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Biopsychosocial-Based Exercise Model for Rheumatic Diseases Via Telerehabilitation: A Case Series with a One Year Follow Up

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Abstract

Purpose: This study aims to examine the sustainability of the biopsychosocial exercise performed by telerehabilitation on individuals with rheumatic disease, with and without supervision, and investigate the effect of the biopsychosocial-based exercise model on biopsychosocial status, general health status, and anxiety-depression levels of individuals. **Method:** Twenty patients with rheumatic diseases performed a biopsychosocial-based exercise model Cognitive Exercise Therapy Approach via telerehabilitation with physiotherapist-supervised and unsupervised exercises who continued for three sessions per week for 12 months. Outcome measures were Health Assessment Questionnaire, Hospital Anxiety and Depression Scale, and Cognitive Exercise Therapy Approach -Biopsychosocial Questionnaire. Patients were assessed at baseline, 3rd, 6th, 9th, and 12th months. **Results:** There was no significant difference by time for Health Assessment Questionnaire ($p=0.512$) and Hospital Anxiety and Depression Scale -anxiety and depression scores ($p=0.162$ and $p=0.825$, respectively) between the five measures at the one-year follow-up. Similarly, there is no significant difference in Cognitive Exercise Therapy Approach -Biopsychosocial Questionnaire score outcomes by time ($p=0.184$). **Conclusion:** In this study a group of rheumatic patients with face-to-face biopsychosocial exercise habits were able to maintain their exercise habits with real-time telerehabilitation with or without supervised during the 1-year follow-up period during the COVID-19 pandemic was shown. Although there was no improvement in the parameters during the pandemic period when social isolation and depression-anxiety disorders increased, the level of recovery which individuals had previously gained was not adversely affected and the healing properties were preserved with the help of telerehabilitation.

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ABSTRACT

Purpose: This study aims to examine the sustainability of the biopsychosocial exercise performed by telerehabilitation on individuals with rheumatic disease, with and without supervision, and investigate the effect of the biopsychosocial-based exercise model on biopsychosocial status, general health status, and anxiety-depression levels of individuals. **Method:** Twenty patients with rheumatic diseases performed a biopsychosocial-based exercise model Cognitive Exercise Therapy Approach via telerehabilitation with physiotherapist-supervised and unsupervised exercises who continued for three sessions per week for 12 months. Outcome measures were Health Assessment Questionnaire, Hospital Anxiety and Depression Scale, and Cognitive Exercise Therapy Approach - Biopsychosocial Questionnaire. Patients were assessed at baseline, 3rd, 6th, 9th, and 12th months. **Results:** There was no significant difference by time for Health Assessment Questionnaire ($p=0.512$) and Hospital Anxiety and Depression Scale -anxiety and depression scores ($p=0.162$ and $p=0.825$, respectively) between the five measures at the one-year follow-up. Similarly, there is no significant difference in Cognitive Exercise Therapy Approach -Biopsychosocial Questionnaire score outcomes by time ($p=0.184$). **Conclusion:** In this study a group of rheumatic patients with face-to-face biopsychosocial exercise habits were able to maintain their exercise habits with real-time telerehabilitation with or without supervised during the 1-year follow-up period during the COVID-19 pandemic was shown. Although there was no improvement in the parameters during the pandemic period when social isolation and depression-anxiety disorders increased, the level of recovery which individuals had previously gained was not adversely affected and the healing properties were preserved with the help of telerehabilitation.

Keywords: Telerehabilitation, exercise, rehabilitation, rheumatology, anxiety

INTRODUCTION

The World Health Organization (WHO) offered recommendations about physical activity for individuals with chronic diseases for the first time in 2020. They remark that the sedentary behaviors of individuals should be reduced.¹ Similarly, the European League of Arthritis Researchers (EULAR) recommendations underline the need for regular exercise to maintain health, and rheumatic diseases and the public are encouraged to do so.²

Telerehabilitation, a subfield of telehealth, is defined as providing rehabilitation services through communication and information technology, including telephone, internet, and videoconferencing between the patient and the health institution. In addition, it includes rehabilitation services such as evaluation, follow-up, intervention, training, and counseling.^{3,4} Exercise, and physical activity are some treatments which physiotherapists can provide through telerehabilitation. Exercise with telerehabilitation can be an effective alternative to reduce pain, improve physical function and quality of life in adults with physical disabilities.⁵ It is recommended the exercise through a video or an application to prevent physical inactivity.⁶ In this regard, telerehabilitation comes as an effective alternative to face-to-face treatment due to the COVID-19 pandemic.⁴ The sustainability of these habits in individuals with rheumatic disease, who have gained the habit of exercise in the face-to-face period, has gained importance during the COVID-19 pandemic.

