

Effects of Unfocused Extracorporeal Shock Wave Therapy on Gram Positive and Gram Negative Bacteria

John Novak¹, Meera Govindaswami¹, Karen Novak¹,
Jeffrey Ebersole¹, Wolfgang Schaden², and Neil House³.

¹University of Kentucky, Lexington, KY, USA

²Trauma Center Meidling, Vienna, Austria

³Tissue Regeneration Technologies, Woodstock, GA, USA

Introduction

- ▶ Unfocused shock waves are increasingly being used to promote hard and soft tissue healing using low energy and low pulse
- ▶ Previous studies have shown bactericidal activity of focused shock waves
 - Lithotripter; $0.96\text{mJ}/\text{mm}^2$; 1000-4000 pulses
- ▶ No studies to date have examined the bactericidal effects of unfocused shock waves at lower energy and pulse levels

Materials and Methods

▶ Shock wave treatment

- Dermagold[®], MTS (Konstanz, Germany)
- 0-500 pulses
- Energy Flux Density (EFD): 0.12mJ/mm², 0.22mJ/mm², 0.30mJ/mm²

▶ Bacteria

- Gram positive
 - ▶ *Streptococcus mutans*, *Actinomyces naeslundii*, *Staphylococcus aureus*,
- Gram negative
 - ▶ *Porphyromonas gingivalis* (\pm capsule), *Fusobacterium nucleatum*,

Materials and Methods

- ▶ Bacteria grown to late log, early stationary phase
- ▶ Bacteria counted using a Petroff-Hausser chamber
- ▶ 3ml ($1-3 \times 10^5$ bacteria/ml) of culture placed in a finger pouch of a sterile surgical glove
- ▶ Each sealed pouch treated with ESWT
- ▶ 0.1ml aliquot aseptically removed every 100 pulses for culturing and enumeration

Results



Figure 1: Effect of Unfocused ESWT on Gram Positive Bacteria
S. mutans ATCC # 25175.

