PRESENTATIONS

OPEN-SOURCE SOFTWARE FOR DATA ACQUISITION AND CONTROL IN HUMAN MOTION: A CASE STUDY ON THE ACTIVE BALANCE BOARD

Jason McDowell[1], Erkan Kaplanoglu[1], Max Jordon[2], Jeremy Bruce[3]

[1] University of Tennessee at Chattanooga, Collage of Engineering and Computer Science, Chattanooga, TN USA
[2] University of Tennessee at Chattanooga, Physical Therapy, Chattanooga, TN USA
[3] University of Tennessee Health Science Center College of Medicine, Department of Orthopaedic Surgery Chattanooga, TN, USA

Abstract— **This paper presents the development of open-source software for physical therapy, focusing on the software components for actuator control, sensor data acquisition, and real-time visualization. The Active Balance Board is used as a case study to illustrate the implementation of a standardized software framework that enhances performance and compatibility across various research projects. The project leverages Python and Tkinter to create a cross-platform user interface, integrating IMU and EMG sensors for comprehensive data acquisition and providing valuable feedback for physical therapy applications.**

INTRODUCTION

The field of physical therapy is continuously evolving, with technological advancements playing a crucial role in enhancing patient outcomes. One such advancement is the development of open-source software tailored for physical therapy applications. This paper focuses on the creation and implementation of an open-source software platform designed to improve actuator control, sensor data acquisition, and real-time visualization in physical therapy settings. Utilizing the Active Balance Board as a case study, the software framework demonstrates standardized and enhanced performance, providing a robust tool for researchers and clinicians alike. By leveraging Python and Tkinter, the project ensures a cross-platform user interface that seamlessly integrates Inertial Measurement Units (IMU) and Electromyography (EMG) sensors, facilitating comprehensive data acquisition and valuable feedback for therapeutic interventions.

Chronic low back pain (cLBP) remains a significant health issue in the United States, contributing to chronic pain and the widespread use of opioids. Despite medical advancements, the prevalence of cLBP continues to rise, necessitating innovative approaches to diagnosis and treatment. Recognizing this critical need, the National Institutes of Health (NIH) has invested over a billion dollars in research aimed at addressing chronic pain. This project aligns with these efforts by proposing a novel technology that aims to diagnose and retrain motor control deficits in patients with cLBP. By integrating advanced sensor technology and open-source software, the project offers a promising solution for improving the management and rehabilitation of chronic low back pain, ultimately reducing the reliance on opioid prescriptions. The Biomechatronics and Assistive Technology Lab (BioAstLab) at University of Tennessee at Chattanooga uses a variety of different sensors and actuators to develop technologies for physical therapy, rehabilitation, prosthetics, and human-machine interaction. We aim to standardize the software for our research projects by using a common framework for data acquisition and actuator control to enhance performance and compatibility across different projects. Additionally, we plan to build cross-platform user interfaces, enabling our software to be easily utilized outside of our research lab by physical therapy departments and for future clinical research at hospitals.

METHOD

In this paper, we used the Active Balance Board for Postural Control Training as a case study to develop software for data acquisition and actuator control, providing a template for other software projects in BioAstLab.

The Active Balance Board (Fig. 1) is a research platform designed for postural measurement and training in individuals with lower back pain. Participants sit on the balance board and maintain their balance while its orientation is adjusted using pneumatic muscles. These muscles are controlled by onboard electronics, receiving signals from a desktop computer over Bluetooth. The Balance Board project employs three Inertial Measurement Units (IMUs) to measure acceleration, angular velocity, and orientation of both the balance board and the participant, as well as two Electromyography (EMG) sensors to monitor the muscle signals of the lower back. IMU 1 is mounted on the balance board, IMU 2 on the participant's chest, and IMU 3 on the participant's lower back. The EMG sensors are also placed on the participant's lower back muscles. All IMUs and EMG sensors communicate with the desktop computer over Bluetooth.

Figure 1. Active Balance board and flow chart
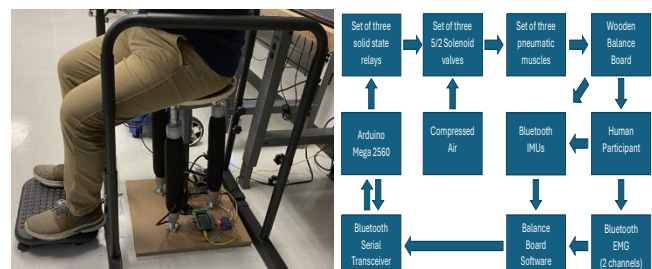
RESULTS

The graphical user interface (GUI) for open-source software and flow chart showing figure 2. The software for the Balance Board project connects to IMU and EMG sensors via Bluetooth, acquiring data at 10 Hz and 1000 Hz, respectively. It sends control signals to the Balance Board electronics, plots real-time data, and saves data in CSV format. Designed for modularity, the system allows easy substitution of different sensor hardware. Python was chosen for its cross-platform compatibility and wide support, with the user interface created using Tkinter. The software runs the user interface, IMU data acquisition, EMG data acquisition, and plotting in separate threads to maintain responsiveness. The project uses WitMotion WT901BLECL IMUs and BITalino (r)evolution Board EMG sensors, both of which have dedicated Python libraries for data interaction. IMU data triggers callbacks in background threads, while EMG data is read in batches of 100 data points. The HC-05 Bluetooth Transceiver module establishes a wireless link between a desktop computer and an Arduino microcontroller, facilitating serial communication. The software plots both EMG channels and IMU data, with options for different types of IMU data. All data is saved in CSV format for later analysis using tools like MATLAB. Initial testing of the system demonstrated that we can accurately track and graph both IMU positions and EMG data and can be used on Windows and Linux based systems within a python environment. This same system can be used in a variety of applications that require IMU and EMG data and can be structured to be used to control other systems whether they be pneumatic or electronic.

The generated plots from the GUI compare participants' data for angular velocity, balance board orientation, and EMG signals for each action, as shown in Fig. 3. The EMG data has been normalized as a percentage of Maximum Voluntary Isometric Contraction (MVIC). These comparison plots help clinicians and researchers easily evaluate the data
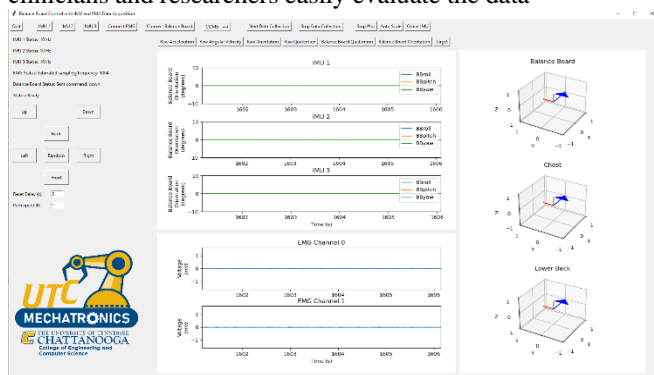
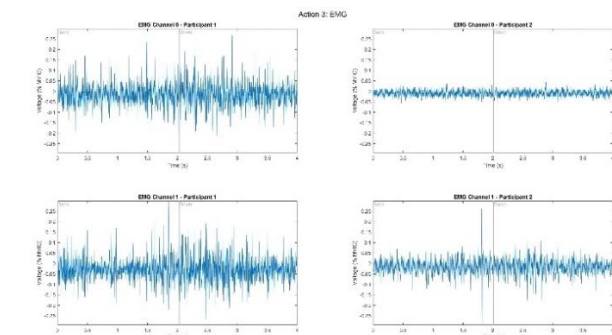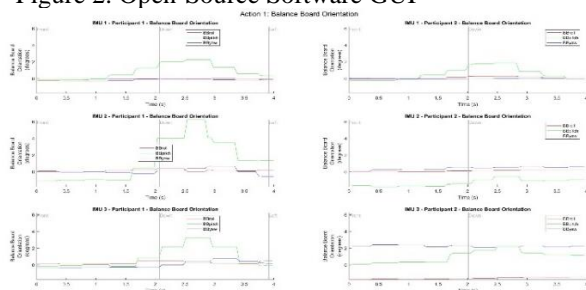

Figure 2. Open-Source Software GUI

Figure 3. Example of generated plots comparing two participants

DISCUSSION AND CONCLUSION

This paper presented the development of an open-source software platform designed to support physical therapy by enhancing actuator control, sensor data acquisition, and real-time visualization. Using the Active Balance Board as a case study, the software's effectiveness in improving performance and compatibility across diverse research projects was demonstrated. The open-source nature of the software ensures accessibility and adaptability, allowing researchers and clinicians to customize and extend the platform according to their specific needs, thereby encouraging collaboration and innovation in the field.

Despite its strengths, there are areas that require further exploration and refinement. Future work should focus on making user configuration easier, enabling therapists and clinicians to set up and calibrate the system efficiently without extensive technical support. Additionally, incorporating feedback from clinical trials will be crucial in optimizing the user interface and functionality based on real-world use cases. In summary, the developed software framework offers a robust and versatile tool for physical therapy, combining ease of use with powerful data acquisition and visualization capabilities.

REFERENCES

[1]   Beniz, D. B. and Espindola, A. M., "Using Tkinter of Python to Create Graphical User Interface (GUI) for Scripts in LNLS," in Proceedings of the 16th International Conference on Accelerator and Large Experimental Physics Control Systems (ICALEPCS 2017), Barcelona, Spain, Oct. 2017, pp. 54-58. https://doi.org/10.18429/JACoW-PCaPAC2016-WEPOPRPO25

[2]   WITMOTION, "WitBluetooth_BWT901BLE5_0," GitHub repository,2023.[Online].Available: https://github.com/WITMOTION/WitBluetooth_BWT901BLE5_0.

[3]   BITalinoWorld, "revolution-python-api," GitHub repository, 2023.[Online].Available: https://github.com/BITalinoWorld/revolution-python-api.

[4]   Jordon M, Kaplanoglu E, Errico R, Carney K, Halbrooks A, Hansford A, Young M. Design and development of a novel EMG supported balance board. J Orthop Sport Phys Ther. 2022;52(1):CSM 94, OPO103.

[5]   Kaplanoglu, E., Nasab, A., Jordon, M., Bruce, J., Young, M. and McDowell, J., 2021. The Real-Time Control of An Active Balance Board with An EMG Monitoring System For Rehabilitation.

[6]   Mehta, R., et al., Altered trunk motor planning in patients with nonspecific low back pain. J Mot Behav, 2010. 42(2): p. 135-44.

[7]   Acasio, J.C., et al., Associations between trunk postural control in walking and unstable sitting at various levels of task demand. J Biomech, 2018. 75: p. 181-185.

[8]   Shamsi, M., et al., Comparison of spinal stability following motor control and general exercises in nonspecific chronic low back pain patients. Clin Biomech (Bristol, Avon), 2017. 48: p. 42-48.

HOME-BASED HAND REHABILITATION: INTEGRATING HAND TRACKING CAMERA WITH GLOVE FOR STROKE RECOVERY

Jason McDowell[1], Brenden Lippard[1], Erkan Kaplanoglu[1]

[1] University of Tennessee at Chattanooga, Collage of Engineering and Computer Science, Chattanooga, TN USA

Abstract— **This study presents the integration of a hand tracking camera with a pneumatic glove designed for home-based hand rehabilitation after a stroke. The system facilitates robotic mirror therapy and active-assisted movement therapy, while monitoring rehabilitation progress by measuring the active range of motion of the participants' fingers. The hand tracking camera measures the flexion angles of each finger joint to control the pneumatically actuated glove. During assisted exercises, the pneumatic glove helps the user complete movements beyond their active range of motion.**

INTRODUCTION

Stroke rehabilitation exercises can be performed at home using assistive devices to improve recovery outcomes and quality of life [1]. This system combines a hand tracking camera with a pneumatic glove for hand rehabilitation after stroke. The hand tracking camera is used to monitor progress and control assisted movements for hand rehabilitation exercises. By monitoring the active range of motion (AROM) of a patient over time and using that data to customize active-assisted movement therapies, this system offers a personalized approach to hand rehabilitation. Additionally, the system facilitates robotic mirror therapy, allowing patients to visualize and mimic the movements of their unaffected hand, further enhancing motor recovery. The integration of real-time data acquisition and feedback ensures that the therapy is both adaptive and responsive to the patient's needs. Ultimately, this home-based rehabilitation tool aims to empower stroke survivors by providing accessible and effective therapeutic options to aid in their recovery journey.

METHODS

The system uses a Leap Motion Controller 2 hand tracking depth camera to track the flexion angle of each finger joint. The camera can be used to track a healthy hand and actuate the pneumatic glove for robotic mirror therapy, or to track the hand wearing the pneumatic glove for active-assisted movement therapy. A desktop computer records data from the camera using a Python API. Python scripts were written to record the maximum and minimum flexion angles of each finger joint to assess the user's active range of motion, and to send hand tracking data over Bluetooth to a Raspberry Pi 4 which controls the pneumatic rehabilitation glove.

Each finger of the pneumatic glove is actuated using a proportional pneumatic valve with an inlet pressure of 75 PSI, and an exhaust port at atmospheric pressure. A Raspberry Pi 4 with a sequent microsystems relay module implementing 0-10V outputs to actuate the solenoid valve for each finger when the flexion angle for the metacarpophalangeal (MCP) joint of the finger reaches a target threshold. This threshold is set according to the active range of motion of the subject, so that the pneumatic glove is actuated only when the user has reached the limit of their active range of motion.

RESULTS

Initial testing of the system with healthy subjects demonstrated the system's capability to accurately track hand movements and effectively actuate the pneumatic glove based on hand tracking data. The system can log data showing adherence to a rehabilitation plan, such as the time, duration and number of repetitions in an exercise session. The system can measure a user's active range of motion.
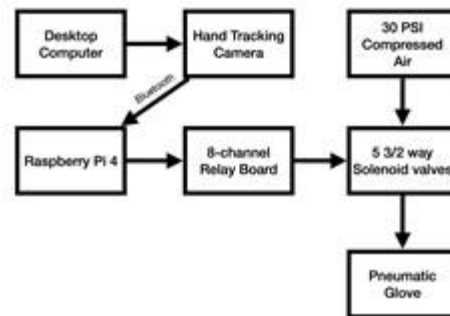
Pneumatic Glove Rehabilitation System and Flow Chart

DISCUSSION AND CONCLUSION

This study developed a home-based hand rehabilitation system integrating a hand tracking camera and a pneumatic glove for stroke patients. The system supports robotic mirror therapy and active-assisted movement therapy, measuring finger flexion angles to control the glove. It helps patients perform movements beyond their active range of motion (AROM) and monitors rehabilitation progress over time, providing personalized therapy. The home-based design makes rehabilitation more accessible, addressing barriers like mobility and cost. The system offers real-time feedback and customized therapy, potentially improving recovery outcomes and quality of life for stroke survivors. Future research should refine the technology and explore its broader applications. Future work should assess the efficacy of threshold-based assistive movement therapy. The integration of hand tracking cameras can enable rehabilitation exercises that require precise finger manipulation. Assistive devices that support precise position control, such as a linear actuator-

based exoskeleton glove or a pneumatic glove with electropneumatic regulators, could be investigated to enhance the effectiveness of these therapies.

REFERENCES
[1] S. Fardipour and M. Hadadi, "Investigation of therapeutic effects of wearable robotic gloves on improving hand function in stroke patients: A systematic review," Curr J Neurol, vol. 21, no. 2, pp. 125-132, Apr. 2022. DOI: 10.18502/cjn.v21i2.10496.
[2] L. Li, S. Tyson, and A. Weightman, "Professionals' Views and Experiences of Using Rehabilitation Robotics With Stroke Survivors: A Mixed Methods Survey," in Front Med Technol, vol. 3, Nov. 2021, Art. no. 780090. DOI: 10.3389/fmedt.2021.780090.
[3] C. Ockenfeld, R. K. Y. Tong, E. A. Susanto, S. -K. Ho and X. -l. Hu, "Fine finger motor skill training with exoskeleton robotic hand in chronic stroke: Stroke rehabilitation," 2013 IEEE 13th International Conference on Rehabilitation Robotics (ICORR), Seattle, WA, USA, 2013, pp. 1-4, DOI: 10.1109/ICORR.2013.6650392.

EXAMINATION OF ELECTROMYOGRAPHIC MUSCLE ACTIVATION DURING FUNCTIONAL ACTIVITIES IN INDIVIDUALS WITH CHRONIC NECK PAIN AND ASYMPTOMATIC INDIVIDUALS

Gizem SOYLU [1], Özlem ÜLGER [1]

[1] Hacettepe University, Faculty of Physical Therapy and Rehabilitation, Ankara, Turkey

Purpose: The primary aim of this study was to investigate muscle activation during different functional activities in individuals with chronic neck pain (CNP) and asymptomatic individuals (AI). The secondary aim of the study was to examine the relationship between muscle activation level and neck pain severity.

Methods: Ten adults with CNP (age=45.9±12.04 years) and 9 with AI (age=37.67±12.96 years) were included in the study. Participants were recruited to perform 3 different functional activity tasks (repetitive reaching task, sustained overhead work, waist to overhead/crown lift). In our study, we evaluated upper and middle trapezius muscle activity of the dominant limb with an objective method (surface electromyography, sEMG) and pain intensity with a subjective method (VAS) during functional activities.

Results: Individuals with CNP showed a significant increase in UT muscle activation during all three tasks. When comparing the groups, a significant (all $p<0.05$) increase in UT activation was observed in individuals with CNP compared to AI during all 3 activities. In addition, the CNP group showed greater activity in the MT muscle compared to the control, but the difference was not significant. EMG amplitude correlated significantly with pain severity ($R^2 = 0.462$).

Conclusions: Our results show that people CNP had significantly increased activation of the UT during functional movements compared to HI. This was significantly associated with their severity of pain. The results of this study highlight the importance of assessing and optimising the neuromuscular activation of these muscles in the rehabilitation of people with chronic neck pain.

