Case Report

Combination of Telerehabilitation with Conventional Therapy in the Treatment of Bilateral Carpal Tunnel Syndrome: A Case Report

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ABSTRACT

Carpal Tunnel Syndrome (CTS) is the most common entrapment neuropathy of median nerve. The current development of global COVID-19 pandemic urges medical rehabilitation services to deliver a comprehensive approach amidst the physical distancing period. This case report aims to investigate the feasibility and efficacy of implementing telerehabilitation to the conventional therapy in the treatment of CTS. A 51-year old female presented with post carpal tunnel release of the left hand, and chronic-severe CTS on right hand. We maintained 5 weeks rehabilitation programs of combined telerehabilitation and face-to-face rehabilitation therapy and evaluation. The patient showed good compliance with the programs and achieved the intended goals within 5 weeks of therapy. Patient showed improvement (in pain, range of motions, hand functions, and ADLs). Telerehabilitation combined with conventional therapy were effective and feasible in treating patient with bilateral (left post-release and right chronic-severe) CTS. The use of telerehabilitation may add accessibility while reducing physical contact in order to minimize the risk of transmission of COVID-19.

Keywords: *carpal tunnel syndrome, home exercise programme, telerehabilitation, therapeutic exercise*

Introduction

Carpal tunnel is the most common site of median nerve entrapment that lead to a set of peripheral neuropathy symptoms.[1,2] Carpal Tunnel Syndome (CTS) occurs in approximately 3-4% of the world's population and most frequently affect women between 40- 60 years old.[1,3,4] Though the exact etiology of CTS remains unclear, the source of CTS are primarily related to dysfunction of the sensory and motor fibers of median nerve.[4,5] Compression of median nerve was suspected to be caused by several factors such as exertion strain, overuse, hyperfunction, repeated or prolonged wrist extension, prolonged grasping of tools, and unaccustomed manual work.[3]

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Conservative rehabilitation programs in CTS are aimed to improve patients' symptoms and increase functional activities in daily living (ADLs). The programs include physical modalities (such as Low Level LASER Therapy, Ultrasound Diatherrmy, and TENS), manual therapy, nerve and tendon gliding exercises, kinesiotaping, and splinting.[4,6] For patients with moderate to severe symptoms, surgery might be indicated[3]. The surgical treatment, however, did not guarantee permanent relieve of CTS. A meta-analysis study explained that symptoms of CTS post- surgery could reemerged after 3 months to 4 years, with the mean time between first and revision surgery was 31 month[2]. Therefore, immediate post-surgery rehabilitation was considered important to control the acute phase of post-surgery condition and facilitate the long-term activity modifications.[7,8]

An emerging approach in the provision of rehabilitation programs during the COVID-19 pandemic is through telerehabilitation. Telerehabilitation is defined as the implementation of telecommunication, sensors, digital, and computing technologies to facilitate the delivery of rehabilitation services at a distance.[9–12] Implementation of telerehabilitation has shown to provide new opportunities that have better effectiveness in improving accessibility and creating the least restrictive environment.[12] This insight becomes more important during today's global and local guidelines to restrict human physical contact in order to overcome transmission of COVID-19 infection, especially in medical settings.

Nonetheless, telerehabilitation has not been investigated extensively in Indonesia. Some researches published in Indonesia were only in the field of stroke rehabilitation from the perspective of nursing.[13,14] The need to further investigate telerehabilitation has become imperative due to the development of COVID-19 pandemic. This case report aims to investigate the feasibility and efficacy of implementing telerehabilitation to the conventional therapy in the treatment of CTS.

Material and Methods

A case of a 51-year old female with chief complaint of pain at both wrists was reported in this study. The reporting of this case study followed the CARE Guidelines for case reports[15]. The case was followed for 5 weeks (15 April 2020 - 14 May 2020). The patient was referred from an orthopaedic surgeon to Physical Medicine and Rehabilitation (PM&R) outpatient clinic in Dr. Soetomo General Hospital, Surabaya with CTS bilateral post release CTS sinistra (1 months).

