



# A new understanding of IFC energy transfer in tissue

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# Background

- Traditionally, IFC has been used for pain management on the theoretical bases of:
  - ◆ producing maximum stimulation where the two currents intersect deep in the tissue.
  - ◆ minimum stimulation occurs at skin surface and outside intersection area



# Background

**No clear effect of IFC in pain** (Beatti et al 2010, Fuentes et al 2010 )

**Resistance of skin and the underneath structures to electric current** (Ozcan et al 2004, Sunaga et al 2002)

**Lack of evidence of IFC transfer in tissue.**

**Does IFC reach target tissue?**



# Objectives

**To investigate:**

- **depth of penetration** of IFC through soft tissues
- **area of spread** during clinical application



# Method

**A laboratory based study of healthy participants**

**12 healthy subjects  $31.67 \pm 5.35$  years and BMI 18-32 kg/m<sup>2</sup>**

## **Inclusion criteria**

**No pain or impairment of lower limb function**

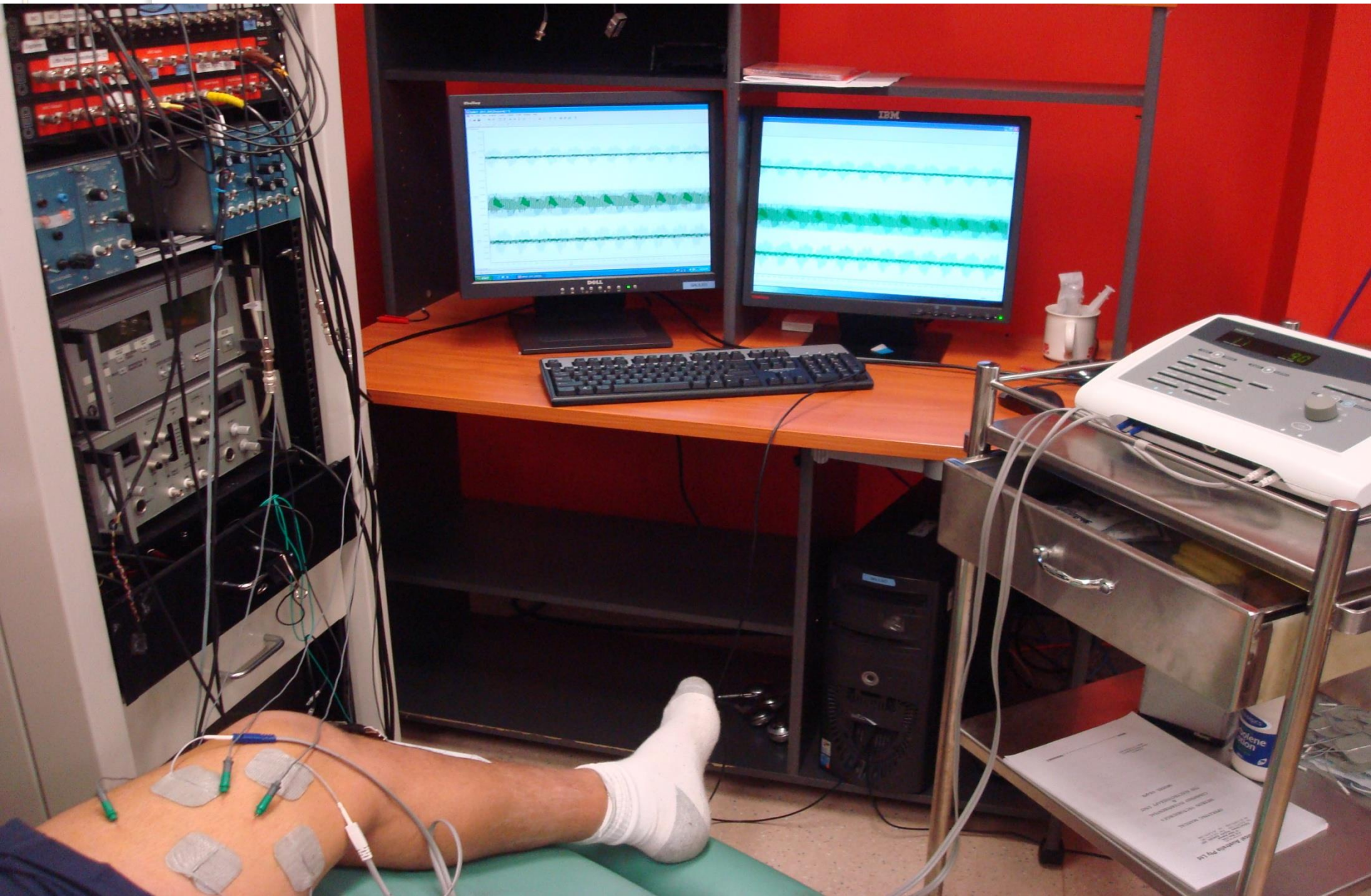
**No orthopedic or neurological pathology**

