

REVIEW ARTICLE

Telerehabilitation and remote occupational therapy: research and practice in Japan and elsewhere

Maki TAKEI, Kayo MATSUO

Osaka Kawasaki Rehabilitation University

Correspondence: Maki Takei, PhD, Faculty of Rehabilitation, Osaka Kawasaki Rehabilitation University, 158 Mizuma, Kaizuka, Osaka 597-0104, Japan. E-mail: takeim@kawasakigakuen.ac.jp*Disclosure:* The authors declare no potential conflicts of interest in writing this report.**Key words:** *Telerehabilitation, Remote Occupational Therapy, Telehealth***Abstract**

Telerehabilitation refers to providing rehabilitation services from a remote location using information and communication technology. It is already in operation for certain patients who cannot easily access hospitals and other facilities, and it widens access to rehabilitation services. In Japan, the impact of COVID-19 has made it difficult to provide face-to-face rehabilitation, and the pandemic has drawn attention to the use and potential of telerehabilitation. In the field of occupational therapy, telerehabilitation has been practiced to people in various age groups with a variety of medical conditions in several countries. In this review article, we summarize efforts and highlight important research on telerehabilitation in Japan and elsewhere, with particular attention to its use in the field of occupational therapy.

INTRODUCTION

In Japan, the Director-General of the Health Policy Bureau of the Ministry of Health, Labor and Welfare issued a notice regarding ‘telemedicine’ in 1997. Telemedicine makes it possible for patients to receive medical examinations and consultations from doctors online. Since those early days, it has attracted attention as a countermeasure to a variety of issues, such as home care in an aging society, manpower shortages, and regional disparities in medical and welfare systems. Owing to the widespread disruption caused by the COVID-19 pandemic, the need for telemedicine has increased further. Telemedicine has thus expanded rapidly, with continued expansion expected. Similarly, telemedicine in the rehabilitation field has gained momentum for use in treatment of patients living in remote or depopulated areas where hospitals are not easily accessible (Yoshikawa, 2022). An increasing number of countries now include telerehabilitation in insurance coverage, so it is becoming established as an option for patients undergoing rehabilitation (Yoshikawa, 2022). Telerehabilitation in Japan is being considered as an alternative to face-to-face rehabilitation due to the impact of COVID-19 (Hagiwara, 2021; Maruyama, 2020; Sakai, 2021; Shinoda, 2021; Uchida, 2021). In this review, we summarize the research and practice of telerehabilitation in Japan and elsewhere with a focus on its use in the field of occupational therapy.

TELEREHABILITATION

The term ‘telerehabilitation’ was first used in 1998 to refer to the provision of rehabilitation services in remote areas using information communication technology (ICT) (Goris, 2019). With the advancement and development of technology, telerehabilitation can be applied in clinical settings such as for athletic rehabilitation, for mental health, and for general and physical health by using the internet, telephones and other mobile technologies (Goris, 2019). Telerehabilitation can reportedly improve patients’ access to rehabilitation services, prevent unnecessary delays in receiving services, and mitigate the impact of a shortage of rehabilitation professionals in underserved areas (Cason, 2012, 2014). In 2011, the World Health Organization and the World Bank reviewed research on telemedicine for disabilities and jointly produced a global report. They reported that telerehabilitation had clinical outcomes comparable to face-to-face interventions in the provision of services such as mental health, cardiac rehabilitation, evaluation for home remodeling, prosthetic/orthotic and wheelchair prescription consultation, and cognitive rehabilitation. Professional telerehabilitation was suggested to be an effective service delivery model.

Telerehabilitation in Japan

Telerehabilitation in Japan is practiced mainly by rehabilitation doctors and physical therapists. Rehabilitation doctors work on various areas of telereha-

bilitation, including respiratory rehabilitation, visual rehabilitation, swallowing rehabilitation, and cardiac rehabilitation (Hasegawa, 2022; Kikuchi, 2021; Machida, 2021; Saito, 2021; Sakata, 2021). In the area of cardiac rehabilitation, clinical research and system development of online-managed cardiac rehabilitation using ICT are underway. The 'Remohab' system, for example, was developed by the venture company Remohab, which was established in 2017 from the Osaka University School of Medicine consists of an internet-of-things ergometer, wearable electrocardiograph, and medical application to integrate them. The system is provided to patients at home, and after being interviewed by a medical practitioner via a video-phone system, they exercise with an ergometer. Vital signs, such as blood pressure and pulse as well as myoelectric waveforms, are transmitted via the cloud to medical staff at the hospital, who can then provide patients with real-time guidance (Taniguchi, 2021). Using this system, tele-cardiac rehabilitation for elderly patients at home with heart disease was shown to create improvements in exercise tolerance and lower limb muscle strength without serious adverse events (Taniguchi, 2022).