Keywords: Surface Electromyography, Neck Pain, Trapezius Muscles, Physiotherapy, Rehabilitation

---

INVESTIGATING RELATIONSHIPS BETWEEN INTEROCEPTION AND PHYSICAL ACTIVITY IN INDIVIDUALS WITH MULTIPLE SCLEROSIS

Firuze AYGUN [1], Ender AYVAT [1]

[1] Hacettepe University, Faculty of Physical Therapy and Rehabilitation, Ankara, Turkey

Purpose: This study was conducted to investigate the relationship between interoception and physical activity in individuals with Multiple Sclerosis (MS).

Methods: The study included 44 participants aged between 20-60 years, with an Expanded Disability Status Scale (EDSS) scores ranging <5.5, who had not experienced a relapse in the last 3 months and had been diagnosed with MS by a neurologist. Comprehensive physical and cognitive assessments were conducted for all participants. Initially, demographic information was collected. Physical activity was assessed self-reported by using the Godin Leisure-Time Exercise Questionnaire and objectively assessed using the Body SenseWear activity monitor over a week period. Perceived fatigue was assessed using the Modified Fatigue Impact Scale and the Fatigue Severity Scale, while measured fatigue was evaluated with the 6-Minute Walk Test. Interoception was measured using the Interoception Sensory Scale.

Results: No statistically significant relationships were found between interoception and both objectively and subjectively measured physical activity ($p>0.005$). Examination of the relationships between interoception and fatigue revealed a statistically significant positive good correlation with the Fatigue Impact Scale ($r=0.679$ and $p<0.005$) and a positive moderate correlation with the Fatigue Severity Scale ($r=0.412$ and $p<0.005$).

Conclusions: The findings of this study demonstrate that interoception influences perceived fatigue. The data suggest that interoception may indirectly affect physical activity, thereby highlighting the importance of considering interoception in both evaluation and treatment within clinical practice.

Keywords: Accelerometer, Interoception, Multiple Sclerosis, Physical Activity

EFFICACY OF USING THE EXOPULSE MOLLII-SUIT IN WOMEN WITH CHRONIC LOW BACK PAIN

Yasemin Özel ASLIYÜCE [1], Sabiha BEZGİN [2], Özlem ÜLGER [1]

[1] Hacettepe University, Faculty of Physical Therapy and Rehabilitation, Ankara, Turkey
[2] Hatay Mustafa Kemal University, Faculty of Health Sciences, Hatay, Turkey

Purpose: The primary aim of this study was to investigate the acute effect of Exopulse Mollii-Suit (EMS) on pain, sleep and function in women with CLBP. The secondary aim was to examine the possible efficacy of this device in the first week and the first month.
Methods: EMS was applied in a single session (1 hour) with a current adjusted according to the current pain intensity. Pain intensity was assessed by Visual Analog Scale (VAS), sleep quality was assessed by Pittsburgh Sleep Quality Index (PSQI) and functional capacity was assessed by repetitive reaching test. The evaluations were repeated before, after, one week and one month after treatment.
Results: A total of 20 women with CLBP were included in the study. There was a significant decrease in low back pain severity before and after treatment (p=0.001), one week (p=0.001) and one month (p=0.002). There was a difference between pre-treatment and first week (p=0.017) and first month (p=0.001) results in PSQI. There was a significant difference in repetitive reaching test(p<0.05).
Conclusions: In our research, a single session of personalized EMS has been shown to reduce pain intensity for up to one week and improve sleep quality for up to one month. The device was also shown to reduce pain in a case of fibromyalgia (2) This and our results support the information that the device promotes inhibitory pain mechanism and parasympathetic activity. There is a need for studies on the effects of the device and the long-term persistence of these effects.
Keywords: Spine, Back Pain, Equipment Design

COMPARING THE ACUTE PHYSICAL AND COGNITIVE EFFECTS OF DIFFERENT EXERCISE TYPES IN PEOPLE WITH MULTIPLE SCLEROSIS: CASE REPORT

Merve Sevik DONDERICI [1], Kurtulus IZZETOGLU [2], Serhat Ilgaz YONER [3], Mehmet Emin AKSOY [3], Muhammed KILINC[4]

[1] Acıbadem Mehmet Ali Aydınlar Unıversıty, Vocational School Of Health Services, Physiotherapy, İstanbul, Türkiye
[2] Drexel Unıversıty, School Of Biomedical Engineering, Science And Health Systems, Philadelphia, ABD
[3] Acıbadem Mehmet Ali Aydınlar Unıversıty, Vocational School, Biomedıcal Equipment Technology, İstanbul, Türkiye
[4] Hacettepe Unıversity, Faculty of Physical Therapy and Rehabılıtatıon, Department of Physiotherapy and Rehabilitation, Ankara, Türkiye

Purpose: The aim of this study is comparing the acute physical and cognitive effects of standard and virtual reality-based exercise training in people with multiple sclerosis (MS).
Methods: A forty-four-years-old female, relapsing-remitting MS patient underwent moderate-intensity aerobic exercise with an arm ergometer and Oculus Quest 2 in two separate days. Before and after the exercises, the individual's body temperature, 2-back and Stroop tests scores were recorded. During the exercises, individual's stress and energy spent level was measured by Shimmer and Sensewear Armband. After the exercises, the physical fatigue was recorded with Modified Borg Scale (MBS), cognitive fatigue was recorded with Visual Analog Scale (VAS) and Symbol Digit Modalities Test (SDMT).
Results: After the aerobic exercises performed with arm ergometer and virtual reality, the individual's body temperature increased by 0.1°C, 0.2°C respectively. During the exercises, amount of energy spent recorded as 648kJ, 362kJ and the skin conductance level increased by 1.897μS and 2.449μS respectively. After the exercises, MBS score was stated as 1 and 3, VAS score was 10 and 7, SDMT score was 46 and 55. While the Stroop test score decreased by 7 points and 2-back test score decreased by 41% after exercise with arm ergometer, Stroop test score increased by 10 points, 2-back test score increased by 23%, after virtual reality-based exercise.
Conclusions: We believe that the physical and cognitive fatigue after moderate-intensity virtual reality-based aerobic exercise training is less than the traditional method and that it helps to increase the patient's cognitive performance in the acute period after exercise.
Keywords: Multiple Sclerosis, Exercise, Fatigue, Virtual Reality, Galvanic Skin Response

INVESTIGATION OF THE RELATIONSHIP BETWEEN CYCLIC MENSTRUAL PAIN INTENSITY AND VISUAL IMAGERY

Özgü İNAL ÖZÜN [1], Merve ÖZTÜRK [2], Esra ÜZELPASACI [3]

[1] Health Sciences University, Faculty of Gülhane Physiotherapy and Rehabilitation, Department of Neurological Physiotherapy and Rehabilitation, Ankara, Turkey
[2] Ankara Etlik City Hospital, Physical Therapy and Rehabilitation Hospital, Ankara, Turkey

[3] Health Sciences University, Faculty of Gülhane Physiotherapy and Rehabilitation, Department of Cardiopulmonary Physiotherapy and Rehabilitation, Ankara, Turkey

Purpose: Motor imagery (MI) contributes to the improvement of motor learning and performance. Regarding MI, both perspectives of movement representations can be taken into account: first-person and third-person (both visual and kinesthetic MI). Research shows that women's motor and visual-spatial skills are modulated by the menstrual cycle. It has also been shown in the literature that chronic pain negatively affects visual imagery skills. However, no study has been found on menstrual pain and visual imagery skills. This study was planned to examine the relationship between cyclical menstrual pain intensity and visual imagery.

Methods: Women with regular menstrual cycles and no known chronic painful disease were included in this study. The socio-demographic information form, Visual Analog Scale (VAS) and Kinesthetic and Visual Imagery Questionnaire were used in the study.

Results: The study was completed with 97 women with a mean age of 25.45 ± 5.09 years. 5.2% of the participants had a high school degree, 91.8% had a bachelor's degree, and 3.1% had a postgraduate degree. A weak negative correlation was determined between menstrual pain intensity and visual imagery skills ($p=.008$ and $r=-.268$).

Conclusions: The study points out that increased pain intensity during the menstrual period negatively affects visual imagery skills. Considering that motor imagery is an important tool used to improve motor performance skills, it is thought to be important to conduct a detailed evaluation of visual imagery skills in women with menstrual pain.

Keywords: Menstrual Pain, Motor Imagery, Visual Ability

EVALUATION OF THE SHORT-TERM EFFECTIVENESS OF TELEREHABILITATION ON PAIN AND FUNCTION IN INDIVIDUALS WITH TOTAL KNEE ARTHROPLASTY: A RANDOMIZED CONTROLLED TRIAL

Sema Nur ASLAN [1,2], Murat DEMİREL [3], Bülent ATİLLA [4,] Gizem İrem KINIKLI [5]

[1] Atilim University, Faculty of Health Sciences, Department of Physiotherapy and Rehabilitation, Ankara, Türkiye
[2] Hacettepe University, Institute of Health Sciences, Department of Orthopedic Physiotherapy and Rehabilitation, Ankara, Türkiye
[3] Medipol University, Faculty of Health Sciences, Department of Occupational Therapy, Ankara, Türkiye
[4] Hacettepe University, Department of Orthopedics and Traumatology, Ankara, Türkiye
[5] Hacettepe University, Faculty of Physiotherapy and Rehabilitation, Department of Musculoskeletal Rehabilitation, Ankara, Türkiye

Purpose: The aim of this study is to evaluate the effectiveness of telerehabilitation compared to a home program in individuals with total knee arthroplasty (TKA).

Methods: A total of 30 participants with TKA were included in the study. The telerehabilitation group (n=15) received exercise instructions digitally, in addition to weekly video calls, voice calls, and messages additional to home program group (n=15) for 8-week. Pain was assessed by using the Visual Analogue Scale during rest, activity, and night-time. Function was evaluated using the Western Ontario Osteoarthritis Outcome Score (WOMAC). Active knee flexion range of motion (ROM) was assessed using a digital goniometer. Assessments were conducted on the day of postoperative discharge, as well as at 4th and 8th weeks after surgery. "p" value less than 0.05 considered to indicate statistical significance.

Results: There was no statistically significance in terms of age and BMI between groups. Reduction in pain while at rest demonstrated a statistically significant difference (p=0.022) in telerehabilitation group. However, there was no significant difference between two groups in pain levels during activity (p=0.056) or at night-time (p=0.357). There was a statistically significant improvement in the active knee flexion ROM of the operated side (p=0.002). The WOMAC pain (p<0.001), stiffness (p=0.001) and function (p<0.001) scores were statistically significant in the telerehabilitation group.

Conclusions: Given that the primary reason for surgery is often pain and functional impairment, our study suggests that telerehabilitation program may enhance the surgical outcome accompanying with functional and pain parameters.

Keywords: Telerehabilitation, Knee, Arthroplasty, Pain

THE CORRELATION BETWEEN DAILY PROSTHESIS USE TIME AND PROSTHESIS EMBODIMENT IN ESTABLISHED USERS OF A LOWER LIMB PROSTHESIS

Senem DEMİRDEL [1], Ertuğrul DEMİRDEL [2], Osman SÖYLER [3]

[1] University of Health Sciences Türkiye, Gülhane Faculty of Physiotherapy and Rehabilitation, Department of Physiotherapy and Rehabilitation, Ankara, Türkiye
[2] Ankara Yildirim Beyazit University. Faculty of Health Sciences, Department of Physiotherapy and Rehabilitation, Ankara, Türkiye
[3] Lokman Hekim University. Health Sciences Institute, Ankara, Türkiye

Purpose: The integration of a prosthesis into the user's body representation, that is, prosthesis embodiment, is important for adoption and acceptance of the prosthesis. The aim of this study was to investigate the correlation between daily prosthesis use time and prosthesis embodiment in established users of a lower limb prosthesis.

Methods: Eighty-one established users of a lower limb prosthesis with an average age of 45.64±14.26 years were included in the study. Daily prosthesis use time was recorded in hours. Prosthesis embodiment was evaluated using Turkish version of Prosthesis Embodiment Scale for Lower Limb Amputees. Spearman rank correlation coefficient (r) was used to determine the correlation between daily prosthesis use time and Prosthesis Embodiment Scale for Lower Limb Amputees total score and subscale scores.

Results: The average daily prosthesis use time was 12.58±3.94 hours. The mean total score of Prosthesis Embodiment Scale for Lower Limb Amputees was 1.45±1.16 point. The subscale scores were 1.88±1.2 for anatomical integrity subscale, 1.09±1.4 point for ownership subcale and 1.72±1.23 point for agency subscale. The statistically significant correlation was found between daily prosthesis use time and total score (r=0.242, p=0.029), anatomical integrity subscale score (r=0.258, p=0.02) and agency subscale score (r=0.228, p=0.041) of Prosthesis Embodiment Scale for Lower Limb Amputees.

Conclusions: Daily prosthesis use time was found to be correlated with prosthesis embodiment in established users of a lower limb prosthesis. Accordingly, by increasing the daily prosthesis use time, prosthesis embodiment may increase, and ensuring high prostheses embodiment may also increase the daily prosthesis use time.

Keywords: Amputation, Proshtheses, Ownership, Embodiment

THE ROLE OF ROBOTIC REHABILITATION IN ENHANCING GAIT PARAMETERS AND FUNCTIONAL INDEPENDENCE IN INDIVIDUALS WITH UNILATERAL CEREBRAL PALSY

Mustafa BURAK [1], Sinem ERTURAN [2], Murat AKINCI [3], Ezgi AYDIN ÖZASLAN [3], Evren YAŞAR [4], Bülent ELBASAN [5]

[1] Fırat University. Faculty Of Health Sciences, Department of Physiotherapy and Rehabilitation, Elazığ, Türkiye
[2] Atatürk University. Faculty of Health Sciences, Department of Physiotherapy and Rehabilitation, Erzurum, Türkiye
[3] Ankara City Hospital, Department of Physical Therapy and Rehabilitation, Ankara, Türkiye
[4] Yozgat Bozok University, Faculty of Health Sciences, Department of Physiotherapy and Rehabilitation, Yozgat, Türkiye
[5] Gazi University. Faculty of Health Sciences, Department of Physiotherapy and Rehabilitation, Ankara, Türkiye

Purpose: The aim of this study is to investigate the effects of robotic rehabilitation, alongside conventional physiotherapy, on gait parameters, functional independence, and quality of life in individuals with uCP.

Methods: Participants with uCP were evaluated before and after treatment by a blinded physiotherapist. Both groups underwent conventional physiotherapy three times a week for six weeks. Additionally, the study group received robotic rehabilitation using the Armeo Spring (Hocoma), with three 30-minute sessions per week for six weeks. Outcome measures included upper extremity joint range of motion evaluated with a universal goniometer, function Quality of Upper Extremity Skills Test (QUEST), quality of life Pediatric Quality of Life Inventory (PedsQL), functional independence Functional Independence Measure for Children (WeeFIM), trunk control Trunk Control Measurement Scale (TCMS), and gait analysis 4D Formetric DIERS.

Results: In the study group, significant post-treatment improvements were seen in shoulder flexion, elbow flexion, forearm supination-pronation, and wrist flexion-extension. Notable improvements were also observed in the QUEST grip section and total score, unlike the control group. WeeFIM self-care subparameters improved significantly post-treatment only in the study group. For PedsQL, a significant improvement was noted solely in the physical health score (parent form) in the study group. TCMS total score significantly improved exclusively in the study group. Gait parameter analysis revealed significant enhancement in the stance and swing phases of the less affected side in the study group (p<0.05).

Conclusions: Upper extremity robotic rehabilitation, shown to positively impact gait parameters and enhance upper extremity skills, is being considered as an adjunct to conventional physiotherapy.

Keywords: Cerebral Palsy, Upper Extremity, Gait, Robot Assisted Therapy

---

EFFECTIVENESS OF PAIN SCIENCE EDUCATION IN PEOPLE WITH SYMPTOMATIC KNEE OSTEOARTHRITIS: A RANDOMIZED CONTROLLED PILOT STUDY

Hilal ATA TAY [1], Gönül ACAR [1], Mert GÜNDOĞDU [2], Murat KAYA [3], Hasan Hilmi MURATLI [2]

[1] Marmara University, Faculty of Health Sciences, Department of Physiotherapy and Rehabilitation, Istanbul, Turkey
[2] Marmara University, School of Medicine, Department of Orthopaedic Surgery and Traumatology, Istanbul, Turkey
[3] Okan University, School of Medicine, Department of Orthopaedic Surgery and Traumatology, Istanbul, Turkey

Purpose: This study aimed to evaluate the effectiveness of pain science education integrated into the rehabilitation program for Turkish individuals with symptomatic knee osteoarthritis (OA) on their pain, functions and quality of life.

Methods: Twenty-four participants with knee OA were randomly assigned to either a pain science education group (n = 12) or a biomedical education group (n = 12). Assessments using the Numerical Rating Scale for pain, Western Ontario and McMaster University Osteoarthritis Index (WOMAC), Tampa Kinesiophobia Scale (TAMPA), International Physical Activity

Questionnaire-Short Form (IPAQ), and Short Form-12 (SF-12) were conducted at baseline, 6 weeks post-treatment, and follow-up.

Results: The pain science education group demonstrated significantly reduced knee pain during activity and rest compared to the biomedical education group. WOMAC scores improved significantly post-treatment and at follow-up in the pain science education group, whereas initial improvements in the biomedical education group were not sustained during follow-up. Both groups showed increased physical activity levels (IPAQ scores). Sleep quality did not significantly change in either group. Kinesiophobia levels decreased and quality of life improved significantly in the pain science education group, while these parameters remained unchanged in the biomedical education group.

Conclusions: Pain science education integrated into the rehabilitation program for knee OA in Turkish individuals led to sustained improvements in pain, functional outcomes, kinesiophobia reduction, and enhanced quality of life compared to biomedical education. These findings underscore the potential benefits of integrating pain science education into clinical practice for managing knee OA and chronic pain.