The EULAR 2021 recommendations emphasize the importance of patient education, problem-solving, and primary self-management interventions such as cognitive-behavioral therapy. Changing individuals' perceptions of illness and cognition of pain, reconceptualizing the pain, and supporting the person psychosocially are substantial in rehabilitation self-management.⁷ However, studies stated that it is difficult to perform a biopsychosocial education with telerehabilitation.⁸ Today, in the presence of conditions such as a pandemic or for any other reason, the importance of sustainability of biopsychosocial treatment in self-management has been emphasized when there is a difficulty in accessing health services face-to-face.⁷

This study aims to investigate the effects of the biopsychosocial based exercise model performed by telerehabilitation on individuals with rheumatic disease, with and without supervision on individuals' biopsychosocial status, general health status, and anxiety-depression levels.

MATERIALS AND METHODS

Participants

Before the COVID-19 pandemic, our patients with rheumatism, who routinely continued exercise therapy for many years in our clinic, had a WhatsApp group to communicate and socialize with each other and with their physiotherapists in their daily lives. One week after the start of pandemic, the participants in this group were asked to continue exercising with telerehabilitation via WhatsApp, and 54 of 91 patients volunteered.

Patients with a diagnosis of rheumatism, aged 18-65 years, no medical contraindications for exercise, regular participation in Cognitive Exercise Therapy Approach (Biopsychosocial-Based Exercise Model [BETY]) training before the pandemic, using WhatsApp, and following these messages during exercise and volunteering were included in the study. Patients who had difficulties reading and writing the messages and those who could not continue the exercise simultaneously were excluded from the study. As a result, a total of 20 participants diagnosed with rheumatism, who met the inclusion criteria, were included in the study (Table 1).

Table 1. Patient Demographics (n = 20)

Characteristic	Mean	SD
Age (years)	56.7	5.0
Body mass index (kg/m ²)	25.8	3.5
Diagnosis	n	
Fibromyalgia	9	
Rheumatoid arthritis	4	
Sjogren's syndrome	4	
Ankylosing spondylitis	3	
Osteoarthritis	3	

Characteristic	Mean	SD
Polymyalgia rheumatica	1	
Psoriatic arthritis	1	
Systemic lupus erythematosus	1	
Vasculitis	1	

N: number of patients; *SD*: Standard deviation; *BMI*: body mass index.

This study was approved by the University of Hacettepe University Health Ethics Subcommittee (GO 18/1182). The study was conducted in accordance with the Declaration of Helsinki standards. The patients were given verbal information on the aim of our research, and written informed consent was obtained from patients.

Intervention

The BETY was an exercise method which the patients already applied in our rheumatologic rehabilitation unit. The BETY's primary exercise type was function-oriented core stabilization exercises. In this method, which could be applied individually or in groups, nociplastic pain and mood management were combined with exercises. BETY includes mind-body interaction information management, pain management strategies, mood information management via dance therapy/authentic movement, and sexual information management. The patient's main functional complaint was corrected with exercises and pain management strategies in the first session.

