

Thermal Stress Potentiates Bupivacaine Chondrotoxicity



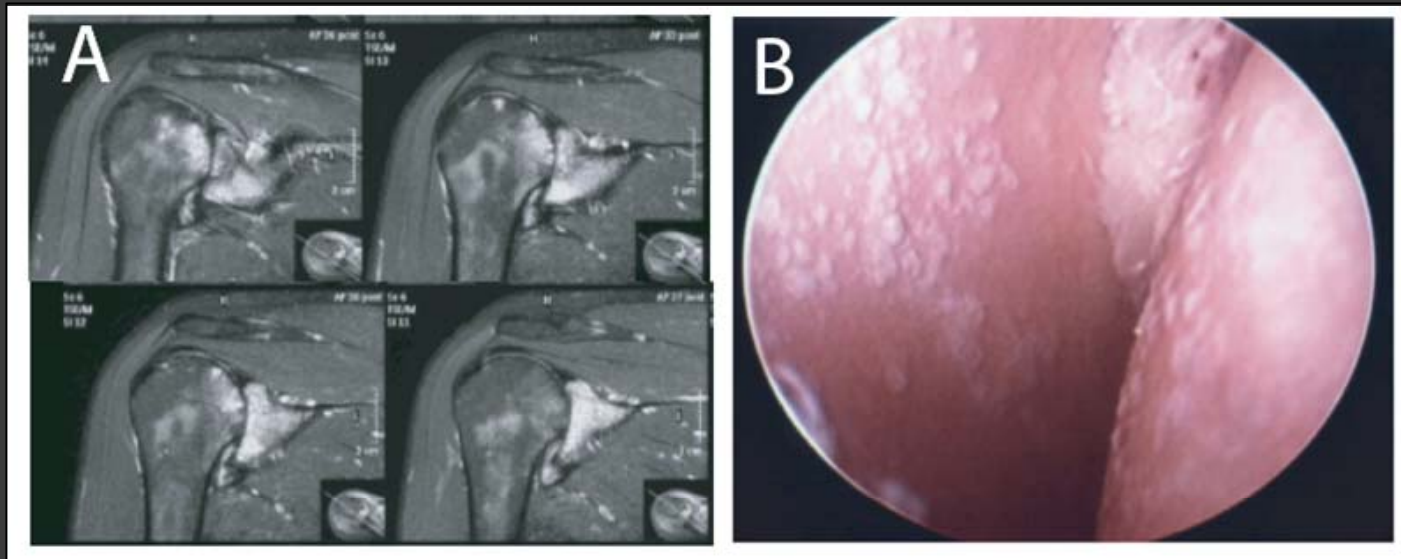
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Background

- Post-arthroscopic chondrolysis is a rare complication of arthroscopy



Potential contributing factors:

Intra-articular local anesthetics

Radiofrequency probes/ thermal stress

Irrigation fluid composition/ pressure

Suture/anchor materials

Background

- Local anesthetics have been shown to be cytotoxic to animal and human articular chondrocytes *in vitro* and *in vivo* in a dose and time dependent manner
- Radiofrequency probes increase intra-articular temperatures
 - Flow dependent
- Thermal stress has been shown to be chondrotoxic to human articular chondrocytes