**No breaks or irritation of the skin**

**IFC was applied to medial thigh**

**Induced voltage was measured via fine coated needle electrodes connected to Cambridge Electronic Design and Spike software**

# Testing environment





# Method

**Subjects tested on 1 occasion for 45 minutes**

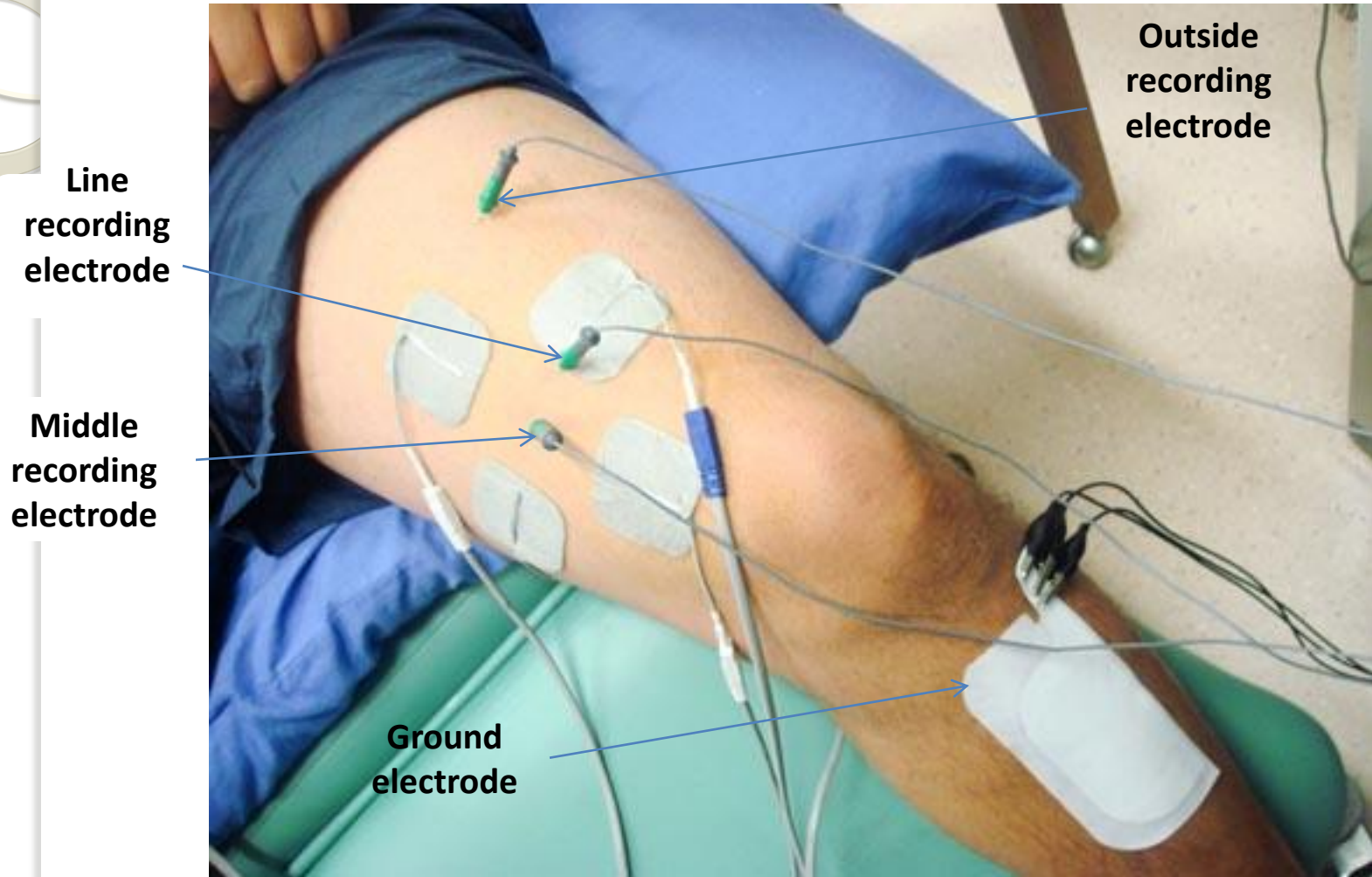
**Three depths (skin, subcutaneous and muscle)**