Practices for patients receiving care at home have also been reported. The provision of telerehabilitation to patients at home enables sharing of information in a visual format, such as the patient's home and lifestyle. It is therefore possible to provide a rehabilitation plan tailored to the patient's condition and lifestyle, as well as to enhance care and provide more specific guidance (Nishiguchi, 2022). Telerehabilitation for patients with intractable neurological diseases reportedly improved their activities of daily living (ADLs) and quality of life (QOL) (Nishiguchi, 2020). The implementation of telerehabilitation for elderly patients with chronic neurological diseases who are receiving home care reportedly reduced the caregiver's sense of burden (Watanabe, 2000). Telerehabilitation may therefore be beneficial to not only the patients, but also to the people providing their care.

Telerehabilitation is beginning to be used not only for diseases, but also as a method to promote frailty prevention and care. An example of frailty countermeasures is a service operated by the Care Prevention Laboratory of the University of Tsukuba to distribute information about frailty prevention and care to elderly people (Yamada, 2022). An e-mail newsletter, distributed once a week to registered users, includes links to web-based videos related to measures against frailty. Those who watch the videos can ask questions about the content and report their

own recent status. Answers to any questions and the users' status reports are posted in the next e-mail newsletter, which is available to all users. The delivery of information to the users on a regular basis was said to facilitate relatively easy access to information. Also, by posting answers to the questions from the users and by responding to their status reports, the elderly users will develop a sense of fellowship and social participation is encouraged, which are themselves good measures against frailty (Yamada, 2022).

Telerehabilitation is also implemented in home-visit rehabilitation. Interventions for exercise therapy, activity adjustment, and environmental adjustment can be performed through a computer screen without the need to visit the patients. Improved physical function through the course of telerehabilitation has been reported (Furuta, 2021). Telerehabilitation also eliminates the need for medical personnel to travel to visit the patients and it reduce travel time, potentially increasing the frequency of interventions for a patient.

REMOTE OCCUPATIONAL THERAPY

The World Federation of Occupational Therapists issued statements on 'Telehealth' in 2014 and on 'Occupational Therapy and Telehealth' in 2021. 'Telehealth' refers to the use of ICT to provide health-related services when the provider and client are in different physical locations. It includes real-time interactions between therapists and clients (e.g., video conferencing, remote monitoring, virtual interactions using apps and game technology, etc.) and data communication (e.g., videos, photos, e-mails, etc.). Telehealth is said to be well suited to describe the entirety of occupational therapy practice, can be an appropriate service model for occupational therapy, and has the potential to improve access to occupational therapy services (World Federation of Occupational Therapists, 2021). Synonyms for telehealth include 'remote occupational therapy,' 'telerehabilitation,' 'teletherapy,' 'telecare,' 'telemedicine,' and 'telepractice' (World Federation of Occupational Therapists, 2014). Remote occupational therapy has been applied to various age groups, from 2 years old to over 65 years old, and to medical conditions including cerebral palsy, strokes, acquired brain injury, traumatic brain injury, breast cancer, quadriplegia, orthopedic disorders, visual motor disorders, fine motor disorders, and autism spectrum disorders (Goris, 2019).

In an examination of the effect of remote occupational therapy for caregiver-directed homebased intensive bimanual training in 24 children with uni-

lateral cerebral palsy, the results showed significant improvement of children's dexterity (Ferre, 2017). Improvement was also observed in caregiver satisfaction, and they reported that remote occupational therapy can be a cost-effective alternative to comparatively expensive clinic-based interventions that allows caregivers to be involved in their child's rehabilitation.

A pilot-randomized controlled trial of 31 rural breast cancer survivors receiving chemotherapy examined the effects of a six-week telephone-delivered problem-solving and occupational therapy intervention (PST-OT) on improving social participation (daily living, social activities, work and leisure activities) (Hegel, 2011). The results demonstrated a better outcome in the PST-OT group compared with the control group, with improved QOL and emotional status. In addition, 92% of the PST-OT group showed high satisfaction with the intervention and reported that it helped them to overcome their limitations of social participation.

A randomized controlled trial examined the effects of home robot-assisted rehabilitation on depression and QOL in patients after a stroke (less than 6 months after onset) (Linder, 2015). Ninety-nine stroke patients were divided into a home robot-assisted rehabilitation + home exercise program group (intervention group) and a home exercise program only group (control group). Significant improvements were shown in the outcomes in both groups. The most important reported finding was that remote occupational therapy, whether robot-assisted therapy or a home exercise program alone, improved depressive symptom scores on Center for Epidemiologic Studies Depression Scale. Delivering robot-assisted therapy and home-based exercise programs through remote occupational therapy was said to be a valuable approach to improving QOL and depression, especially in underserved post-stroke populations. Other studies have reported significant improvement in subjects' functionality, occupational performance, motivation, and cognitive function, as well as reduced stress for care givers, as a result of remote occupational therapy (Goris, 2019).

