

Michelangelo Hand with Axon-Bus System

Clinical Evidence

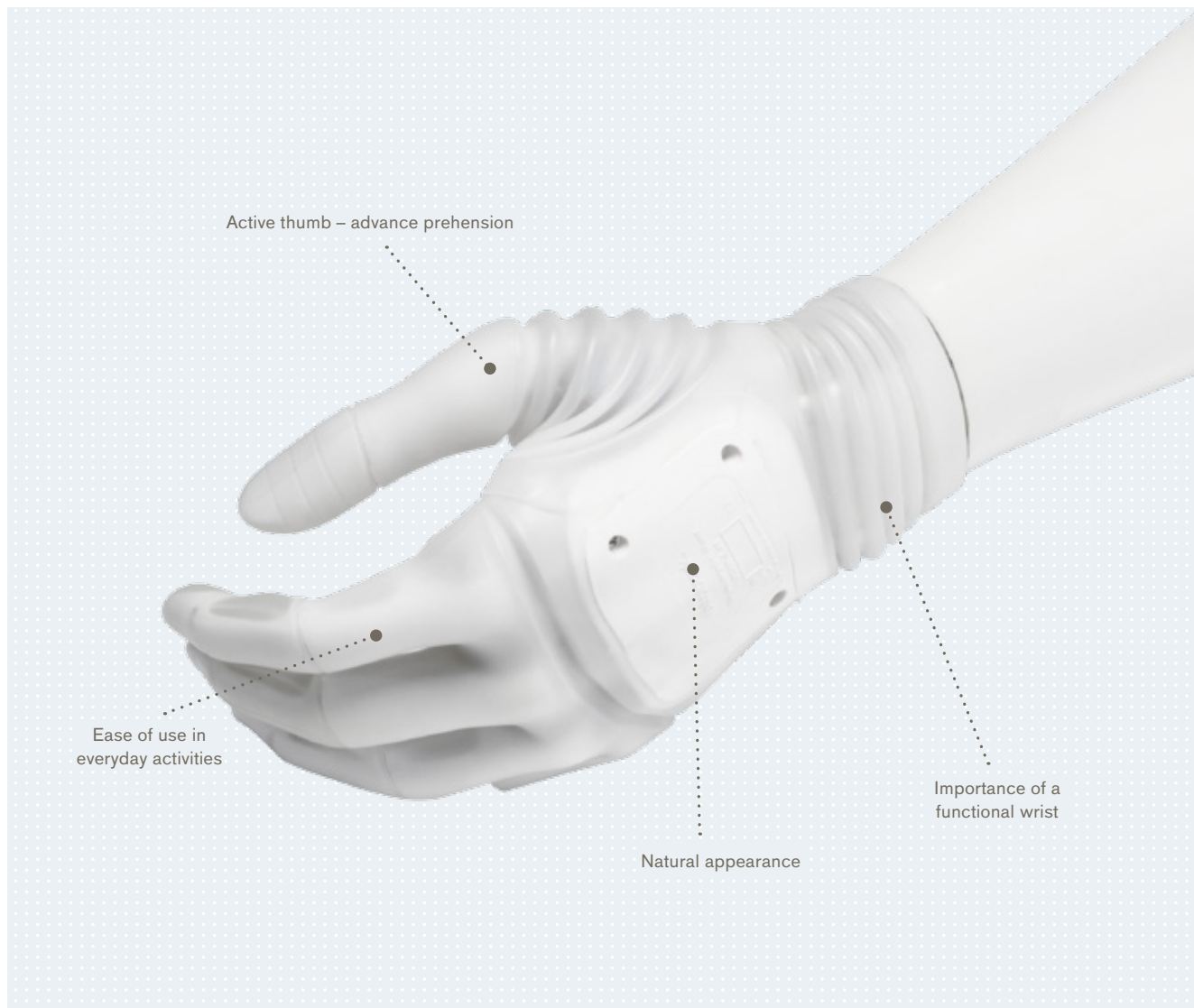


Quality for life

Clinical evidence and benefits of the Michelangelo Hand

The loss of an upper limb results in significant limitations when exercising everyday activities. The major functional objective of the Michelangelo Hand and Axon-Bus control technology is to help affected individuals recover a portion of the hand's natural dexterity. In addition to providing physiologic hand, wrist, and finger movement, the Michelangelo Hand also minimises unwanted

