UTILIZING THE ITERATIVE DESIGN PROCESS TO DEVELOP A HEEL STRIKE DETECTION DEVICE

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Patients who have had a stroke often experience hemiparesis after their incident, resulting in dysfunctional gait patterns. If not corrected, these temporary gait patterns may develop into a permanent gait dysfunction, which may include insufficient dorsiflexion during swing phase and impaired initial contact.[1] The aim of this research was to design and construct a low-cost heel strike detection device for use as an external cue during gait rehabilitation. In practice, the module attaches to the ankle and operates as a real-time positive biofeedback device.

In order to save money and time, an iterative design process was used to develop the functional device. The iterative design process is a repetitive process that involves prototyping, building, analyzing, and improving a design in order to meet predetermined specifications. For this project, most of the initial designs were built on a breadboard with larger components to give proof of concept. The first generation of the design yielded a prototype that worked when handled very carefully, but constantly broke in practice. In order to be used in practical application, the device needed to be more robust and be able to withstand stresses associated with walking. The functional first iteration provided for proof of concept and illuminated areas in which the device could be improved. The current iteration includes a printed chassis to provide stability for the wires and microcontroller and allows the device to be strapped to the ankle of the patient with the force sensing resistor attached to a pre-sized insole. The iterative design process was shown to be successful as each iteration came closer to meeting the evolving needs of the client. The iterative design process is one of the fundamental concepts of practical engineering allowing one to conserve resources and allocate time, providing for an efficient progression through ideas and functional prototypes.

[300 words]

1. Kerrigan, D.C., Burke, D.T., Nieto, T.J., Riley, P.O. Can toe-walking contribute to stiff-legged gait?*Am J Phys Med Rehabil*. 2001;80:33–37