Partial Hand Prosthetic Solutions: Intricate Socket Design and Precise Finger Geometry

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INTRODUCTION

The human hand is a masterpiece of design and resilience. Its architecture, strength, range of motion, and versatility make the hand an invaluable component of the human body. On average, more than 20,000 partial hand amputations occur each year in the United States (www.hcup-us.ahrq.gov/databases.jsp 2011) and result in a multitude of residual partial hand presentations. While these presentations share commonalities, they also have uniquely individual characteristics. Partial hand anatomical presentations are variable and range from single digit or multiple digits to transmetacarpal and transcarpal. Careful consideration must be given to each presentation to preserve the strength and mobility of the remaining anatomy. When physicians have different approaches to surgical techniques and methods, it is often because several methods work reasonably well but no single way of managing the injury is vastly superior to another. This leads to different treatment options (Smith 2007).

The purpose of this presentation is to demonstrate that intricate socket design and precise prosthetic finger geometry are crucial to tolerance and acceptance of partial hand prostheses.

METHOD

A number of partial hand cases have been examined that encompass a diverse range of presentations. The design and contours of the socket are of utmost importance, balancing the forces placed on the residual anatomy while allowing for maximum range of motion. In addition, therapeutic training (OT/PT) that is concurrent with fitting the socket helps facilitate the precise placement and orientation of prosthetic fingers for optimal function. Data was collected from patients at pre-prosthetic evaluation and throughout the prosthetic fitting process. This data was specific to: previous experience with a prosthesis, functional ability, psychological challenges, and expectations of the functional capacity of the prosthesis.

RESULTS

Cases exhibit anatomical and prosthetic range of motion, and socket design considerations for optimal comfort, function and stabilization. The finger position in space, and its orientation relative to other prosthetic fingers, is primary to successful prosthetic function. Comparisons of patient data suggest improved functional outcomes with use of a prosthesis and increased patient understanding of the process of comprehensive prosthetic rehabilitation.

DISCUSSION AND CONCLUSION

Partial hand amputations vary widely in terms of residual anatomy and appearance. The objective in partial hand prosthetic rehabilitation is to mimic the anatomical grasp pattern. The static positioning of prosthetic fingers necessitates that maximum attention is given to the functional envelope of each finger with respect to the residual anatomy. It is equally essential to create a comfortable and lightweight socket that stabilizes the global forces placed on the residual anatomy.

CLINICAL APPLICATIONS

Clinicians who understand the importance of precise finger geometry and intricate socket design can significantly improve prosthetic acceptance rates for partial hand amputees – a patient population that represents more than 75 percent of all upper limb amputees. (www.hcup-us.ahrq.gov/databases.jsp 2011).

REFERENCES

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