Editorial

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Approaching the clinical field through robotic exercise rehabilitation: a task for practical use

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Robotic exercise rehabilitation is a research field that studies the process of using robotic devices to help patients with injuries recover. These robotic devices are customized to support various sensorimotor functions, development, and evaluation of various plans to support therapeutic training. The advent of rehabilitation robots for injured patients began 20 years ago for those with neurological disorders (Gimigliano et al., 2021). The original purpose of the first rehabilitation robot was to recognize objects through touch and help people with neurological disorders. Now, rehabilitation robots are used in the recovery process of patients with disabilities in gaiting, standing, and balancing (Carrera et al., 2011). It has been reported that robotic exercise rehabilitation has provided some degree of customized treatment to patients.

To effectively use robots for exercise rehabilitation in a clinical setting, various problems must be solved. First, rehabilitation robots need to measure human movements (Bhardwaj et al., 2021). Therefore, manufacturers of machines must ensure that the equipment is suitable for the patient. In other words, since rehabilitation robots are used to assist people with disabilities, the basic design must be carefully considered. Second, the technology must be able to determine the patient's adaptation level. Techniques to date include active assisted exercise, active restriction exercise, active resistance exercise, passive exercise, and adaptive exercise. All these techniques are used by therapists, but since there are no standardized protocols that are widely used, this problem must also be solved. Third, exercise rehabilitation robots that have been used until today are difficult to wear and inconvenient when performing activities. For patients with musculoskeletal disorders or those who use wheelchairs, wearing the devices and performing activities should be easy. Fourth, the currently used exercise rehabilitation robots are used only for the purpose of rehabilitation because it has not yet developed past the initial stage. Since the treatment process is monotonous and difficult to induce interest, it needs to be designed in conjunction with virtual reality (VR) or augmented reality (AR) technology. The VR and AR platform stimulates the human senses, such as sight, hearing, and touch, to provide a realistic experience of exercising first-hand. In situations where patients and therapists cannot meet in person, such platforms may prove to be an effective alternative. Fifth, object recognition technology allows the patient to feel movement or activity through a rehabilitation device, while motion recognition technology tracks the patient's movements. Motion recognition technology is not widely used in hospitals due to technical limitations and the lack of practical use, but if it is also combined with rehabilitation robots, it will help to increase the therapeutic effect. Sixth, it is also necessary to graft artificial intelligence (AI) technology for patients with physical disabilities who are unable to control themselves or for patients with severe musculoskeletal injuries that make it difficult to live independently. Since AI can imitate human intelligence to perform tasks and repeatedly improve movements based on the collected information, the therapeutic effect will be maximized.

We are currently living in the era of the 4th industrial revolution. The core technologies of this era are the Internet of Things, mobile technology, cloud services, big data, and AI. As data-based, demand-oriented industrial restructuring accelerates, various smart technologies are expected to emerge. Obviously, we can expect that these technologies will be applied to the field of exercise rehabili-

tation to maximize the therapeutic effect, as well as the early recovery of patients.

CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

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