The BETY nociplastic pain management strategy includes the following steps;

1. It was requested to stop the physical activity when pain was felt.
2. Due to the pain-central sensitivity relationship, the patient was asked to question whether he was worried about something and to turn his attention away from this point in case of anxiety.
3. Distraction from pain and negative emotion was achieved by positive thoughts and cognitive restructuring.
4. It was recommended to do exercise for the painful area

Sessions carried out with a physiotherapist or volunteer patient management at different periods of the study were applied for one hour, three days a week, in accordance with the habits of the patients (on the same day and at the same time as in the exercise program carried out before the pandemic). As with face-to-face BETY sessions, patients were asked to undertake the management of some sessions. During the telerehabilitation period, 14 patients volunteered to lead the sessions. These periods were planned as follows: Physiotherapist-supervised for 0-3 months and 6-9 months and voluntary patient management for 3-6 months and 9-12 months. The physiotherapist monitored all exercise sessions managed by volunteer patients. Physiotherapist-supervised and patient-supervised exercises who continued for three sessions per week for 12 months were described via a social texting platform to the exercise group. The exercise instructions were described via a social texting platform to the patients by the physiotherapist or volunteer patient. Video or audio recordings were not included in the instructions. Patients followed instructions and gave feedback by chat while doing exercises simultaneously.

Exercises were started with a standing position. At the beginning of each session, patients walked with small and big steps and warmed up with authentic movements accompanied by music for about 10 minutes. For the next 40 minutes, function-oriented core stabilization exercises were performed in standing, supine, prone, long sitting, and side-lying positions. BETY nociplastic pain management was applied simultaneously in the side-lying position. The patients expressed their negative cognition when they felt pain throughout the day during the week's arm openings exercises. When they lay on the other side, they expressed the positive cognitions they used for the coping skills during the same exercise. The last 10 minutes of the session was finished with the target of willpower in positive thinking used in cognitive reconstruction via dance therapy – the dramatization of the authentic move.

Outcomes

Demographic and physical assessments of the individuals such as age, height, body weight, body mass index were recorded. Outcomes were measured at baseline, 3, 6, 9, and 12 months. Health Assessment Questionnaire (HAQ), Hospital Anxiety and Depression Scale (HADS), and BETY-Biopsychosocial Questionnaire (BETY-BQ) were applied via WhatsApp. Evaluation results of anonymized patients were calculated and processed as data by a blinded evaluator who had no communication with the patients.

HAQ was used to assess the functional impairment and physical disability level in performing daily living activities. It includes 20 questions and eight subtitles, including dressing, sitting, eating, walking, hygiene, reaching out,

comprehending, and daily life activities. Each answer is rated between 0 (without any difficulty) and 3 (unable to do) points.⁹ A high score indicates low functionality.¹⁰

HADS is a multidimensional scale which evaluates depression and anxiety in diseases. This 14-item scale consists of Anxiety (HADS-A) and Depression sub-scale (HADS-D). The answer to each question is scored between 0-3 using the four-point Likert scale. The anxiety subscale has a cut-off score of 10/11, whereas the depression subscale has a cut-off score of 7/8. Scores beyond this threshold are associated with an increased risk of anxiety and depression.^{11,12}

BETY-BQ was developed by feedbacks received from rheumatic patients who participated in a BETY for many years. Scoring of the questionnaire was made using the 5-point Likert system. Each question is scored as "0 = No never, 1 = Yes rarely, 2 = Yes sometimes, 3 = Yes often 4 = Yes always". This patient self-reported biopsychosocial questionnaire includes questions about pain management, mood status, functionality, fatigue, socialization, sleep quality, and sexuality. Higher score indicates a lower biopsychosocial status.^{13,14}

Statistical Analysis

Statistical analysis was performed using SPSS Software Version 23 (SPSS Inc., Armonk, New York, USA). The normality of data was assessed using both graphical (e.g., Q-Q plot, histogram, etc.) and analytical (e.g., Shapiro-Wilk's normality test) approach. Data were expressed as mean (standard deviation) and median values depending on the normality of the data. The Friedman test was used within the intervention group to analyze the longitudinal effects of the program. All of the tests were two-sided, and the statistical significance level is considered as $p \leq 0.05$.

RESULTS

Table 1 summarizes the characteristics of patients in the study population. All of the 20 patients were female. The mean age was 56.7 ± 5 years, and they had a mean BMI of 25.8 ± 3.5 kg/m². The patients suffer from one or more rheumatic diseases stated in Table 1. All patients had participated in face-to-face BETY sessions for at least one year before being included in the study.

