

PURPOSE:

Following repair of tendon laceration, it would be useful to know the most sensitive imaging method for detection of repair failure or gapping at the repair site. Although clinical exam is important, adhesions, callus at the repair site, and recurrent rupture may be difficult to differentiate clinically. MRI (1.5T or 3.0T) and ultrasound can both be used for tendon imaging of tendon lacerations but it is unknown how various suture materials and gapping at the tendon repair site interfere with MRI and ultrasound imaging.

HYPOTHESIS:

Due to potential suture artifact, high resolution ultrasound may be more sensitive and accurate than 1.5T and 3T MRI for gap measurement after Zone 2 flexor tendon repair.

METHODS:

- 48 digits (thumbs excluded) from 12 matched fresh-frozen cadaver upper extremities
- FDP was transected in Zone 2, and a 4-strand locked cruciate repair was performed
- Repairs were randomized to 3 gap sizes:
 - 0mm- no gap
 - 2mm
 - 4 mm
- Repairs also randomized to suture type
 - 4-0 Fiberwire
 - 4-0 Ethibond,
 - 4-0 Prolene
- Specimens evaluated by:
 - 1.5T MRI
 - 3 T MRI
 - high resolution ultrasound

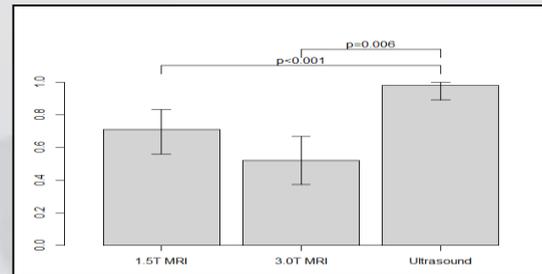


Figure 1: Proportion of measurements that were analyzable based on imaging type.

RESULTS:

- Multivariate regression indicates that imaging method and gap are responsible for observed differences in accuracy and number of measurements that could be made ($p < .05$) (Figure 1)
- 1.5T MRI had less artifact than 3T MRI (more gaps able to be measured confidently) ($p = 0.11$) (Figure 1)
- Ultrasound had significantly less artifact than both ($p = 0.001$ and 0.006 respectively), but accuracy in determining smaller gap sizes (0 and 2mm) was sacrificed and less than both MRI types (Figure 1)
- For larger gap sizes (4 mm), all 3 modalities underestimated, again with ultrasound's accuracy inferior to both MRI types. Suture type did not have a significant impact on measurement error between imaging modalities (Figure 2).

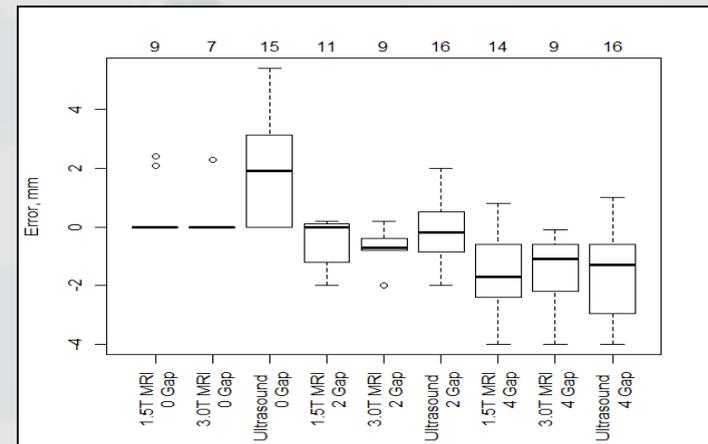


Figure 2: Tendon Gap vs Imaging Type

For MRIs that could be interpreted, MRI showed less error in gap measurement

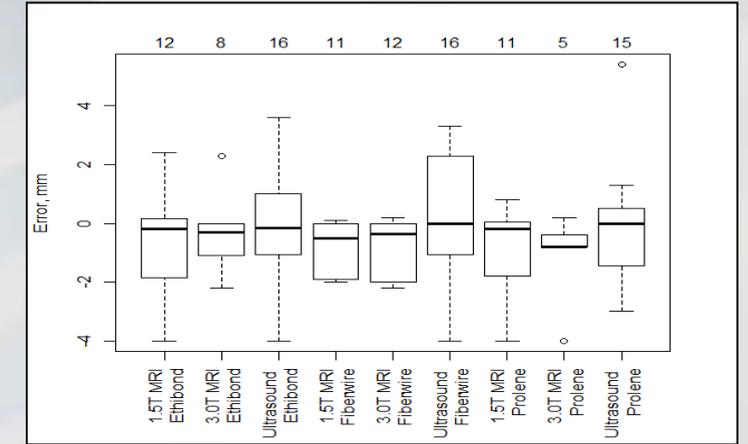


Figure 3: Tendon Gap vs Suture Type

Suture type does not appear to affect detection of gap as much as imaging modality

CONCLUSIONS:

- Suture type does not appear to affect measurement error as much as gap size and imaging modality
- Measurement of large gaps have more error (underestimation) for all 3 imaging modalities, with ultrasound being inferior to MRI
- Fewer images are analyzable with MRI compared to ultrasound due to artifact, but sensitivity and accuracy are superior to ultrasound for smaller gaps (<4mm)
- Future studies will address variation in MRI protocols/sequencing to determine if this can minimize artifact and error in measurement

•Images were interpreted by a board certified musculoskeletal radiologist and ultrasonographer blinded to gap and suture material used in repair

•Gap measurements were compared using regression and GEE models. Gaps not measured confidently due to artifact were excluded

•Generalized estimating equations (GEE) were used to compare predictors of error and measurability. McNemar's test for paired data compared predictability between groups. Error was plotted by imaging technique, gap, and suture type using boxplots. Lin's concordance correlation coefficient determined interobserver agreement between imaging techniques.