**Three areas ( middle, in line and outside the electrodes )**

**Four currents tested ( Premodulated , true IFC 4, 40 and 90Hz)**

**Voltage readings taken at each tissue depth from each electrode during each tested frequency**

# Methods

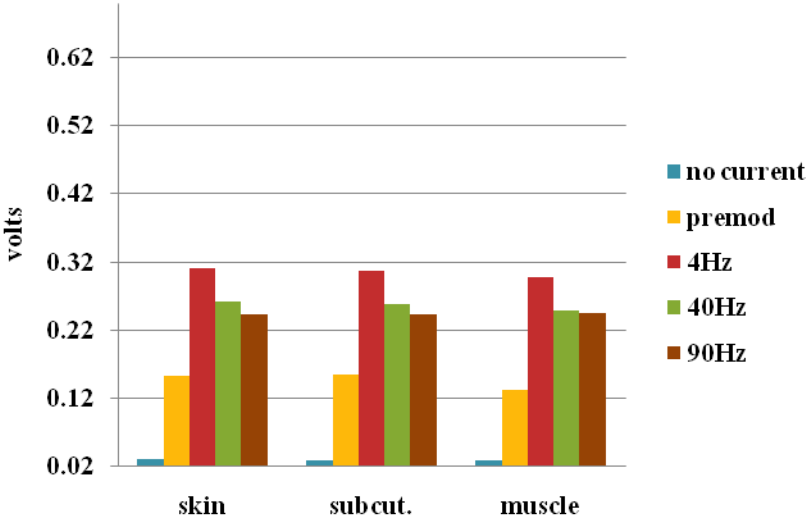


IFC electrodes and needles placement

