

# Rehabilitation robotics in India

Sir,

Robot is “a re-programmable, multifunctional manipulator designed to move material, parts, tools or specialized devices through variable programmed motions for the performance of a variety of tasks.” Although this definition was intended for industrial robots, it identifies the key features of programmability, flexibility, and movement. Rehabilitation is “the restoration of a person to an optimal level of physical, mental, and social function and well being.”

Rehabilitation robots include diverse mechatronic devices ranging from artificial limbs to robots for supporting the rehabilitation therapy or for providing personal assistance in hospital and residential set ups.

Most of the work in specific areas of rehabilitation robotics started in mid-1970's. Earlier works are as follows: CASE manipulator (1960's), Rancho Los Amigos manipulator, Work--station- based system (Germany, mid-1970's), robot arm mounted to a wheel--chair (New York, 1970's), fixed site robots (1980's) like DeVAR (Desktop Vocational Assistive Robots), powered feeding devices like winsford feeder, mobile assistive robots like manus wheel--chair mounted manipulators (since 1990's), and MoVAR (Mobile Vocational Assistive Robots).

Other robots include mobile robots like automatic guided vehicles for obstacle avoidance, tracking along the wall, manoeuvring through a door and meldog project to guide a person with visual impairment, orthotics and prosthetics, robots in education and robots in therapeutical applications such as MIME system, MIT-Manus system for stroke rehabilitation, GENTLE/S project for stroke rehabilitation in a computer-generated 3D room, robot- assisted treadmill training in individuals with spinal cord injury.<sup>[1]</sup>

Rehabilitation has been revolutionized with the use of robots in many parts of the world and much research is being done on in this field. Contrary to this, in India, there is only one private hospital where three robotic devices were installed in the year 2009. These devices are-- the Lokomat, the Armeo and the Erigo. These devices are designed and manufactured by Hocoma

for patients with stroke, spinal injuries, brain injuries, multiple sclerosis, and other neurological disorders.

Lokomat combines a robotic gait orthosis and an advanced body weight support system with a treadmill. The robotic arms move paralyzed hips and knees at an adjustable speed. Armeo has an adjustable arm support and a sensitive handgrip for upper limb retraining. Erigo includes verticalisation of leg movement and loading on an adjustable tilt table with a robotic stepping mechanism. These devices have advantages like improvement in a patient in a shorter span, better gait and symmetry and reduced manpower. The cost of this equipment is one million dollar. The hospital charges INR 1500 for a session of forty min. and the total cost for the entire course of therapy is INR 25 000-40 000.<sup>[2]</sup> Even though this seems like not a significant sum, it is a great deal of money for the average Indian. However despite the cost of treatment, the hospital will have a struggle on its hands to break even in 2--3 years.

Various robotic projects are undergoing in Indian Institute of Technology (IIT) though, but their applicability to rehabilitation is not clear. Although there have been research projects reported from various premier institutions in this area, none of the products have reached the mainstream.

According to 2005 World Bank estimate, 42% of India's population falls below the international poverty line and as mentioned in BBC News Night in October 2006, about 300 million people in India are living on less than 50 pence per day.<sup>[3]</sup> This would be the main roadblock for the use of imported technology. Government hospitals are under tremendous economic constraints to provide expensive and prolonged care. Private institutions which cater to less than 10% of the population are in business for profit and prolonged care would be cost intensive. Besides patients in India have to pay their own medical costs and this would act as another prohibitive aspect.

India has some 40 to 80 million disabled people. At least one in twelve households has a member with disability. Illiteracy, unemployment, and poverty among the disabled are high.<sup>[4]</sup> According to census 2001; there are 21.9 million people with disabilities in India which constitutes 2.13% of the total population. Seventy five percent of persons with disabilities live in rural areas, 49% population is literate and only 34% are employed.<sup>[5]</sup> Despite these staggering statistics, India like other developing countries invests most of its health care budget in preventing communicable diseases. Disability rehabilitation is a luxury where

inroads can be made only when infectious diseases are controlled and we can achieve total immunization.

There is a strong correlation between disability and poverty. Poverty leads to increased disability and disability leads to increased poverty. Thus, a majority of people with disabilities have lack of access to health care and even basic rehabilitation.

Is the future bleak then? Perhaps, with intuitive policymaking, we can help disabled in a way that it will not be a financial drain. For this premier institutions in India both in the medical and technological fields must join hands and come up with feasible alternatives to state-of-the-art technology. However this must not stop at the research stage as is happening now. Products that are designed for rehabilitation must reach the target population. When even basic assistive technology is prohibitively expensive or absent, robotics as a rehabilitation medium sounds farfetched and unrealistic.

There is another aspect that cannot be overlooked--one of awareness. An informal survey conducted by us among physicians, therapists and nurses concerned with rehabilitation revealed that the vast majority of health care workers were unaware of the role or sometimes even existence of this technology. How then can research develop?

Perhaps some of the reasons for this languid state of affairs are the cultural emphasis on "accepting" your fate. Empowerment of the disabled, their families, and education of health care workers and policy makers may bring about a difference.

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