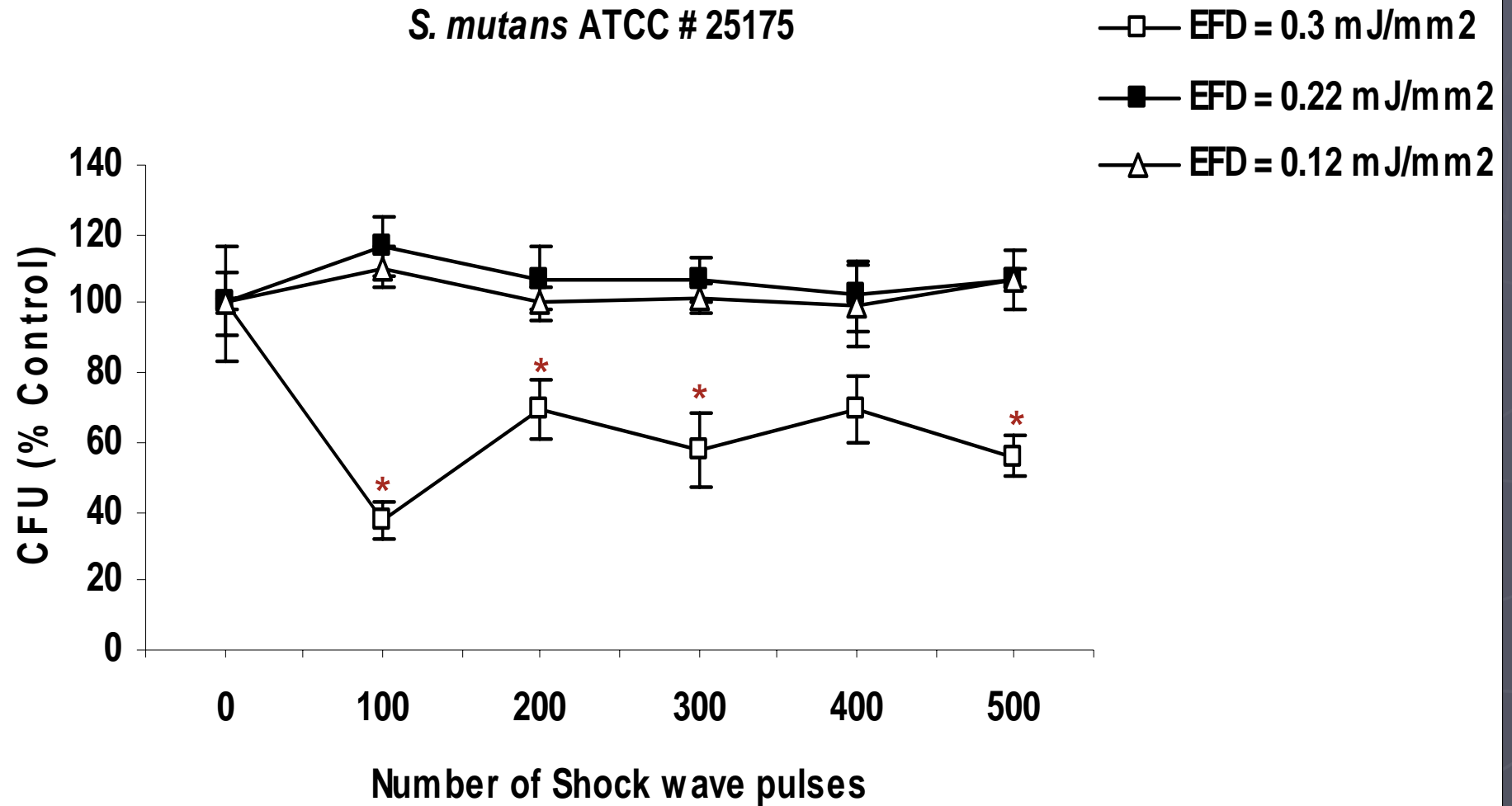


Figure 2: Effect of Unfocused ESWT on Gram Positive Bacteria
A. naeslundii ATCC # 49340

