UPPER LIMB PROSTHETIC TREATMENT CHALLENGES INVOLVING INDIVIDUALS WITH TRANSHUMERAL AMPUTATIONS SECONDARY TO BURN INJURIES: 2 CASE STUDIES

Ryan Spill CP, Brian Waryck CP, Marc Brog OTR
Advanced Arm Dynamics, LLC

INTRODUCTION

Upper limb amputations caused by burn injuries often present with several fitting challenges. Skin integrity following burn injuries require prosthetic interfaces that offer protective and healing properties and reduce shear forces. Some of these interfaces are prefabricated; others must be custom made. Materials for these interfaces include silicone, urethane, and mineral oil-based gels. When fitting amputees with burn injuries for myoelectrically controlled prostheses, challenges arise regarding the introduction of electrodes that must allow surface EMG signal to transmit through the gel interface. Two brief case studies will be presented illustrating the use of different examples of gel interfaces while allowing trashumeral amputees to use myoelectric signal to control an electric elbow, wrist rotator, and terminal device. Different types of electrodes and preamplifiers were used for both of these patients. Several of the challenges posed during these fittings will be presented as well as their corresponding solutions.

PRESENTATION OF CASE STUDIES

The first case study follows the fitting of a young man (age 27) who was injured approximately five years ago during a volunteer firefighting incident. The patient sustained several injuries which resulted in the amputation of his right leg proximal to the knee and his left arm proximal to the elbow. Although the patient retained full range of motion in both shoulders and elbows, the strength and dexterity of the contralateral hand were limited. The patient was fit initially with a transhumeral myoelectric prosthesis with a Dynamic Arm, a wrist rotator, and a Sensor Hand Speed. As the residual limb presented with burn scars and grafted skin, initial attempts at a skin-fit, suction socket were rejected. The initial interface was a custom silicone gel interface with two custom-made suction seals. The fitting process evolved into using prefabricated gel interfaces. The failure of suspension using standard electrodes necessitated this evolution. The final prosthesis included a prefabricated mineral oil-based gel locking liner, Motion Control snap electrodes, and Otto Bock preamplifiers. The second case study involves a young female patient (age 30) who was injured in a high-speed motor vehicle accident approximately 10 years ago. The majority of the body proximal to the waist was burned as she was trapped within the vehicle, and caused the amputation of the left upper limb proximal to the elbow. The injuries ultimately caused the amputation of the five digits of the right hand between the MCP and PIP joints. The patient was initially fit with a transhumeral myoelectric prosthesis with a Dynamic Arm, a wrist rotator, and a Sensor Hand Speed. The skin required the gel medium. Initially, a custom Silicone liner for use with standard electrodes was provided. Difficulty in inverting the liner for donning/doffing resulted in rejection. The use of standard electrodes caused suspensory challenges. The final prosthesis included a prefabricated silicone locking liner with LTI preamplifiers and Magnesnap electrodes.

DISCUSSION

These challenging case studies are important because they address the relationship between two critical elements, suspension and myoelectric control. Compromised skin integrity and volume fluctuations made the clinical choices not as obvious. The custom silicone liners were the initial choices for suspension, but difficulty with donning and frequent volume fluctuations caused patient rejection. Furthermore, the use of standard electrodes and openings in the liners caused failures in suspension. The prefabricated liners ultimately provided the best suspension when used with liner-integrated electrodes.

CONCLUSION

This subject presented the clinicians involved with multiple fitting experiments; the most challenging was the combination silicone suction suspension with myoelectric control. In one patient's case, the redundancy of suspensory mechanisms and snap electrodes were necessary for reliable prosthetic use. In the other patient's case, a prefabricated liner with Magnesnap electrodes was necessary for ease of repetitive donning and for reliable prosthetic control.

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