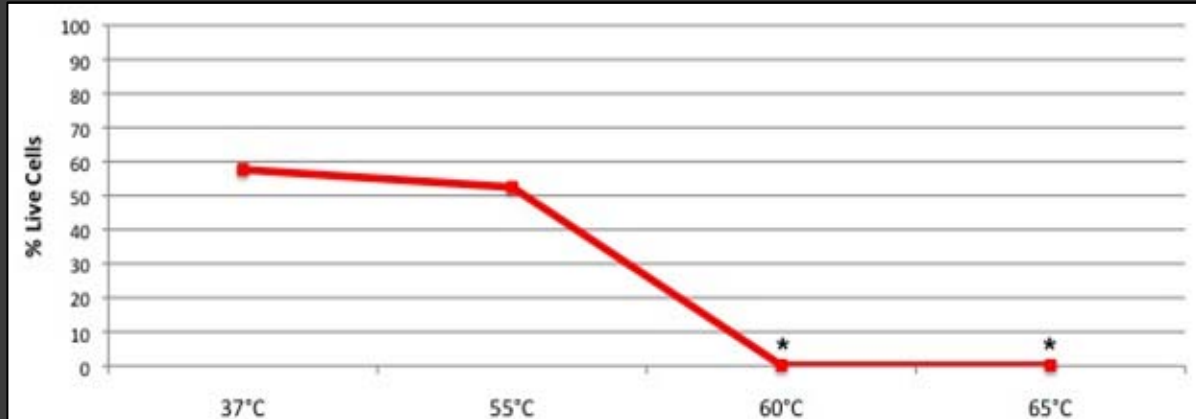
Hypothesis

- ⦿ Sequential exposure to thermal stress followed by bupivacaine will result in decreased articular chondrocyte viability compared to exposure to bupivacaine alone

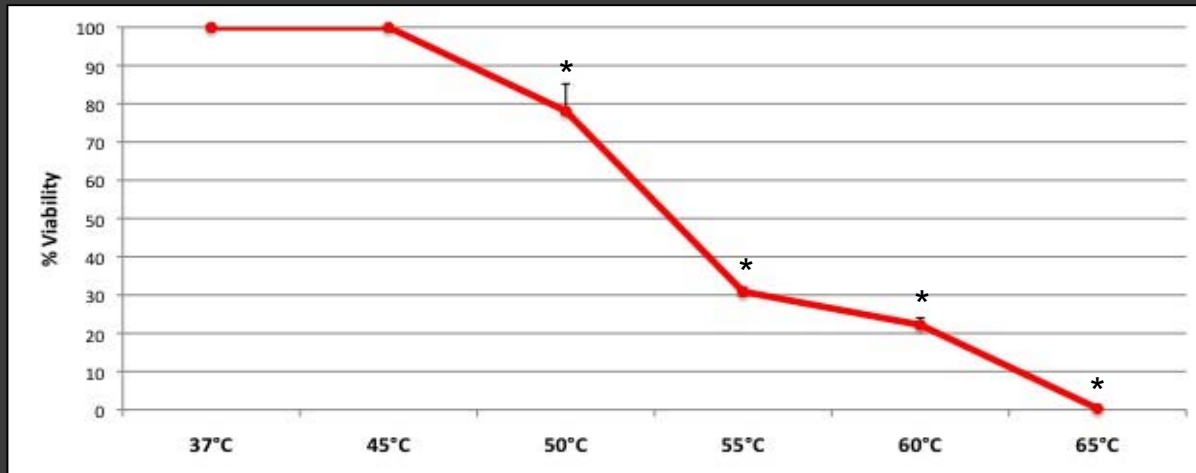
Methods

- ⦿ Bovine articular cartilage obtained from six hind stifle joints
 - Full-thickness cartilage explants and monolayer chondrocyte cultures taken from each specimen
- ⦿ Three specimens used to produce temperature/viability curve
 - 37 (control), 45, 50, 55, 60 and 65°C for 20 minutes
 - Viability measured 24 hours after treatment
 - Live/Dead Cell Viability/Cytotoxicity Assay for cartilage explants
 - CellTiter-Glo Luminescent Cell Viability Assay for cultured chondrocytes
- ⦿ Thermo-toxicity threshold:
 - Temperature that did not cause a significant decrease in chondrocyte viability compared to control

