



# Can the Michelangelo Hand Improve Acceptance Rates For Upper Limb Prostheses?

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## INTRODUCTION

There has been significant study devoted to quantifying the rate of rejection of upper limb prostheses. While much of the available data is either inconclusive or out of date, a comprehensive study (Biddiss E and Chau T, Sept 2007) indicates that a combined rejection and non-wear rate for adults is 46% for body-powered and 43% for myoelectric. Clinicians specializing in upper limb prosthetic rehabilitation recognize numerous factors that influence acceptance and successful use of a prosthesis. (Schultz A, 2007; Biddiss E and Chau T, Dec 2007). One of the primary factors can be the type of terminal device that is selected. Recent breakthroughs in multi-articulating compliant hands have advanced functionality while retaining the natural appearance of a human hand. The Michelangelo hand by Otto Bock, with an electric thumb that allows for automatic grasp changes, may contribute to increasing rates of acceptance of upper limb prostheses.

## METHOD

A group of clinicians has more than four years of in-depth clinical involvement with the Michelangelo hand, including the involvement of an American patient in international beta testing at Otto Bock research facilities in Austria.

*Subjects:* 20 transradial patients have had successful fittings of the Michelangelo hand over a four-year period and their direct observations have been documented. Traditional occupational therapy training protocols were modified specific to the multiple grasp function of the Michelangelo hand, insuring that patients received sufficient therapy to integrate the prosthesis into their lifestyle. Data was collected from patients that compares and contrasts the function of the Michelangelo terminal device with electric and body-powered control systems.

## RESULTS

Daily users adapted quickly to the positional thumb that moves automatically between lateral and opposition grip. More than half of daily users reported, "an increased sense of predictability,"

which contributes to higher confidence in using the hand. Daily users also experienced a psychological benefit from the more "human" appearance and motion of the hand and stated that when wearing the Michelangelo hand with a cosmetic glove, "the prosthesis was largely unnoticed by other people." Patients accustomed to wearing a body-powered prosthesis with a hook reported, "a dramatic increase in grip force, comparable to that of a human hand." Patients accustomed to wearing a standard myoelectric hand noted, "increased responsiveness for changing quickly from open to close." Patients also commented favorably on the compliance of the flexible-positional wrist joint. Therapists noted that the flexion-extension of the wrist joint reduced compensatory body movements.

## DISCUSSION

People with acquired or congenital upper limb loss have long desired prosthetic designs that combine functional qualities with natural appearance and movement. (Atkins D, 1996). Multi-articulating hands represent the highest evolution to date of function and appearance in a single upper limb prosthesis. Michelangelo takes this one step further by including an electric positional thumb.

While the Michelangelo hand has many advantages, one drawback is that presently, it does not include a powered wrist rotator. Otto Bock states that this feature is being addressed.

## CONCLUSION & CLINICAL APPLICATIONS

Initial feedback from regular Michelangelo users is largely favorable and may indicate that this technology could have a key role in improving acceptance rates for upper limb prostheses.

## REFERENCES

- Biddiss E and Chau T. *Prosthet Orthot Int.* Sept 2007;31(3):236-57.
- Schultz A et al. *JRRD.* 2007;44(4):483-490
- Biddiss E and Chau T. *AJPMR.* Dec 2007; 86(12):977-87
- Atkins D et al. *JPO.* 1996;Vol 8:2-11