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# Efficacy of Telerehabilitation in Patients with Stroke in Turkey: A Pilot Study

## *Türkiye'de İnmeli Hastalarda Telerehabilitasyonun Etkinliği: Pilot Çalışma*

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### Abstract

**Objective:** Telerehabilitation (TR) is not used very widely in our country. Our study was planned to evaluate the usefulness and effect of TR in patients with hemiplegia.

**Materials and Methods:** The study was performed at Mustafa Kemal University Health Practice and Research Hospital. After the demographic data were questioned, cognitive levels were assessed using the Mini Mental State Examination, balance using the Berg Balance Scale, and quality of life using the Short Form-36 (SF-36) Quality of Life Scale. A TR program was performed for 3 weeks with 3 sessions per week, a total of 9 sessions. After the therapy program was planned, TR was applied by contacting the patients via laptops with a camera and microphone and an internet connection. The first and last assessments were done at the clinic.

**Results:** According to the results of the study, the balance levels of patients significantly improved after the TR program (p=0.026). There was no difference in terms of quality of life and mental status before and after TR (p>0.05).

**Conclusion:** It was concluded that TR could improve the functionality of patients with stroke and routine use of TR would be beneficial. However, our country's technological equipment for TR application has been found not sufficient in the countryside.

**Keywords:** Telerehabilitation, Turkey, stroke

### Öz

**Amaç:** Telerehabilitasyon (TR), ülkemizde çok yaygın bir şekilde kullanılmamaktadır. Çalışmamız inmeli hastalarda TR'nin kullanılabilirliğinin ve etkisininin araştırılması amacıyla planlandı.

**Gereç ve Yöntem:** Çalışma, Mustafa Kemal Üniversitesi, Sağlık Uygulama ve Araştırma Hastanesi Nöroloji Ünitesi'ne başvuran hastalar üzerinde yapıldı. Hastaların demografik bilgilerinin alınmasını takiben kognitif düzey, Mini Mental Test ile; denge, Berg Denge Ölçeği ile; yaşam kalitesi, Kısa Form-36 Yaşam Kalitesi Ölçeği ile değerlendirildi. TR programı 3 hafta süre ile haftada 3 seans olmak üzere 9 seans olarak gerçekleştirildi. Çalışma programı planlandıktan sonra, hastalarla kameralı ve mikrofonlu, internet bağlantısı olan dizüstü bilgisayarlar aracılığıyla iletişime geçilerek TR uygulandı. İlk ve son değerlendirme klinikte yapıldı.

**Bulgular:** Çalışmanın sonucunda tedavi sonrasında tedavi öncesine göre bireylerin denge düzeylerinde anlamlı düzeyde fark olduğu ve dengenin geliştiği saptandı (p=0,026). Ancak yaşam kalitesi ve mental durum düzeyinde fark olmadığı bulundu (p>0,05).

**Sonuç:** TR'nin inmeli hastalarda fonksiyonelliği desteklediğinden dolayı rutin kullanımının faydalı olacağı düşünüldü. Ancak TR uygulaması için gerekli teknolojik donanımın ülkemizin kırsal kesimlerinde henüz yeterli olmadığı bulundu.

**Anahtar Kelimeler:** Telerehabilitasyon, Türkiye, inme

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## Introduction

Cerebrovascular accident is the most common neurologic disorder in the world, the third most frequent cause of death after coronary artery disease and cancer, the most frequent cause of disability, and it occupies a significant place in hospital admissions and health care expenditure in developed countries (1,2).

Stroke is an important health problem that affects all areas of life by causing neurologic and functional disability. Developments in intensive care and other health services have increased the number of stroke survivors and resulted in an increase in the number of patients with stroke who need rehabilitation. Rehabilitation aims to improve life quality and independence of patients with stroke by using physical, functional, physiologic and social approaches. Recently, developments in technology provided telerehabilitation (TR), which has started to be used in neurologic rehabilitation in addition to classic rehabilitation (3,4,5,6,7).

TR involves giving rehabilitation services with computer-based technologies and communication tools by rehabilitation specialists to provide access to rehabilitation services and improve the independence levels of patients. TR is a developing technique that diminishes distance and cost handicaps and brings patients and rehabilitation service providers together who are far from each other by using technology (3,4,5,6,7). TR is a different model of presentation of rehabilitation services. It provides various services including counseling, prevention, diagnosis, evaluation, intervention, and treatment for patients.

