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Master memory

# Conception of a prosthetic hand for a disabled person

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# Summary

Une prothèse est un dispositif artificiel conçu pour remplacer la fonction et souvent l'apparence d'une main humaine manquante. Ces dispositifs vont des versions mécaniques simples, qui fournissent des fonctions de poignée de base, aux mains bioniques avancées qui offrent des mouvements complexes et une habileté accrue. Les prothèses modernes utilisent souvent la technologie myoélectrique, où les capteurs détectent les signaux électriques des muscles restants de l'utilisateur pour contrôler les mouvements de la main. Les prothèses améliorent la qualité de vie des amputés en rétablissant les fonctions essentielles des mains, en leur permettant d'accomplir les tâches quotidiennes et en améliorant leur indépendance et leur confiance.

A prosthetic hand is an artificial device designed to replace the function and often the appearance of a missing human hand. These devices range from simple mechanical versions, which provide basic gripping functions, to advanced bionic hands that offer intricate movements and enhanced dexterity. Modern prosthetic hands often use myoelectric technology, where sensors detect electrical signals from the user’s remaining muscles to control the hand’s movements. Prosthetic hands improve the quality of life for amputees by restoring essential hand functions, enabling them to perform daily tasks and improving their overall independence and confidence.

# General introduction

Prosthetic hand design has undergone significant advancements in recent years, driven by technological innovations, interdisciplinary collaborations, and a growing understanding of user needs and preferences. The development of prosthetic hands aims to restore functionality, improve aesthetics, and enhance the quality of life for individuals with upper limb loss or limb differences. This paper provides an overview of the design principles, technological advancements, challenges, and future directions in the field of prosthetic hand design.

## 1. Historical perspective:

The history of prosthetic hand design dates back centuries, with early attempts focusing primarily on restoring basic functionality. However, advancements in materials science, robotics, and bioengineering have transformed the landscape of prosthetic hand design. Modern prosthetic hands strive to replicate the dexterity, agility, and sensory feedback of natural hands, offering users a greater degree of independence and functionality [1].

## 2. Design principles:

Effective prosthetic hand design involves a balance between functionality, comfort, and aesthetics. Design principles include biomechanical compatibility, user interface design, sensory feedback integration, and cosmetic customization. Prosthetic hands must be lightweight, durable, and capable of performing a wide range of tasks with precision and efficiency. Additionally, user-centered design approaches emphasize the importance of involving prosthetic users in the design process to ensure that devices meet their unique needs and preferences [2].

## 3. Technological innovations:

Recent technological innovations have revolutionized prosthetic hand design, enabling the development of highly sophisticated devices with advanced capabilities. These include myoelectric control systems, which utilize electromyography signals from residual muscles to control hand movements intuitively. Additionally, advancements in materials science have led to the development of lightweight and durable prosthetic components, such as carbon fiber and 3D-printed polymers. Furthermore, the integration of artificial intelligence and machine learning algorithms has enabled prosthetic hands to adapt to users' preferences and anticipate their actions, enhancing usability and functionality [3].

## 4. Challenges and limitations:

Despite the significant progress in prosthetic hand design, several challenges and limitations persist. These include the high cost of advanced prosthetic devices, limited access to healthcare services, and the need for improved robustness and reliability of prosthetic components. Additionally, achieving seamless integration between prosthetic devices and the user's residual limb remains a technical and clinical challenge. Furthermore, the lack of standardized outcome measures and evaluation criteria complicates the assessment of prosthetic hand efficacy and user satisfaction [4].

## 5. Future directions:

The future of prosthetic hand design holds great promise, with ongoing research focusing on addressing current challenges and pushing the boundaries of technological innovation. Future directions include the development of neurally integrated prosthetic systems, which directly interface with the user's nervous system to provide natural and intuitive control. Furthermore, advancements in materials science, soft robotics, and haptic feedback technology are expected to further enhance the functionality and user experience of prosthetic hands. Additionally, efforts to improve affordability, accessibility, and customization options will ensure that prosthetic devices are accessible to individuals from diverse socioeconomic backgrounds and cultural contexts [5].