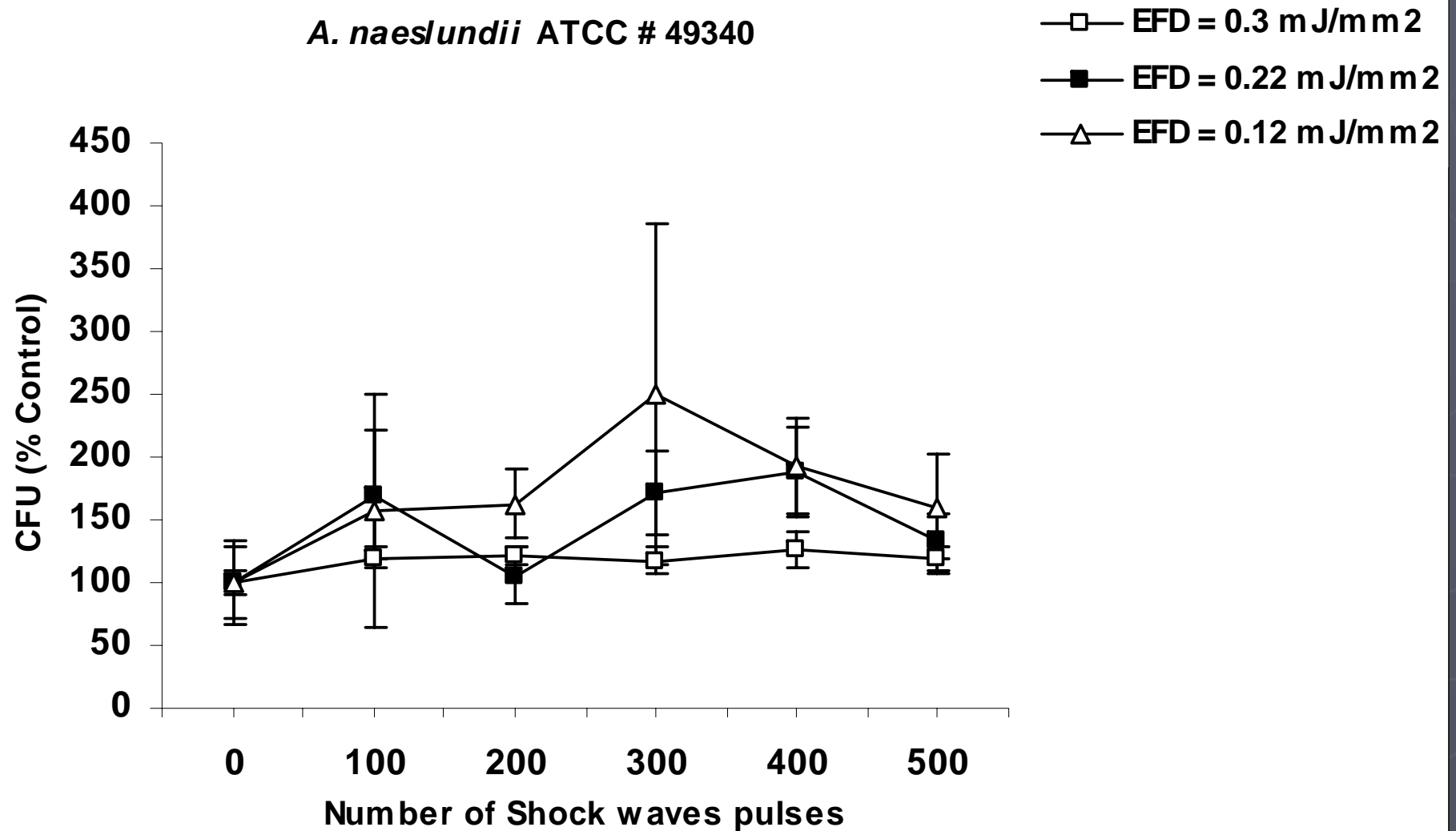


Figure 3: Effect of Unfocused ESWT on Gram Positive Bacteria
S. aureus ATCC # 12600