TR eliminates the distance handicap between physicians and patients who need rehabilitation services and helps to reduce health care costs of the country. It also eliminates financial burdens caused by transportation and enables patients to save money (6,7,8). TR is also favorable for patients who live in metropoles who have problems in transportation.

Many studies have been performed in many countries regarding the efficacy of TR but there are few and limited studies performed in our country and such studies are needed.

TR is not widely used in our country, but the difficulties in reaching hospitals and rehabilitation centers located in city centers for patients who live in rural areas and transporting patients with stroke in vehicles to and from hospital requires TR to be used widely. This study aimed to test TR's usability and investigate its efficacy in patients with hemiplegia. The hypotheses of the study were:

**H0:** TR affects balance in patients with stroke,

**H1:** TR affects quality of life in patients with stroke.

## Materials and Methods

Patients who were admitted to the neurology unit of Mustafa Kemal University Health Practice and Research Hospital and accepted to be involved in the study were included in the study. Patients who were hemiplegic and had sufficient equipment for TR and would not take another treatment other than TR were selected. The study was approved by the Ethics Committee of Mustafa Kemal University, Tayfur Ata Sökmen Medical Faculty (protocol no: 27/10/2015/123).

Inclusion criteria were patients aged between 45 and 60 years, 3rd or higher Brunnstrom stages, sufficient equipment to allow video commmunication at home, patients who received no treatment other than medical treatment, ability to comprehend and apply verbal orders, and to speak and understand Turkish.

The Berg Balance Scale, which was used in this study, is a reliable and valid scale used for predicting balance performance, postural control, and falling risk of patients with stroke (9). The Short Form-36 (SF-36) is an 8-part scale. It is used to measure a person's physical and mental health status and has been shown to be reliable and valid (10). The Mini Mental State Examination, developed by Folstein et al. (11) in 1975, is widely used for patients with stroke. This 30-point questionnaire consists of 11 questions; scores between 24-30 indicate normal cognition, 18-23 indicates mild dementia, and 17 or below indicates severe dementia (11).

The study started with face-to-face observations. After demographic information of the patients was gathered, cognitive levels, balance, and quality of life were measured using the Mini Mental State Examination, Berg Balance Scale, and SF-36 quality of life scale, respectively. The last examination was performed face to face after the rehabilitation program was performed 3 times a week for 3 weeks (9 sessions). All evaluations and rehabilitation programs were performed by the same physiotherapist under the same environmental conditions. The rehabilitation program was planned after the first examination. The first session was performed just after the first examination in the hospital. The patients were then informed about how they would do the exercises at home and were given appointments for TR. Patients were contacted via laptops with cameras, microphones, and internet connections in TR sessions. Our laptops' cameras were positioned so that the patients could see us as we were describing the exercises. Cameras of the patients' laptops were positioned so that they could see us and also we could see them while they were doing their exercises (Figures 1, 2).

Fifteen patients were included in the study for the TR program but only 10 could complete the course due to technical difficulties. Exercises that were appropriate for the patients and remotely applicable were chosen from exercises included in the scope of neurodevelopmental treatment. The exercise programs were created by choosing appropriate exercises from those described below relevant to the individual's needs and demands after evaluating each patient. Exercise repetition numbers were determined relative to the individual's needs and demands.

Exercises included in the scope of neurodevelopmental treatment:

1- For the trunk: in the supine position, trunk rotation and bridging exercises,

2- For the lower extremities: in the supine position, plantar dorsiflexion of the ankle, extension-flexion of the hip, straight leg lift, abduction of the hip, pulling a leg down from the edge of the bed with flexion of the knee and pulling the leg back onto the bed; while standing, extension of the hip and flexion of the knee (rolling a bottle under the feet), isolated flexion-extension of the knee of a weight-bearing leg, touching different parts of a tile with a foot in the air, weight transfer, swinging the trunk to left and right.