The patient felt pain at both wrists since 6 years ago (2014). The left wrist pain was more severe than the right wrist. The sensation of pain was like "electric shock' that radiated to the first until fourth finger. It worsened when she rode motorcycle, cooked, cut and grinded the spices, washed dishes, mopped and swept the floor, lifted water dipper while taking a bath, lifted plate while eating, lifted water gallon, and wore undergarments. The pain was experienced continuously at the right hand Wong-Baker FACES score (WBFS) was 4 and left hand WBFS was 7. The pain was relieved when she extended and shook her hand. She would feel the pain both at night and during activity throughout the day. She underwent left open carpal tunnel release on March 4th, 2020.

After surgery, the pain at her left wrist was improved. However, she still felt pain on the site of surgery and on her finger joints with WBFS 3. The pain exacerbated with movement of the hand especially when tried to flex her fingers and wrist. Her palm was swollen. She also felt

warmth and stiffness on all of her fingers. It was "kemeng" sensation and did not radiate. She did not feel numbness and tingling sensation on the left hand. However, the symptoms on her right hand remain constant (WBFS was 4). She was unable to drive motorcycle, cook, cut and grind the spices, wash dishes, mop and sweep the floor, lift plate while eating, and wore undergarments without pain. The patient hoped that she could return to do her daily house chores, self-care, and driving motorcycle to the market without pain on her wrists and hands.

Physical examination of the left hand showed inflammation signs (redness, warmth, and swelling). The range of motions (ROM) of left wrist and fingers were limited due to pain and stiffness. Muscle strength of 1st and 2nd lumbrical muscles, opponens pollicis, abductor pollicis brevis, and flexor policis longus muscles were 4/5 MRC scale due to pain on the left side, and 5/5 MRC scale on the right side (**Figure 1**). On the right hand there were atrophy of the thenar eminence, no inflammation signs, no limitation of ROM and no weakness of hand muscles. The Tinel's test, Phallen's test, flick sign, and prayer sign were positive for right hand only. The hand functions (grasp, spherical, silindrical, hook, pinch, lateral tip, palmar tip) of the left hand were weak, while the right hand's functions were fully functional. Electrodiagnostic examination showed bilateral severe demyelinating sensory median nerve mononeuropathy.

The treatment goals for this patient were to manage pain, to improve hand function, return to previous daily activity and work, and to increase quality of life. PMR programs focused on pain and edema reduction, ROM and muscle strength training, ADLs modification and hand function exercise, and prevention of right CTS progression and recurrences of left CTS.

Figure 1. Clinical status at initial assessment

The hospital-based modalities prescribed for this patient were low level LASER therapy and Ultrasound Diathermy (USD) phonoporesis method to reduce pain,inflammation, stimulate soft tissue healing, and improve joint stiffness. Supervised-based therapy with an occupational therapist was also planned to improve hand function and ADLs modification. However, due to COVID-19 pandemic the patient was advised to stay home.

We combined routine telerehabilitation program and 2-weekly home visits to closely monitor conventional home education (HE) and home education programmes (HEP). We advised the patient to do contrast bath for right and left hands, Piroxicam gel 0.5% application, wrist splint (for right wrist), and prescribed exercise at home with guidance. We also gave health education about her condition and the importance of home exercise program and to avoid repetitive movements of the wrists. The prescribed exercises were:

- Cold pack for 20 minutes at left wrist, every two hours: pre- and post-exercise, before sleep at night, in the morning, and before doing ADLs
- Elevation of wrists
- Gentle stroking massage left hand and wrist
- Bandaging left wrist when not doing exercise (not too tight, as tolerated, regularly checked/ open as needed)
- Active ROM exercise both wrists and

fingers

- CTS exercise for tendon and nerve gliding at both hands, start low, gradually, as tolerated by the patient
- Isometric strengthening exercise for intrinsic left hand muscles and isotonic strengthening exercise for intrinsic right hand muscles
- Activity modification