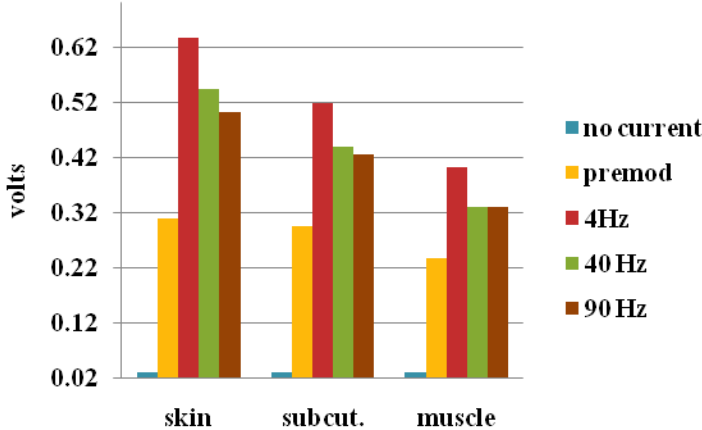


# Results

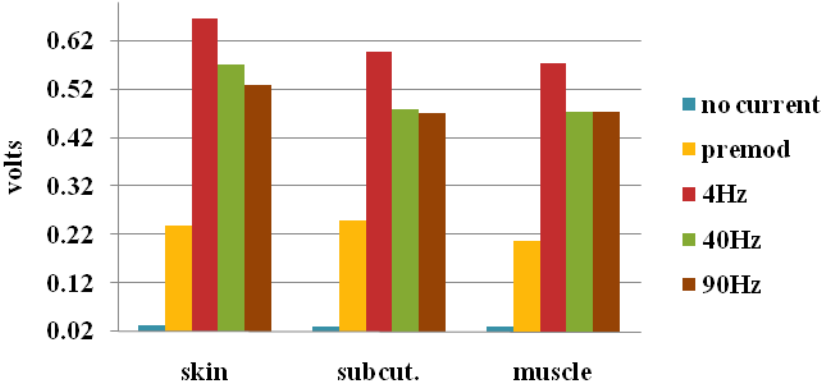
### Middle of 4 electrodes



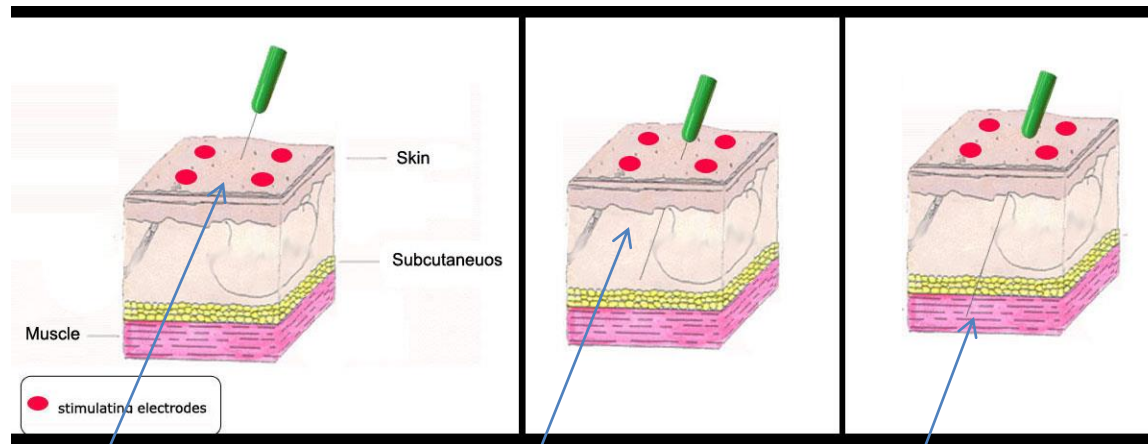
### In line with one circuit



### Out side 4 electrodes



# Results: Depth of penetration



Highest  
volt.

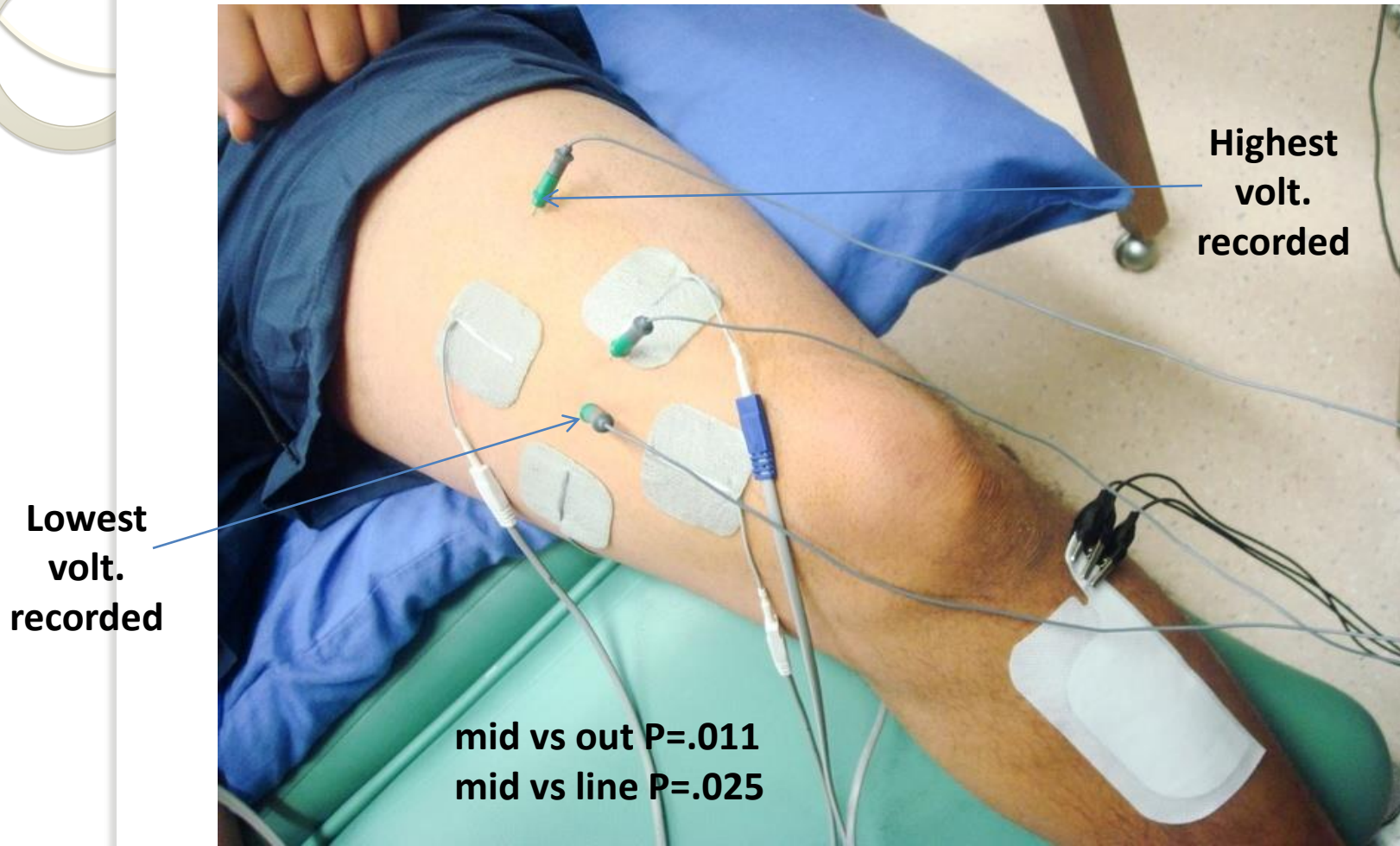
lower volt.