Keywords: Osteoarthritis, Pain, Education, Biomedical, Knee

COMPARISON OF THE LONG-TERM EFFECTS OF CLINIC-BASED AND TELEREHABILITATION-BASED EXERCISES ON PATIENT EXPERIENCE IN INDIVIDUALS WITH CHRONIC LOW BACK PAIN

Aybüke FANUSCU [1], Özlem ÜLGER [1]

[1] Hacettepe University. Faculty of Physical Therapy and Rehabilitation, Ankara, Türkiye

Purpose: The aim of this study is to compare the effects of clinic-based (CB) and telerehabilitation-based (TR-B) exercise interventions on patient experience at the 6-month follow-up in individuals with chronic low back pain (CLBP).

Methods: The study was conducted between July 2021 and 2022. A total of 23 individuals aged 20-50 years with CLBP were included. Participants were randomly assigned to groups. The TR-B group (n=11) performed progressive motor control exercises via asynchronous video recordings, while the CB group (n=12) performed the exercises in the clinic under a supervision for 8 weeks, three times a week. Patient experience was assessed using the Exercise Adherence Rating Scale (EARS), the Health Care Satisfaction Questionnaire (HCSQ) total score, and the professional relationship sub-parameter.

Results: A total of 23 individuals (15 females, 8 males) participated. The mean age was 37.3 ± 10 years. There were no significant differences between the groups in terms of exercise adherence, satisfaction and professional relationships at post-treatment and 6-month follow-up ($p>0.05$).

Conclusions: Our study demonstrates that both CB and TR-B exercise interventions provide similar patient experiences immediately after treatment and at the 6-month follow-up in CLBP. TR-B interventions support patients' self-management skills and enhance the therapeutic alliance. TR-B exercises have reported higher satisfaction levels compared to paper-based home exercises. In conclusion, the similar outcomes suggest that TR-B interventions offer effective patient experience in both the short and long term for individuals with CLBP. This finding has implications for the provision of more accessible and flexible healthcare services.

Keywords: Spinal Pain, Rehabilitation, Follow-Up Studies, Satisfaction

---

COMPARATIVE EFFECTS OF ACTION OBSERVATION THERAPY AND VIDEO-BASED GAME THERAPIES ON UPPER EXTREMITY FUNCTIONS IN UNILATERAL CEREBRAL PALSY

Sinem ERTURAN [1], Mustafa BURAK [2], Bülent ELBASAN [3]

[1] Atatürk University, Faculty of Health Sciences, Department of Physiotherapy and Rehabilitation, Erzurum, Türkiye
[2] Fırat University. Faculty of Health Sciences, Department of Physiotherapy and Rehabilitation, Elazığ, Türkiye
[3] Gazi University. Faculty of Health Sciences, Department of Physiotherapy and Rehabilitation, Ankara, Türkiye

Purpose: This study aims to examine the effects of Action Observation Therapy (AOT) and Video-Based Game Therapies (VBG) applications on upper extremity functions in children with unilateral cerebral palsy (UCP).

Methods: The study included 45 children aged 5–15 with UCP, randomly assigned to AOT, VBG, and Control (CNT) groups. All received conventional physiotherapy twice weekly for 45 minutes over 3 weeks. The AOT group also had daily 30-minute telerehabilitation sessions five days a week, while the VBG group participated in XBOX sessions for the same duration. To evaluate upper extremity capacity, we employed the Quality of Upper Extremity Skills Test (QUEST), JAMAR Hand Dynamometer for gross grip strength, Pinchmeter for fine grip strength, Trunk Control Measurement Scale for trunk control, and Pediatric Quality of Life Inventory (PedsQL) for quality of life assessment. Treatment satisfaction for both families and children was measured using the Visual Analog Scale (VAS). Post-treatment differences were statistically analyzed using One Way ANOVA and Kruskal-Wallis tests, with significance set at $p < 0.017$.

Results: The study revealed significant benefits for the AOT and VBG groups in gross, fine, and lateral grip strength on the affected side. AOT specifically improved tripod grip strength on both affected and unaffected sides. The VBG group demonstrated superior trunk control. Additionally, both AOT and VBG groups achieved higher total QUEST and PedsQL scores compared to the control group. Family and child satisfaction scores were higher in AOT and VBG groups compared to CNT group (p<0.017).

Conclusions: Adding VBG and AOT to conventional physiotherapy shows promise in improving upper extremity functions for children with UCP, addressing their specific rehabilitation needs effectively.

Keywords: Cerebral Palsy, Action Observation Treatment, Virtual Reality, Upper Extremity

---

INVESTIGATION OF THE EFFECTS OF ROBOT-ASSISTED TREATMENT ON UPPER LIMB MOTOR PERFORMANCE, SPASTICITY, DAILY LIVING ACTIVITY AND QUALITY OF LIFE IN STROKE PATIENTS

İzel DEMİRHAN [1], Ender AYVAT [2], Fatma AYVAT [2], Özge ONURSAL KILINÇ [2], Sibel AKSU YILDIRIM [2], Muhammed KILINÇ [2]

[1] University of Health Sciences, Faculty of Health Sciences, Physiotherapy and Rehabilitation, Istanbul, Turkey

[2] Hacettepe University, Faculty of Physiotherapy and Rehabilitation, Department of Neurological Physiotherapy and Rehabilitation, Ankara, Turkey

Abstract: Upper limb (UE) disorders are present in ~85% of stroke patients. Robotic rehabilitation is treatment option that encourages active participation, offers intensive treatment and supports motor learning.

Purpose: The aim of the study was to investigate the effect of robot-assisted treatment (RAT) protocol on UE motor disorders, spasticity, activities of daily living (ADL) and quality of life (QoL) in stroke patients.

Methods: The study included 17 stroke patients (5K/12E). Patients received 60 minutes of treatment 3 days a week for 8 weeks. 30 minutes of treatment with robotic device and 30 minutes of neurological rehabilitation protocol were applied. All evaluations were performed before and after treatment. Muscle spasticity was evaluated with the Modified Ashworh Scale (MAS) and UE motor performance was evaluated with the Fugl Meyer Assessment (FMA-UE), Action Research Arm Test (ARAT) and Box and Block Test (BBT). ACTIVLIM and ABILHAND scales were used for ADL assessment, and the Stroke Impact Scale (SIS) was used for QoL assessment. Data were analysed by Wilcoxon test. Statistical significance was accepted as p<0.05 for all analyses.

Results: The mean age of patients was 61.94±2.82 years. Result of study, statistically significant difference was found in the muscle spasticity values of the patients compared to MAS in all muscles (p<0.05). However, there was statistically significant improvement in FMA-UE, ARAT, BBT, ACTIVLIM, ABILHAND and SIS results (p<0.05).

Conclusions: Our study showed that neurological rehabilitation applied with RAT in stroke patients may be effective in reducing spasticity and improving UE motor performance. RAT may improve the QoL by increasing the person's participation.

Keywords: Stroke, Robotics, Motor Performance, Muscle Spasticity, Activities of Daily Living

---

ASSISTIVE TECHNOLOGIES IN HIGHER EDUCATION FOR SPECIAL EDUCATION: FIELD RESEARCH BY DIVERSASIA PROJECT

Ecem YILDIZ ÇANGUR [1], Adem TEKEREK [2], Seyhan FIRAT [3], Aslihan Selcen BINGÖL [4], Bülent ELBASAN [5]

[1] Gazi University. Faculty of Health Sciences, Department of Physiotherapy and Rehabilitation , Ankara, Türkiye

[2] Gazi University. Faculty of Technology, Department of Computer Engineering, Ankara, Türkiye

[3] Gazi University. Faculty of Technology, Department of Civil Engineering, Ankara, Türkiye

[4] Gazi University. Faculty of Education, Department of Educational Sciences, Ankara, Türkiye

[5] Gazi University. Faculty of Health Sciences, Department of Physiotherapy And Rehabilitation, Ankara, Türkiye

Purpose: The aim of this study is to conduct detailed research on assistive technologies used in higher education to provide special education and support the students with disabilities.

Methods: In this study, assistive technological devices categorized in various fields such as Text-to-Speech and Speech-to-Text Technologies, Screen Readers, Alternative İnput Devices, Electronic Braille Display, Cognitive Support Software, Captioning and Transcription Tools and Virtual Reality and Simulation Software, their usage areas and the benefits they provide the students were reviewed.

Results: Text-to-speech and speech-to-text technologies help students with reading and writing diffculties by converting text into speech and vice versa.Screen readers: Screen reading software aids visually impaired students by audibly conveying on-screen content. Alternative input devices, such as eye-tracking systems and adaptive keyboards, enable students with motor impairments to interact with computers. Electronic Braille display devices convert digital text into Braille, facilitating learning for visually impaired students. Cognitive support software is assistive technologies with features like mind mapping and organizational tools help students with cognitive impairments manage their tasks and information more effectively. Captioning

and transcription tools provide real-time captioning and transcription, benefting deaf or hard-of-hearing students. Virtual reality and simulation software offers experiential learning opportunities for students with various disabilities.

Conclusions: To increase the success of individuals with special needs in educational settings where they attend with their peers, to minimize the diffculties they experience some arrangements/designs are needed in the education process. In this context, considering individual differences and needs, rich learning environments can be created for learners with universal design and assistive technologies.

Keywords: Assistive Technologies, Higher Education, Special Education

---

INVESTIGATION OF THE EFFECTS OF FUNCTIONAL TARGET PRESENCE ON MUSCLE ACTIVATION AND CONTRACTION TIMING IN INDIVIDUALS WITH STROKE

Özlem NAVRUZ [1], Gülcan HARPUT [2], Muhammed KILINÇ [1]

[1] Hacettepe University, Faculty of Physical Therapy and Rehabilitation, Department of Neurological Rehabilitation, Ankara, Turkey
[2] PTrust Academy, Ankara, Turkey

Purpose: The effect of function-oriented approaches used in rehabilitation on muscle performance is not clearly known. The aim of this study to examine the effects of functional target presence on muscle activation in individuals with stroke.

Methods: 18 individuals with stroke (55.22 ± 6.47) and 14 healthy individuals (50.92 ± 11.00) were included. Modified Ashwort Scale and Standardized Mini Mental Test were used as evaluation scales. After these scales, EMG measurements were taken while the subjects were performing 60° and 90° shoulder elevation. Measurements were performed in both non-functional and functional conditions.

Results: It was found that the activation onset times of the UT, AD ve BB muscles of stroke patients were shifted earlier, especially in the 90° shoulder elevation condition when the function was loaded, compared to the non-function condition ($p<0,05$). Compared to healthy individuals, it was found that the muscle activation levels of UT, AD and BB muscles were higher in 60° and 90° shoulder elevations, the contraction times of TB, UT and BB elevation were later ($p<0.05$).

Conclusions: The results of our study showed that the muscles in stroke patients started to contract earlier to approach normal under the condition of function loading and completed the activity with less effort in some muscles for the same activity. Functional loading of the movement has shown that the muscles participate in the movement with more normal timing and activation patterns, thus supporting that the preference of function-based exercise approaches will provide more patient gains.

Keywords: Function, Reaching, Electromyography, Stroke, Upper Extremity

---

EFFECTIVENESS OF IMMERSIVE VIRTUAL REALITY SUPPORTED UPPER EXTREMITY REHABILITATION IN PATIENTS WITH PARKINSON'S DISEASE

Enes Tayyip BENLİ [1], Ramazan KURUL [1], Tuba KAYA BENLİ [1], Şule AYDIN TÜRKOĞLU [2]

[1] Bolu Abant Izzet Baysal University, Faculty of Health Sciences, Department of Physical Therapy and Rehabilitation, Bolu, Turkey
[2] Bolu Abant Izzet Baysal University, Faculty of Medicine, Department of Neurology, Bolu, Turkey

Purpose: This study was designed to examine the effect of virtual reality- supported upper extremity position matching exercises on disease severity, upper extremity function and quality of life in individuals with Parkinson's disease.

Methods: Individuals were divided into two groups as control and VR group. The control group received standard physical therapy methods twice a week for 8 weeks, while the VR group received immersive virtual reality supported position matching exercises in addition to these standard physical therapy methods. Angle Repetition Test, Box and Block Test (BBT), Unified Parkinson's Disease Rating Scale (UPDRS), Disabilities of the Arm, Shoulder and Hand Questionnaire (DASH) and Activlim Scale and Parkinson's Disease Questionnaire (PDQ-8) were used in the evaluations.. Individuals' satisfaction levels with the treatment after the program were evaluated with the Intrinsic Motivation Inventory.

Results: Analyses were performed on 34 subjects who participated in the final evaluations. The groups were similar in terms of age, gender and disease severity at baseline ($p>0.05$). In the control group, statistically significant improvements were found in BBT ($p:0.028$) and UPDRS ($p:0.013$), while in the VR group, in addition to BBT ($p<0.001$) and UPDRS ($p<0.001$), significant differences were found in Activlim scores ($p:0.012$) and proprioception assessments at different angles (at 40º: $p:0.007$ / at 100º: $p:0.037$). Although there were improvements in the scores in both groups, there was no significant change in DASH and PHA-8 ($p>0.05$). There was also a significant difference in the motivation levels of the individuals after treatment in favor of the VR group ($p:0,025$).

Conclusions: This study has shown that upper extremity rehabilitation with immersive virtual reality is a suitable alternative to standard treatment methods and has some advantages in various aspects. Increases in proprioception and activities of daily living and the motivation levels of individuals for treatment emphasize the advantages of virtual reality methods in upper extremity rehabilitation.

Keywords: Parkinson's disease, Proprioception, Rehabilitation, Virtual reality

THE EFFECT OF TELEREHABILITATION-BASED SPINAL STABILIZATION EXERCISES ON FATIGUE IN STROKE PATIENTS

Ali Naim CEREN[1], Ayla FİL BALKAN[1], Mehmet Akif TOPÇUOĞLU[2]

[1]Hacettepe University, Faculty of Physical Therapy and Rehabilitation, Department of Physiotherapy and Rehabilitation, Ankara, Turkey
[2]Hacettepe University, Faculty of Medicine, Department of Neurology, Ankara, Turkey

Purpose: The aim of the study was to investigate the effect of telerehabilitation-based spinal stabilization exercises on fatigue in chronic stroke patients.
Methods: Thirteen chronic stroke patients (6 females,7 males), aged between 50 and 75, were included in the study. Fatigue of the patients was assessed with the Fatigue Severity Scale (FSS) and the Fatigue Impact Scale (FIS). After the initial evaluation and before telerehabilitation, patients were explained how to contract their core muscles for 3 days, every other day for a week. The patients who were able to perform the exercises correctly were then given online exercises in 1-hour sessions a day, 3 days a week for 6 weeks.
Results: The mean of the ages of the patients was 60,92±6,83 and the mean of body mass index was 26,89±3,22. Statistically significant improvement was seen in the fatigue of the patients according to the FSS and the FIS score (respectively, p=0,001 and p=0,002). Moreover, there were no negative situations during online exercises.
Conclusions: Telerehabilitation-based spinal stabilization exercises can be safely applied to chronic stroke patients and a decrease in fatigue levels of the patients can be achieved.
Keywords: Stroke, Exercise, Fatigue

EFFECTS OF SCAPULAR TRAINING ON SCAPULAR KINEMATICS, PERISCAPULAR MUSCLE THICKNESS, SHOULDER SUBLUXATION AND UPPER EXTREMITY FUNCTIONALITY IN INDIVIDUALS WITH STROKE

Özge ONURSAL KILINÇ [1], Muhammed KILINÇ [1], Ender AYVAT [1], İrem DÜZGÜN [1], and Levent ÖZÇAKAR [2]

[1] Hacettepe University, Faculty of Physical Therapy and Rehabilitation, Ankara, Turkey;
[2] Hacettepe University, Faculty of Medicine, Department of Physical and Rehabilitation Medicine, Ankara, Turkey

Purpose: This randomized controlled study was planned to examine the effects of additional scapulo-humeral training to the Neurodevelopmental Treatment Approach (NDT) on scapular kinematics, periscapular muscle thickness, subluxation and upper extremity functionality in stroke individuals.
Methods: 30 individuals were randomized into the scapulo-humeral training and the control group, and included in the treatment for 8 weeks/3 sessions/60 minutes. Conventional rehabilitation program was applied to both groups, and a scapulo-humeral training exercise protocol was added for the scapulo-humeral group. Clinical evaluations were made using the Fugl Meyer Assessment-Upper Extremity(FMA-UE), Action Research Arm Test(ARAT), Visual Analog Scale, and Trunk Impairment Scale 2.0(TIS). Ultrasonographic evaluations and an electromagnetic system were used for periscapular muscle thickness (Serratus Anterior-SA/Lower Trapezius-LT) and shoulder subluxation (Acromion-Greater Tubercule-AGT/Acromiohumeral Distance-AH), 3-dimensional scapular kinematics, respectively.
Results: The mean ages of individuals in the scapulo-humeral training and control groups were 52.87±10.17 and 53.06±12.09 years. After the treatment, there was a difference between the groups in FMA-UE, ARAT, VAS and TIS scores. While SA thickness on the paretic side increased in both groups; AGT and AH distances and LT muscle thickness on the paretic side improved only in the scapulo-humeral training group. The improvement on the scapular upward rotation in resting position was seen in the scapulo-humeral training group (all p<0.05).
Conclusions: Additional scapulo-humeral training is superior to NDT in improving subluxation, periscapular muscle thickness, upper extremity functionality, shoulder pain, trunk performance, and some scapular kinematics. These results suggest that adding this training to the treatment will increase treatment success in individuals with upper extremity impairments.
Keywords: Stroke, Upper Extremity, Shoulder, Ultrasound, Kinematics

THE RELATIONSHIP BETWEEN FRAILTY, PHYSICAL PERFORMANCE, AND BALANCE IN GERIATRICS

Onur AYDOĞDU [1], Canan GÜNAY YAZICI [1], Yasemin ELÇİÇEK [1], Özkan ANIL [1], Zübeyir SARI [1]

[1] Marmara University, Faculty of Health Sciences, Dept. Physiotherapy and Rehabilitation, Istanbul, Türkiye

Purpose: The aim of this study was to investigate the relationships between frailty, physical performance, and balance in geriatrics. In addition, the frailty, physical performance and balance levels of older people living in residential care homes were compared with those of older people living with their families at their homes.

