# ADVANCEMENTS IN MODULAR SOCKET INTERFACE DESIGNS - NASA ROBOTICS RESEARCH ENHANCES SOCKET INTERFACE CAPABILITIES

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## INTRODUCTION

As the evolution of prosthetics component technologies continues, great advancements in capabilities and quality of life are being realized. However, one of the remaining critical aspects of enabling persons with limb loss to function to their full potential is the development of novel socket interface designs. With the increasing performance capabilities of prosthetic limbs, a result of greater forces on the body is realized. This requires changes to be made in clinical interface designs to maintain comfort and functional outcomes.

Research and development in conjunction with NASA and the DoD has lead to significant enhancements in design of modular clinical prosthetics interfaces. Instead of using a typical encapsulated socket, these new interfaces utilize compliant fabrics for the prosthetic fit.

New designs for transfemoral, hip disarticulation, and upper extremity prosthetic interfaces have been developed using the technology from the NASA program.

## METHOD

These new interface designs effectively distribute the forces through integrated special fabric, versus rigid or semi-rigid materials of conventional socket systems, thereby allowing for the ability to increase loads and torques while simultaneously increasing user comfort and stability.

Extensive biomechanical research and development was conducted to find the optimal specific contouring of these specially selected materials about the body. Interface designs were then fabricated for prosthetic devices of various levels. Each of these designs provided predominantly fabric based contact about the body, versus conventional laminates or gels. Tests were conducted on various able-bodied and amputee subjects to determine comfort and stability outcomes, in various embodiments.

## RESULTS

In each of the tests, subjects found the fabric-based devices to be preferable over their pre-existing prosthetics fabricated from conventional materials.

In addition, these novel compliant materials provide a significant reduction in heat and moisture buildup. The use of these materials results in incredibly lightweight interface designs, and provide enhanced comfort and functional outcomes, especially when in conjunction with the most capable prosthetic components.

## DISCUSSION

The use of these prosthetic interface technologies have shown successful outcomes in practical clinical application. Their inherent modularity allows for them to be quickly and easily adjusted to accommodate for patient size fluctuations or preferences.

This presentation will discuss specific clinical case studies around the modular fabric-based interface designs use in upper and lower extremity prosthetics. It will additionally provide practical information on fitting and fabricating these interface designs.

## CONCLUSION

The use of modular compliant fabric-based prosthetic interfaces allow for greater heat dissipation, volume accommodation, and comfort. Additionally, our testing has shown for greater skeletal stability through these socket designs.

As prosthetic interface designs integrate new materials, the functional and comfort outcomes of their users will be enhanced.

## CLINICAL APPLICATIONS

Through educating clinical prosthetic practitioners how to perform these fittings, these and other designs will continue to evolve, allowing those who use prosthetics to gain greater experience and outcomes.