3- For the upper extremities: while sitting, flexion-extension of the shoulder while non hemiplegic hand hold the hemiplegic hand, reaching out with elbow extended and touching the nose

and the mouth with elbow flexed while hands are together pressing the bed with the weak hand and doing approximations with body weight, elevation of the shoulder, supination-pronation of the forearm with the help of the strong hand while hands are together flexion-extension of the elbow on the edge of a table while holding an item in the palm of the hand and reaching front and sides.

The study data were analyzed using the Statistical Package for Social Sciences (SPSS) version 22. Variables determined with measurement are expressed as median (minimum-maximum). Number (n) and percentage (%) values were calculated for variables determined with counting. The Wilcoxon signed-rank test was used to analyze changes in the group before and after the treatment.

## Results

Six men and 4 women were included in the study whose ages ranged between 44-61 years (Table 1). Patients' balance performances were significantly better after the treatment ($p<0.05$). There was no difference in terms of quality of life and mental status before and after the treatment ($p>0.05$) (Table 2).

**Figure 1.** Bridging exercises

**Figure 2.** Bridging exercises

## Discussion

TR resulted in an increase in balance function of the patients, but quality of life and mental status measures did not change after TR.

Patients included in the study had 3 or more Brunnstrom stages and we could communicate with them via video conference, which meant that they were partially dependent patients. We demanded a caregiver to provide security and assistance of every patient when the patients were performing the exercises we showed via camera. During the program, caregivers helped the patients while they were performing exercises such as weight transfer. However, untrained caregivers affected our data. Caregivers tried to help patients using non-ergonomic methods, which increased the risk of injury to the patients and themselves. It was concluded that caregivers were impatient and they were untrained about helping the patients to manage the physiotherapy program. Although patients' physical and psychological wellness are improved when given care by their own relatives, studies have shown that caregivers have some problems. Family caregivers are inadequate in giving care, they have no education about giving care at home, and need a specialist's help for their problems (12,13,14). Being elderly and lacking social support causes social, physical, psychological, and economic problems in caregivers who give care for long periods, and also long-term caregiving causes health problems in caregivers. It has been reported that caregivers' freedom is restricted, their psychological health is adversely affected, they are stressed and become depressed (12,13,14,15). Hence, companions who give care in TR programs should be trained and receive psychological support before the initiation of the program.

Although physicians consider TR as a therapeutic tool for patients with chronic diseases who live in rural areas, some of the patients included in our study did not agree and they believed that face-to-face methods would be more helpful. Some of the patients stated that therapists should be in close contact with patients and

**Table 1. Demographic features of the patients**

| | | x±SD | |
|---|---|---|---|
| Age (years) | | 52.60±6.45 | |
| Height (cm) | | 168±9 | |
| Weight (kg) | | 78.30±9.90 | |
| Disease duration (months) | | 10.30±6.51 | |
| | | **n** | % |
| Hemiplegic side | Right | 5 | 50 |
| | Left | 5 | 50 |
| Dominant extremity | Right | 10 | 100 |
| | Left | 0 | 0 |
| Sex | Male | 6 | 60 |
| | Female | 4 | 40 |

SD: Standard deviation

remote rehabilitation would not be enough. Some of the patients requested us to give them rehabilitation at home instead of giving rehabilitation via the internet. We think that our patients were distant from technology because of their generation and this could account for their choice of face-to-face rehabilitation instead of remote rehabilitation.

In contrast with studies in the literature that showed TR had favorable effects on quality of life and depression, we found no differences in terms of quality of life in our patients (16). Most of the patients reported that transportation to hospital helped them to socialize, gave them the opportunity to go out from home, and they could find someone to talk with in hospitals and keep up their morale. We believe that rehabilitation given at home improved balance but this acquisition was not reflected in quality of life because patients did not leave their homes.

Mini Mental test scores were in the normal range before TR so there was no change found in the scores after TR. Also, cognitive rehabilitation was not given in this study, so no changes in mental status were expected.

TR is a more reachable and cheaper method compared with rehabilitation given at clinics. However, we think that TR is not suitable for patients with severe deficits and more studies are needed to show the efficacy of TR in patients with stroke. We believe that TR is not used widely in our country because not everyone has access to computers and the internet, and those that do have access have difficulties in their use.

