



# Robot-assisted therapy for upper extremity rehabilitation in Erb-Duchenne palsy: A case report

I. Akgün, E.E. Avcı, E. Timurtaş, İ. Demirbüken, M.G. Polat

Marmara University, Physiotherapy and Rehabilitation, İstanbul, Turkey

## 1. Introduction

Erb-Duchenne palsy (EDP), happens during a difficult birth due to the lesion in the upper brachial plexus (involving 5th and 6th, and rarely 7th cervical nerve roots), is characterized by muscle weakness and loss of motor functions in the affected upper extremity. While some injuries are temporary with full recovery, some may be lifelong resulting in significant functional limitations in daily life [1]. Various conservative rehabilitation approaches including muscle strength and range of motion training in upper extremity have been widely used in rehabilitation clinics [2]. Robot-assisted therapy (RAT) as an intervention for upper extremity rehabilitation is an encouraging approach in order to improve upper limb function in patients with neurological impairments [3]. RAT would offer motivational and intensive rehabilitation for a pediatric patient with EDP to interact and train with task-related games in the robotic devices.

## 2. Research question

Does RAT improve upper extremity motor functions in a pediatric patient with EDP?

## 3. Methods

An 11-year-old girl (height 144 cm, weight 44 kg) sustained a right side EDP (C5-C7) at birth due to being overweight. She had two tendon transfer operations in 2011 and 2017, respectively. She has been receiving physiotherapy and rehabilitation treatment for 10 years. She had initially active 110° elbow flexion, 55° wrist flexion, 10° wrist extension, 20° supination, and 18° pronation (measured by universal goniometer) and 3/5 elbow flexor muscle strength according to Medical Research Council (MRC) grade. The RAT, structured by repetitive elbow flexion-extension, wrist flexion-extension, and forearm pronation-supination range of motion exercises, implemented for 24 sessions (30 min per session, 2 sessions per week, during 12 weeks). Quality of

Upper Extremity Skills Test (QUEST) was used to assess the quality of upper limb functions. All assessments were performed at the beginning and the end of the 24 sessions.

## 4. Results

Improvements were noted in both active flexion and extension ranges of the elbow, especially for flexion (increase 18° in elbow flexion, 4° in elbow extension). The forearm range of motions including wrist flexion-extension, supination, and pronation had a slight gain. Muscle strength did not change in wrist flexors, supinators, and pronators however, remarkable improvements were observed in the strength of elbow flexion, extension, and wrist flexion. The QUEST score increased by 3.96 points that showed improvements in arm and hand functions.

## 5. Discussion

The literature up to date regarding the functional rehabilitation of children with EDP is considerable scarce. Findings of the current study suggest that RAT would be a successful and comprehensive rehabilitation tool for EDP patients suffering from impaired upper extremity functions. Future randomized controlled studies on this motivating and entertaining approach for the pediatric population with EDP are warranted to support variety in successful rehabilitation.

## References

- [1] D.I. Zafeiriou, K. Psychogiou, Obstetrical brachial plexus palsy, *Pediatr. Neurol.* 38 (4) (2008) 235–242.
- [2] J. Raducha, B. Cohen, T. Blood, J. Katarincic, A review of brachial plexus birth palsy: injury and rehabilitation, *R. I. Med. J.* 100 (11) (2017) 17.
- [3] G.E. Francisco, N. Yozbatiran, J. Berliner, M.K. O'Malley, A.U. Pehlivan, Z. Kadivar, K. Fittle, C. Boake, Robot-assisted training of arm and hand movement shows functional improvements for incomplete cervical spinal cord injury, *Am. J. Phys. Med. Rehabil.* 96 (10) (2017) S171–S177.