The telerehabilitation methods that we used included the use of instant messages and video calls using Whatsapp Messenger. We also sent materials to enhance HE and HEP such as pictures and video of recommended exercises. The length and frequency of online chats and video calls were as patient's need. In this case we communicated every 4-5 days in average, with durations varying from 5-40 minutes. Through online communications, we guided patient's HEP and gave feedback on her performance. The patient was able to report her recent condition, ask questions regarding her problems, and send pictures or videos of her activities. Additionally, we developed patient-specific paper-based journal that scheduled HEP for the patient.

The frequency of home visits were 3-times, 2-weeks apart, aimed to follow-up the patient's condition, help with patient's HEP, and re-adjust the programs to suit the patient's recent condition. We monitored resolution of edema, hand function, WBFS, MMT, ROM, Disabilities of the Arm, Shoulder and Hand (DASH), Functional Independence Measure (FIM), and Barthel Index (BI) scores.

Result

After 5 weeks of close monitoring and guidance on rehabilitation program, patient showed improvement of symptoms. Based on progress notes, the symptoms of disease are considerably improved by the implementation of rehabilitation programs. The pain was subsided (**Figure 2**), edema was reduced (**Figure 3**), ROM was increased, and hand function was improved. Improvement of functional states according to DASH, FIM, and BI scores were shown in **Figure 4.**

At the end of the follow-up, patient was able to wear undergarments, cook, sweep and mop the floor without pain (**Figure 5**). However, she was still hesitant to drive motorcycle by herself. She still hoped that the remaining mild pain she felt on both hands would recede and she could be pain-free and continue tending at her store more efficiently.

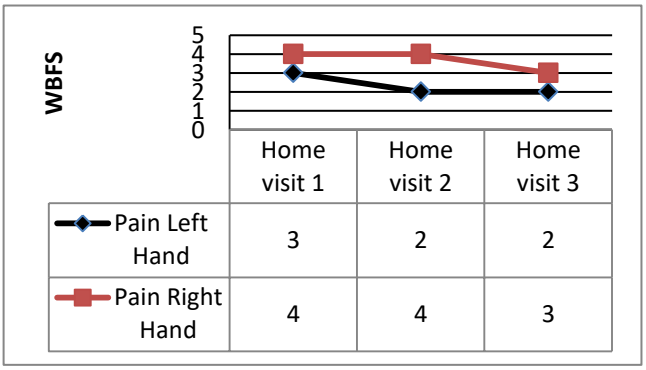

Figure 2. Progress of Pain Scale

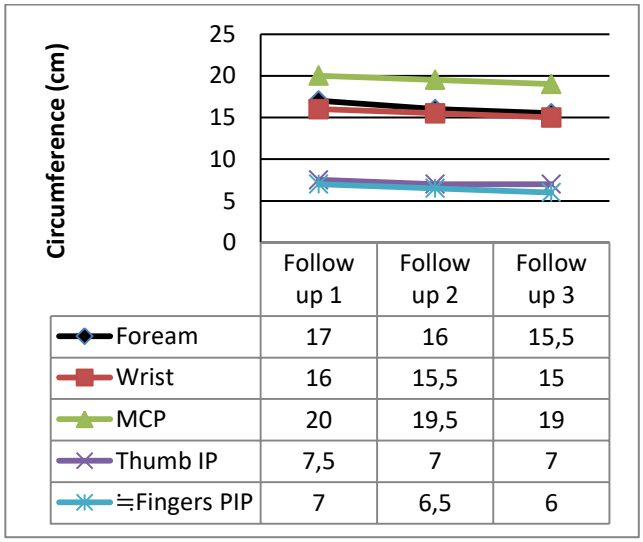

Figure 3. Progress of left hand edema as reflected on measurement of circumferences