Reported HAQ, HADS, and BETY-BQ values are summarized in Table 2 and shown in Figure 1. ;

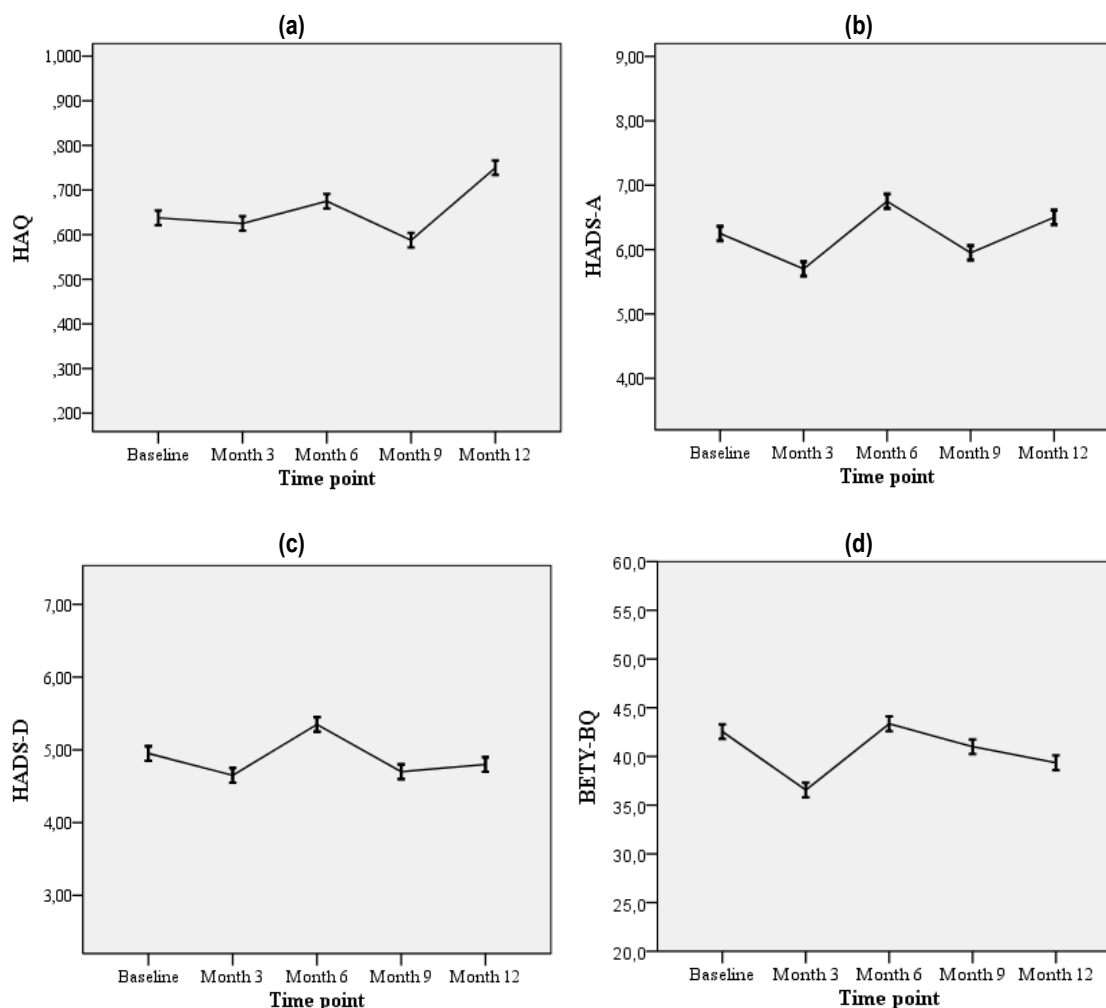
Table 2. HAQ, HADS-A, HADS-D and BETY-BQ Scores During the Course of Treatment

Time Point	HAQ		HADS-A		HADS-D		BETY-BQ	
	Median	IQR	Median	IQR	Median	IQR	Median	IQR
Baseline	0.9	0.3, 1.0	7.0	3.0, 8.0	5.0	1.2, 7.7	41.5	27.0, 58.2
Month 3	0.6	0.2, 0.9	6.5	2.2, 8.0	5.0	1.0, 6.7	37.0	18.7, 50.2
Month 6	0.6	0.2, 0.9	7.5	3.2, 9.0	6.0	2.2, 7.0	46.0	23.5, 59.0
Month 9	0.5	0.4, 0.7	6.5	3.0, 8.0	4.0	1.2, 7.7	44.0	23.2, 55.2
Month 12	0.6	0.4, 1.0	7.0	3.0, 8.7	4.0	2.2, 7.7	42.5	22.0, 54.0
p	0.512		0.162		0.825		0.184	

