Migraine-Focused Iontophoresis and TENS Therapy using NSAIDs (MITT-N)
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Corporate Sponsor: CerSci Therapeutics
Department of Bioengineering
BMEN 4389 – Spring 2017

Project Motivation

- Chronic pain affects nearly 100 million Americans, but the treatment methods that exist to alleviate long-term pain have harmful side effects
- Current treatment options, such as non-steroidal anti-inflammatory drugs (NSAIDs) taken orally, present poor systemic availability due to poor drug absorption in the gastrointestinal (GI) tract
- Other significant challenges, including drug-related overdoses, ulcers, cardiovascular conditions, blood clots, and kidney damage are associated with the oral administration of NSAIDs

Project Goals

- Design a long-term wearable device for migraine pain relief that administers both iontophoresis to enhance the absorption of topical over-the-counter (OTC) drugs through skin and transcutaneous electrical nerve stimulation (TENS)
- Utilize a graphical user interface to allow users to adjust the current amplitude for both TENS and iontophoresis, pulse width and frequency to accommodate therapeutic needs
- Develop an in vitro drug absorption testing protocol with iontophoresis application to quantify transdermal drug delivery

Final Design

MITT-N Device

In Vitro Drug Absorption Testing Setup

Table 2. Drugs compounded and used for testing

<table>
<thead>
<tr>
<th>Name</th>
<th>Concentration (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Diclofenac</td>
<td>2</td>
</tr>
<tr>
<td>Ibuprofen</td>
<td>2, 10</td>
</tr>
</tbody>
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In Vitro Drug Absorption Results

- Porcine cadaver testing and UV-Vis performed in experimental triplicates with n = 3, resulting in data from n = 9
- Data in Figure 5 and Table 3 was recorded without the use of iontophoresis

Table 3. Drug absorption data collected via UV-Vis showing average values and standard deviations.

<table>
<thead>
<tr>
<th>Drug</th>
<th>Optical Density</th>
<th>Concentration [mg/L]</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ibuprofen 10%</td>
<td>3.7286 ± 0.0218</td>
<td>257.6644 ± 84.3231</td>
</tr>
<tr>
<td>Diclofenac 2%</td>
<td>3.7404 ± 0.0609</td>
<td>50.7581 ± 44.0165</td>
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Conclusions & Future Works

- Novel combination of TENS with iontophoresis-mediated transdermal drug delivery can potentially improve long-term pain management outcomes
- Further in vitro drug absorption testing with additional drug candidates (resveratrol)

Acknowledgements

- Dennis Robbins, Greg Dussor, Lucas Rodriguez and our sponsor CerSci Therapeutics for their guidance
- Engineering Directors Joe Pacheco, Todd Polk, and Robert Hart for their technical advice and continued support
- Steven Folan, Clark Meyer, members of the Dussor lab, Animal Biotech and other individuals who provided facilities and input

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