We had difficulties in finding appropriate patients who were hemiplegic due to the restrictive inclusion criteria. The number of patients who had appropriate tools and technology were insufficient and families did not find TR trustworthy because of the use of video conferencing.

Communication has an important role in TR. Patients were given orders because they could understand how to perform the particular exercises. We did not have a chance to do active assistive exercises with patients if they understood wrongly or insufficiently. Instead, we tried to communicate with verbal orders or showed the exercises on ourselves.

Studies are limited with regards to showing whether the efficacy of TR is similar to conventional treatment in patients with stroke (17). Our study contributes to the literature in this area.

It has been reported in the literature that home-based TR increases the trust of people with technology, reduces costs, and is easy to use (18,19). We believe that the use of TR in patients who live in rural areas in our country will be favorable because it will eliminate the difficulty of transportation of patients to hospitals.

In a study, the satisfaction of 6 patients and physiotherapists with TR treatment were questioned. Eighty-six percent of the patients and 90% of the physiotherapists reported that they were satisfied. Improvement in patients' balance was also reported. We found improvement in patients' balance similar to that study but we did not question patients' satisfaction in our study (20). We plan to evaluate patients' and physiotherapists' satisfaction levels in future studies.

### Limitations of the Study

TR requires a strong internet connection and is used to reach patients who live in rural areas, but the internet connection in rural areas of Turkey is not strong enough, which limits the use of TR. Due to internet problems we had to change the meeting hours, which reduced the effects of TR. Also, disruptions of electricity in Hatay during our study caused delays in the TR program. The insufficient number of patients, short treatment durations, and lack of a control group given face-to-face rehabilitation were the other limitations of this study.

## Conclusion

The handicaps in the spread of TR in clinical practice should be eliminated because TR could reduce health costs and burdens of hospitals, and allow effective use of hospital facilities (15,19,20). We found that our technological equipment was not enough to perform TR in rural areas in our country. We believe that development of appropriate equipment for TR will be favorable for the country and patients.

**Table 2. Mental status, balance levels, and quality of life measures of the patients before and after treatment**

| | | Before treatment | After treatment | | |
|---|---|---|---|---|---|
| | | Median (minimum-maximum) | Median (minimum-maximum) | p | z |
| | Mini Mental Test | 26.5 (15-30) | 28 (15-30) | 0.066 | -1.841 |
| | Berg Balance Scale | 35 (18-48) | 36.5 (21-50) | **0.026*** | -2.232 |
| SF-36 | Physical functioning | 42.5 (0-65) | 42.5 (0-75) | 0.180 | -1.342 |
| | Physical role limitation | 12.5 (0-100) | 12.5 (0-100) | 0.999 | 0.000 |
| | Bodily pain | 36.5 (10-84) | 37 (12-84) | 0.892 | -0.135 |
| | General health perceptions | 40 (10-77) | 48.5 (10-72) | 0.071 | -1.807 |
| | Vitality | 57.5 (30-85) | 55 (30-85) | 0.564 | -0.577 |
| | Social role functioning | 25 (0-75) | 37.5 (0-75) | 0.096 | -1.667 |
| | Emotional role functioning | 0 (0-100) | 0 (0-100) | 0.317 | -1.000 |
| | Mental health | 72 (48-80) | 70 (48-76) | 0.238 | -1.179 |

*p<0.05, Wilcoxon signed-rank test, SF-36: Short-Form-36

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**Ethics**

Ethics Committee Approval: The study was approved by the Ethics Committee of Mustafa Kemal University, Tayfur Ata Sökmen Medical Faculty (protokol no: 27/10/2015/123), Informed Consent: Consent form was filled out by all participants.

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**Authorship Contributions**

Surgical and Medical Practices: Esra Doğru Hüzmeli, Taşkın Duman, Hatice Yıldırım, Concept: Esra Doğru Hüzmeli, Taşkın Duman, Design: Esra Doğru Hüzmeli, Data Collection or Processing: Taşkın Duman, Analysis or Interpretation: Hatice Yıldırım, Literature Search: Esra Doğru Hüzmeli, Taşkın Duman, Hatice Yıldırım, Writing: Esra Doğru Hüzmeli, Taşkın Duman.