Methods: A total of 64 geriatric individuals were included in the study, comprising 44 females (68.8%) and 20 males (31.3%). Half of the geriatric individuals were living in a residential care home, while the other half were living at home with their families. The frailty, physical performance, and balance levels of the geriatric individuals were evaluated using the Edmonton Frailty Scale, the Short Physical Performance Test, and the Berg Balance Scale, respectively.

Results: The mean age of 64 geriatric individuals who participated in the study was 78.12±9.24 years. The mean body mass index was 25.90±3.92 kg/m², and the mean mini mental test level was 26.04±2.54 points.

Although no significant correlation was observed between the levels of frailty, balance, and physical performance (p>0.05), a statistically positive correlation was found between physical performance and balance levels (p=0.001).

No statistically significant difference was observed between the geriatric individuals living at home with their families and those living in residential care homes in terms of frailty (p=0.459), physical performance (p=0.471), and balance (p=0.514) levels.

Conclusions: The findings of our study indicate that there is no significant difference in frailty, physical performance, or balance between geriatric individuals living at home with their families or in residential care homes. Furthermore, it was concluded that an approach that could lead to an increase in physical performance in geriatrics could also improve their balance.

Keywords: Geriatrics, Frailty, Physical Performance, Balance

A NEW PERSPECTIVE ON MIRROR THERAPY: THE EFFECT OF LEAP MOTION-BASED MULTI-AXIS IMMERSIVE VIRTUAL REALITY MIRROR THERAPY

Ramazan KURUL [1], Enes Tayyip BENLİ [1], Muhammed Nur ÖĞÜN [2], Mustafa Fatih YAŞAR [3], Gülizar ÇİT [4], Kayhan AYAR [4]

[1] Bolu Abant Izzet Baysal University. Faculty of Health Sciences, Department of Physiotherapy and Rehabilitation, Bolu, Türkiye

[2] Bolu Abant Izzet Baysal University. Faculty of Medicine, Department of Neurology, Bolu, Türkiye

[3] Bolu Abant Izzet Baysal University. Faculty of Medicine, Department of Physical Medicine, Bolu, Türkiye

[4] Sakarya University. Faculty of Sample, Department of Sample, Sakarya, Türkiye

Purpose: This study aims to develop a system that enables daily bilateral activities in virtual reality mirror therapy and investigates the effectiveness of these applications in patients with stroke

Methods: A total of 24 stroke patients were divided into two groups: virtual reality (n=12) and conventional mirror therapy (n=12). Both groups received their allocated therapies for 30 minutes, three times a week, over 8 weeks. Outcome assessments were performed using the Fugl-Meyer Upper Extremity Rating Scale (FMAE), EEG measurements, Motor Activity Log-28 (MAL-28), Simulator Sickness Questionnaire (SSQ), System Usability Scale (SUS), Stroke-Specific Quality of Life Scale (SS-QOL), and Barthel Index. Assessment performed at baseline and after last treatment session.

Results: Patients in the virtual reality group showed significantly greater improvement compared to the conventional group in FMAE and SS-QOL scores (p<0.05). However, there were no significant differences between the groups for MAL-28 and Barthel Index scores (p>0.05). Mu rhythm activities were found to be significantly lower in the virtual reality group while imagining upper extremity activities (p<0.05). Additionally, the new mirror therapy was found to be usable and did not induce motion sickness according to the SSQ and SUS scores.

Conclusions: Multi-axis mirror therapy is effective in rehabilitation and can be safely used with stroke patients without inducing motion sickness. Patients using the virtual reality mirror therapy program showed better motor imaging after 8 weeks compared to those using standard mirror therapy.

Keywords: Leap Motion, Stroke, Virtual Reality

IMPACT OF A STUDENT-CENTRED DIGITAL APPROACH ON THE LEVEL OF CONTENTMENT OF STUDENTS IN THE FACULTY OF HEALTH SCIENCES

Kadir ÖZKAN [1], Mehmet ÖZKESKİN [1]

[1] Ege Unıversıty, Faculty of Health Scıences, Department Of Physıotherapy And Rehabılıtatıon, İzmir, Türkiye

Purpose: The current student-centered model of education is limited in scope, focusing only on the student as a participant in the educational process. However, there is a lack of evidence regarding students being involved in managing faculties or departments. Furthermore, it's unknown the feasibility of incorporating students into management roles in a digital way. Our study aims to determine whether students can be involved in faculty management in a digital context and whether this affects their contentment and involvement with the faculty.

Methods: This cross-sectional study was conducted with 135 Ege University Faculty of Health Sciences students. All volunteers were asked to answer the Demographic Form and the Questionnaire on Contentment with the Student-Centred Digital Approach.

Results: The mean age of the 136 volunteers (36 men, 100 women) who participated in our study was 20.81±3.63 years. 71.1% of the volunteers are physiotherapy students. 61.5% of the students preferred their faculties in the first five lists of the university examination (YKS). 95.6% of the participants have access to the faculty's website and 86.7% follow the faculty's social media accounts. 78.5% of exhibitors say they prefer to communicate digitally. 72.6% of volunteers say that the approach improves their career development. 55.6% of students say they are satisfied with the student-centered digital approach.

Conclusions: The results demonstrate that the student-centered digital approach has a positive impact on students, including their contentment level, career support, involvement, and motivation toward their profession. Thus, this approach can be used to improve health sciences departments.

Keywords: Student-Centred Approach, Digitalisation, Health Sciences, Physiotherapy

---

THE COMPARISON OF VIDEO-CONFERENCE AND HOME-BASED EXERCISE PROGRAM IN PATIENTS WITH TEMPOROMANDIBULAR JOINT DYSFUNCTION

Naile FAZLIOGLU [1], **Nukhet Kutuk** [2], **Beliz SERDAROGLU** [3], **Buket AKINCI** [4]

[1] Biruni University Undergraduate Institue, Physiotherapy and Rehabilitation Program, İstanbul, Turkey

[2] Bezmi Alem Vakıf University, Faculty of Denstistry, Department of Oral and Maxillofacial Surgery, İstanbul, Turkey

[3] Bezmi Alem Vakıf University, Faculty of Dentistry, Department of Oral and Maxillofacial Surgery, İstanbul, Turkey

[4] Biruni University, Faculty of Health Sciences, Department of Physiotherapy and Rehabilitation (English), İstanbul, Turkey

Purpose: This study aims to evaluate the effectiveness of telerehabilitation in patients with temporomandibular joint (TMJ) dysfunction.

Methods: Fifteen subjects were included and randomized into Group A (n=7, mean age:26.29±5.96/years) or Group B (n=8, mean age:32.75±13.52/years). Maximum Painless Mouth Opening (MPMO), Mouth Opening With Maximum Passive Assistance (MOMPA), and Mandibula Lateral Shift (MLS) were measured. Temporomandibular dysfunction was assessed using the Fonseca Anamnestic Index (FAI) and quality-of-life with the Oral Health Impact Profile-14 (OHIP-14). Both groups followed the same exercise program, including relaxation, neck exercises, soft tissue friction massage, mandibular mobility exercises, and stretching exercises, twice a week for six weeks. Group A followed the program under the supervision of a physiotherapist via video-conference, while Group B had one educational session via video-conference and received a brochure explaining the program.

Results: After treatment, Group A showed significant improvements in FAI (p=0.018), OHIP-14 (p=0.018), MPMO (p=0.018), MOMPA (p=0.043), and MLS left (p=0.024). Group B also showed significant improvements in FAI (p=0.018), OHIP-14 (p=0.028), MPMO (p=0.039), and MLS left (p=0.041), though not in MOMPA (p=0.180). There were no significant differences between the groups for any parameter in terms of observed changes.

Conclusions: Our pilot results showed that a structured exercise program delivered via video-conference or performed at home may lead to similar benefits in terms of temporomandibular dysfunction severity, oral movements, and QoL in patients with TMJ dysfunction. Both exercise delivery methods, led by a physiotherapist, seem effective in clinical practice and can be chosen based on patient preferences.

Keywords: Temporomandibular Joint Disorders, Telerehabilitation, Exercise

---

EFFECTS OF MOLLII SUIT IN CHILDREN WITH CEREBRAL PALSY WITH DIFFERENT AMBULATION LEVELS: A PRELIMINARY STUDY

Kübra Uğurlu [1], Hidayet Çuha [2], Merve Öztürk [3], Pelin Atalan Efkere [4], Bülent Elbasan [5]

[1] Kirikkale University. Faculty of Health Science, Department of Physiotherapy, Kirikkale, Türkiye

[2] Kastamonu University. Çatalzeytin Vocational School , Department of Physiotherapy, Kastamonu, Türkiye

[3] Gazi University. Faculty of Health Sciences, Department of Physiotherapy And Rehabilitation, Ankara, Türkiye

Purpose: The EXOPULSE Mollii Suit method, is a wearable, non-invasive neuromodulation approach that features a full-body garment and electrodes placed within it. The aim of this study is to examine the effect of Mollii Suit application on functional patameters in children with cerebral palsy (CP) with different ambulation levels.

Methods: Children with spastic cerebral palsy between the ages of 4 and 12 were included in the study. The study consisted of 2 groups: Ambulatory group (Gross Motor Function Classification Level (GMFCS): 1-2-3, n=5) and non-ambulatory group (GMFC: 4-5, n=5) Children who received Botulinum Toxin A injection in the last 3 months and surgical intervention in the last 6 months were excluded from the study. The Mollii Suit method was applied to all children for 60 minutes, 2-3 times a week for 6-8 weeks. Children were evaluated before and after the applications. Trunk control was evaluated with Trunk Impairment Scale (TIS), lower extremity selective motor control with Selective Control Assessment of the Lower Extremity

(SCALE) and gross motor function with Gross Motor Function Measure (GMFM). SPSS 24.0 was used for statistical analysis. Wilcoxon Signed Rank test and Mann-Whitney U test were used to determine the differences before and after application. The significance level was $p<0.05$.

Results: Before and after the treatment, the TIS and GMFM scores of ambulatory children were better ($p<0.05$). While there was no statistically difference in the scores of the non-ambulatory group after treatment ($p>0.05$), the TIS and SCALE scores of the ambulatory group were better ($p<0.05$). No significant difference was found when comparing the difference values of the groups before and after treatment ($p>0.05$).

Conclusions: It was concluded that Mollii Suit could lead to functional improvements, especially in children with ambulatory CP. There is a need to continue the study with larger samples.

Keywords: Cerebral Palsy, Rehabilitation Technology, Gross Motor Function, Selective Motor Control, Postural Control

---

POSTURE AND BALANCE IN YOUNG ADULTS: AN EVALUATION WEARING GLASSES

Dilan YÜCEDAĞ [1], Berkant Anıl ÖZÇELİK [1], Hatice ÇETİN [1]

[1] Hacettepe Unıversıty, Faculty of Physıcal Therapy and Rehabılıtatıon, Ankara, Türkiye

Purpose: To examine how wearing glasses influences posture and balance in healthy young adults.

Methods: The study included 12 individuals who have been wearing glasses for at least 3 years and 12 individuals who do not wear glasses. Posture was evaluated by measuring the forward head posture angles and using the New York Posture Rating. Balance outcomes were obtained using Freemed®. Static balance was measured by recording the sway velocity while standing on monopodial with eyes closed. Dynamic balance was assessed by recording mediolateral loading and initial contact times during walking.

Results: The forward head posture angles of individuals who wear glasses were within normal values compared to those who do not wear glasses. Additionally, the New York Posture Rating results were similar. According to the balance results, individuals who wear glasses had higher sway velocities on the right foot with eyes closed, longer mediolateral loading times on the right foot, and shorter right/left initial contact times.

Conclusions: Individuals who wear glasses may have developed habitual head and neck positions to accommodate their eyewear, potentially leading to a normalized forward head posture. This adjustment aims to optimize vision clarity, influencing posture maintenance. However, glasses can alter visual and depth perceptions critical for balance. These changes could result in longer mediolateral loading times and shorter initial contact times as the body adjusts. Users may compensate with adapted posture and balance strategies, possibly resulting in increased sway velocities when eyes are closed. Further research is necessary to investigate these mechanisms and implications.

Keywords: Glasses, Posture, Balance, Forward head posture, Young Adult

---

THE EFFECT OF MENSTRUAL PAIN ON THE NON-DOMINANT UPPER EXTREMITY REACTION TIME

Büşra MEHDER AKBAŞ [1,] ,Samet KIRAYKIR [1], Merve COĞ [1], Hasan Hüseyin BATMAN [1], Muhammed Şeref YILDIRIM [1], Sinem SALAR [2], Hilal KEKLİCEK [1]

[1] Trakya University, Faculty of Health Sciences, Department of Physiotherapy and Rehabilitation, Edirne, Türkiye
[2] Trakya University, Faculty of Health Sciences, Department of Ergotherapy, Edirne, Türkiye

Purpose: Menstrual pain (MP) is an important symptom that affects women's daily activities. The effect of MP on physical functions has been frequently studied, but the effect of MP on upper extremity reaction time is unknown. Although the non-dominant extremity generally plays as a supportive role, it can assume a dominant role in many bimanual activities. For these reasons, the aim of our study was to investigate the effect of MP on the reaction time of the non-dominant upper extremity.

Methods: Thirty four participants aged between 18-23 were included. Groups were with menstrual pain (n=17) group (MPG) and the control group (n=17) with no pain (CG). The participants were evaluated at the first day of menstruation. Finding different colors mode was used to assess the non-dominant upper extremity reaction time performance by using The Light Trainer®.The number of correct movements and the total number of movements of the participants in one minute were recorded.

Results: The demographic characteristics of the groups were similar ($p>0.05$). It was found that the number of correct movements ($p<0.024$) and the total number of movements ($p<0.027$) of the CG were higher than the MPG.

Conclusions: Painful menstruation negatively affects the reaction time and rapid response time of the non-dominant extremity. It is thought that strategies that enhance the reaction time should be included in rehabilitation practices of MP.

Keywords: Dysmenorrhea, Upper Extremity, Reaction Time

INVESTIGATION OF JOINT RANGE OF MOTION CHANGE IN STROKE PATIENTS AFTER ROBOT-ASSISTED TREATMENT

İzel DEMİRHAN [1], Ender AYVAT [2], Fatma AYVAT [2], Özge ONURSAL KILINÇ [2], Sibel AKSU YILDIRIM [2], Muhammed KILINÇ [2]

[1] University Of Health Sciences, Faculty of Health Sciences, Physiotherapy and Rehabilitation, Istanbul, Turkey

[2] Hacettepe University, Faculty of Physiotherapy and Rehabilitation, Department of Neurological Physiotherapy and Rehabilitation, Ankara, Turkey

Abstract: Most of patients after stroke have problems such as weak muscle strength, decrease in normal joint range and motor performance, contracture and pain. Rehabilitation robots, on the other hand, encourage participation and provide intensive treatment to restore functionality to patients.

Purpose: The aim of this study was to investigate the change of robot-assisted treatment protocol on ROM in stroke patients.

Methods: The study included 9 stroke patients (4K/5E). Patients received 60 minutes of treatment 3 days a week for 8 weeks. In the treatment, 30 minutes of treatment with Assist-on Arm Exeskeleton Robotic device and 30 minutes of neurological rehabilitation protocol were applied. Active range of motion (ROM) of all patients before and after treatment was measured by the robotic device. After the treatment, mean ROM of shoulder abduction-adduction, shoulder flexion-extension, elbow internal-external rotation, elbow flexion-extension were analysed with percentage data.

Results: The mean age of the patients was 61.11 ± 3.90 years. Result of the study, it was determined that there was an increase of 59% in shoulder abduction-adduction angle, 85% in shoulder flexion-extension angle, 37% in elbow internal-external rotation angle, and 64% in elbow flexion-extension angle before and after treatment.

Conclusions: The results of our study showed that neurological rehabilitation protocol applied together with robotic therapy may be effective in increasing ROM range in stroke patients. Personalised robot-assisted therapy may increase movement capacity for stroke patients. Assist-On Arm robotic device designed to target the shoulder, elbow and wrist may improve the ROM of patients by encouraging active movements.

Keywords: Stroke, Robotics, Upper Extremity, Range Of Motion

INVESTIGATION OF THE EFFECTS OF EXOPULSE MOLLII SYSTEM ON SPASTICITY AND FUNCTIONALITY IN PATIENTS WITH MULTIPLE SCLEROSIS

Fatma AYVAT[1], Sabiha BEZGİN[2], Ender AYVAT[1], Özge ONURSAL KILINÇ[1], Oğuzhan KURŞUN[3], Özlem ÜLGER[1], Muhammed KILINÇ[1]

[1] Hacettepe University. Faculty of Physical Therapy and Rehabilitation, Department of Physiotherapy and Rehabilitation, Ankara, Türkiye

[2] Hatay Mustafa Kemal University. Faculty of Health Sciences, Department of Physiotherapy and Rehabilitation, Hatay, Türkiye

[3] Ankara Bilkent City Hospital, Department of Neurology, Ankara, Türkiye

Purpose: The aim of the study was to investigate the effect of the EXOPULSE Mollii Suit system on spasticity, balance and gait in patients with Multiple Sclerosis (PwMS).

Methods: Fourteen patients (7 Mollii Suit/7 Mollii Suit+Exercise) were included in the study. All patients were treated one hour a day, one day apart, for a total of 4 weeks. The severity of spasticity was evaluated with the Modified Ashworth Scale (MAS), balance was evaluated with the Timed Up and Go Test (TUG) and Berg Balance Scale (BBS), gait was evaluated with the 10 Metre Walk Test (10MWT), and lower extremity functional strength was evaluated with the 5 Times Sit to Stand Test (5XSST).