upper arm compensatory movements. Scientific analysis based internationally recognised empirical methods, rather than subjective user assessments, have verified the functional value of hand design in respect to job performance and everyday life. The study's findings below point out significant distinctions of the Michelangelo Hand compared to other commonly used hand prostheses.



Index

Active thumb – advanced prehension	4
Ease of use in everyday activities	6
Natural appearance and importance of the wrist	8
Ease of phantom limb pain due to extensive prosthetic use	10

Active thumb – advanced prehension

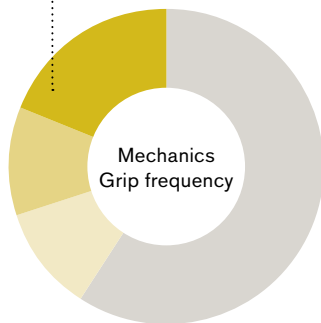
Grip patterns

► Needed for every day activities

For people with **jobs where precise manipulation and lifting heavy objects are required** (e.g. mechanics), most

19%

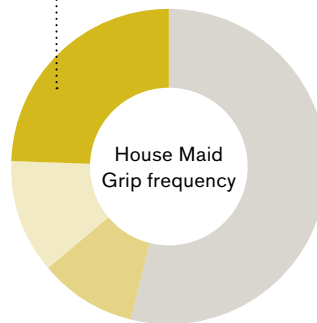
commonly used grips lateral pinch



- 19 % lateral pinch
- 11 % tripod pinch
- 11 % lateral power grip
- 59 % other grips

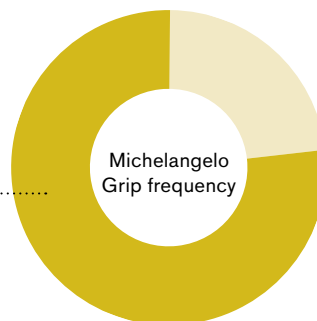
... while for household activities lateral and opposition power grip as well as lateral pinch

27%



- 27 % lateral power grip
- 13 % opposition power grip
- 11 % lateral pinch
- 59 % other grips

Interestingly, the recent study showed a clear preference towards the lateral grips in more than **77%** of the time when Michelangelo was used



Grip force

- ▶ Similar to a sound hand

A grip force of **68 N** is minimally required for a human hand to carry out ADLs



The Michelangelo Hand opposition grip provides **70 N** grip force, while lateral grip 60N grip force, similar to a sound hand



Note: Prosthetic hands need a minimum grip force of 45N for practical use. Compared with other hands in the publication by Belter et al., 2013, the Michelangelo Hand was shown to have the highest lateral grip force.



Ease of use in everyday activities

Activities of daily living

► Improvements in regard to various activities of daily living

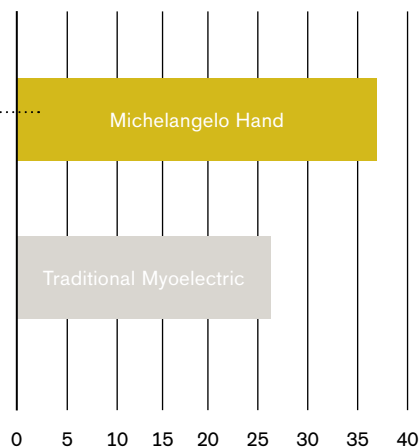
With the Michelangelo Hand it was 31 % easier to perform bimanual activities. As for these activities these activities the hand was used to actively grasp an object. From 23 activities of daily living (ADLs) that were assessed, 16 were rated as easier and 5 as significantly easier to perform with the Michelangelo Hand:

- Wash face
- Put on socks
- Tie shoe laces
- Cut meat with knife and fork
- Carry a laundry basket

User appraised that the overall ease of use is **35%** higher with the Michelangelo Hand when compared to single grip hands

The total **OPUS-UEFS**^x score presented on the graph was 35 % higher with Michelangelo prostheses, showing that tasks were easier to conduct with the Michelangelo Hand.

