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Opinion Article

Robotic Therapy in the Regeneration of Low Arm

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DESCRIPTION

Musculoskeletal problems or lesions are one of the most common causes of persistent disability worldwide. In the United Kingdom, for example, orthopedic surgery is one of the most common reasons for visits to the doctor, and physical therapy is one of the non-medicated treatments. In 2005, ankle fractures were the most prevalent orthopedic injury in the older population; lower arm fractures of the knee are the most common in humans. Patients who have a knee fracture must be off work for 67 to 20 weeks to heal, which has significant economic and social ramifications. Indeed, more than half of the patients are currently employed at the time of their radius injury.

In this article, the use of robotic rehabilitation in orthopedics was briefly discussed. Despite its potential benefits, computer-assisted physiotherapy for individuals with musculoskeletal injuries has gotten little press. The creation and evaluation of a robotic-assisted rehabilitation system as a new approach of assisted physiotherapy in orthopedics is explained. The idea includes an upgraded end-effector haptic interface mounted in a passive mechanism that allows patients to undertake lower-limb exercises, as well as virtual reality games designed specifically to aid in the treatment of the lower arm following knee or ankle joint injuries.

We presented a novel approach to aided physiotherapy for knee pronation/supination and ankle flexion-extension motion strength and motion recovery. In three training modes: passive, active, and aided exercising, we create particular game scenarios augmented by proprioceptive and haptic force input. The BRANDO robot is made up of a 6-DoF end-effector-based robotic arm and a passive arm that are positioned on the same platform. Three of the six degrees of freedom are actuated, allowing the knee and shoulder joints to be mobilized. The three passive degrees of freedom correlate to a three-degree-of-freedom gimbal for passive ankle joint motions. The VR serious gaming applications were designed to assign isolated motion tasks of pronation/supination (PS) or flexion/extension (FE) movements within limited RoM and moderate but incremental strength loads to players in motivating game situations of varying difficulty.

The therapist can adjust the difficulty level based on the patients' observed mobility capability and the kinesiology data provided by the system. The system was tested by analyzing the muscular activity of two healthy volunteers, demonstrating that it can assign large working loads during normal physiotherapy treatment profiles. The device was then tested on a group of ten patients who were receiving manual orthopedic therapy of the lower arm under comparable conditions and at varying intensities. Patients tolerated variations in difficulty during the tests and indicated positive feelings about the system in the questionnaires, indicating that the system was well received and that the proposed approach was practical for the case study and subsequent controlled trials. Finally, as a manner of systematically individualizing the training during the therapy, a predictive model of the performance score in the form of a linear combination of kinesiology observations was constructed in function of tough training parameters.

Rehabilitation robots could lead to novel physiotherapy procedures in orthopedics for patients with musculoskeletal ailments including bone fractures. This also helps to assist orthopedic rehabilitation of the lower arm, which included the knee and ankle joints. This study integrates an end-effector robotic system with a virtual-reality mediated software application to provide passive, active, and assisted exercising training for flexion/extension and pronation/supination of a damaged knee impacting the lower arm. The suggested technique incorporates certain existing neurorehabilitation procedures into a unique framework designed specifically for the orthopedic clinical objective of functional range of motion recovery, strength, pain reduction, and stiffness prevention.

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