Results: The mean age of the patients in the Mollii Suit group was 40.00 ± 9.27 years and in the Mollii Suit+Exercise group was 42.71 ± 2.92 years. The decrease in the severity of spasticity in both groups was found to be statistically significant ($p<0.05$). The decrease in the duration of the TUG and 5XSST was found to be significant in the Mollii Suit+Exercise group ($p<0.05$). When the difference between the groups was analysed, the decrease in the duration of the 5XSST was statistically more significant in the Mollii Suit+exercise group ($p<0.05$).

Conclusions: The early results showed that Mollii Suit alone and in combination with exercise decreased spasticity in PwMS. When exercise was applied during Mollii Suit, it was found that there was a change in functional parameters such as balance and lower extremity functional strength. We think that exercise during Mollii Suit application may be more effective on functionality.

Keywords: Wearable Technology, Multiple Sclerosis, Spasticity, Balance, Gait

THE IMMEDIATE EFFECTS OF ECCENTRIC AND PERTURBATIVE LOADING DURING WALKING ON HEMODYNAMIC RESPONSES IN YOUNG SEDENTARY INDIVIDUALS

Büşra MEHDER AKBAŞ [1], Hasan Hüseyin BATMAN [1], Rümeysa ESER [1], Buse Sıla PULLU [1], Melek ÇİFTCİ [1], Muhammed Şeref YILDIRIM [1], Sinem SALAR [2], Hilal KEKLİCEK [1]

[1] Trakya University, Faculty Of Health Sciences, Department Of Physiotherapy And Rehabilitation, Edirne, Türkiye
[2] Trakya University, Faculty Of Health Sciences, Department Of Ergotherapy, Edirne, Türkiye

Purpose: Walking is known as a safe form of loading for the body and is often recommended to individuals. Determining the clinical effects of walking in different conditions is important in terms of using walking as a rehabilitation strategy. The hemodynamic responses (HR) to functional eccentric loading (EL) while walking were previously investigated, but the effect of perturbative loading (PL) still remains unclear. Comparing the immediately effects of eccentric and perturbative loading during walking on HR in young sedentary individuals were the aims of the study.

Methods: Twenty-four sedentary young adults aged between 18-30 were randomized to the EL and to the PL groups. The loading pace was determined as the participants' daily self-selected gait speed. Each loading session included a 5-minute warm-up and a 20-minute training session on a motorized treadmill (ReaxRun, Reaxing, Milano, Italy). Systolic and diastolic blood pressure and oxygen saturation were measured three times; initially (1st), immediately after the loading session completed (2nd), and at 5-minute after the session was completed (3rd).

Results: There were similarities in the O2 saturation and systolic pressure values between the groups at the 1st, 2nd, and 3rd assessments (p>0.05). Also, diastolic blood pressure values at the initial evaluation were similar (p>0.05). Diastolic blood pressure values were significantly lower in the 2nd (p=0.003) and the 3rd (p=0.005) assessments in favor of EL.

Conclusions: These results showed that PL caused more cardiovascular loading than EL in sedentary young individuals. It is recommended to consider this when training sedentary individuals.

Keywords: Walking, Eccentric Exercise, Hemodynamics, Perturbation, Loading

---

IMPLEMENTATION AND EXAMINATION OF VESTİBULAR REHABILITATION IN AN AUGMENTED REALITY ENVİRONMENT BY GAMIFICATION IN PATIENTS WITH BENIGN PAROXYSMAL POSITIONAL VERTIGO

Şevval ÖZÜM AÇIKSÖZ [1], Işilay ÖZ [2], Hasan Hüseyin YAY [3]

[1] Lokman Hekim University. Faculty of Health Science, Department of Audiology, Ankara, Türkiye
[2] Başkent University. Department of Ear Nose Throat Diseases, Ankara, Türkiye
[3] Computer Engineer, Ankara, Türkiye

Purpose: Balance exercises are recommended because dizziness is often observed in Benign Paroxysmal Positional Vertigo (BPPV). Home-based programs create positive results, but continuity cannot be achieved due to lack of motivation. Although technological applications can be used to increase motivation, there is no current application for BPPV patients. From here, it is aimed to enable BPPV patients to quickly and easily return to their daily activities by turning vestibular exercises into an application in a gamified, augmented reality (AR) environment that can be easily accessed from mobile devices.

Methods: Software development will be done for AR-based application for residual dizziness in BPPV patients. After this, patients between the ages of 18-75, who have scored at least 18 points in the Standardized Mini Mental Test and who come to the Başkent Hospital Audiology Clinic and are diagnosed with BPPV will be divided into 3 groups: AR application, traditional method, no exercise. Daily Living Activities Scale in Vestibular Disorders, Short Form-12 Quality of Life Scale and Dizziness Handicap Inventory will be applied, and time-dependent changes within the group and differences between the groups will be examined. Patients will be included in the study considering the conditions that may affect the test results and the characteristics that will disrupt the homogeneity of the group.

Results: In the study, the exercises to be given to patients are currently being determined, gamified and scenario-ized to be converted into an AR application. In the future, trials will be conducted on healthy individuals.

Conclusions: The study will be an example for the world literature as it is the first AR-based mobile application for patients with BPPV and will also be a step towards increasing and developing Turkish applications.

Keywords: Vestibular Rehabilitation, Gamification, Augmented Reality, Tele-Audiology, Tele-Rehabilitation

---

EXAMINING THE EFFECT OF SEDENTARY BEHAVIOUR MEASUREMENT BASED ON STEP COUNT CHRONOTROPIC INDEX IN INDIVIDUALS WITH OBESITY

Safak YIGIT[1,2], Buket AKINCI [3], Busra ULKER EKSI [1,2], Ilhan SATMAN [4]

[1] Biruni University. Graduate Education Institute, Deparment of Physiotherapy and Rehabilitation, Istanbul, Türkiye
[2] Istanbul Galata University. Vocational School Therapy And Rehabilitation, Deparment of Physiotherapy Program, Istanbul, Türkiye
[3] Biruni University. Faculty Of Health Science, Deparment of Physiotherapy and Rehabilitation (English), Istanbul, Türkiye
[4] Istanbul University. Faculty Of Medicine, Department of Internal Medicine, Department of Endocrinology and Metabolic Diseases, Istanbul, Türkiye

Purpose: The chronotropic response is an increase in heart rate due to physical activity and metabolic demand. Sedantary behaviour can cause chronotropic incompetence in obese individuals and increased cardiovascular disease (CVD) risk. Wearable technologies are useful to monitorize physical activity participation and may have a potential to determine long-term

CVD risk. The aim of this study is to examine the effect of sedentary behaviour based on step count on chronotropic index (CI) in individuals with obesity.

Methods: 96 obese subjects (mean body mass index= 36.32 ± 4.48 kg/m^2) aged 35-65/years (72 female, 24 male, mean age=50.57 ± 7.27/years) were included in the study. CI was calculated according to the 6-minute walking test (6MWT), using the formula; (heart rate immediately after 6MWT−resting heart rate)/(220−age in year−resting heart rate). Chronotropic incompetence is defined as <0.8. The mean step count was recorded using a hip-worn pedometer (Omron HJ 321E Walking Style) for seven days of monitorization. Subjects then categorized as sedentary (step count<5000, n=47, mean step count=3383.79 ± 1021.37/steps) or non-sedentary (step count≥5000, n=49, mean step count=7632.24 ± 2892.58/steps) based on the step count.

Results: Sedantary and non-sedantary subjects were similar in terms of age, gender and BMI. All subjects included in this study represents chronotropic incompetence (<0.8). CI was not significantly different in subjects with or without sedentary behavior (p= 0.594).

Conclusions: Our results showed that individuals with obesity have chronotropic incompetence regardless of sedantary behaviour based on step count. Further studies needed to investigate the relationship between different step count cut-offs and chronotropic response in large obese populations.

Keywords: Obesity, Chronotropic Index, Step Count, Wearable Technology Device

---

DEVELOPMENT OF AN EFFECTIVE METHODOLOGY FOR REHABILITATION ROBOTICS: CASE STUDY ON A HAND REHABILITATION SYSTEM

Mertcan KOÇAK [1], Özgün BAŞER [1], Erkin GEZGİN [1]

[1] İzmir Katip Çelebi University, Faculty of Engineering and Architecture, Department of Mechatronics Engineering, İzmir, Türkiye

Purpose: The purpose of this work is to develop an effective interaction control methodology for rehabilitation robotics and combine it with game environment. As a case study, single degree of freedom (DOF) hand rehabilitation system was utilized from control design to gamification.

Methods: Interaction control strategy were developed for a hand rehabilitation system that was designed with body guidance kinematic synthesis methodology by collecting motion data from healthy subjects to mimic natural hand grasping motion for post stroke patients. System includes a six-bar mechanism with continous crank input capability with non-backdrivable actuator. Due to its design characteristic, a torque sensor was placed at the motor output, which was challenging location in application. Admittance control structure was utilized with virtual parameters to contribute patient-active interactions. Combining virtual parameters with developed game, rehabilitation procedures were implemented as patient-passive, patient-active assistance/resistance. Besides virtual parameters, control structure was created with additional offset torque reference that increases intreaction effects.

Results: The torque created by user and rehabilitation system in assistive/resistive ways were recorded and analyzed. Despite the challenging location of torque sensor in practice and non-linearity between input/output, extracted data and user comments support the idea of active rehabilitation procedures, which gives promising results.

Conclusions: An effective overall methodology for rehabilitation robotics, in order of; real kinematic data collection, kinematic synthesis accordance with the data to decrease the motion DOF, interaction control utilization and gamification, were focused and worked on a hand rehabilitation case study, which gives promising results to get into clinical studies.

Keywords: Interaction Control, Hand Rehabilitation, Gamification, Kinematic Synthesis

---

USE OF THE MARBES DEVICE IN FALL RISK AND BALANCE ASSESSMENT IN ELDERLY NURSING HOMES RESIDENTS: A PILOT STUDY

Canan GÜNAY YAZICI[1], Tuğba KURU ÇOLAK[1], Aliye Harika ALBOĞA[2], Zübeyir SARI[1]

[1] Marmara University, Faculty of Health Sciences, Department of Physiotherapy and Rehabilitation, Istanbul, Türkiye
[2] Professor Dr. F. Kerim-Nilüfer Gökay Nursing Home Elderly Care and Rehabilitation Centre, Istanbul, Turkey

Purpose: To investigated use of the MarBES balance device, a force platform-based system, in the assessment of fall risk and balance in elderly nursing homes.

Methods: This pilot study was conducted with 24 elderly in nursing home. Those who experienced a fall in the last 12 months were classified as "High-Risk Fall Group" and those who did not experience a fall were classified as "Low-Risk Fall Group". Standing on MarBES (double leg eyes open-close=DLEO; DLEC) and standing on one leg (SLEO-SLEC) balance tests were performed. MarBES balance test (Centre of Pressure; COPX, COPY) was compared with clinical tests; Berg Balance Scale (BBS), Timed Up and Go Test (TUGT), Short Physical Performance Battery (SPPB) (4 Metre Walk Test; 4MWT, 5 Times Sit Stand Test; 5TSST).

Results: The mean age of participants was 74.5±8.94 years. There were 11 (45.8%) individuals in high-risk fall group. MarBES DLEO COPX (mean difference (md)=-4.01±1.59; p=0.02), DLEC COPX (md=-7.53±3.13; p=0.025), COPY (md=-8.18±3.71; p=0.038) and right SLEC COPY (md=-14,89±4,09; p=0,02) results showed a statistically significant difference between both fall groups. There was a moderate negative correlation between MarBES DLEC COPX (r=-0.41; p=0.047), right SLEC COPY (r=-0,53; p=0,016), left SLEC COPX (r=-0.62; p=0.003) and BDS. There was a moderate positive correlation between MarBES DLEC COPX and 5TSST (r=0.52; p=0.009), right SLEO COPY and TUGT (r=0.42; p= 0.041), right SLEC COPY and TUGT (r=0.60; p=0.005) and 4MWT (r=0.68; p=0.001).

Conclusions: The results of this pilot study indicated that balance measurements with MarBES may be useful in determining the fall risk of elderly in nursing homes.

Keywords: Balance, Elderly, Falls, Nursing Homes

EXAMINATION OF THE EFFECTIVENESS OF PELVIC FLOOR MUSCLE TRAINING INCLUDING 360-DEGREE EXPANSIVE DIAPHRAGM EXERCISES IN WOMEN WITH STRESS URINARY INCONTINENCE: RESULTS OF A DOUBLE-BLIND, RANDOMIZED CONTROLLED PRELIMINARY STUDY

Seda YAKIT YEŞİLYURT [1], Gonca ŞAHİNER PIÇAK [2], Merve BAŞOL GÖKSÜLÜK [3], Meriç BALIKOĞLU [4], Nuriye ÖZENGİN [5]

[1] İzmir University of Economics, Faculty of Health Sciences, Department of Physiotherapy and Rehabilitation, İzmir, Türkiye
[2] İzmir University of Economics, Health Services Vocational School, Physiotherapy, İzmir, Türkiye
[3] Erciyes University, Health Services Vocational School, Medical Services and Techniques, Kayseri, Türkiye
[4] İzmir University of Economics, Faculty of Medicine, Surgical Medical Sciences, İzmir, Türkiye
[5] Bolu Abant İzzet Baysal University, Faculty of Health Sciences, Department of Physiotherapy and Rehabilitation, Bolu, Türkiye

Purpose: The aim of the study is to assess the impact of 360-degree expansive diaphragm exercises on urinary symptoms, pre-contraction of pelvic floor muscles (PFM), and their functions in women with stress urinary incontinence (SUI).

Methods: Forty women diagnosed with SUI were randomly assigned to two groups: Group 1 received standard diaphragm exercises and PFM training, while Group 2 underwent 360-degree expansive diaphragm exercises using two Ohmbelt sensors (upper lumbar triangle and inguinal region) along with PFM training. Both groups used EMG biofeedback for PFM training. PFM functions were assessed using EMG biofeedback and vaginal palpation, while urinary symptoms were evaluated using the Incontinence Severity Index (ISI) and International Consultation on Incontinence Questionnaire Short Form (ICIQ-SF) before and after the 8-week treatment period.

Results: The study was completed with 34 women (17 in each group). There were significant improvements within both groups in ISI, ICIQ-SF scores, muscle strength, endurance, and mean PFM contraction strength (p<0.05). However, these improvements did not significantly differ between the two groups (p>0.05). Notably, the 360-degree expansive diaphragm group showed a significant increase in PFM reflex muscle activity during Valsalva maneuver (p=0.013), whereas the standard diaphragm group did not show a significant change (p=0.182).

Conclusions: Both standard and 360-degree expansive diaphragm exercises combined with PFM training improved urinary symptoms, PFM endurance, strength, and contraction values in women with SUI. Notably, 360-degree expansive diaphragm exercises enhanced PFM reflex activation compared to standard exercises, suggesting their potential as an effective therapeutic approach for women with SUI.

Keywords: Diaphragm, Physiotherapy, Sensor, Stress Urinary Incontinence

---

COMPARISON OF SENSOR-BASED LOWER EXTREMITY REACTION TIME AND PHYSICAL PERFORMANCE TEST IN OLDER ADULTS WITH HISTORY OF FALL

Fatma Kübra ÇEKOK [1], Bahar KÜLÜNKOĞLU [2]

[1] Tarsus University, Faculty of Health Sciences, Department of Physiotherapy and Rehabilition, Mersin, Turkey.
[2] Ankara Yıldırım Beyazıt University, Faculty of Health Sciences, Department of Physiotherapy and Rehabilition, Ankara, Turkey

Purpose: Falls among older adults pose significant health risks and can lead to severe injuries and a decline in overall quality of life. The study aims to compare sensor-based lower extremity reaction time and physical performance tests in older adults with a history of fall.

Methods: In this cross sectional study 43 participants (72.20±7.25) were allowed two Group 1 (older adults with history of fall). Group 2 (older adults without history of fall lower extremity Sensor-Based Lower Extremity Reaction Time was evulated by BlazePod™ (Play Coyotta Ltd., Tel Aviv, İsrail) Time up Go Test (TUG), 30s Sit To Stand Test (30sSTS) and Berg Balance Scale (BBS) were used to evaluate the physical performance.

Results: Older adults with a history of falls had significantly increased reaction time (715.90±115.23 ms vs 508.60±112.76 p<0.001) and lower number of hit (12.7 ± 4.5 vs 17.5 ± 4.42 p<0.001) compared with older adults without history of fall

(p<0.001). Furthermore, the, TUG ,BBS and 30Ssts in the older adults with a history of fall group were significantly lower than that of the older adults without history of fall (p<0.001).

Conclusions: This study found that decreased reaction time and physical performance in older adults with a history of falls. We recommended that by leveraging sensor technology, clinicians can gain valuable insights into fall risk and implement more effective, personalized interventions to enhance the safety and quality of life for older adults.

Keywords: Older Adults, Reaction Time, Physical Performance

THE RELATIONSHIP BETWEEN THE BIOMECHANICAL PROPERTIES OF THE STERNOCLEIOMASTOID MUSCLE AND GROSS MOTOR DEVELOPMENT IN INFANTS WITH CONGENITAL MUSCULAR TORTICOLLIS

Derya AZİM [1], Gönül ACAR[2], Emine ATICI [3], Türkü DÜZEL[3]

[1] Bandırma Onyedi Eylül Unıversıty, Faculty of Health Scıences, Department of Physıotherapy and Rehabılıtatıon, Balıkesir, Türkiye

[2] Marmara Unıversıty, Faculty of Health Scıences, Department of Physıotherapy and Rehabılıtatıon, İstanbul, Türkiye

[3] İstanbul Okan Unıversıty, Faculty of Health Scıences, Department of Physıotherapy and Rehabılıtatıon, İstanbul, Türkiye

Purpose: The aim of our study is to examine the relationship between the biomechanical properties of the Sternocleidomastoid muscle and gross motor development in infants with congenital muscular torticollis.

Methods: Eleven infants with an average age of 4.18 months, diagnosed with congenital muscular torticollis and receiving treatment at a single center in Istanbul, were included in the study. The muscle tone, muscle stiffness, and muscle elasticity of the Sternocleidomastoid (SCM) muscle were assessed using the Myoton Pro device. The gross motor skills of the infants were evaluated using the Alberta Infant Motor Scale. The relationship between muscle biomechanics and gross motor performance was analyzed using Spearman's correlation analysis.