$P < 0.05$

IQR: interquartile range; HAQ: health assessment questionnaire; HADS-A: hospital anxiety and depression scale-anxiety; HADS-D: hospital anxiety and depression scale-depression; BETY-BQ: cognitive exercise therapy approach-biopsychosocial questionnaire.

Figure 1. Changes in the questionnaire outcomes over time: **(a)** Changes in functional status assessed by HAQ score over time; **(b)** Changes in anxiety assessed by HADS-A score over time; **(c)** Changes in depression assessed by HADS-D score over time; and **(d)** Changes in biopsychosocial status assessed by BETY-BQ score over time



Abbreviations: HAQ, Health Assessment Questionnaire; HADS-A, Hospital Anxiety and Depression Scale-Anxiety; HADS-D, Hospital Anxiety and Depression Scale-Depression; BETY-BQ, cognitive exercise therapy approach-biopsychosocial questionnaire.

Regarding the HAQ, it remained similar to the baseline value at the first three months. Although the HAQ score was higher at six months and 12 months than the baseline, it indicated an improvement between follow-up months 6 and 9 months during supervised group exercise and attained the baseline again. The Friedman test found no significant difference at these time points ($p = 0.512$). Table 2 and Figure 1a show HAQ score evaluation at five-time points.

The changes by time in the HADS-A and HADS-D were similar to the HAQ score (Table 2 and Figure 1 b and c). While the scores for anxiety and depression improved by three months, the scores worsened at month 6. Similarly, the anxiety and depression scores improved at month 9, which regressed at month 12. Nonetheless, the Friedman test yielded no significant difference by time for HADS-A and HADS-D scores ($p = 0.162$ and $p = 0.825$, respectively).

In the first three months, there was an improvement in the BETY-BQ score during a supervised group exercise. A similar result occurred between follow-up months 6 and 9. In the absence of professional supervision, though, while the BETY-BQ score regressed between follow-up months 3 and 6, it improved between follow-up months 9 and 12 (Table 2 and Figure 1d). However, the Friedman test revealed no significant difference in BETY-BQ score outcomes by time ($p = 0.184$).

DISCUSSION

Our study showed that a group of rheumatic patients with face-to-face biopsychosocial exercise habits were able to maintain their exercise habits with real-time telerehabilitation during the one-year follow-up period during the COVID-19 pandemic. During this period the improvement gained previously was not adversely affected and the healing properties were preserved via telerehabilitation.

Since the pre-pandemic period, it has been stated that real-time telerehabilitation effectively treats various musculoskeletal problems, improving physical function and pain. It is effective in the clinical management of these problems and is comparable to conventional methods.¹⁵ A recent systematic review examining the effects of telerehabilitation on pain, physical function, and quality of life in people with physical disabilities reported that exercise through telerehabilitation may be an alternative treatment, despite the lack of evidence in the literature.⁵ The participants in our study were patients who continued the same training face-to-face in the pre-pandemic period. The fact that patients still had the gains they made during the pandemic supports this statement. In the pandemic period, along with the prominence of exercise, many questions such as exercise type, intensity, content, effectiveness, follow-up of the exercising population, and exercises which should be given priority have arisen. For individuals looking to stay active during the COVID-19 pandemic, 150-300 minutes of aerobic exercise per week and moderate-intensity muscle-strengthening exercises twice per week were recommended, following American College of Sports Medicine recommendations.^{16,17} Function-oriented core stabilization exercises, which form the basis of BETY sessions, consist of exercises targeting strength, stabilization, and flexibility and are safely progressed to higher levels as the patient can do, starting from the elementary level. It also includes the aerobic and cognitive components through dance therapy-authentic movement.

