Biofilm Elimination via Combined Thermal and Antibiotic Treatment

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Introduction

- **Biofilm**
  - More than 150,000 (patients/year) in US
  - Biofilm resistance to antibiotic

- **Current Therapy**
  - High dose of antibiotics
  - Two invasive surgeries
  - Long time of recovery
  - Increase infection possibility
Introduction

Thermal Mitigation Approach

Long Term Goal: Develop remote heating technique by which biofilms on medical implants can be eliminated and address high cost and long-term recovery of multiple invasive surgeries.

Previous Work: Applying a localized thermal shock have reduced and eliminated biofilm infection.

Hypothesis

We hypothesize that biofilms can be eliminated at milder temperature if combined with antibiotics which have no effect by themselves.
Methods

- **Alternating Magnetic Field**
  - Generate localized heat
  - Heat-up surface of implants
  - Thermal shock biofilm

- **Synergism with Antibiotics**
  - Apply heat before, during and after thermal shock
  - Test wide range of doses
Results

- **Mild Thermal Shock only**
  - Reduce biofilm population density

- **Antibiotics Only**
  - Biofilm resistant

- **Antibiotics and Mild Thermal Shock**
  - Enhanced thermal shock
  - Complete biofilm eradication

![Diagram](image.png)
Conclusions

- Thermal shock is more effective than antibiotics on biofilm.
- Combined effect of thermal shock and antibiotics enhance thermal shock efficacy.
- Combined effect of thermal shock and antibiotics on biofilm elimination proceed far after the thermal shock is removed.
- Biofilms can be eliminated with milder thermal shocks than previously believed.

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