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Novel Methodology for Using Radiostereometric Analysis to Monitor Fracture Healing

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Et al.

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Background

•Radiostereometric Analysis (RSA) is a method for performing highly accurate three-dimensional measurements *in-vivo* using sequential radiographs.

• RSA has been used extensively for monitoring prosthesis fixation in hip and knee replacements.

• Recently, there has been increasing interest in applying RSA towards the monitoring of fracture healing.

Purpose

The purpose of this study was to evaluate the feasibility of using RSA to measure strain, stress, and plate migration in a distal femur fracture model.

Methods

Femoral sawbones with a distal femur fracture were used as models. A distal femur condylar locking compression plate (LCP) was used to reduce the fracture. Stainless steel screws were used to fasten the plate to the sawbone. Translucent polyester screws were composed, embedded with 1mm steel beads, and fastened to the most proximal and distal portions of the plate. This allowed for recognition by RSA imaging. The femoral sawbones were placed in a mechanical testing complex and RSA X-rays taken at different forces of compression. The radiographs were analyzed for plate migration using the 1mm steel beads as points of reference.

Results

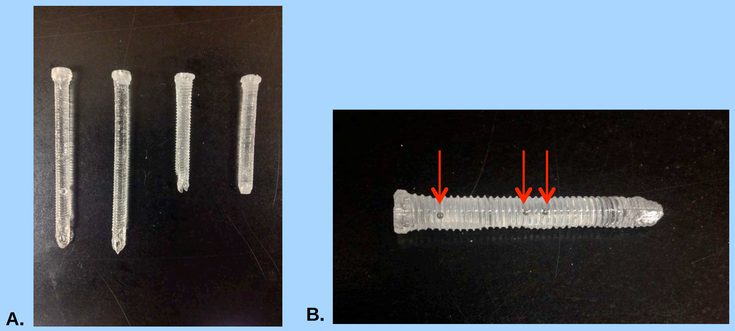

Figure 1. Translucent polyester resin screws (A) embedded with 1mm chrome steel ball bearings as indicated by arrows (B).

Figure 2. Sawbone femur model with distal femur locking plate and fracture gap (A). AP and oblique x-ray views of distal femur model with 1mm chrome steel bearings visualized as labeled by arrows (B).

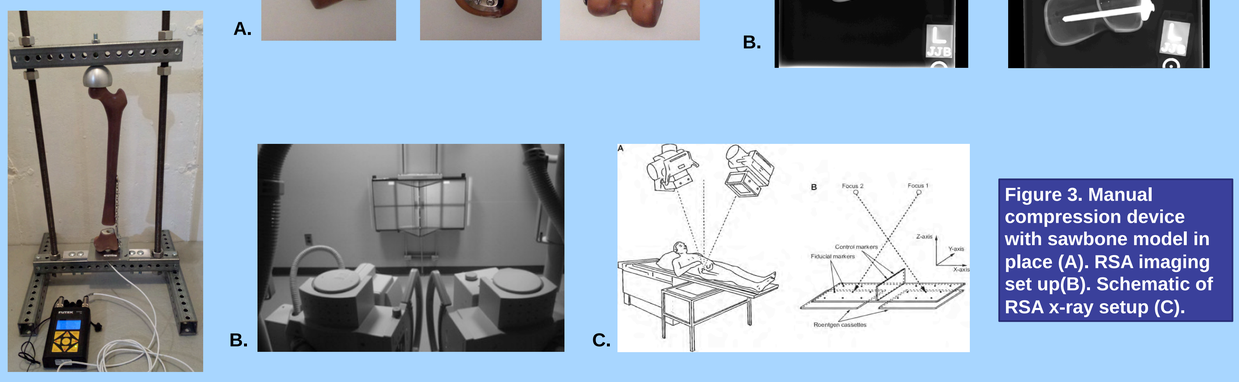

Figure 3. Manual compression device with sawbone model in place (A). RSA imaging set up(B). Schematic of RSA x-ray setup (C).

Summary

•Interfragmentary displacement was observed and measured directly under manual compression using RSA.

•The chrome steel beads were visualized using RSA allowing for the possibility of direct measurements of migration at different loads of force.

Conclusion

•The ability to measure plate migration in a Radiostereometric Analysis X-ray model is an important step towards improving the ability of orthopedic surgeons to monitor fracture healing and prevent non-union.

•The next stage of this research will involve using this model in clinical trials of distal femur fractures and building a database to correlate levels of plate migration with surgical outcome.

Acknowledgments

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