Senior Design / BS / Project
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SCI Wrist Splint

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Abstract

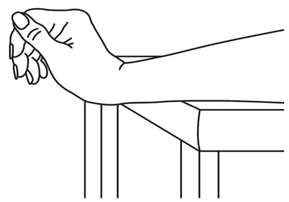
A quarter-million people in the United States suffer from spinal cord injury (SCI) and have difficulty eating without assistance. There is a need for a natural way to increase wrist stability and grip function to strengthen hand grasp and improve quality of life. Our project looks to utilize 3D printing to create an adjustable wrist splint for SCI patients with tetraplegia. Our first goal was to assure our splint had an angle deflection of once less than 5° when placed on the hand of a healthy subject. Results showed that deflection was less than 3.5°. Future directions include testing grip with a tetraplegic patient.

Introduction

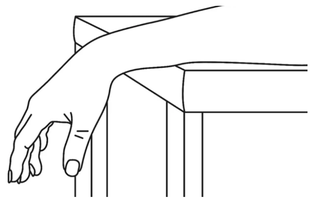
Out of the approximate 276,000 people in the United States living with spinal cord injury, more than half are tetraplegic. This population ranks regaining hand function as their highest priority. Tenodesis grip can be used to grasp food and other items. To induce tenodesis grip, the wrist must be at an angle of 135-145° with respect to a surface; a deflection of greater than 5° from the angle range greatly reduces grip strength. Standard splints only support the lateral open hand position.

Target positions to be induced with adjustable splint

Tenodesis Grip



Lateral Open



From Jung et al, Spinal Cord (2018)

Methods I Design I Analysis

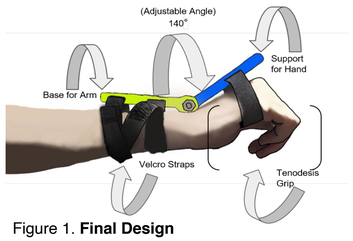


Figure 1. **Final Design**

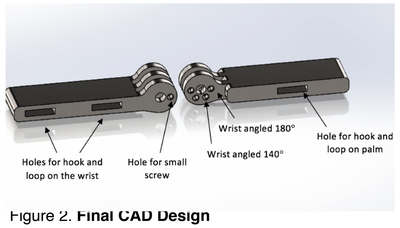


Figure 2. **Final CAD Design**

- Angle of 140° used for tenodesis grip
- Angle of 180° used for lateral open
- Angles controlled with adjustable screw

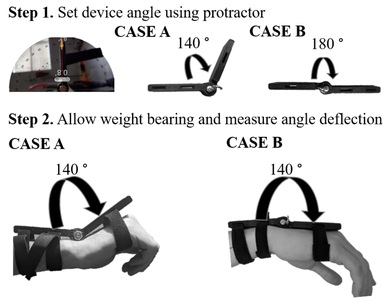
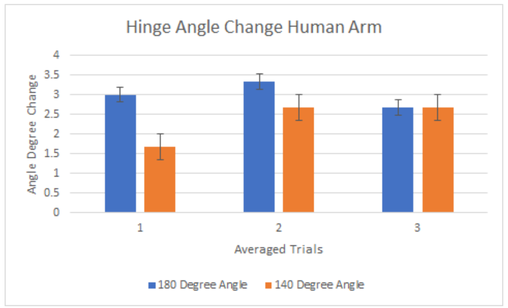


Figure 3. **Testing Methods**

Results



In the above results, both angles show a deflection of less than 3.5°. The angle deflection for the 140° and 180° are also observed to be within 2° of each other.

Conclusion

- **Angle deflection is within proper range**
- **Device works with healthy human subjects**
- **Future studies can test device with tetraplegic patients**

Acknowledgments

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References

National Spinal Cord Injury Statistical Center. (2014). Facts and figures at a glance. **Anderson, K. (2004).** Targeting recovery: Priorities of the spinal cord-injured population. *Journal of Neurotrauma, 21*(10), 1371-1383. **Harvey, L.** (1996). Principles of Conservative Management for a Non-orthotic Tenodesis Grip in Tetraplegics. *Journal of Hand Therapy, 9*(3), 238-242. **Jung, H. Y.,** Shin, H. I., & Lee, J. (2018). The natural course of passive tenodesis grip in individuals with spinal cord injury with preserved wrist extension power but paralyzed fingers and thumbs. *Spinal Cord, 56*(9), 900-906.