^x OPUS: Orthotics and Prosthetics User Survey
UEFS: upper extremity functional status
Assesses functional status, quality of life, and satisfaction with devices and services.



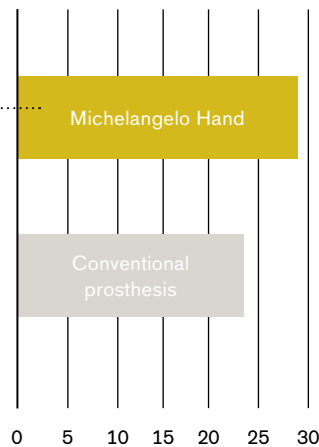
Improved object manipulations

▶ The “Box and Blocks Test”

The “Box and Blocks Test” serves to evaluate manual dexterity regarding the number of blocks transferred from one box to another within 60 seconds. Test users wearing the Michelangelo Hand were capable of transferring an additional 5 blocks on an average.

Manual dexterity is the ability to perform coordinated hand and finger movements in order to grasp and manipulate objects. The recent study showed the manual dexterity of the Michelangelo Hand was significantly higher when compared to single grip myoelectric hands (measured by standard tests: The Box and Blocks Test showed 23 %, the Minnesota Manual Dexterity Test 15 % and the Southampton Hand Assessment Procedure 11 % dexterity improvement)

With the Michelangelo Hand **29 blocks** were moved on average from one box to another in 60 seconds. With traditional single opening hands 24 blocks were moved.



Natural appearance and importance of the wrist

More natural and posture

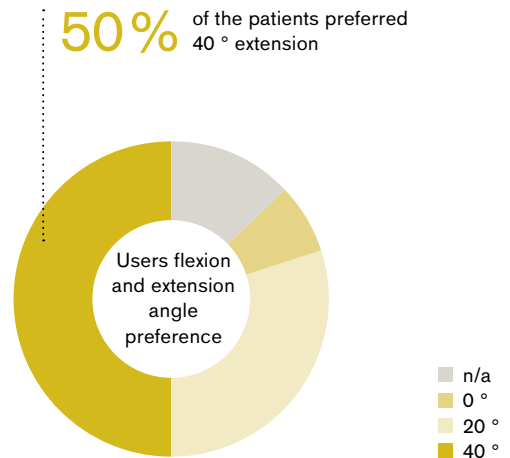
- By reducing compensatory movements of shoulder and trunk

The benefit of the integrated active wrist rotator is confirmed through the reduction in compensatory movements of the shoulder. In addition, wrist flexion and extension of 40° is preferred by 50 % of the patients, since it restores more natural movement and appearance.





Many prosthetic users make compensatory movements to compensate for the functional limitations of their prosthesis. Some of these movements involve abnormal upper arm positions towards or away from the body, abnormally high high tilting of the shoulder or enhanced trunk rotation when performing certain ADLs. Continuous use of compensatory movements may lead to long-term health problems, such as pain and discomfort. Studies showed that compensatory movements of the trunk, shoulder and elbow can be reduced by using a flexible wrist as included in the Michelangelo Hand.



Ease of phantom limb pain due to extensive prosthetic use

Phantom limb pain

► Enhanced use may reduce phantom limb pain

Phantom pain following upper limb amputation is a common problem. A 1999 study conducted by a team of neurobiologists reported that frequent and extensive use of a myoelectric prosthesis decreased phantom limb pain. Amputees who used myoelectric prosthesis more than 8 hours per day reported a reduction in phantom pain over time. As the Michelangelo Hand is perceived more functional by prosthetic users and requires less compensatory movements than traditional myoelectric hands, active prosthesis use may decrease with the potential of phantom limb pain.





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