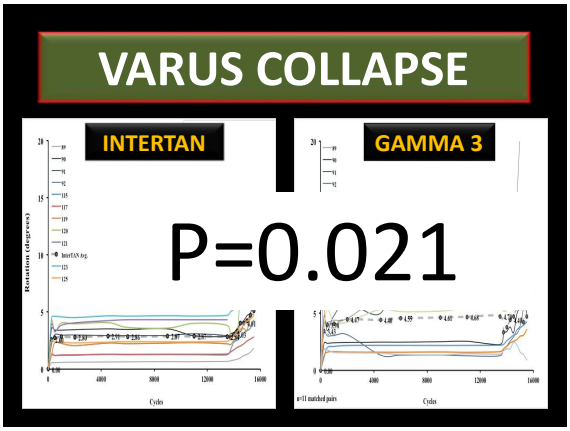
4X BW @ 15,500 - INTERTAN

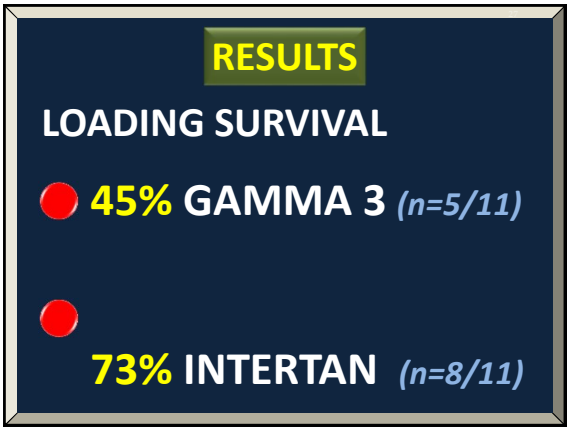
> 3 MONTHS CONTINUOUS CHAIR RISE





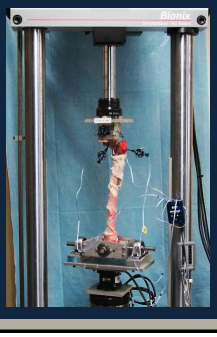

FEMORAL NECK ROTATION
InterTAN
Gamma3
Rotation (degrees)
2X BODY WEIGHT
InterTAN << Gamma 3 p=0.018
24.67
3.40
INTERTAN
GAMMA 3
4X BODY WEIGHT
InterTAN << Gamma 3 p=0.005
35.42
5.24
INTERTAN
GAMMA 3


VARUS COLLAPSE
INTERTAN
GAMMA 3
P=0.021
Rotation (degrees)
Cycles


RESULTS
LOADING SURVIVAL
45% GAMMA 3 (n=5/11)
73% INTERTAN (n=8/11)

SUMMARY

DIRECT AXIAL COMPRESSION **NOT SUITABLE TO TEST IMPLANTS IN ROTATION**



SUMMARY

A **NOVEL BIOMECHANICAL MODEL** TO TEST IMPLANTS UNDER DYNAMIC LOADS AND MOMENTS IS NECESSARY

SUMMARY

MAXIMAL LOADING OF SIMULATED CHAIR RISE ACTIVITY

P = 0.006

GAMMA 3	INTERTAN
35.4^0 ROTATIONAL INSTABILITY	5.5^0 ROTATIONAL INSTABILITY

SUMMARY

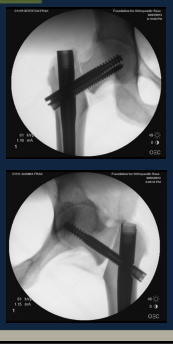
MAXIMAL LOADING OF SIMULATED CHAIR RISE ACTIVITY

P = 0.021

GAMMA 3	INTERTAN
8.4^0 VARUS COLLAPSE	5.4^0 VARUS COLLAPSE

CONCLUSION

- THIS MAY HAVE SIGNIFICANT CLINICAL IMPLICATIONS



Thank You