Explant Temperature/Viability Curve



Monolayer Temperature/Viability Curve



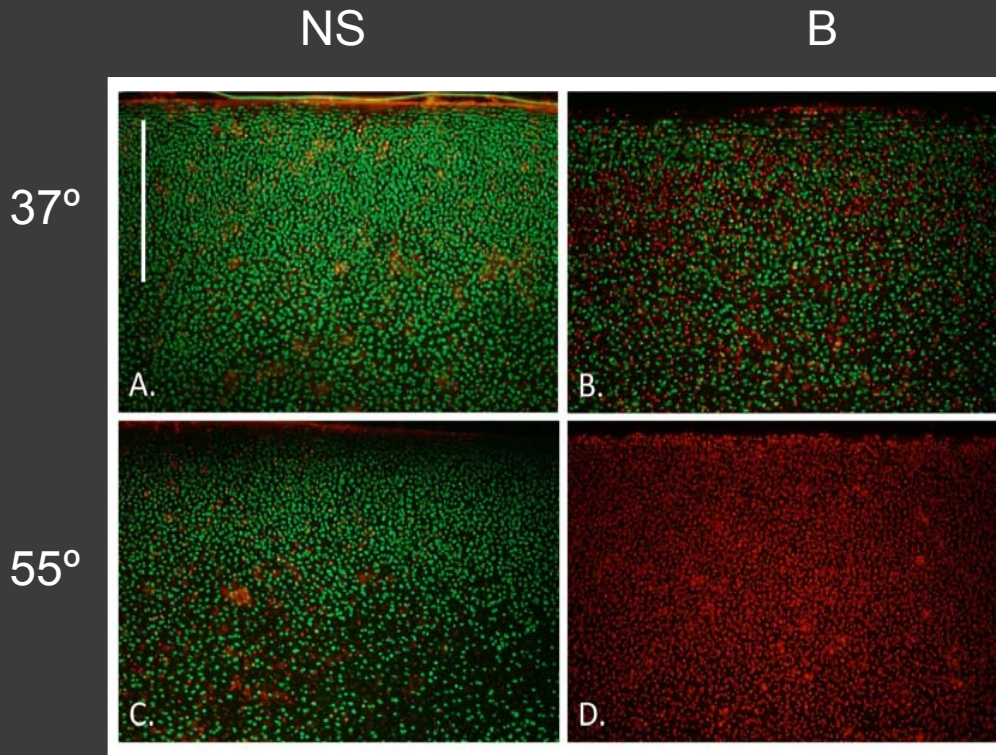
Error bars= SE, n=5, *= p<0.05

Methods

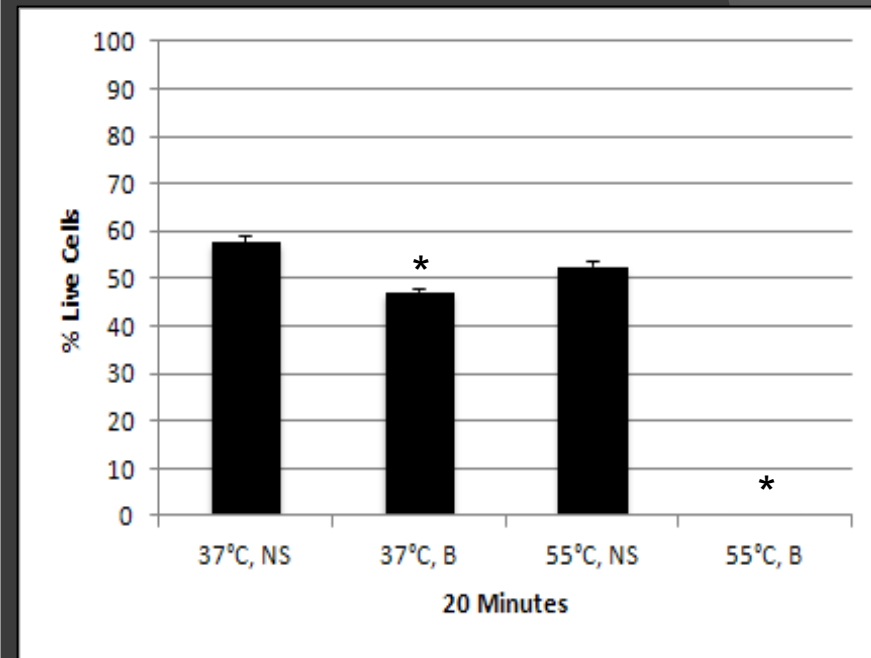
- ① Five specimens then were treated in the following manner:
 - Explants exposed to 37° or 55° C for 20 minutes
 - Cultured chondrocytes to 37° or 45° C for 20 minutes
 - Thirty minutes later, the explants and cultured chondrocytes treated with either 0.9% normal saline or 0.5% bupivacaine for 30 minutes
 - 24 hours after treatment, chondrocyte viability was measured as described previously
- ① Significance determined using ANOVA with Tukey's post-hoc analysis
 - Significance set at $p < 0.05$