lowest  
volt.

Skin vs muscle P=1

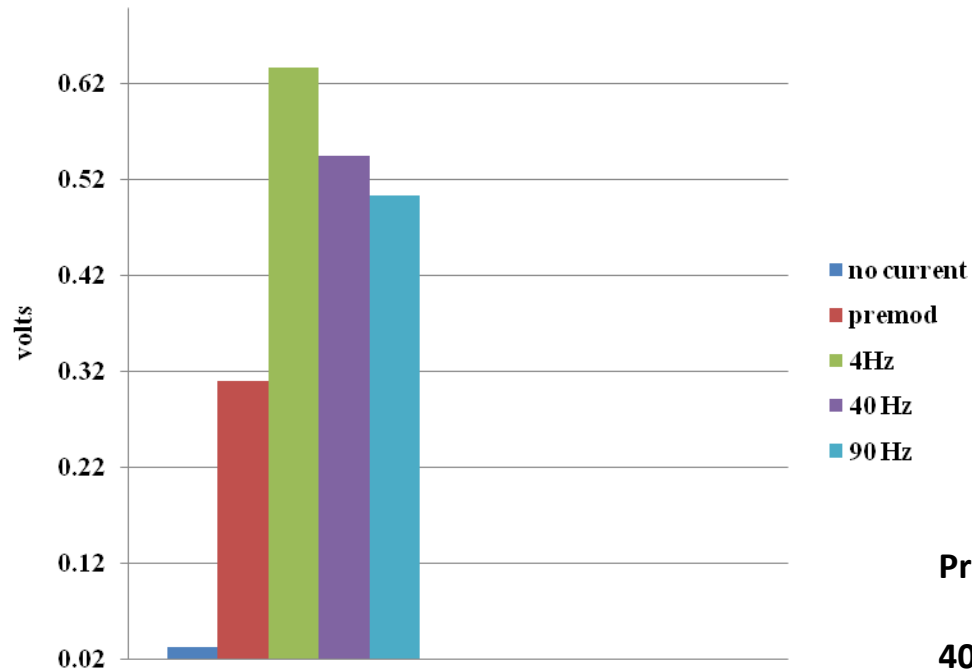
Comparison of depths

# Results: Area of spread



Comparison of areas

# Results



**Premod. vs "true" IFC P=.001**

**40Hz vs 90Hz P=0.047.**

**Comparison of currents**



# Conclusion

**All tested currents passed through soft tissues and reached muscle tissue .**

**For each frequency of “true” IFC, the voltage was higher in the skin outside the electrodes. **Not in muscle at crossing point****

**Premodulated had higher voltages recorded from the subcutaneous in the line with one circuit.**

**Further studies with larger sample size are required to confirm the results of this study**



# Clinical significance

**Clinical evidence based of the penetration of the IFC to reach target tissue for treatment purposes**

**If pain management depends on the amount of voltages inside the tissue then:**

- **the crossing application method IFC is not the best way to apply IFC**
- **beat frequency of 4Hz is most efficient**
- **premodulated is less effective when targeting deeper tissue.**

# Thank you

