


Chapter 7

Role of Prosthetic Technology and Design in Improving Quality of Life of the Amputees and Challenges Ahead

Akshay Kumar

 <https://orcid.org/0000-0003-3978-8635>

Composite Regional Centre for Persons With Disabilities, Kozhikode, India

Vinita

Pace Rehabilitation Research and Artificial Limb Centre, India

Rajeev Kumar

College of Applied Medical Sciences, Al Majmmah, Saudi Arabia

ABSTRACT

Prosthetic devices replace a missing body part lost through disease, trauma, or congenital disorder. The prosthesis is an external physical ‘medicine’ that is applied to restore the movement, function, and cosmetic appearance of the lost body parts like a leg, hand, finger, ear, nose, etc. Prosthetists are the healthcare and rehabilitation professionals who assess, examine, prescribe, fabricate, and fit prosthetic devices to the amputees and also train them, if required, in acceptance of the prosthesis to the patient. The person who lost his or her limb through surgery in any form or having absence of limb by birth is known as an amputee. The technological advancement in the field of prosthetics has improved the quality of life of amputees in this century like nothing before and allowed them to interact with the wider world. Prosthesis plays an important role in returning the individual with limb loss to the pre-injury level of function. The future of prosthetic development appears to be promising.

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INTRODUCTION

Prosthetics is the branch of healthcare and rehabilitation. Therein a person with limb loss, either due to trauma, injury or congenital conditions, is treated to improve quality of life by providing them appropriate artificial replacements of missing body parts. The replaced body parts are known as prosthesis that can be aesthetic or functional and fulfill the desire and expectation of the end-user/amputees. The clinician who assesses, prescribes and fits the prosthesis to the amputee is a prosthetist.

Amputation forces vigorously and bound the amputee's function, sensation and body image. Along with the level of amputation, phantom pain, co-morbidities and older age impact negatively on movement and activity. The individual with amputation needs to expend an effort above the normal to walk, even at a reduced speed. However, the advancement in prosthetic technology can minimize energy expenditure and improve the comfort of the amputee (Berry et al., 2009). The advancement in technology has changed the health care environment (Hacker, 2010) and the field of prosthetics is not an exception. A major technological change happened in prosthetic technology and design just as the other medical culture have developed (Thimbleby, 2013). Removal of the part or whole of the limb by surgical procedure through bone or joint is known as amputation (Ajibade et al., 2013). Evidence of amputation is found from the era of Hippocrates, about 2500 years ago. It is the last option to remove the limb to save the person's life or if part of limb is dead or useless (Paudel et al., n.d.). Amputation has intense impact on individual's social, psychological and economic condition, especially in the countries where prosthetic care is poor (Yinusa & Ugbeye, 2003), and is often unaffordable.

In the 16th century, the Ambroise Paré designed relatively sophisticated prostheses (Kim et al., 1996). Currently, Peripheral Vascular Diseases is the major cause of amputation in developed countries; whereas, in developing countries, the main causes are trauma, infections, diabetes and malignancies. In addition, younger generation in developing countries is more prone to amputation than in developed nations (Sabzi Sarvestani & Taheri Azam, 2013). The International Diabetes Federation states that, around the globe, in every 30 seconds one amputation procedure happens due to diabetes alone (*Diabetic Foot*, n.d.). In a report, during 1989 and 2010 years, the amputation rate among diabetic and general population respectively the amputation rate ranged from 5.6 to 600 per million to 3.6 to 68.4 per million of population (Rümenapf & Morbach, 2017). It shows that diabetes is the prevalent cause of amputation, and to the extent of 25 to 90 percent (Unwin, 2002). According to the global burden of disease results in the year 2017, 57.7 million people worldwide live with limb amputation due to trauma. The prevalence of traumatic amputations is more in East Asia and South Asia. To treat the amputee nearly 75,850 prosthetists are needed globally (McDonald et al., 2021a). Limb amputations are also linked with compromised quality of life, decreased life expectancy and increased health cost (Hoffstad et al., 2015). However, an appropriate prosthesis optimizes the functioning and health of an amputee.

PROSTHETIC TECHNOLOGY

In ancient times the prosthesis was used for function, cosmetic appearance and to maintain the wholeness of the socio-psychological aspect. In some cultures, it was believed to be the result of karma of previous birth and continuing post-death. The human being has traversed a long way in science and technology intending to maintain and improve the quality of life. In the field of prosthetics and orthotics, too, user-needs have forced multidisciplinary research and accelerated the development of new prosthetic and

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