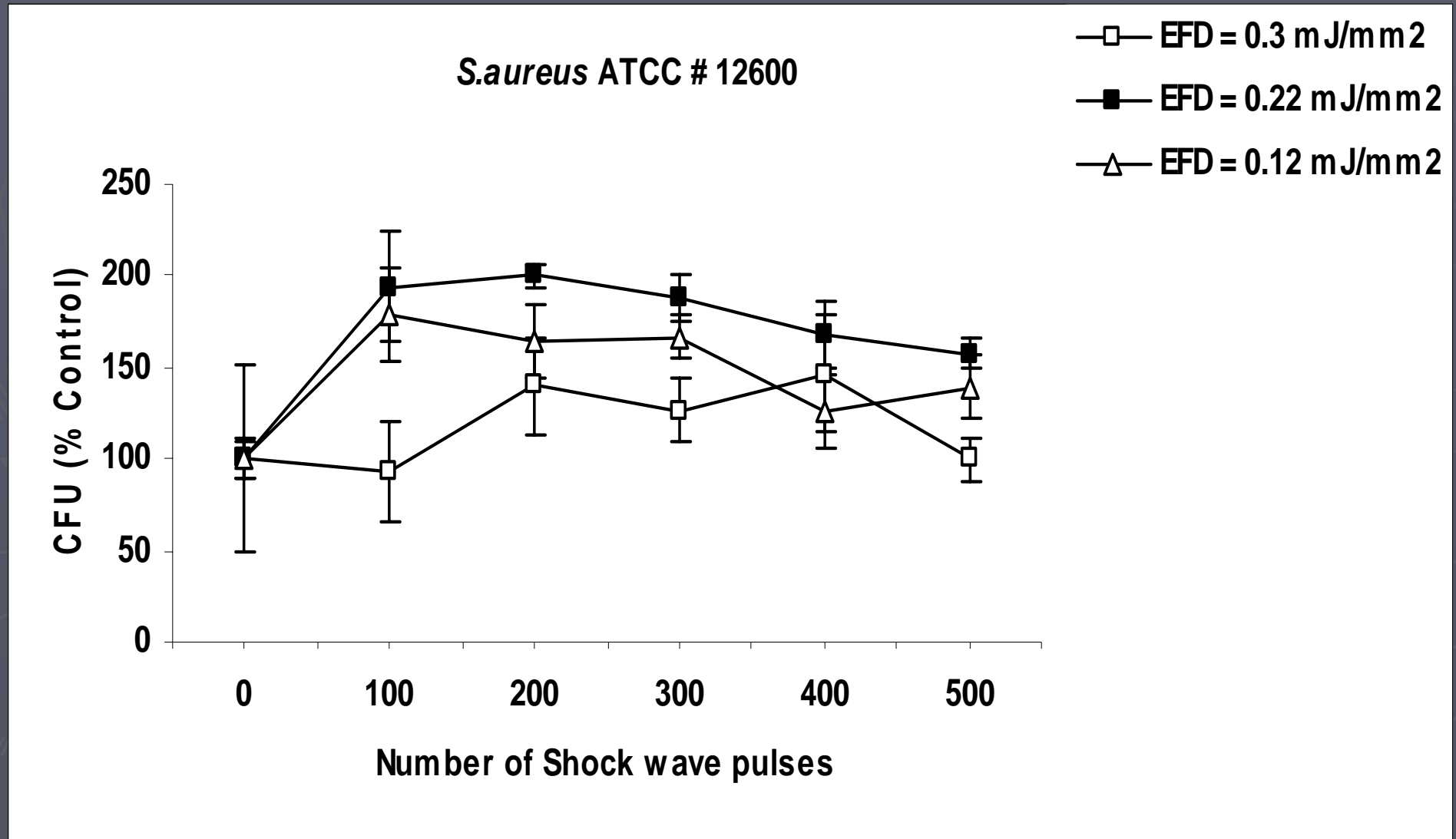


Figure 4: Effect of Unfocused ESWT on Gram Negative Bacteria
P. gingivalis 381

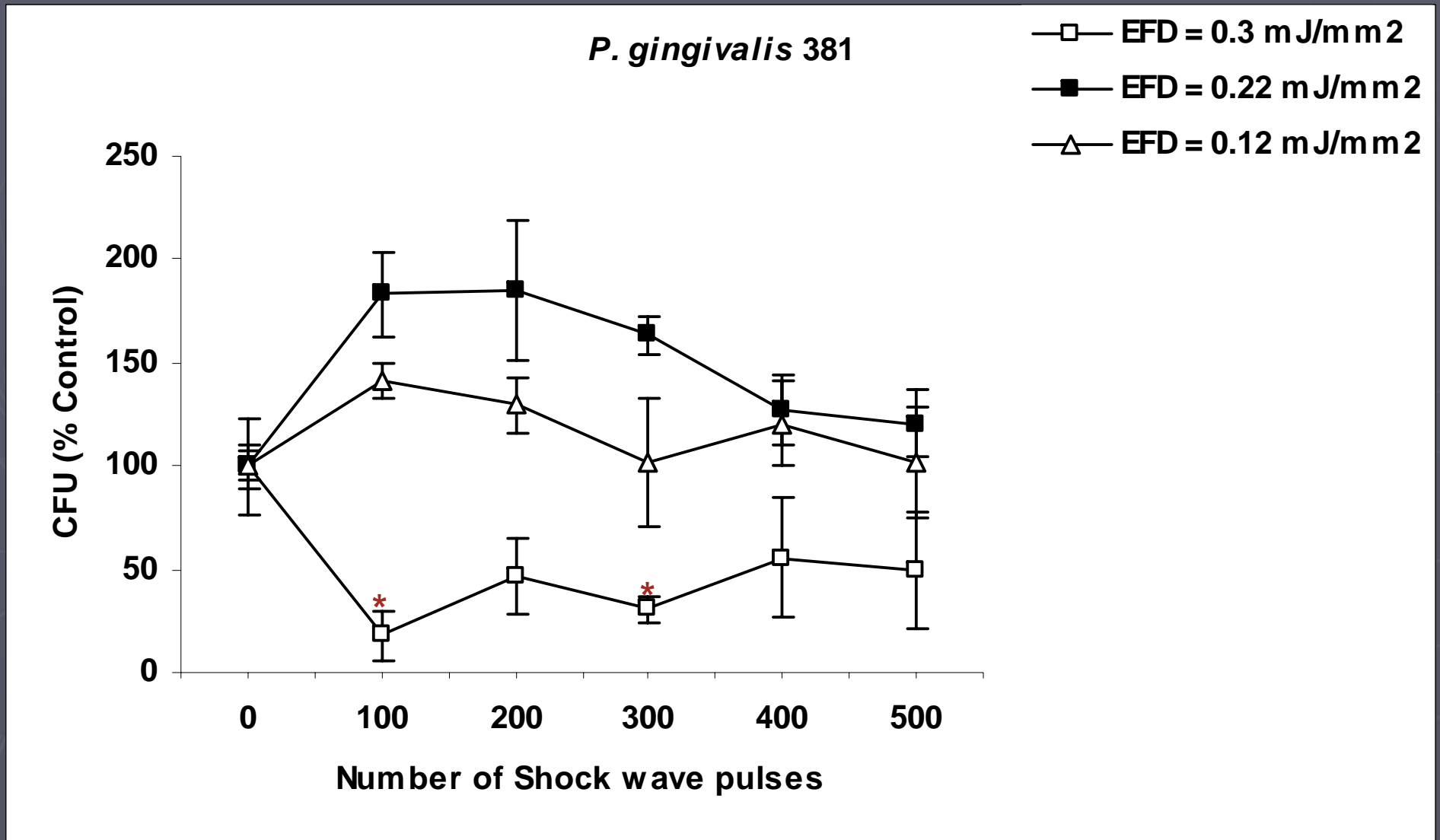


Figure 5: Effect of Unfocused ESWT on Gram Negative Bacteria
P. gingivalis W83 ATCC # BAA-308