Results: The average values of muscle tone, muscle stiffness, and muscle elasticity of the SCM muscle, assessed by the Myoton Pro device, were 16.28±1.72; 291±67.99; and 1.36±0.38, respectively. The average score of the Alberta Infant Motor Scale used to evaluate the infants' gross motor skills was found to be 13.81±7.80. A negative correlation was found between SCM muscle tone and stiffness (r= -0.528; -0.446) and the AIMS, while no significant correlation was found between muscle elasticity and the AIMS.

Conclusions: These results suggest that the biomechanical properties of the SCM muscle may have an impact on gross motor development in infants with congenital muscular torticollis, particularly muscle tone and stiffness, which appear to be related to motor development. This pilot study indicates the need for follow-up measurements after applying specific physiotherapy techniques aimed at reducing muscle tone and stiffness, and for studies with larger populations.

Keywords: Congenital Muscular Torticollis, Development, Muscle Properties

---

EFFECTIVENESS OF BIOMEDICAL DEVICE ASSISTED MYOFASCIAL RELEASE TECHNIQUES IN LATE REHABILITATION AFTER L3 BURST FRACTURE SURGERY-A CASE STUDY

Abdurahim Aslıyüce [1], Hasan Erkan Kılınç [1], Özlem Ülger [1]

[1] Hacettepe University, Faculty of Physical Therapy and Rehabilitation, Ankara, Turkey.

Purpose: It was planned to evaluate the effectiveness of the biomedical device-assisted myofascial release program in the late rehabilitation period in a patient who underwent L3 burst fracture surgery.

Methods: In this case, a 46-year-old male patient with burst fracture of the L3 vertebral corpus, dislocation of the spinal canal extending to the spinous process and marked narrowing of the canal. There was no history of loss of consciousness, vomiting, bleeding or seizure as a result of the fall. Pain intensity was assessed by Visual Analog Scale(VAS), disability level by Oswestry Disability Index(ODI), quality of life by SF-36 and gait analysis by OptoGait. For 6 weeks, Exopulse Mollii-Suit device was used in addition to myofascial release twice a week. Spinal stabilization exercises were also performed.

Results: Activity VAS value decreased from 7cm to 5cm, ODI score decreased from 58 to 48, all sub-parameters of SF-36 and general health score improved to a clinically significant level, and in gait analysis, double stride length increased from 92.0±5.4 to 137.8±8.6 and average speed (m/s) from 0.54±0.51 to 1.18±0.12.

Conclusions: This case report is the first study to evaluate the effectiveness of the Exopulse Molli Suit, a biomedical device applied in addition to conventional rehabilitation in a patient with a history of L3 burst fracture. According to our results, myofascial release, stabilization exercises and the use of Exopulse Mollii-Suit had positive effects on pain intensity, disability level, quality of life and gait in a surgically treated patient with L3 burst fracture.

Keywords: Wearable Technology, Physical Therapy, Rehabilitation

---

ASSOCIATION OF TRACE SCORE WITH COBB AND ANGLE OF TRUNK ROTATION IN PATIENTS WITH ADOLESCENT IDIOPATHIC SCOLIOSIS IN 4C PATTERN

Tuğba KURU ÇOLAK [1], Burçin AKÇAY [2], Adnan APTİ [3], İlker ÇOLAK [4]

[1] Marmara University. Faculty of Health Sciences, Department of Physiotherapy and Rehabilitation, Istanbul, Türkiye
[2] Bandirma Onyedi Eylül University. Faculty of Health Sciences, Department of Physiotherapy and Rehabilitation, Istanbul, Türkiye
[3] Istanbul Kültür University. Faculty of Health Sciences, Department of Physiotherapy and Rehabilitation, Istanbul, Türkiye
[4] Vm Medical Park Maltepe Hospital. Department of Orthopaedics and Traumatology, Istanbul, Türkiye

Purpose: Aesthetic evaluation plays a crucial role in scoliosis treatment as it helps in assessing the visual impact of the spinal deformity and guides personalized treatment plans to improve the patient's overall appearance and self-esteem. The aim of this study was to investigate the relationship between the severity of the deformity and the TRACE score, developed for aesthetic evaluation, in patients with adolescent idiopathic scoliosis classified as having a 4C pattern according to the ALS classification.
Methods: This study included 23 female and 5 male patients with an average age of 13.7 years (ranging from 10 to 18 years). Cobb angle was evaluated with standing AP orthorontgen and trunk rotation angle was evaluated with Bunnel scoliometer in standing forward bending position. Age, gender, maximum Cobb and ATR angles, scoliosis patterns according to ALS classification, and TRACE scores were recorded. Correlation analysis between Cobb and ATR angles and TRACE score, which indicate the severity of deformity, was analyzed using SPSS v.16 program.
Results: There was a moderately positive (r=0.529, p=0.004) significant correlation between the total score of TRACE scoring and Cobb angle and a moderately positive (r=0.456, p=0.015) significant correlation between TRACE score and ATR.
Conclusions: The TRACE score was developed to cosmetically evaluate the deformity in patients with scoliosis. However, in clinical use, it should be kept in mind that the magnitude of the deformity and the cosmetic appearance are not always similar, especially in patients with two major curves. This score can be used to provide patients with numerical values to evaluate the cosmetic effect.
Keywords: Scoliosis, Rehabilitation, Assessment

THE EFFECT OF TRIFLO USE ON SLEEP, DEPRESSION AND PHYSICAL ACTIVITY IN HEALTHY INDIVIDUALS

Tuğçe ÖZEN [1], Taha AKPINAR [1], Esra Nur ÇIFTÇI [1], Hacer BILTEKIN [1], Rümeysanur SATAŞMAZ [1], Tuğba KURU ÇOLAK[1]

[1] Marmara University, Faculty of Health Sciences, Department of Physiotherapy and Rehabilitation, İstanbul, Türkiye

Purpose: The aim of this study was to investigate the effect of triflo use on sleep, depression and physical activity in healthy adults between the ages of 18-30 years.
Methods: Thirty healthy individuals aged 18-30 years were included in the study. The participants were asked to perform inspiratory and expiratory muscle training with triflo every day for 8 weeks. The sociodemographic evaluation form was used to obtain information about gender, weight, height, body mass index, age, and occupation. Anthropometric measurements, saturation (pulse-oximeter), 10-meter walking test (stopwatch), depression (Beck Depression Scale), sleep quality (Pittsburgh sleep quality index), physical activity (international physical activity questionnaire (short)) were evaluated. The assessments were performed before the start of triflo use and 8 weeks after the first assessment.
Results: A significant difference was found in saturation, 10-meter walking test and Pittsburgh Sleep Quality Index score after the intervention in healthy individuals (p<0.05). Although there was no significant difference in Beck Depression Scale score, it approached significant difference (p=0.061).
Conclusions: According to the results, saturation, walking speed and sleep quality improved after 8 weeks of respiratory muscle training. Based on the results of this study, we think that respiratory muscle training should be included in various rehabilitation protocols for healthy individuals.
Keywords: Breathing, Exercise, Respiratory Muscle Training

THE EFFECT OF DYNAMIC INNOVATIVE BALANCE SYSTEM TRAINING ON STATIC WEIGHT BEARING IN HEALTHY INDIVIDUALS

Bünyamin HAKSEVER [1], Kimiya HAJIGHORBANI [2], Halise ERCİYAS [3]

[1] Fit Level Wellness Center, Ankara, Turkey
[2] Hacettepe University, Institute of Health Sciences, Department of Physiotherapy and Rehabilitation, Ankara, Turkey
[3] Gazi University, Faculty of Health Sciences, Department of Physiotherapy and Rehabilitation, Ankara, Turkey

Purpose: This study aims to evaluate the impact of Dynamic Innovative Balance (DIBA) system training on the static weight-bearing distribution between the right and left foot in healthy individuals.

Methods: We analyzed 16 healthy participants without orthopedic pathology or trauma to the lower extremities. Static weight bearing was assessed using the Impronta Medica pedobariographic analysis system, recording the weight-bearing percentages of the forefoot, midfoot, and full foot relative to BMI and foot size. Demographic data were collected. Participants then underwent DIBA training, performing mini squats at 450 rpm with a 45 cm step interval for 15 minutes. After a 5-minute rest, the pedobariographic analysis was repeated to assess changes in weight distribution percent between the right and left foot. The difference in total weight bearing percent between the paired feet before and after training was analyzed using the Wilcoxon test.

Results: The Wilcoxon test indicated a significant change in static total weight-bearing percent differences between the right and left foot before and after DIBA training in healthy individuals (p = 0.039).

Conclusions: The significant change suggests that DIBA training can effectively improve weight distribution between the right and left foot. Further studies with larger sample sizes and extended training programs are recommended to validate these findings.

Keywords: Postural Balance, Weight-Bearing, Biomechanical Phenomena, Exercise Therapy

---

SPINAL ALIGNMENT IN CHILDREN WITH DUCHENNE MUSCULAR DYSTROPHY AND ITS RELATION TO MUSCULAR PERFORMANCE: A PILOT STUDY

Ali Naim CEREN [1], Aysu KAHRAMAN [1], Numan BULUT [1], Esra ATEŞ NUMANOĞLU [1], Asude ARIK [1], İpek GÜRBÜZ [1], Öznur YILMAZ [1]

[1] Hacettepe University, Faculty of Physical Therapy and Rehabilitation, Department of Physiotherapy and Rehabilitation, Ankara, Turkey

Purpose: The aims of the study were a) to investigate spinal alignment of children with Duchenne Muscular Dystrophy (DMD) and b) to assess its relationship with muscular performance.

Methods: Fifteen children with DMD (9.36±2.07 years) and 8 typically developing peers (8.54±2.24 years) were included in the study. The children's spinal alignment parameters, including coronal imbalance, kyphosis and lordosis, were assessed by using the Diers formetric 4D system. Six-minute walk test (6MWT) was performed to determine the muscular performance of children with DMD.

Results: There were no differences in demographic characteristics between children with DMD and their typically developing peers (p>0.05). The children with DMD had higher lordosis (45.71±8.61 vs 35.78±7.44 degrees) and coronal imbalance (10.11±7.30 vs 3.35±2.76 mm) compared to typically developing children (p<0.05). The children with DMD and their typically developing peers had similar kyphotic angles (p>0.05). No correlation was found between the 6MWT distance and the spinal alignment parameters (p>0.05).

Conclusions: This study showed that although children with DMD may have impaired spinal alignment, this may not be reflected in muscular performance. It was emphasised that children with DMD should be screened from an early period in order to prevent/reduce the problems that may occur due to impaired spinal alignment at an advanced age with this study.

Keywords: Duchenne Muscular Dystrophy, Spine, Posture, Physical Functional Performance

---

CONCURRENT VALIDITY AND RELIABILITY OF THE NEWLY DEVELOPED S-GAIT INSOLE FOR MEASURING THE AMOUNT OF WEIGHT BEARING

Zilan Bazancir Apaydın [1], Muharrem Gökhan Beydağı [2], Hande Güney Deniz [3], Nazlı Ciğercioğlu [3], Gül Baltacı [4]

[1] Ankara Medipol University. Faculty of Health Science, Department of Physiotherapy and Rehabilitation, Ankara, Türkiye
[2] Firat University. Faculty of Health Science, Department of Physiotherapy and Rehabilitation, Elazig, Türkiye
[3] Hacettepe University. Faculty of Physical Therapy and Rehabilitation, Ankara, Türkiye
[4] Istanbul Atlas University. Faculty of Health Science, Department of Physiotherapy and Rehabilitation, Istanbul, Türkiye

Purpose: S-gait is an insole developed by the Turkish researcher that measures the amount of weight bearing. The aim of the study was to evaluate the validity of the S-gait insole with a plantar pressure distribution system (PPD) in healthy adults.

Methods: Twenty-one participants (14 female, 7 male, mean age=32.6±7.3 years) were included in the study. Participants performed two standing position during which the weight bearing was measured with the S-gait insole and the PPD. The PPD was evaluated using the Digital Biometry Scanning System and Milletrix software (DIASU, Italy). The amount of weight bearing was assessed with S-gait insole.

Results: There were no significant differences in the measures of participant weight bearing between the S-gait and the PPD (p>0.05). Pearson correlations of 0.832–0.838 (p<0.001) and intraclass correlation coefficients of 0.89–0.94 (95% confidence interval: 0.73–0.95) were recorded for all measures. Using the Bland–Altman method, the standard error of the mean of the differences were low.

Conclusions: The S-gait were reliable to measure of the weight bearing each of foot, and had concurrent validity for this sample and protocol compared to the PPD. The S-gait may be used to assess the amount of weight bearing and provide exercise training in the static position.
Keywords: Weight Bearing, Plantar Pressure, Insole

ACUTE EFFECT OF PHYSIOLOGIC® EXERCISES ON MUSCLE TONE AND STIFFNESS IN AIS PATIENTS: A PRELIMINARY STUDY

Burçin AKÇAY[A], Nur YİĞİT KESKİN[B], Tuğba KURU ÇOLAK[C], Ozan Bahadır TÜRKMEN[A]

[A] Bandirma Onyedi Eylül University, Faculty of Health Sciences, Department of Physiotherapy and Rehabilitation, Balikesir, Türkiye
[B] Bandirma Onyedi Eylül University, Institute of Health Sciences, Department of Physiotherapy and Rehabilitation, Balikesir, Türkiye
[C] Marmara University, Faculty of Health Sciences, Department of Physiotherapy and Rehabilitation, İstanbul, Türkiye

Purpose: The literature reports the effect of Physiologic® exercises on correcting deformity in adolescent idiopathic scoliosis (AIS) patients by decreasing the degree of trunk rotation. In this preliminary study, we aimed to investigate the acute effect of Physiologic® exercises on muscle tone and stiffness in AIS patients.
Methods: Five patients diagnosed with AIS with a mean age of 16.2 years and a mean Cobb angle of 24.8 were included in this study. Participants underwent Physiologic® exercise to improve sagittal physiologic curvatures of the spine. Before and after exercise muscle tone and stiffness were measured with Myoton Pro device.
Results: Decrease in the tone of the trapezius (Right(R)=7.23%, Left(L)=3.75%), latissimus dorsi upper part (R=9.34%, L=5.1%), latissimus dorsi lower part (R=7.69%, L=1.7%) and increase in the tone of the erector spinae muscles (R=1.75%, L=4.32%) were observed after the exercise. After exercise, a decrease in the stifness of the trapezius (R=18.38%, L=9.20%), latissimus dorsi upper part (R=19.65%, L=5.92%), latissimus dorsi lower part (R=19.48%, L=4.02%) and an increase in the stifness of the erector spinae (R=6.37%, L=9.03%) were detected.
Conclusions: In AIS In patients, decreased stifness and tonus in the right and left side trapezius and latissimus dorsi muscles and increased erector spinae were demonstrated with Physiologic® exercise. This study is a preliminary study evaluating the acute efficacy and there is a need for studies in which the changes in muscle tone and stiffening with physiologic exercise are examined long-term and changes in different curvature types are presented.
Keywords: Muscle Tone, Muscle Stifness, Adolescent Idiopathic Scoliosis, Physiologic Exercise

---

EFFECTS OF SENSOR-BASED DEVICE ASSISTED EXERCISES IN ANKYLOSING SPONDYLITIS

Seda Yakıt Yeşilyurt [1], Barış Gürpınar [1], Özkan Urak [2], İsmail Sarı [2]

[1] Izmir University of Economics, Faculty of Health Sciences, Department of Physiotherapy and Rehabilitation, İzmir, Türkiye
[2] Dokuz Eylul University, Faculty of Medicine, Department of Internal Medicine, Division of Immunology - Rheumatology, İzmir, Türkiye

Purpose: Although pulmonary manifestations are asymptomatic in individuals with Ankylosing Spondylitis (ASD), respiratory diseases are the third most common cause of death in ASD. Improving thoracic mobility and pulmonary function are important in ASD. This study aimed to investigate and compare the effects of standard diaphragmatic breathing and of sensor-based device assisted breathing combined with exercise on pulmonary function and disease indices in ASD.
Methods: This pilot study included a total of 11 patients with definite ankylosing spondylitis according to the modified New York criteria. Patients were randomly allocated to 360-degree expansive diaphragm breathing (EG) and diaphragm exercise (DG) group twice in a week for 6 weeks. Pulmonary Function Tests (PFT), maximal inspiratory mouth pressure (MIP), maximal expiratory mouth pressure (MEP), and disease indices such as Bath Ankylosing Spondylitis Functional Index (BASFI), BATH Ankylosing Spondylitis Disease Activity Index (BASDAI), Bath Ankylosing Spondylitis Metrology Index (BASMI) were measured before and after the intervention.
Results: MIP (p=0.009), MEP (p=0.013), peak expiratory flow (p=0.041) and disease indices improved after treatment in all patients regardless of group (p<0.05). In EG group, MIP (p=0.043), MEP (p=0.043) and all disease indices improved (p<0.05). Improvement was observed in BASFI (p=0.042) and BASMI (p=0.028) values in the exercise group performed with diaphragm breathing without technological sensor-based support.
Conclusions: The positive effect of exercise therapy on pulmonary function and disease indices in ASDs can be increased with sensor-based device.
Keywords: Axial Spondyloarthritis, Respiratory Function Tests, Exercise

INNOVATIVE APPROACHES IN FORENSIC MEDICINE: DETECTING PATHOLOGICAL GAIT SIMULATIONS WITH AI AND MOTION ANALYSIS

Ali YALÇIN [1], Engin DEMİR [2], Emre Nuri İĞDE [3], Emirhan DEMİRAY [4], Zeyit ALEMDAR [5], Ali Rıza TÜMER [4], Semra TOPUZ [1]

[1] Hacettepe University, Faculty of Physical Therapy and Rehabilitation, Ankara, Türkiye
[2] Hacettepe University, Faculty of Engineering, Department of Computer Engineering, Ankara, Türkiye
[3] Forensic Medicine Institute Ankara Group Presidency, Ankara, Türkiye
[4] Hacettepe University, Faculty of Medicine, Department of Forensic Medicine Ankara, Türkiye
[5] Council for Forensic Medicine, Muş, Türkiye

Purpose: Although the Forensic Medicine Department (FMD) has mechanisms for determining disability rates, there is a need for systems supporting these mechanisms for individuals simulating pathological gait to obtain higher rates. This study aimed to develop mechanisms for detecting simulated gaits using motion analysis and artificial intelligence (AI).

