The Effect of Wrist Braces on Wrist Tremor in Parkinson’s Patients

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Abstract

Parkinson’s Disease (PD) is a major problem in the human population, affecting 6.3 million people worldwide, and diagnosed in 1% of the population over 60. Unfortunately, Parkinson’s has no cure at the moment, so treatments and therapies are aimed at reducing the symptoms, namely tremor. One especially problematic area for PD is in the wrist and forefingers, which makes everyday precision tasks difficult. In this study, we hypothesized that a simple forearm brace could possibly alleviate the tremors found there. Tremor in the wrist is primarily caused by muscles in the forearm, including the pronator and supinator muscles. In this presentation, we explore the possibilities of a forearm brace designed to constrain these muscles at the command of the patient, and return to a relaxed state when the reduced tremor is no longer necessary. When we explored the potential of commercially available injury braces, we found that they reduced the tremor by up to 50%, based on simulated tremor induced by an EMS (Electrical Muscle Stimulation) device. Further work in this field can be utilized and helpful to Parkinson’s patients, as well as patients of Essential Tremor, a condition very similar to PD.

Background & Goal

Parkinson’s Disease is a life changing diagnosis which can impact nearly every aspect of a person’s daily life. Although PD is most commonly diagnosed in the elderly, it is not solely found in those cases, and can become present at any age. Tremor caused by Parkinson’s or essential tremor is most commonly found in the upper extremities, but can also occur in the jaw or face. As of now, PD has no absolute cure, however it is possible to treat and mitigate some of the symptoms through proper treatment. This premise is the reason behind why I chose to conduct this study.

The goal of this study is to provide a basis for further research in the development of braces specifically designed to alleviate or reduce the severity of the tremor incurred by patients of PD and Essential Tremor. Although these devices were store bought and not modified specifically to reduce tremor, if their general stabilizing properties could be proven to slightly help patients with Parkinson’s, then any specifically targeted adjustments would amplify the effects these wrist braces have on tremor.

Materials & Methods

Wrist braces used in this study include:
- Walgreens brand wrist support bandage (by ACE)
- Walgreens brand wrist support bandage with removable splints (by ACE)
- Walgreens brand elastic bandage (by ACE)
- Walgreens brand comfort lift elbow support (by ACE)

The PM-55S EMS Digital Muscle Stimulator was used to simulate tremor in a test subject that was not diagnosed with PD.

Approach

In order to simulate Parkinson’s tremor without a patient, we attached an Electrical Muscle Stimulant Device (EMS) to Professor Andrew Gouldstone, which allowed us to test the effects of these braces safely and easily.

Parkinson’s tremor is most accurately measured using a real-time laser positioning system that can plot and calculate the amplitude, frequency and position of the patient’s hand. Unfortunately, since these machines are expensive and bulky, we used an easier, more understandable method to communicate the benefits of wrist braces: handwriting. One task that PD patients seem to have an immense amount of trouble with is writing, as tremor in the wrist and forefingers makes sturdily gripping a pen very difficult. As a result, we determined that handwriting analysis for this study would be appropriate.

To begin, we applied the EMS device to the subject but did not turn it on, and asked the subject to sign his name and draw a spiral on a sheet of paper with minimal effort. After this, we repeated the process with the EMS device on. I wrapped each brace around the subject’s wrist and asked him to sign his name and draw a spiral. Then, the same process was carried out for two elbow braces as well, to determine whether or not an elbow brace could also potentially reduce tremor.

Results

<table>
<thead>
<tr>
<th>Experiment #</th>
<th>Brace Name</th>
<th>Tremor Analysis (With 1 being little to no tremor and 10 being the same amount of tremor as in the control.)</th>
<th>Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Control (with EMS)</td>
<td>N/A</td>
<td>10</td>
<td>N/A</td>
</tr>
<tr>
<td>1</td>
<td>Elastic bandage (Wrist)</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>Wrist support bandage</td>
<td>7</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>Wrist support bandage (With Splints)</td>
<td>6</td>
<td>2</td>
</tr>
<tr>
<td>4</td>
<td>Comfort lift elbow support</td>
<td>12</td>
<td>4</td>
</tr>
<tr>
<td>5</td>
<td>Elastic bandage (Elbow)</td>
<td>12</td>
<td>4</td>
</tr>
</tbody>
</table>

Conclusions & Future Work

As can be seen in the table above and by the handwriting analysis, a wrist brace can indeed reduce the severity of the tremor by 30-50%. However, the elbow brace did the opposite of intended and amplified tremor, causing the handwriting to become worse than it was with only the EMS device. Using this information, future research can now be conducted about possibly making effective braces that can reduce tremor. If future work was to be done in this area, it should be focused on the wrist rather than the elbow, and should have properties more like that of the elastic bandage due to its higher satisfaction value and its neater, less irregular handwriting patterns.

Also, this experiment did not take comfort into account, which might need to be considered for consumer satisfaction. The current goal of this study is to provide foundation for the creation of a comfortable consumer wrist brace that would allow a PD patient to carry out a variety of every day tasks without being a burden or uncomfortable for the consumer to wear.

References

http://www.pdf.org/symptoms_primary

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