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Introduction

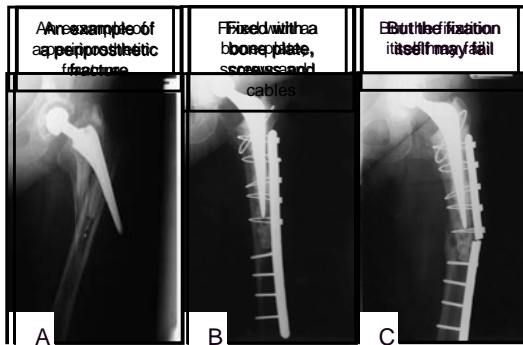


Figure 1- A: a typical periprosthetic fracture, B: a fracture fixed with a locking plate, C: the same patient after 4 months following a domestic fall, with a fractured plate. Adapted from [1].

- Periprosthetic fractures have a reported occurrence rate between 0.1-2.3% after primary arthroplasty, and 2.8-7.8% after revision arthroplasty [2-4].
- With an ageing population and the rate of total hip arthroplasty in the UK increasing to over 77,000 in recent years, the occurrence of periprosthetic fractures is expected to rise accordingly [5].

Aim

- To investigate the ability of locking plate fixation in its standard mode of application to restore pre-fracture biomechanics when compared to long stem revision.

Methods

- The mechanical behaviour of n=5 specimens in four groups shown below were evaluated under 500N axial loading at angles of 0° and 10° of adduction in the frontal plane and aligned vertically in the sagittal plane.
- Strain gauges were attached at predetermined sites along the length of one femur from each test group.
- Load against displacement data was used to calculate the stiffness of each specimen.

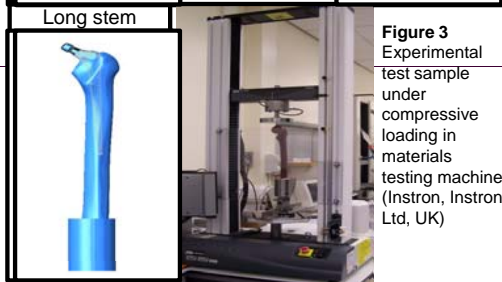
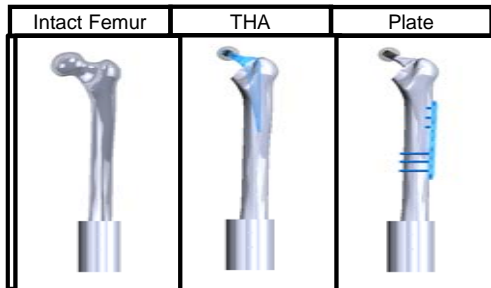


Figure 3 Experimental test sample under compressive loading in materials testing machine (Instron, Instron Ltd, UK)

Results

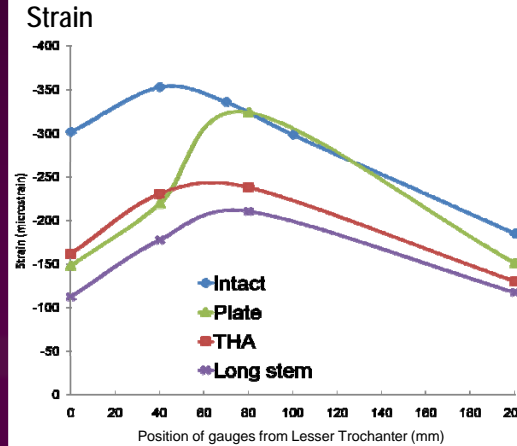


Figure 4: Strain (microstrain) along the length of the femur on the medial side, measured distally from the Lesser Trochanter, for the intact specimens and all instrumentation cases at 0° adduction.

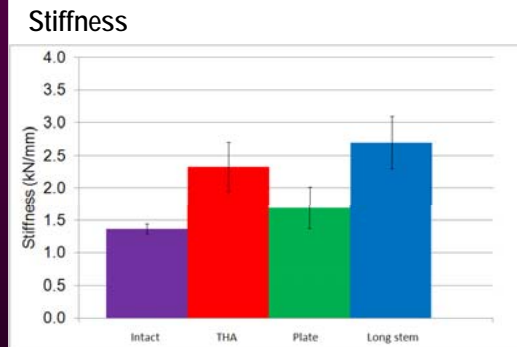


Figure 5: Stiffness of the specimens calculated from loading at 0°. Significant differences shown with * (ANOVA P<0.01, Tukey post-hoc).

Results

- Moving from 0° loading to the more anatomically realistic 10° causes all cases to show higher overall stiffness and lower strain, however the patterns observed remain the same.

Conclusions

- This study demonstrates that long stem revision results in a more stable construct compared to locking plate fixation.
- Long stem revision may therefore provide a reduced risk of non-union in transverse B1 fracture cases and be a good option in cases where the surgeon can afford to revise.
- The results of this study will be used going forwards to validate finite element models which will then enable several more fixation configurations to be evaluated and optimised for different types of PFF.

Significance

- This comparison of two periprosthetic femoral fracture fixation techniques currently used, provides information on their relative stability, moving towards clearer clinical recommendations and fewer fixation failures.

References

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