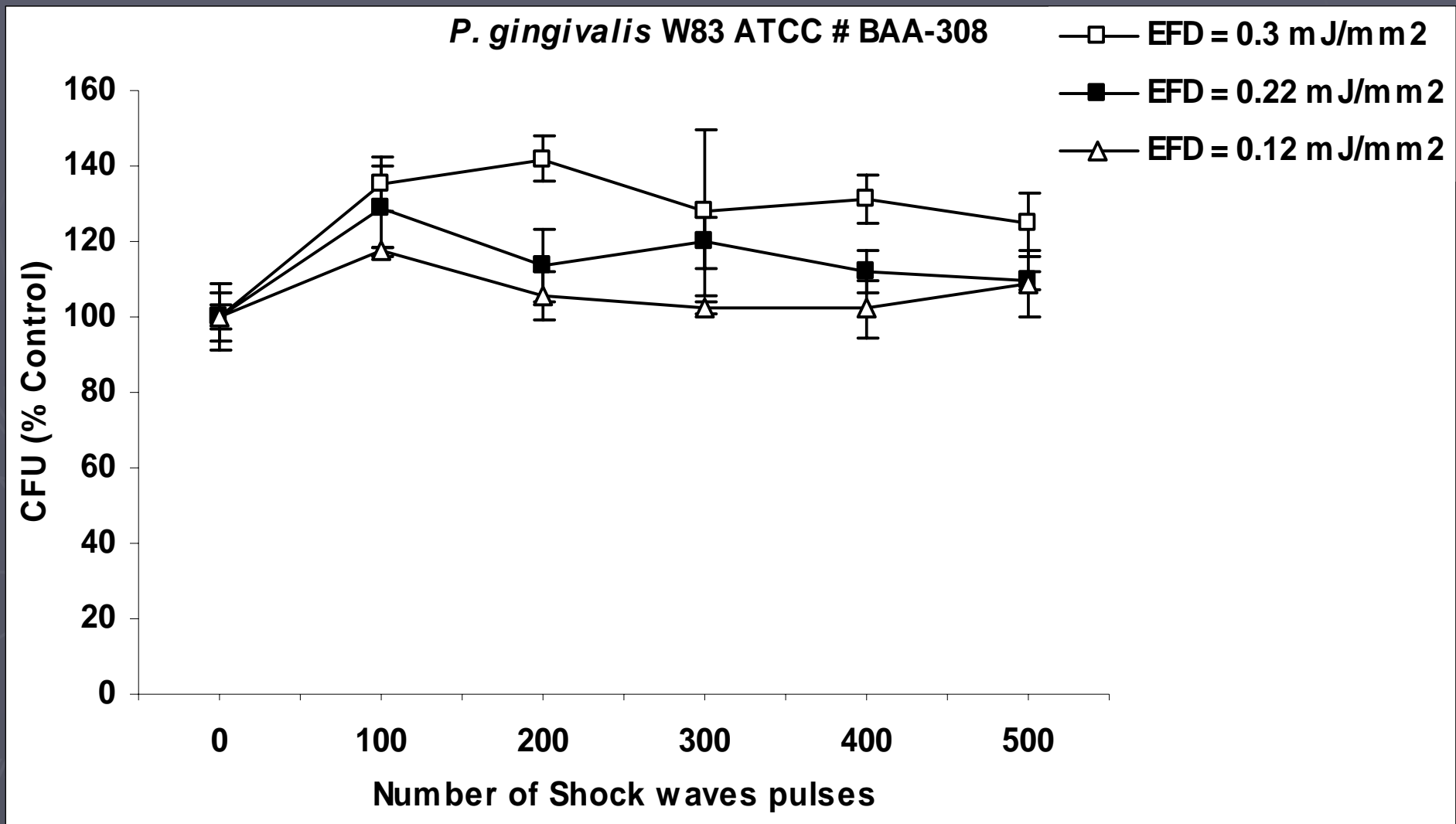
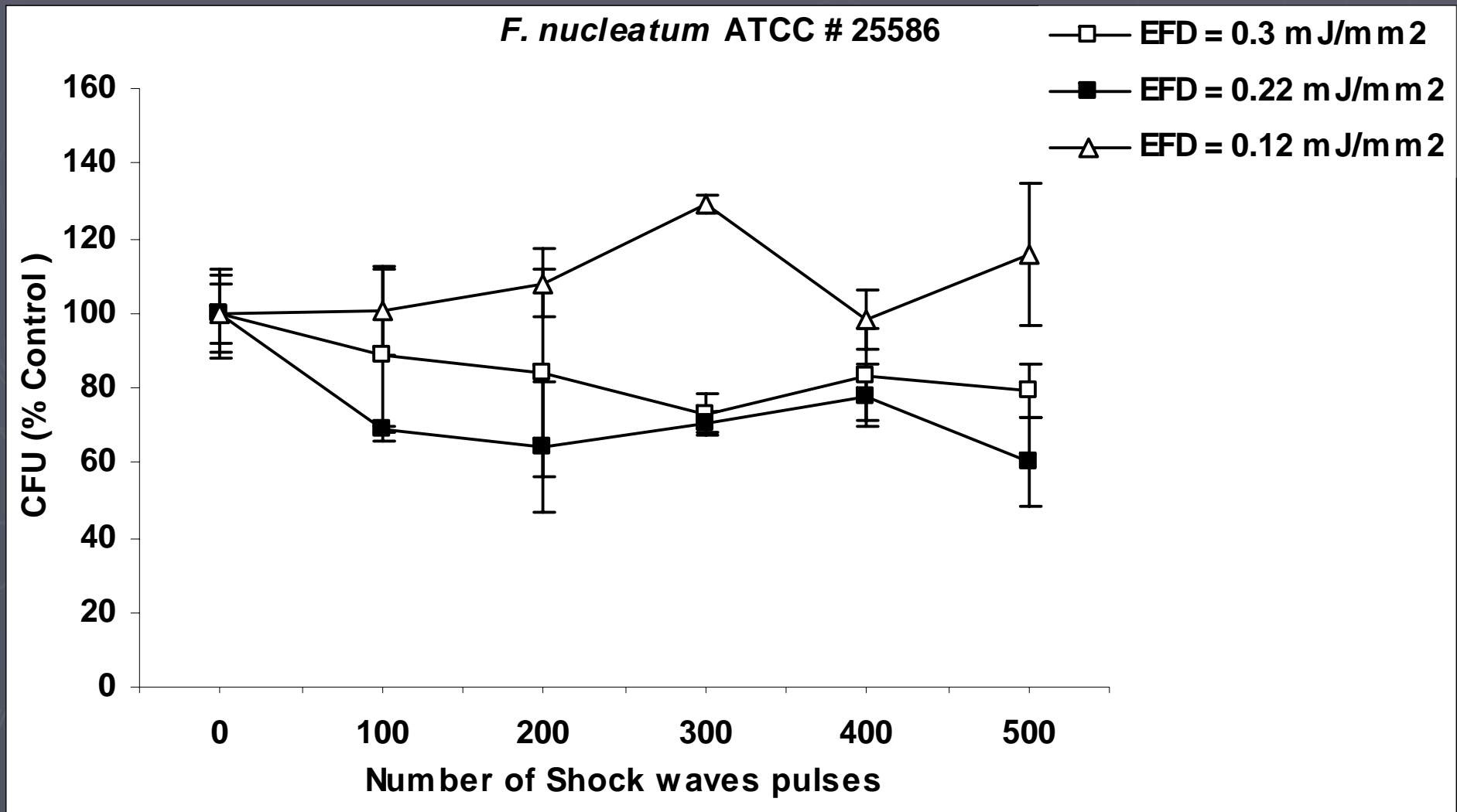


Figure 6: Effect of Unfocused ESWT on Gram Negative Bacteria
F. nucleatum ATCC # 25586



Conclusions

- ▶ Unfocused shock waves, at energy levels and pulse frequencies frequently used to promote healing of soft and hard tissue lesions,
 - are bactericidal for selected Gram positive and Gram negative bacteria.
 - can disrupt bacterial aggregates potentially making them more susceptible to antibacterial treatment

▶ Email: mjnova2@uky.edu

▶ Phone: 859-323-5159

▶ Fax: 859- 257-6566

▶ Address:

- Dr. John Novak
University of Kentucky
Center for Oral Health Research
414, Health Sciences Research Bldg
Lexington, KY 40536-0305