Methods: The study was conducted within the TUBITAK 1001 221S678 project. It included patients with unilateral lower extremity fractures who applied to FMD for disability evaluation at least 12 months post-fracture. Participants underwent routine assessments at FMD and simultaneous evaluations in the Faculty of Physical Therapy and Rehabilitation (PTR) Motion Analysis Laboratory with 8 cameras 3D motion analysis system and a GAITRite electronic walkway. PTR opinions were determined from repetitive walking results with GAITRite. A decision support system was created with AI using deep learning models from motion capture data.

Results: A total of 20 individuals with a mean age of 28.75 ± 7.71 years and a body mass index of 24.05 ± 2.8 m/kg² were enrolled. The decisions made after gait analysis in FMD and the laboratory were 75% compatible. The AI model correctly classified participants who imitated, but some gaits were inconsistent with PTR and FMD opinions.

Conclusions: The AI model requires further enhancement to be used independently for identifying simulations in forensic medicine. However, it could serve as a third opinion in cases of discrepancies between FMD and PTR opinions.

Keywords: Forensic Medicine, Gait, Imitation, Artificial Intelligence

SCAPHOLUNATE INSTABILITY: COMPARATIVE ANALYSIS OF WRIST MUSCLE STRENGTH AND REACTION TIME

Arzu DAĞ [1,2], Ömer Ayık [3], Tüzün FIRAT [1], Orhun AYAN [4], İsmail Bülent ÖZÇELİK [5], Türker ŞAHINKAYA [4], Bülent BAYRAKTAR [4], Semra TOPUZ [1]

1 Faculty of Physical Therapy and Rehabilitation, Hacettepe University, Ankara, Turkey
[2] Department of Physiotherapy and Rehabilitation, Faculty of Health Science, Istanbul Yeni Yuzyıl University, Istanbul, Turkey
[3] *Department of Orthopedics and Traumatology, Istanbul University, Istanbul Faculty of Medicine, Istanbul, Turkey*
[4] Department of Sports Medicine, Istanbul Faculty of Medicine, Istanbul University, Istanbul, Turkey.
[5] Department of Hand and Reconstructive Microsurgery, İstanbul Yeni Yuzyil University Gaziosmanpaşa Hospital, İstanbul, Türkiye

Purpose: This study aims to investigate wrist flexor and extensor isokinetic muscle strength and reaction time in scapholunate instability (SLI), as no studies have measured these factors before.

Methods: Fifteen patients (12 females, 3 males; mean age was 35.33 ± 9.03 years) with SLI were included. Flexors-extensors isokinetic muscle strengths (peak torque and work per-repetition) and endurance (total work done) was measured using isokinetic dynamometer and were compared with those of healthy extremity. Hand reaction time was assessed with Blazepod-Trainer-Device.

Results: All parameters were lower in the affected wrist compared to the contralateral wrist. Extensor muscles were significantly weaker than flexor muscles of affected sides, with significant differences in muscle strength ($p=0.03$), work per repetition ($p=0.01$) and endurance ($p=0.006$). No significant differences were found in muscle strength and work-per repetition values of flexors or extensors between the affected and healthy sides ($p>0.05$). However, significant differences were observed in the endurance of flexor muscles when comparing the involved and unaffected sides. The endurance of the extensor muscles was also statistically significant between involved and unaffected wrists. There were no significant differences in reaction time between the involved side and unaffected side.

Conclusions: This study especially highlights the differences in isokinetic muscle strength, and endurance parameters in individuals with SLI. These findings will guide clinical practices and contribute to the development of appropriate treatment plans, suggesting the need for including more participants in future research.

Keywords: Scapholunate Instability, Carpal Instability, Isokinetic Muscle Strength Test, Reaction Time

A GENERAL OVERVIEW OF THE USAGE FEATURES OF LOKOMAT (ROBOT-ASSISTED GAIT TRAINING SYSTEM) FOR INDIVIDUALS WITH STROKE: A SYSTEMATIC REVIEW

Merve AKINCI [1], Murat AKINCI [2], Meriç Selim ŞIPAL [2], Muhammed KILINÇ [3]

[1] Kırıkkale University, Vocational School Health Services, Ankara, Turkey
[2] Ankara City Hospital, Ankara, Turkey
[3] Hacettepe University, Department of Physical Therapy and Rehabilitation, Ankara, Turkey

Purpose: Stroke is a significant health problem worldwide and a major cause of disability. In addition to conventional physiotherapy approaches, one of the recommended rehabilitation methods after a stroke is robot-assisted gait training (RAGT). Lokomat is one of the widely accepted RAGT systems. The aim of this research is to identify the features of the Lokomat that are used in stroke rehabilitation.
Methods: The databases Pubmed, Web of Science, and ScienceDirect were searched using the keywords "Stroke" and "Lokomat" with the "AND" Boolean operator. Retrospective studies, case reports, reviews, and studies involving other diseases or healthy individuals were excluded.
Results: After the screening, 300 research articles were reviewed, excluding duplicates. Gait speed, Body Weight Support, and Guidance Force parameters were found to be frequently used features in these studies. Additionally, Augmented Performance Feedback (Virtual Reality Games) and Free-D (Pelvis lateral movements) were found to be other utilized features.
Conclusions: It has been concluded that while there are many features that can affect the effectiveness of Lokomat, current scientific research has focused on a few of them and neglected the others. Almost no study has used all these features simultaneously or provided details on how they were used. Conducting research with protocols that correctly incorporate these features together and in accordance with the literature is important for accurately measuring the true impact of robot-assisted gait training.
Keywords: Locomotion, Robotics, Stroke

REHABILITATION ROBOTS IN TÜRKİYE: FOCUS ON THE SPA PARADIGM

Meriç Selim ŞİPAL [1], Murat AKINCI [1], Emre ADIGÜZEL [1], Muhammed KILINÇ [2]

[1] University of Health Sciences. Physical Medicine and Rehabilitation Hospital, Ankara Bilkent City Hospital, Ankara, Türkiye
[2] Hacettepe University. Faculty of Physical Therapy and Rehabilitation, Ankara, Türkiye

Purpose: For a system to be considered robotic, it must follow the 'sense–plan–act' (SPA) paradigm. Examining rehabilitation robots that adhere to the SPA paradigm is crucial for demonstrating the development and dissemination of rehabilitation technologies in Türkiye. This research aims to analyze rehabilitation robots invented or produced in Türkiye, assessing their compliance with the SPA paradigm.
Methods: Turkish Patent Institute (TÜRK PATENT) and the Product Tracking System (ÜTS) databases were searched to identify rehabilitation robots invented or produced in Türkiye. The TÜRK PATENT database search included the terms 'robot,' 'rehabilitasyon,' 'fizik tedavi,' and 'egzersiz' in abstracts, using 'AND' and 'OR' Boolean operators. In the ÜTS database, the criteria were set to "Branch Type: Robotic Rehabilitation" and "Country of Origin: Türkiye."
Results: After screening, 18 results were identified in the TÜRK PATENT and 10 in the ÜTS databases. A total of 28 results were analyzed, and after eliminating unrelated and duplicate entries, 16 relevant results were identified. Following evaluations, 13 robots met the SPA criteria, with one lacking sufficient information. Among the results compatible with the SPA paradigm, only one is registered in the ÜTS.
Conclusions: It has been concluded that while there are 13 robots originally invented in Türkiye with the SPA paradigm, most are not in clinical use. Only one robot with the SPA paradigm is registered in the ÜTS and thus available on the market. It is crucial to produce these inventions, integrate them into the medical device ecosystem, and make them available for patient use.
Keywords: Robotics, Rehabilitation

INVESTIGATION OF SPINAL PAIN AND POSTURAL AWARENESS LEVELS OF OFFICE WORKERS: A PILOT STUDY

Ertuğrul DEMİRDEL[1], Hilal ASLAN [2]

[1, 2] Ankara Yildirim Beyazit University. Faculty of Health Sciences, Department of Physiotherapy and Rehabilitation, Ankara, Türkiye

Purpose: The aim of this study was to examine the complaints of posture-induced spinal pain and postural awareness levels of office workers who work in a desk position for long hours.

Methods: Volunteer office workers were invited to the study. In addition to the demographic data, the duration of working in a desk position (working years and average working hours per day), the localization of the pain they experienced due to postural problems were questioned and the pain intensity (at rest and during activity) was evaluated with the Numeric Pain Scale (NPS). Postural awareness' of the participants were also questioned.

Results: The study included 50 volunteer office workers (27 women and 23 men) with a mean age of 39.20±9.10 years. 32% (n: 16) of the participants had been working in a desk position for more than 15 years, 70% (n: 35) reported that they spent 5-8 hours of their day in a desk position, and 86% (n: 43) reported pain while working in a desk position. It was determined that the region where the participants felt the most pain was the neck (n: 36, 72%). According to NPS, the participants' pain intensity during activity was 4.98±2.36 and their pain intensity during rest was 3.90±2.43.

Conclusions: Working long hours in a desk-based position can cause stress on the posture, especially in the neck region, which can cause pain and negatively affect the quality of life. Practices to increase postural awareness are important in occupational groups such as office workers.

Keywords: Office workers, Pain, Postural Awareness.

DEVELOPMENT OF VIDEO EXERCISE-BASED MOBILE APPLICATION TO IMPROVE THE CLINICAL OUTCOMES IN PATIENTS WITH KNEE OSTEOARTHRITIS: A RANDOMIZED CONTROLLED TRIAL

Fatih ÖZDEN [1], Baki Umut TUĞAY [2], Barış Ethem SÜZEK [3], Nazan TUĞAY [4], Zübeyir SARI [5], İrem ÇETİNKAYA [6], Gülser CİNBAZ [7], İsmet TÜMTÜRK [8], Muhammed BUĞA [9]

[1] Muğla Sitki Koçman University. Köyceğiz Vocational School of Health Services, Department of Health Care Services, Muğla, Türkiye

[2] Muğla Sitki Koçman University. Faculty of Health Sciences, Department of Physiotherapy and Rehabilitation, Muğla, Türkiye

[3] Muğla Sitki Koçman University. Faculty of Engineering, Department of Computer Engineering, Muğla, Türkiye

[4] Sanko University. Faculty of Health Sciences, Department of Physiotherapy and Rehabilitation, Gaziantep, Türkiye

[5] Marmara University. Faculty of Health Sciences, Department of Physiotherapy and Rehabilitation, İstanbul, Türkiye

[6] Haliç University. Faculty of Health Sciences, Department of Physiotherapy and Rehabilitation, İstanbul, Türkiye

[7] İstanbul Medeniyet University. Faculty of Health Sciences, Department of Physiotherapy and Rehabilitation, İstanbul, Türkiye

[8] Süleyman Demirel University. Institute of Health Sciences, Department of Physiotherapy and Rehabilitation, Isparta, Türkiye

[9] Muğla Sitki Koçman University. Faculty of Engineering, Department of Computer Engineering, Muğla, Türkiye

Purpose: The purpose of this study was to develop a video exercise-based mobile application and investigate its effectiveness in terms of pain, function, satisfaction, and expectation in patients with knee osteoarthritis (OA).

Methods: A randomized controlled trial was carried out with 40 individuals with knee OA. Participants were randomly allocated into two groups: the mobile application (MAG) group (n=20) and the control group (CG) (n=20). MAG received the two-month rehabilitation program via the developed application. CG was given paper-based exercise forms with the same protocol. The patients were evaluated with the Visual Analog Scale (VAS), Western Ontario and McMaster Universities Osteoarthritis Index (WOMAC), and Satisfaction and Expectation-based VAS.

Results: Both MAG and CG showed statistically significant improvement in VAS-rest, VAS-activity, WOMAC-pain, WOMAC-stiffness, WOMAC-function, and WOMAC-total scores (p<0.05). However, there was no significant difference between MAG and CG for all pain and function scores (p>0.05). In addition, no difference was observed between the two groups regarding expectation-satisfaction changes (p>0.05). Besides, satisfaction-expectation change was not significantly different within each group (p>0.05).

Conclusions: Rehabilitation presented with the mobile application was effective regarding rest-activity pain and function. However, rehabilitation via mobile application did not provide additional contribution to pain and function compared to usual rehabilitation.

Keywords: Gonarthrosis, Pain, Remote Rehabilitation, Telerehabilitation

---

ACTION OBSERVATION TRAINING IN IMMERSIVE VIRTUAL REALITY: ENHANCING UPPER EXTREMITY FUNCTIONS IN PATIENTS WITH MULTIPLE SCLEROSIS

Tuba KAYA BENLİ [1], Enes Tayyip BENLİ [1], Şule AYDIN TÜRKOĞLU [2], Yeşim BAKAR [3]

[1] Bolu Abant Izzet Baysal University, Faculty of Health Sciences, Department of Physiotherapy and Rehabilitation, Bolu, Turkey

[2] Bolu Abant Izzet Baysal University, Faculty of Medicine, Department of Neurology, Bolu, Turkey

[3] Izmir Bakirçay University, Faculty of Health Sciences, Department of Physiotherapy and Rehabilitation. Izmir Turkey

Purpose: The aim is to investigate the effects of 3D virtual reality-based action observation training on upper extremity functions in multiple sclerosis patients.

Methods: Participants were divided into two groups: a Control Group and an Action Observation Training (AOT) Group. Both groups participated in treatment consisting of upper extremity activities three times a week for 6 weeks. Both groups performed upper extremity activities for 3 minutes after watching the video for 3 minutes through virtual reality goggles. The AOT group watched the upper extremity activities while the control group watched the landscape videos. Before and after the intervention, upper extremity function was assessed using the Nine-Hole Peg Test, grip strength was assessed using a digital hand dynamometer, and participants' attention and information processing speed were assessed using the Paced Auditory Serial Addition Test (PASAT).

Results: Analyses were performed on 10 individuals with a mean age of 56.8 ± 10.16 years. The groups were similar at baseline in terms of age, gender and EDSS scores (p>0.05). While there was no improvement in the outcome assessments in the control group, there was a statistically significant improvement in the dominant hand NHPT (p:0.030) in the action observation group.

Conclusions: According to the results of this study, action observation training demonstrated more effective results in terms of speed and function development compared to conventional methods. Activity observation training in immersive virtual reality with real-life recordings taken from the First Person Point of View has a high potential for increases in upper extremity functions.

Keywords: Multiple Sclerosis, Action Observation Training, Virtual Reality

---

THE TWO-MINUTE STEP TEST IS A VALID TEST TO ASSESS FUNCTIONAL PERFORMANCE IN PATIENTS WITH KNEE OSTEOARTHRITIS

Sibel BOZGEYİK-BAĞDATLI [1], Yusuf KOCAKANAT [1], Mustafa Buğra ÇEVİK [1], Hande GÜNEY-DENİZ [1]

[1] Hacettepe University, Faculty of Physical Therapy And Rehabilitation, Department Of Musculoskeletal Physiotherapy And Rehabilitation, Ankara, Türkiye

Purpose: This study aimed to determine whether the 2-minute step test (2MST) can be used as a substitute for the 6-minute walk test (6MWT) and 2-minute walk test (2MWT) to asses functional performance in individuals with knee osteoarthritis (OA).

Methods: Nineteen female patients aged 45–65 years, diagnosed with unilateral knee OA were included in the study. The demographic data of the patients, including age, height, weight, body mass index (BMI), dominant lower extremity, and affected lower extremity, was recorded. 2MST, 6MWT, and 2MWT were used to assess functional performance. Patients' pain intensity after functional tests were eassessed with the Numeric Rating Scale, and the fatigue levels were assessed with the Borg Fatigue Scale.

Results: The mean age of the patients was 58.11 ± 6.31 years; the mean height was 160.37 ± 6.77 cm; the mean weight was 81.37 ± 15.17 kg, and the mean BMI was 31.72 ± 5.48 kg/m^2. Among the patients, 94.7% were right-leg dominant, and 57.9% had their right lower extremity affected. A high correlation was found between the number of steps in the 2MST and the walking distances in the 6MWT and 2MWT (r=0.775, p≤0.001 and r=0.718, p≤0.001, respectively). There was no significant difference in pain intensity (p=0.065) and fatigue levels (p=0.812) after the tests.

Conclusions: Our results suggest that the 2MST is an easily applicable and valid test that does not require extra space and can be used as a substitute for the 6MWT and 2MWT in assessing functional performance in clinical for patients with Stage II and Stage III knee OA.

Keywords: Knee, Osteoarthritis, Functional Performance

RELIABILITY OF A MOBILE APPLICATION IN THE EVALUATION OF ELBOW JOINT POSITION SENSE

Gülfem Ezgi ÖZALTIN [1], Dilan DEMİRTAŞ KARAOBA [2], Havva ADLI [3], Burcu TALU [1]

[1] Inonu University. Faculty of Health Sciences, Department of Physiotherapy and Rehabilitation, Malatya, Turkey

[2] Igdir University. Faculty of Health Sciences, Department of Physiotherapy and Rehabilitation, Igdir, Turkey

[3] Inonu University. Vocational School of Health Services, Department of Therapy and Rehabilitation, Malatya, Turkey

Purpose: This study aimed to evaluate the interobserver and test-retest reliability of elbow joint position sense measurements at 45°-60°-75° flexion angles using the mobile application "Angle Meter".

Methods: 74 healthy individuals aged between 18-25 were included in the study. Joint position sense at 45°-60°-75° elbow flexion angles was evaluated using a universal goniometer and a mobile application called "Angle Meter". 2 different researchers made measurements for interobserver reliability. For test-retest reliability, the same measurements were repeated for each participant at 3-day intervals. The intraclass correlation coefficient (ICC) and Spearman Correlation coefficient between the results of the two applications were calculated.