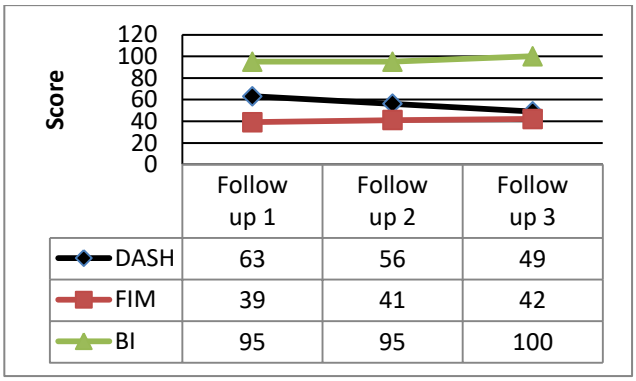

Figure 4. Progress of FIM, BI, DASH

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Discussion

The digital literacy in Indonesia varies with the different characteristics of different populations. However, in the time of global COVID-19 pandemic, an alternative approach to the conventional face-to-face rehabilitation should be developed. The patient in our case was encouraged to fill in the journal of her prescribed rehabilitation programs in order to support the patient's compliance of the programs. The feature of video call was also helpful for us to properly evaluate the patient about her condition, given the current pandemic situation. The total face-to-face meetings were 3 times lower (3 meetings) than if the patients were to follow the conventional therapy (10 meetings) over the course of 5 weeks. This was a considerable reduced of physical contact between patients and health professionals. We planned to resume the

prescribed modalities and occupational therapies after the pandemic situation has become more stabilized, depending on the patient's condition.

Figure 5. Patient was able to carry out household chores with minimal pain while using wrist splint (right hand) and elastic bandage (left hand)

Comprehensive follow up examinations are key to adjust HEPs for patients with CTS pre-or post-surgery. Our patient showed substantial improvement of clinical signs and symptoms (reduced pain, increased hand ROM and functions, and improve functional ADLs indicators). Therefore, close collaboration and communication with patients and other related disciplines were also important to set up programmes that are tailored to suit the patient's progress. The recommendation from telerehabilitation studies encouraged multidisciplinary and collaborative management rehabilitation, especially for chronic hand impairment cases.[16,17] Physiatrists' role as a leader of rehabilitation management is vital to evaluate and manage the patient's condition to give education on which rehabilitation approaches that are more suitable to the patient, and to work in collaboration with other professions to ensure patient's comfort and engagement with our programs.[5,6,8,16,17]

Our consideration to combine telerehabilitation with conservative rehabilitation therapy was in line with previous studies. A patient communication study in Denmark analysed that patient's experience was mainly reported negative for using full web-based rehabilitation programmes. The study suggested that to establish a positive contribution from digital communication tools to rehabilitation, combination of both face-to- face consultations with online care by user- friendly web portals should be considered[18]. Other studies in telerehabilitation also reported that although enhancement of patients' sense of autonomy and relatedness to their rehabilitation program[19], telerehabilitation still have some barriers in its application especially for patients with psychological distress[20], lack of technical competences, difficulty in operating of equipment, and attitudes that digital services undermine in self-care and independence .[19,21,22]

Hence, insights to the ideal telerehabilitation program could be very beneficial, all the more so in post-pandemic

setting. Further research should be conducted with more participants and more elaborate incorporation of technology with conventional therapy that are suitable in Indonesian setting to propose a more robust approach toward telerehabilitation.

Conclusion

Telerehabilitation combined with conventional therapy were effective and feasible in treating patient with bilateral (left post-release, right chronic-severe) CTS. Limited technical resources, digital literacy, and certain patient's conditions may contribute as the barriers to the implementation of telerehabilitation despite the industrial revolution 4.0 in todays' society. The use of telerehabilitation may add accessibility while reducing physical contact in order to minimize the risk of transmission of COVID-19.

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