Results

Thermal Stress and Bupivacaine in Explants



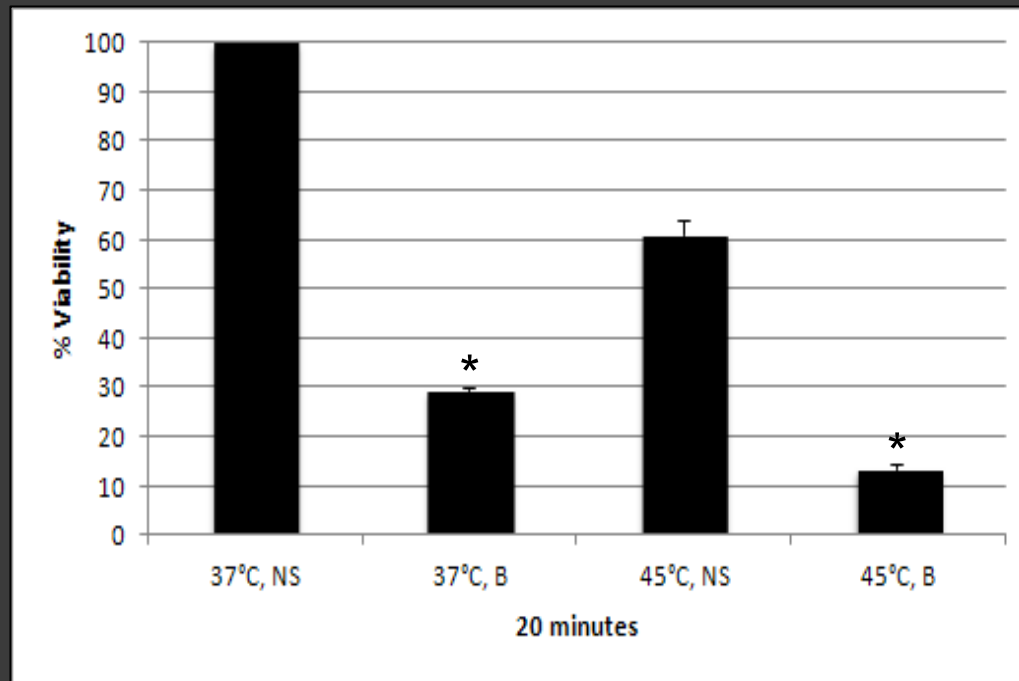
Mag. x10, Calibration bar 1mm



Error bars= SE, N=5, *= p<0.05

Results

Thermal Stress and Bupivacaine in Monolayer



Error bars= SE, N=5, *= p<0.05

Conclusions

- ⦿ Thermal stress potentiates the chondrotoxic effect of bupivacaine in bovine articular cartilage in vitro
 - This occurs after sequential exposure
- ⦿ This effect is seen in intact cartilage but not monolayer culture
 - Increased potentiation in explants may be due to protective effects of extracellular matrix
- ⦿ Additional studies are needed to investigate potential clinical implications

Acknowledgements

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