A PUSH-UP DEVICE FOR TRANSHUMERAL AMPUTEES

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INTRODUCTION

The ability to perform regular exercise is important to the quality of life of many individuals. This push-up device is designed to support the residual limb to allow a person with a transhumeral amputation to perform push-ups for recreational exercise. The initial design was brought to the University of South Florida by an individual with a transhumeral amputation who had developed it for personal use. After analyzing the subject using the device, modifications were made and a second prototype was developed. This paper presents the analysis of the device and how these results led to design parameters for a new version of the device.

METHOD

Subject: One male amputee subject and one non-amputee control subject were included in this study.

Apparatus: Movement data were collected with an eight camera Vicon motion analysis system, and 20 passive reflective markers placed on anatomical landmarks of the subjects' upper body. Two AMTI force-plates were used to measure the ground reaction force under the each of the subjects' arms.

Procedures: Subjects were asked to complete three sets of three consecutive push-ups.

Data Analysis: Elbow angle, torso tilt, and weight distribution were calculated for the both subjects. Data from the motion analysis were then used to evaluate the design of the push-up device.

RESULTS

Both subjects were able to complete the push-ups with little difficulty. The subject with an amputation exhibited greater torso tilt, and more variance in torso tilt and weight distribution. Average elbow angle, torso tilt, and weight distribution are shown in Figures 1, 2, and 3 respectively. A picture of the original device designed by the subject is given in Figure 4.

DISCUSSION

The device was able to support the residual limb sufficiently to provide support during the entire activity, adding additional compliance to the sling, and slightly lowering the height could improve the torso tilt for the amputee subject, but requires further testing. Differences in elbow angle could be a result in hand placement during the push-up where the control subject used a more narrow hand placement then the amputee subject. Qualitative reports from the subject suggest the device reduced back pain that was present, possibly from lack of physical conditioning of the amputated side, but this result was not tested.

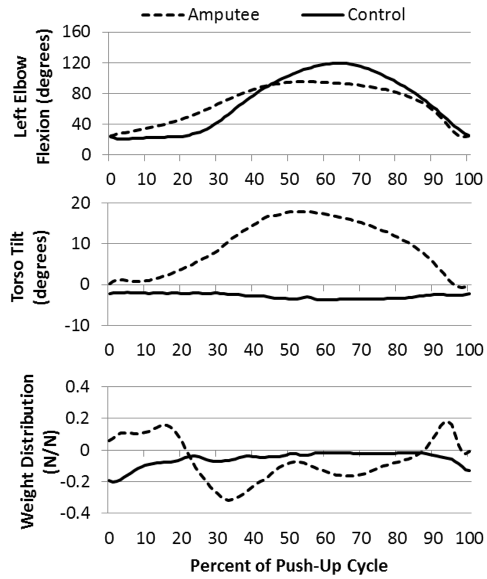

Figure 1,2,3. Normalized average elbow angle, torso tilt, and weight distribution for the amputee and control subjects, respectively.

Figure 4. The push-up device.

Future testing could include measuring electromyography signals from the pectorals and analyze the symmetry of muscle activation.

CONCLUSION

This device enables transhumeral amputees to perform bilateral push-ups similar to those of a non-amputee.

CLINICAL APPLICATIONS

This device can be built by prosthetist and patients who wish to perform push-ups as recreational exercise. Additionally this may lead to a variety of health benefits associated with regular exercise.

REFERENCES

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