

The Use of Custom Silicone for a Sport-Specific Partial Hand Prosthesis: Design and 4 Month Follow-up

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ABSTRACT

Prosthetic solutions for the pediatric partial hand remain custom in design and fabrication. This case study moves through the fitting and fabrication process of the prosthesis and follows the patient, AM, through 4 months of use. AM was born with a congenital limb difference of her 2nd-4th fingers of her left hand. Her right hand is normal. At age ten, she began gymnastics and came to enjoy the uneven bars. Her left hand limited her progression in the event. AM was fitted with her prosthesis in March 2016. Follow-ups continued through July 2016. This case study demonstrates that a functional, sport-specific prosthesis can be entirely of high consistency rubber (HCR) silicone.

BACKGROUND

Prosthetic solutions for the partial hand and partial finger levels of amputation continue to expand. However, specific designs for sport application have not increased for these populations and the size of many of these devices are too large for pediatric application.

PATIENT

The patient, AM, is an 11 year old girl, weighing 65# (29.5 kg) and standing 4' (1.22m) tall. She has a congenital partial aphyalangia of the left hand (2nd-4th fingers). Her right hand is normal. She was beginning to work the uneven bars in gymnastics, but was limited by the grip of her left hand. This patient desired to continue advancing in her skill level. A typical partial hand solution of a wrist-based prosthesis was not an acceptable solution as it would limit her wrist motion, which can be crucial to acceleration and deceleration during the exercise.

PROSTHESIS

A custom, all silicone oppositional prosthesis was fabricated to restore the finger lengths of AM's left hand. All of the minor fingers were encapsulated within a low durometer (Shore ~25) custom silicone interface. The device restored power grip (flexed fingers 2-5) [1]. To increase the durability of the device, higher durometer HCR silicone (Shore ~80) was utilized for the finger extension. The final contour of the finger extension was directly

shaped around a bar of approximate diameter corresponding to the uneven bars.



Figure 1: The low durometer interface encompassing the minor fingers.

FOLLOW UP

AM was successful in increasing her skills and speed on the un-even bars with the new prosthesis within a week. She soon began producing sufficient centripetal force around the bar, that the prosthesis would inadvertently doff and cause her to fall. A double ring closure Dacron strap was added to the prosthesis at the wrist to increase the hold of the prosthesis to AM's hand. This was initially successful but soon proved insufficient to retain the prosthesis in place as AM increased her speed around the bars. Velcro was added to the strap to increase the security of the closure in April of 2016. The last report (July 2016) from the patient's mother was of gratitude for our work on the prosthesis: AM had placed 9th on the uneven bars in a gymnastics meet against able-bodied adolescents.

REFERENCES

- [1] Blair, SJ and Kramer, S. "Partial Hand Amputation" in *Atlas of Limb Prosthetics*. 1st Edition. Mosby, New York, USA, 1981.