A SELF-GRASPING HAND PROSTHESIS

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BACKGROUND

This study presents an innovative approach for passive adjustable hand prostheses. Around a third of the upper limb amputees uses a passive prosthetic device, which can be a prosthetic hand or tool. In literature there has been very little attention for improvement of the function of passive adjustable (PA) hand prostheses.

GOAL

The goal of our study was to design a next generation adjustable prosthetic hand. This prosthetic hand must be able to grasp objects without the help of the sound hand, and without the need of a harness or batteries.

METHODS

An analysis of PA prostheses and relevant prosthetic characteristics was performed. We identified design requirements for a new and better PA prosthetic hand. The design of this new PA prosthesis mainly focused on two features; the grasping mechanism and the locking mechanism. For both features a function analysis was performed. Different working principles were designed and tested. A final prototype was designed, built and evaluated.

RESULTS

We designed an innovative passive prosthetic hand, the Delft Auto-grasping Hand (DAH). This hand has articulating fingers and can perform the hook grip, power grip and pinch grip. The gripping function is controlled indirectly by pushing an object to the hand, or directly by pushing the prosthetic thumb against a fixed object. The grip force is proportional to the applied push force. By releasing the push force, the grip force is locked and the object is being held. In order to release the object, a button has to be pushed after which the object can be released by pushing the object slightly into the hand. The DAH has a mass of only 130 grams. In an evaluation the DAH was compared with a conventional PA prosthesis. Activities were performed 11 % faster and required less user effort with the DAH. During the activities, the grasping function of the DAH was used 54% more often.

CONCLUSION

This study presents a next generation passive adjustable prosthetic hand, the Delft Auto-grasping Hand (DAH). The hand can grasp objects without the help of the sound hand. The DAH is the first PA prosthetic hand which has articulating fingers and can perform the hook grip, power grip and pinch grip. The evaluation showed that the DAH has a good grasping functionality and is easy to control. This innovative prosthetic hand offers an attractive alternative to current passive prosthesis, and possibly even to active prostheses.