
Telerehabilitation: a coming of age

Trevor G Russell

*Telerehabilitation Research Unit, The University of Queensland
Australia*

From the way we stay in touch with current events, to the way we purchase real estate, technology has permeated society and created a fundamental shift in how we think and act. Over the course of the last century all sectors of industry have become infatuated with technology and the benefits it brings: the ability to operate with greater efficiency and to access a wider market place. While industry has been enjoying these benefits for some time, it is exciting to live in an era when technology is crossing the threshold and gathering strength in the profession of physiotherapy. Technologies such as practice management software, electronic medical records, eReferral systems, ePortfolios, online education delivery systems, and telerehabilitation technologies have the potential not only to optimise our conventional practice, but to fundamentally revolutionise the way in which we deliver services to our clients. Of all these technologies, there is none that promise more radical change to the way we deliver services than telerehabilitation.

To some, the term 'telerehabilitation' may conjure images of futuristic robots delivering therapeutic intervention on our behalf. However, the term simply describes the provision of *conventional* rehabilitation services at a distance using telecommunication technology as the service delivery medium. It is an alternate means of providing all aspects of care including the interview, physical assessment and diagnosis, intervention, maintenance activities, consultation, education, and training to clients at a remote location. The ability to provide equitable, high quality rehabilitation services to clients regardless of their physical location is certainly an attractive proposition. This is especially true in a country as vast as Australia where the tyranny of distance and the difficulty of recruiting and retaining therapists in rural and remote locations often results in a lack of rehabilitation services. Apart from access to services, a number of other factors are at play in progressing the telerehabilitation agenda, including: (1) the savings of potential transportation cost and time from the perspective of both the health care system and the client; (2) the continuity of client care that can be achieved through the remote provision of services; (3) the heightened ability to control the timing, intensity, and sequencing of the intervention; (4) the potential environmental impacts of reducing travel; and (5) other benefits such as the positive effects of rehabilitating clients in their own social and vocational environment.

Given the tremendous array of potential benefits, one must ask 'Why has the profession been so slow to adopt telerehabilitation technologies?' The answer is likely to be multifactorial. However, two obvious considerations emerge: physiotherapy is a 'skills-based' profession, relying heavily on physical touch; and therapists rely on the objective measurement of physical performance to inform

diagnosis and intervention. These requirements present significant technical challenges for the developers of telerehabilitation technologies. Only in the past decade or so with the development of more complex optical and sensor based technologies have these barriers started to erode. For example, The University of Queensland has recently commercialised a telerehabilitation system called eHAB™, developed specifically for rehabilitation consultations, which combines real-time videoconferencing with a host of measurement tools designed to enable the remote measurement of physical outcomes. Such technologies are proving not only to enable accurate remote diagnosis (Russell 2007) but evidence is emerging to demonstrate that outcomes of telerehabilitation services are equivalent to conventional face-to-face intervention (Russell et al 2003). It is the combination of these advanced technologies and a growing evidence base that is driving the adoption of telerehabilitation technologies into routine service delivery.

Broadly speaking, contemporary technologies described in the telerehabilitation literature can be classified as: image-based technologies, sensor-based technologies, and virtual environments and virtual reality. Image-based technologies, such as those that employ videoconferencing, have the longest history in telerehabilitation and have been used in telerehabilitation research since the early 1990s (Delaplain et al 1993). There is a growing body of research to demonstrate that image-based technologies can be used successfully for remote diagnosis and management; this has led to the use of these technologies for routine client care in a number of public health service districts in Australia. Sensor-based telerehabilitation utilises sensor technologies such as tilt switches, accelerometers, and gyroscopes to sample and quantify movement in three-dimensional space. Although considerable progress has been made in the interpretation of biosignals to produce clinically-relevant information, it is surprising to note that there have been few attempts to integrate this information with telecommunication technologies for the remote measurement and rehabilitation of clients. This is likely to be an area of rapid development over the next few years. Virtual reality-based telerehabilitation systems make use of configurable computer-generated three-dimensional virtual environments to elicit specific movements from the client. The virtual environment can be displayed to the client via computer screen, or fully-immersive environments are possible with the use of head-mounted visual displays and haptic feedback devices. Physiotherapists are able to manipulate these environments to incorporate key rehabilitation concepts such as task repetition, feedback, and motivation which have been demonstrated to result in the learning of new motor skills which translate to the real world.

The future for telerehabilitation looks bright and is set to offer significant benefits to the physiotherapy profession. However, challenges do exist and must be met with innovation and a willingness to adapt our current approaches when necessary. For instance, to circumvent the need to use our hands on a client, self-applied techniques, the use of a carer's or spouse's hands, or the use of alternate exercise or self-management strategies may need to be considered when providing intervention remotely via telerehabilitation technology. Other immediate issues the profession must consider include: professional portability—the ability to perform consultations across state lines, reimbursement for services in the private sector, training, and the ever-present need for more high-quality research to crystallise the evidence base for telerehabilitation practice. Such research is critical to fuel the acceptance of these practices by professional, government, and health funding bodies. Research is needed to set minimum technical specifications and standards, validate clinical protocols, investigate the effectiveness of interventions, report client and therapist satisfaction, and establish the cost-effectiveness of telerehabilitation.

With the maturation of telerehabilitation technologies, and the rapid increase in the speed and quality of the telecommunication solutions they rely upon, we are entering an age where telerehabilitation consultations are not only feasible, but can be effective in the remote management of clients. The Australian Physiotherapy Association realises this potential and has recently established a new standing committee, the Clinical Informatics Committee to monitor and advise on the best way to leverage advancements in technology for its members. As empirical research emerges demonstrating the efficacy of these technologies, it behooves us as a profession to adopt such services and integrate them into routine clinical practice. Failure to do so would constitute a grave disservice to our clients.

References

- Delaplain CB et al (1993) *Hawaii Medical Journal* 52: 338–339.
- Russell TG (2007) *Australian Journal of Physiotherapy* 53: 136.
- Russell T et al (2003) *Journal of Telemedicine and Telecare* 9: 44–47.