Remote occupational therapy in Japan

There are no Japan-based research articles on the effectiveness of remote occupational therapy, and publication seems to be limited to practical reports, some of which are introduced here. Remote occupational therapy was conducted based on Cognitive Orientation to Daily Occupational Performance (CO-

OP) for 19 elementary school students (1st to 6th graders) with reading and writing difficulties (Shiozu, 2021, 2022). Two forms of therapeutic materials were prepared, 'online intervention' and 'video content.' The online intervention was conducted once every two weeks for 90 minutes through a web conference system (Zoom, Zoom Video Communications, Inc., San Jose, CA, USA) for up to five children (with parents present). The online intervention facilitated children's understanding through visualization using slides. The video content was made available on YouTube (YouTube LLC, San Bruno, CA, USA) to provide a brief overview of CO-OP so that parents (and children) could review it outside of the online intervention. Although it was a limited effort for about a month and a half, positive reactions were observed from the target children and their parents. Online interventions reportedly had the potential to promote parental involvement, and remote occupational therapy was hoped to become a means to provide services in the event that face-to-face occupational therapy becomes difficult (Shiozu, 2021).

From the perspective of occupational therapy involved in the judicial field, Go-Go-OT-Net was established as a group that promotes online support for people released from prisons and juvenile training schools, probationers, and others who have committed offenses against the law (Yoshida, 2022). They meet once or twice a month through Zoom to provide support to the subjects. In the practice, the Canadian Occupational Performance Measure and others are used to help clarify the subjects' interests and problems in their lives. For example, advice is offered on voluntary exercise and physical care, as well as ideas for living for the subjects with physical discomfort. For those with interpersonal problems, interventions focusing on cognition and behavior are conducted with social skill training and other techniques. Their supporters are also encouraged and shown how to interact with the subjects. The fact that the occupational therapists are online can make the subjects feel easier to convey complaints with the facility or can more readily ask for help than in person. Occupational therapists can mediate with the facility while offering their views and advice to the subject and build a relationship with their surrounding environment to collaborate with the facility to support. Furthermore, it is reportedly advantageous to be able to use various functions that are possible only with ICT, such as using the screen sharing function to conduct interviews and the screen switching function to prevent monotony.

Activities of remote occupational rehabilitation were reported that utilize ICT in five departments: child development support for children with severe mental and physical disabilities, after-school care services, welfare, functional training, and daycare services (Mogi, 2022). The online services were smoothly delivered in the department of child development support, where parents were familiar with mobile devices and the internet and had little resistance to online services. The delivery was also successful in the department of functional training, where the target subjects were comparably young. It was more difficult to introduce in the department of day-care services, where the subjects were more reluctant to go online, but there were several cases in which effective implementation was possible. One example is remote cooking training for a patient with brain injury. In the training, the patient cooked alone at home, while the occupational therapist checked and corrected the cooking through a computer screen. Remote occupational therapy by group training using cognitive tasks such as memory, judgment, and comprehension was also effective. Furthermore, other cases were reported on individualized functional training, which provided exercise instruction and lifestyle advice to a patient with hemiplegia, and exercise videos created exclusively for subjects and released on YouTube.

ISSUES AND LIMITATIONS

While the effectiveness and benefits of remote rehabilitation, including remote occupational therapy, have been reported throughout Japan and elsewhere, issues remain in providing new ICT-based services. For example, service recipients must possess a computer or smartphone and have the skills to use it, but not all rehabilitation targets meet such prerequisites (Inukai, 2019). Internet access would be an issue with the communication environment (Shiozu, 2021). Meanwhile, issues from the service provider side include the difficulty in palpation, assessment, and movement analysis. In occupational therapy, there are many things that can only be done face-to-face, such as adjusting self-help devices. Measures need to be taken to address how such services are offered (Inukai, 2019; Shiozu, 2021).

CONCLUSION

Telerehabilitation, including remote occupational therapy, has been used as a measure to prevent COVID-19 infection and can be used for people who

are in remote areas such as remote islands, who have restrictions on time, transportation, and attendance. Intervention is possible for those who have difficulty in undergoing rehabilitation through outpatient care and those who are socially isolated. Telerehabilitation can also reduce the therapist's travel and time constraints, thus enabling efficient provision of rehabilitation services as well as resolving certain manpower issues. Although there are outstanding issues, further development is expected as research and practice reports accumulate.

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