Results: In the evaluation between 2 observers, a high level of correlation was found between the results in all angles (p = 0.001), (45° r = 0.954, 60° r = 0.986, 75° r = 0.966). In test-retest reliability, a high level of correlation was found between the results in all aspects (p = 0.001), in the evaluations made at 3-day intervals (45° r = 0.977, 60° r = 0.979, 75° r = 0.951).

According to the ICC values calculated to evaluate test-retest and interobserver reliability, the mobile application was found to have excellent reliability in all aspects.

Conclusions: The mobile application called "Angle Meter" is a reliable evaluation tool for measuring joint position sense at 45°-60°-75° elbow flexion angles.

Keywords: Joint Position Sense, Mobile Application, Test-Retest Reliability, Interobserver Reliability

---

TEST-RETEST RELIABILITY ANALYSIS OF THE COMPREHENSIVE KINESIOPHOBIA ASSESSMENT SCALE

Havva ADLI [1], Gülfem Ezgi ÖZALTIN [2], Burcu TALU [2]

[1] Inonu University. Vocational School of Health Services, Department of Therapy and Rehabilitation, Malatya, Türkiye

[2] Inonu University. Faculty of Health Sciences, Department of Physiotherapy and Rehabilitation, Malatya, Türkiye

Purpose: This study aimed to evaluate the test-retest reliability of the newly developed Comprehensive Kinesiophobia Assessment Scale (CKAS) to evaluate kinesiophobia in a wide range.

Methods: The newly developed scale was created with the help of Google form and was applied twice with an interval of 3 days to 200 patients, 86 people with neurological diseases and 114 people with orthopedic diseases, to evaluate test-retest reliability. Intraclass correlation coefficient (ICC) and Spearman Correlation Coefficient between the results of the two applications, and Cronbach α values were calculated to determine internal consistency.

Results: Cronbach's alpha reliability coefficient for the entire scale was found to be $\propto$ =0.947. The internal consistency reliability number of the sub-dimensions of the scale was determined as "postural control" $\propto$ =0.941, "pain" $\propto$ =0.761, and "psychosocial interaction" $\propto$ =0.906. According to the ICC values calculated to evaluate test-retest reliability, it was seen that the factors for the entire scale had excellent reliability (ICC: 0.983). The ICC value of the sub-dimensions of the scale was determined as "postural control" ICC = 0.983, "pain" ICC = 0.925, and "psychosocial interaction" ICC = 0.973. In the correlation analysis between the two measurements, it was seen that there was a high level of correlation in the 3 sub-dimensions and the total score (p = 0.01) (postural control r = 0.963, pain r = 0.847, psychosocial interaction r = 0.946, total score r = 0.964).

Conclusions: The Comprehensive Kinesiophobia Assessment Scale is a reliable method that measures kinesiophobia in different disease groups.

Keywords: Kinesiophobia, Pain, Postural Control, Psychosocial Interaction, Scale

---

SHORT-TERM RESULTS OF EXTRACORPOREAL SHOCK WAVE THERAPY IN TRAPEZIOMETACARPAL OSTEOARTHRITIS: A CASE REPORT

Feray KARADEMİR [1], Adalet Elçin YILDIZ [2], Tüzün FIRAT [1], İbrahim Faruk ADIGÜZEL [3], Özlem ÜLGER [1]

[1] Hacettepe University, Faculty of Physical Therapy and Rehabilitation, Ankara, Turkiye

[2] Hacettepe University, Faculty of Medicine, Department of Radiology, Ankara, Turkiye

[3] Etlik City Hospital, Department of Hand Surgery, Ankara, Turkiye

Purpose: Trapeziometacarpal osteoarthritis (TMC OA) may lead to spasm or contracture of the adductor pollicis (AdP) muscle, narrowing the first web and potentially reducing pinch strength and dexterity. Treatments such as massage, stretching and orthotic support aim to maintain muscle elasticity and prevent thumb deformity. Extracorporeal shock wave therapy (ESWT) is effective in regulating muscle tone and viscoelastic properties, although its effect on AdP stiffness is not known. This case report investigates the effect of ESWT on functional and clinical outcomes in a TMC OA patient with AdP stiffness.

Methods: A 54-year-old woman with stage III TMC OA of the right thumb (Eaton-Littler classification) presented with palpable AdP muscle spasms. Shear wave elastography (SWE) was performed using an ACUSON S3000 ultrasound system to assess muscle elasticity. Outcome measures included pain (VAS), Disabilities of the Arm, Shoulder, and Hand (DASH) questionnaire, Michigan Hand Outcome Questionnaire (MHQ), SF-36 for quality of life, pinch strength, and Roles-Maudsley score for treatment satisfaction. After the baseline examination, the patients' AdP muscle was treated with ESWT (10 Hz, 2.4 bar, 1600 pulses) was applied to the AdP, one session per week for 6 weeks. After treatment, all assessments were repeated.

Results: At baseline, AdP muscle elasticity was 2 m/s (11 kPa), VAS pain score was 6.5, pinch strength was 3.7 kg and DASH score was 53.3. At six-week follow-up, the patient reported no pain and good treatment satisfaction (Roles-Maudsley score). The AdP muscle elasticity value was 1.2 m/s (8.0 kPa). Significant improvements were noted in pinch strength (4.5 kg), DASH score (20 points) and SF-36 subscores and MHQ subscores.

Conclusions: ESWT shows promise in reducing AdP muscle stiffness and improving functional outcomes in patients with TMC OA. Further research is needed to confirm these results and to investigate long-term outcomes.

Keywords: Trapeziometacarpal Osteoarthritis, Thenar Muscles, Shear Wave Elastography, Stiffness, Extracorporeal Shock Wave Therapy

THE EFFECT OF MENTAL FATIGUE INDUCED BY SMARTPHONE USE ON SHOULDER JOİNT POSITION SENSE

Ozan Bahadır TÜRKMEN [1] , Burçin AKÇAY [1]

[1] Bandirma Onyedi Eylül University, Faculty of Health Sciences, Department of Physiotherapy and Rehabilitation, Balikesir, Türkiye

Purpose: Mental fatigue has been found to have negative effects on performance in the literature. However, its effect on proprioception is not clear. Therefore, in this study, we aimed to investigate the effect of mental fatigue caused by phone use on shoulder joint position sense.

Methods: 40 young adults with a mean age of 31.7 years were included in the study. Mental fatigue was induced by 30 minutes of smartphone use. Shoulder position sense before and after the use of the phone was measured with a digital goniometer at 125, 90, and 55 degrees of shoulder flexion. A sample t-test was used to analyze the data.

Results: After mental fatigue, no significant differences were observed in the shoulder position sense at 125 (p:0.455), 90 (p:0.508), and 55 (p:0.585) degrees in the dominant extremity.

Conclusions: The results of this study indicate that mental fatigue induced by smartphone use does not affect shoulder position sense. In this study, only the position sense of shoulder flexion was examined, and it is recommended that all upper extremity joints and movement patterns should be examined in further studies.

Keywords: Mental Fatigue, Position Sense, Smart Phone

COMPARISON OF LOWER EXTREMITY MUSCLE BIOMECHANICS IN CHILDREN WITH HEMIPARETIC AND DIPARETIC CEREBRAL PALSY

Derya AZİM [1], Emine ATICI [2]

[1] Bandirma Onyedi Eylül University, Faculty of Health Sciences, Department of Physiotherapy and Rehabilitation, Balikesir, Türkiye
[2] İstanbul Okan University, Faculty of Health Sciences, Department of Physiotherapy and Rehabilitation, İstanbul, Türkiye

Purpose: This study compares lower extremity muscle biomechanics in children with hemiparetic and diparetic Cerebral Palsy (CP).

Methods: Sixteen children with Spastic CP, 8 hemiparetic and 8 diparetic, classified within GMFCS levels I-III, were evaluated at a private center in Istanbul. Muscle tone, stiffness, and elasticity of the Hamstring, Gastrocnemius, and Tibialis Anterior were assessed using the Myoton Pro device.

Results: The mean age was 9.12 ± 2.90 for the hemiparetic group and 8.12 ± 2.90 for the diparetic group. In the diparetic group, Hamstring tone was 16.76 ± 2.07, stiffness 261.63 ± 48.08, elasticity 11.19 ± 29.42; Gastrocnemius tone 15.59 ± 1.72, stiffness 251.13 ± 37.51, elasticity 0.94 ± 0.12; Tibialis Anterior tone 19.48 ± 2.94, stiffness 394.75 ± 57.80, elasticity 1.18 ± 0.19. In the hemiparetic group, Hamstring tone was 15.03 ± 2.02, stiffness 226.75 ± 51.06, elasticity 0.81 ± 0.22; Gastrocnemius tone 12.74 ± 4.78, stiffness 237.63 ± 57.21, elasticity 0.84 ± 0.12; Tibialis Anterior tone 18.63 ± 1.46, stiffness 392.13 ± 99.27, elasticity 1.05 ± 0.17. No significant differences were found between groups (p>0.05).

Conclusions: Although the diparetic group showed higher averages in muscle tone, stiffness, and elasticity, the differences were not statistically significant (p>0.05). This suggests no significant difference in muscle biomechanical properties between children with hemiparetic and diparetic CP. Children with hemiparetic CP are equally affected and should be considered similarly in treatment.

Keywords: Diparetic Cerebral Palsy, Hemiparetic Cerebral Palsy, Muscle Properties

VALIDITY AND RELIABILITY STUDY OF THE TURKISH VERSION OF THE "REGICOR SHORT PHYSICAL ACTIVITY QUESTIONNAIRE"

Berna Deniz DEMİR [1], Özgün UYSAL [2], Salih BARDAKCI [2], İrem DÜZGÜN [2]

[1] Hacettepe University, Graduate School of Health Sciences, Sports Physiotherapy, Ankara, Türkiye
[2] Hacettepe University, Faculty of Physical Therapy and Rehabilitation, Ankara, Türkiye

Purpose: To translate the Regicor Physical Activity Questionnaire (REGICOR-TR) into Turkish for adults, ensure its cultural adaptation, and evaluate its validity and reliability.

Methods: Ethical approval and permission from the questionnaire's authors were obtained. The translation and cultural adaptation followed Beaton et al.'s guidelines (1). The REGICOR-TR was administered to 233 healthy participants aged 18-65, both face-to-face and online. Participants with musculoskeletal disorders hindering physical activity, severe cardiovascular or systemic diseases, or cognitive impairments were excluded. Demographic data, including gender and age, were recorded.

The REGICOR-TR, consisting of six questions on leisure-time and physical activity over a typical month and two subsections on occupational activity and sedentary behavior, was administered alongside the International Physical Activity Questionnaire - Short Form (IPAQ-SF) (2). Fourteen days later, the REGICOR-TR was re-administered to 20 participants face-to-face and 20 participants online.

Results: The concurrent validity of REGICOR-TR was evaluated using the Spearman correlation coefficient with IPAQ-SF, showing a strong correlation for total scores (r=0.52), a moderate correlation for vigorous physical activity (r=0.36) and light physical activity/walking scores (r=0.44), and a weak correlation for moderate physical activity (r=0.11). Reliability was assessed with the intra-class correlation coefficient (ICC), yielding values from 0.82 to 0.95. Internal consistency measured by Cronbach's alpha was 0.9.

Conclusions: The REGICOR-TR is a more reliable questionnaire than IPAQ-SF and demonstrates similar validity (3). It effectively assesses leisure-time physical activities of Turkish adults, enhancing diversity in physical activity assessment and contributing to public health research and clinical applications.

Keywords: Exercise, Survey and Questionnaires

PARTICIPANT EXPERIENCES OF SIX WEEKS OF PILATES-BASED TELEREHABILITATION AMONG PATIENTS WITH MULTIPLE SCLEROSIS

Kader ELDEMIR [1], Arzu GUCLU-GUNDUZ [2], Ceyla IRKEC [3]

[1] Sivas Cumhuriyet University, Faculty of Health Sciences, Department of Physiotherapy, Sivas, Türkiye
[2] Gazi University, Faculty of Health Sciences, Department of Physiotherapy, Ankara, Türkiye
[3] Lokman Hekim University, Faculty of Medicine, Department of Neurology, Neuroimmunology Unit, Ankara, Türkiye

Purpose: This study aimed to explore the experiences and opinions of patients with Multiple Sclerosis (PwMS) who participated in six weeks of Pilates-based Telerehabilitation (Pilates-TR).

Methods: Ten PwMS who participated in six weeks of Pilates-TR (three sessions/weekly) were invited and agreed to be interviewed. Data were collected via interviews of participant experiences. Interviews were undertaken via phone or videoconferences. Participants were asked to provide feedback on various aspects of Pilates-TR, including their overall satisfaction, the most positive and negative aspects, and suggestions.

Results: The participants' attendance rate for the Pilates-TR was 100%. A satisfaction rate of 81-100% was reported for Pilates-TR. All participants stated that the telerehabilitation content was 100% sufficient. An analysis of participants' feedback about telerehabilitation revealed as most positive comments: "I had fun","My motivation increased","It broke the monotony", "It provided a new perspective on exercises","It prevented fatigue during transportation and made exercises easy to perform","I received individual attention","I did not have to use public transportation", "My use of technology increased", and "I was able to exercise without disrupting my daily activities" and as most negative comments: "I experienced technological problems","the connection was lost", and "I felt that I couldn't perform the exercises correctly". Furthermore, PwMS reported improvements in health problems following Pilates-TR.

Conclusions: Pilates via telerehabilitation can overcome participatory and accessibility barriers to exercise, and contribute to physical, social, and emotional well-being among PwMS.

Keywords: Multiple Sclerosis, Telerehabilitation, Pilates training, Patient Satisfaction

---

SATISFACTION, DIGITAL LITERACY, AND PERCEIVED BENEFIT LEVEL WITH A HOME-BASED REAL-TIME VIDEOCONFERENCING TELEREHABILITATION EXERCISE PROGRAM IN PEOPLE WITH PARKINSON'S DISEASE

Sefa Eldemir [1], Arzu Guclu-Gunduz [2], Rezzak Yilmaz [3], Muhittin Cenk Akbostancı [4]

[1] Sivas Cumhuriyet University, Faculty of Health Sciences, Department of Physiotherapy and Rehabilitation, Sivas, Türkiye
[2] Gazi University, Faculty of Health Sciences, Department of Physiotherapy and Rehabilitation, Ankara, Türkiye
[3] Ankara University, School of Medicine, Department of Neurology and Ankara University Brain Research Center, Ankara, Türkiye
[4] Ankara University, School of Medicine, Department of Neurology and Ankara University Brain Research Center, Ankara, Türkiye

Purpose: This study aimed to determine the satisfaction, digital literacy, and perceived benefit level in individuals with Parkinson's disease (PD) who underwent telerehabilitation.

Methods: Eleven PwPD (Hoehn & Yahr stage I-III) were recruited. All patients had previously received task-oriented circuit training-based telerehabilitation for upper extremity training (3 sessions/weekly, six weeks). Satisfaction was measured with the Telerehabilitation Satisfaction Questionnaire (TrSQ) and digital literacy was measured with the Digital Literacy Scale (DLS). The scores varied between 11-55 and 17-85, respectively, with a high score indicating high satisfaction or digital literacy level. The perceived benefit was measured with semi-structured interviews.

Results: Participants showed a high satisfaction level (48.45±2.20) in the TrSQ score and a low digital literacy level (29.27±7.96) in the DLS score. 100% of participants reported that they received telerehabilitation for the first time and would

like to receive it again. Two participants reported that their tremors had decreased. One participant stated that her writing was now understandable and that she could drink water without spilling. Five patients reported that they were now able to move faster in daily activities. Four patients reported that there was no improvement at the end of the treatment.

Conclusions: PwPD was highly satisfied with the telerehabilitation. Exercise implemented through telerehabilitation may improve the perceived benefits of patients. Although satisfaction is high when planning telerehabilitation, it should be taken into consideration that patients' digital literacy level may be low and therefore whether the patients are suitable for the selected telerehabilitation system.

Keywords: Parkinson's Disease, Telerehabilitation, Patient Satisfaction, Literacy

---

INVESTIGATION OF THE EFFECTIVENESS OF BACKUP SYSTEM TREATMENT IN INDIVIDUALS WITH CHRONIC LOW BACK PAIN

Yasemin Özel Aslıyüce [1], Müzeyyen Öz [2], Aybüke Fanuscu [1], Özlem Ülger [1]

[1] Hacettepe University, Faculty of Physical Therapy and Rehabilitation, Ankara, Turkey
[2] Çankırı Karatekin University, Faculty of Health Sciences, Çankırı, Turkey

Purpose: The primary aim of this study was to investigate the effect of Backup System (StimaWELL 120MTRS, Germany) on pain, function and catastrophisation in individuals with chronic low back pain.

Methods: The Backup System was administered to the patients over a period of 4 weeks, with 2 sessions per week, each session lasting 30 minutes. Waitlist control group did not receive any treatment. Pain intensity was assessed by Visuel Analog Scale (VAS), disability was assessed by Oswestry Disability Index (ODI), and catastrophisation was assessed by Pain Catastrophisation Scale (PCS). The evaluations were repeated before and after treatment.

Results: 20 individuals were included in the study, with 10 in the waitlist control group and 10 in the Backup group. VAS-rest ($p=0.011$), VAS-night ($p=0.012$) and ODI ($p=0.012$) scores improved in the Backup System group. However, there was no time-dependent improvement in the waitlist group ($p>0.05$). PCS did not show significant improvement in both groups ($p>0.05$).

Conclusions: Our research used a Backup System device that can deliver electrical stimulation to the whole back. After 4 weeks of treatment, there was a reduction in pain and an improvement in function. This device could be promising for a problem such as low back pain, where there are insufficient treatment options. There is a need for long-term follow-up studies with larger sample sizes.

Keywords: Electric Stimulation Therapy, Biomedical Technology, Back Pain, Chronic Pain