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## References

1. Armağan O. İnme sonrasi afazi ve yaşam kalitesi. Türk Beyin Damar Hastalıkları Dergisi 2011;17:89-94.
2. Utku U. İnme tanımı, etyolojisi, sınıflandırma ve risk faktörleri. Türkiye Fiziksel Tıp Dergisi Özel Sayı 2007;53:1-3.
3. Forducey PG, Ruwe WD, Dawson SJ, Scheideman-Miller C, McDonald NB, Hantla MR. Using telerehabilitation to promote TBI recovery and transfer of knowledge. NeuroRehabilitation 2003;18:103-111.
4. Durfee W, Carey J, Nuckley D, Deng J. Design and implementation of a home stroke telerehabilitation system. Conf Proc IEEE Eng Med Biol Soc 2009;2009:2422-2425.
5. McCue M, Fairman A, Pramuka M. Enhancing quality of life through telerehabilitation. Phys Med Rehabil Clin N Am 2010;21:195-205.
6. Akinci B, Zenginler Y. Tele-rehabilitation. Turkiye Klinikleri J Physiother Rehabil-Special Topics 2015;1:14-21.
7. Gürşen C. Tele-rehabilitasyon. Hacettepe Üniversitesi Sağlık Bilimleri Fakültesi Fizyoterapi ve Rehabilitasyon Bölümü Fizyoterapi Seminerleri 2013;151-161.
8. McCue MJ, Palsbo SE. Making the business case for telemedicine: an interactive spreadsheet. Telemed J E Health 2006;12:99-106.
9. Şahin F, Büyükavcı R, Sağ S, Doğu B, Kuran B. Berg Denge Ölçeği'nin türkçe versiyonunun inmeli hastalarda geçerlilik ve güvenilirliği. Türk Fiz Tıp Rehab Derg 2013;59:170-175.
10. Brazier J, Harper R, Jones N, O'Cathain A, Thomas KJ, Usherwood T, Westlake L. Validating the SF-36 health survey questionnaire: new outcome measure for primary care. BMJ 1992;305:160-164.
11. Folstein MF, Folstein SE, McHugh PR. "Mini-mental state". A practical method for grading the cognitive state of patients for the clinician. J Psychiatr Res 1975;12:189-198.
12. Navaie-Waliser M, Feldman PH, Gould DA, Levine C, Kuerbis AN, Donelan K. When the caregiver needs care: the plight of vulnerable caregivers. Am J Public Health 2002;92:409-413.
13. Dramalı A, Demir F, Yavuz M. Evde kronik hastaya bakım veren hasta yakınlarının karşılaştıkları sorunlar. I. Ulusal Evde Bakım Kongresi Özet Kitabı, İstanbul, 24-26 Eylül 1998.
14. Karahan A, Güven S. Yaşlılıkta evde bakım. Geriatri 2002;5:155-159.
15. Çayır Y, Avşar ÜZ, Avşar Ü, Cansever Z, Khan AS. Evde sağlık hizmetleri alan hastaların özellikleri ve bakım verenlerin beklentileri. Konuralp Tıp Dergisi 2013;5:9-12.
16. Linder SM, Rosenfeldt AB, Bay RC, Sahu K, Wolf SL, Alberts JL. Improving quality of life and depression after stroke through telerehabilitation. Am J Occup Ther 2015;69:6902290020p1-10.
17. Chen J, Jin W, Zhang XX, Xu W, Liu XN, Ren CC. Telerehabilitation Approaches for Stroke Patients: Systematic Review and Meta-analysis of Randomized Controlled Trials. J Stroke Cerebrovasc Dis 2015;24:2660-2668.
18. Zheng H, Black ND, Harris ND. Position-sensing technologies for movement analysis in stroke rehabilitation. Med Biol Eng Comput 2005;43:413-420.
19. Holden MK. Virtual environments for motor rehabilitation: review. Cyberpsychol Behav. 2005;8:187-211; discussion 212-9.
20. Corriveaua H, Tousignanta M, Gosselinc S, Boissy P. Patients satisfaction with an in-home telerehabilitation exercise program and physiotherapists' satisfaction toward technology for an acute stroke population: a pilot study. Assistive Technology: From Research to Practice 2013:753-757.