Introduction

- Peripheral neuropathy arises from multiple different underlying medical conditions and can lead to serious functional limitations and significant long-term healthcare costs.
- Lumbar spinal stenosis (LSS) and diabetic peripheral neuropathy (DPN) are often misdiagnosed
  - due to the similarities in symptoms and pathologies
  - The ability to classify these impairments non-invasively and with high specificity at a low cost would be beneficial.
- A head-mounted, triaxial inertial measurement unit (IMU) sensor may offer a unique and non-invasive method to identify various features in physiological vibration acceleration signals following sensory re-weighting.

Purpose

- To investigate the application of IMU sensors to differentially classify LSS from DPN compared to a control participant.

Methods

- EO and EC cumulative powers were similar for LSS and CON but were both meaningfully elevated for DPN (See Figure 3).
- The EO:EC ratio was higher in LSS compared to either DPN or CON. (See Figure 4).
- Left-right asymmetry was highest in the control during EO but was highest in DPN during EC (See Figure 5.)
- PSD distributions showed greater power at higher frequencies (12 to 15 Hz) for LSS, compared to either DPN or control (See Figure 6).

Results

<table>
<thead>
<tr>
<th>Classification</th>
<th>Gender</th>
<th>Age (Years)</th>
<th>Height (cm)</th>
<th>Weight (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>DPN (n=1)</td>
<td>Male</td>
<td>67</td>
<td>170</td>
<td>75</td>
</tr>
<tr>
<td>LSS (n=1)</td>
<td>Female</td>
<td>33</td>
<td>165</td>
<td>75</td>
</tr>
<tr>
<td>CON (n=1)</td>
<td>Male</td>
<td>42</td>
<td>176</td>
<td>74</td>
</tr>
</tbody>
</table>

Table 1. Participant Characteristics

- The IMU sensor was attached to participant’s right mastoid using a disposable medical adhesive.
- Participants were instructed to:
  - Stand upright in a relaxed position with feet together and arms by their sides
  - Participants maintained this position twice for 20 s each test:
    - once with eyes open (EO)
    - once with their eyes closed (EC)


Conclusion

- These preliminary data suggest that the unique digital signatures for DPN and LSS may enable classification of the different pathologies.
- These signals may also be used as a quantitative tool to monitor and assess patient treatment plans based on each patient’s unique digital signature.