Examining the effectiveness of digital interventions designed to increase compliance with physical activity in individuals with inflammatory arthritis, a systematic review provided moderate-quality evidence and emphasized that facilitating strategies for online exercise and psychosocial support should also be included in treatment.¹⁸ As a facilitating strategy in our study, visual imagery was used to perform the exercises correctly. The patients were informed about the benefits of each exercise via WhatsApp during the exercise session. In addition, the increased social isolation during the pandemic period was improved by maintaining communication with other individuals in the group.

In recent studies, the presentation of individualized treatment approaches based on the biopsychosocial health model on the internet has started to come to the fore. An online cognitive behavioral therapy (CBT) model was developed to be combined with exercise therapy for patients with knee osteoarthritis at high risk of chronic pain after total knee arthroplasty. In this model, physiotherapists were used as mentors to optimize patients' compliance with the program and were trained on CBT principles by an experienced psychologist. The feasibility phase of the created iCBT program has been completed, and it is aimed to conduct a multicenter randomized controlled study.¹⁹ In the present study, the fact that patients with rheumatism were included in the BETY program face-to-face in the pre-pandemic period and mastered the essential elements of the treatment allowed the same program to be continued with telerehabilitation with or without supervised during the pandemic period.

Serrat et al carried a multi-component program called FIBROWALK, which was effective in FM patients before, including pain neuroscience training, therapeutic exercise, cognitive behavioral therapy, and mindfulness training, into virtual format during the pandemic. In this study, in which 151 FM patients were randomly assigned to the FIBROWALK group consisting of weekly videos together with standard treatment and only to the standard treatment group, FIBROWALK was recommended at the end of 12 weeks with its positive effects on functional disability, kinesiophobia, anxiety and depression parameters. However, there was a decrease in the scores of the study group in this study, which used HADS to evaluate anxiety and depression, the scores before and after the treatment remained above the cut-off values.²⁰ In our study, our patients were followed up in real-time for one year. There was no significant change in HADS scores over time. However, the HADS scores of our patients remained below the depression and anxiety cut-off values from the beginning. The reason for this was interpreted as this group of patients, who all exercised regularly in the pre-pandemic period, already had some healing properties. Therefore, in this period when social isolation and depression-anxiety disorders increase, although there was no improvement in the evaluated parameters, it is very important that the previously gained development was not negatively affected. It is crucial to maintain these healing characteristics

According to EULAR's recommendations for individuals with inflammatory arthritis, patient education should be given by trained patients in a multidisciplinary team as well as health professionals.²¹ In addition, within the scope of cognitive-behavioral therapies, the patient should not remain passive in their treatment, instead they should take some control and responsibility over their health and life, which is, take an active role in order to see the effects of the treatment.²²

In this context, our study was the first example in the literature in which the exercises were performed under the leadership of volunteer patients in some periods during the telerehabilitation process.

Limitation

A limitation of this study is the lack of a control group. Thereby, the outcomes of this study should be interpreted with caution. With the pandemic, newly rheumatic individuals could not be assessed as they could not go out and access the hospital. Therefore, it was not possible to evaluate by creating a control group who does not do exercise, one-year follow-up with three-month intervals, and self-management investigation. However, the primary aim of this study was to see the effect and sustainability of BETY, which is a biopsychosocial exercise model, in individuals who previously applied it face-to-face, with telerehabilitation applied in groups for one year during the pandemic period. The results of this study can be discussed in detail by making comparative studies with other biopsychosocial exercise models.

CONCLUSION

Increasing physical activity levels and engaging in regular exercise is crucial for rheumatism sufferers during the pandemic period, when inactivity is on the rise globally. Although studies on telerehabilitation in the sustainability of exercise are increasing, there is no consensus

BETY, a biopsychosocial-based exercise model, can be applied to rheumatic patients via telerehabilitation in addition to face-to-face was shown with this case series. Since the patients had applied BETY before, they had no difficulty in adapting to telerehabilitation and no concentration problems were reported during the application of the exercise by texting. It was remarkable that improvements during the exercises under the supervision of a physiotherapist were sustainable also under the supervision of rheumatic individuals. Therefore, this study also assumed that self-management skills of rheumatic individuals increased by continuing and managing BETY sessions under pandemic conditions. The studies in these areas should be widespread, and there is a need for comparative studies.

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