



Original Article

Effects of individual and group exercise programs on pain, balance, mobility and perceived benefits in rheumatoid arthritis with pain and foot deformities

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Abstract. [Purpose] To verify the effects of individual and group exercise programs on pain, balance, mobility and perceived benefits of rheumatoid arthritis patients (RA) with pain and foot deformities. [Subjects and Methods] Thirty patients with RA pain and foot deformity were allocated into two groups: G1: individual exercise program and G2: group exercise program. The variables analyzed were Numerical Rating Scale (NRS) for pain, Berg Balance Scale (BBS) for balance, Timed Up & Go Test (TUG) and Functional Reach (FR) for mobility, and Foot Health Status Questionnaire (FHSQ-Br) for perceived benefits. Both exercise programs consisted of functional rehabilitation exercises and self-care guidance aimed at reducing pain and improving balance and mobility. Intragroup comparisons of variables between A1 (pre-intervention) and A2 (post-intervention) were performed. [Results] Patients in both groups were similar in A1 (pre-intervention) in all the variables analyzed. Comparison between A1 and A2 for each variable showed improvement for G1 in the NRS, BBS, FR, TUG and in four out of ten domains of FHSQ-Br. G2 showed improvement in the NRS, BBS and eight out of ten domains of FHSQ-Br. [Conclusion] Both individual and group programs revealed benefits for patients with RA, however, group exercise programs showed better perception of benefits.

Key words: Exercise therapy, Mobility limitation, Rheumatoid arthritis

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INTRODUCTION

Rheumatoid arthritis (RA) is a common systemic disease in which foot involvement has been largely damaged. Synovial hypertrophy and capsular tension generated by hyperplasia, ligamentous laxity, muscular imbalance and ultimately joint subluxation and dislocation all play a role in the development of foot deformities in RA. Furthermore, inflammation causes destruction in the cartilage and pericapsular structures. Due to these changes, the loading on joints causes different deformities and constitutes a severe disability in the patient's mobility and functional independence.

A functional foot must reveal musculoskeletal integrity such as joint alignment and range of motion, mobility and muscular strength¹⁾. Healthy feet are also essential for posture and balance control, as well as effective propulsion during gait and mobility^{2, 3)}. Many reports state that impairment of foot somatosensory information leads to balance instability and produces a severe negative impact on mobility and in activities of daily living^{4, 5)}. Plantar sensitivity is decreased in patients with RA, reinforcing that RA patients show deficits in balance and functional activities as a result of alterations of foot functioning^{2, 3, 6)}.

Despite the significant importance of pharmaceutical intervention, physiotherapy and training exercises are also mean-

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ingful to patients with RA⁷⁻¹⁰). However, RA patients tend to avoid physical activity due to their fear of overloading or pain exacerbations^{10, 11}). There is a need for interventions that support RA patients in overcoming barriers of pain and foot deformities.

In our study, we elaborated two programs: one for individual exercise and one for group exercise. The programs take into consideration that participants are chronic patients with mobility limitations and foot pain, who rely on public healthcare and who would benefit from fast and effective programs. Both programs will provide similar exercises and guidelines for self-care.

Our objective is to verify the effects of individual and group exercise programs on pain, balance, mobility and perceived benefits of rheumatoid arthritis patients with pain and foot deformities.

SUBJECTS AND METHODS

The study was conducted in the Divisão de Fisioterapia do Hospital das Clínicas da Faculdade de Medicina da Universidade de São Paulo. Approval was obtained from Local Ethics Committees (CAPESq N° 276/06). Patients were informed about the study, and their written informed consent was obtained.

Participants who were admitted in this study were diagnosed with RA, complaining of pain and foot deformity, with more than five years of disease and classification I–III of global functional status in RA (American Rheumatism Association 1991 revised criteria for RA). Subjects were excluded if they had a neurological or respiratory pathology, sensorial systems diseases, previous surgery in lower limbs or trunk, dizziness, cognitive impairments or other musculoskeletal disorder associated with RA. During the period of the study, prescription medication could not be changed. If changes in medication were needed, the participant continued the treatment, however, the patient would be excluded from the study.

From the waiting list of RA patients referred to the Physiotherapy Service of the hospital, the secretary of the service allocated patients into groups G1 and G2 sequentially.

The study was outlined as shown in Fig. 1.

All measurements were carried out by trained examiners. Measurements of all the variables were performed for both groups in the pre-intervention period (A1) and post-intervention period (A2) so that the effect of the treatment could be verified.

The Numerical Rating Scale (NRS) was applied to pain. Patients were asked about the intensity of foot pain in the last 24 hours on a scale of 0 (no pain) to 10 (worst pain).

The Berg Balance Scale (BBS)¹² was used for balance. BBS was developed to measure balance among older people with impairment in balance function, and it was translated and validated for our language and country. It uses 14 items (graded 0–4), and the maximum score is 56 points, where the higher scores denote better balance performance.

Mobility was measured with two tests: (i) Functional Reach (FR)¹³. FR has been proposed as a clinical measure of dynamic mobility; it is the measurement of the maximum distance of the outstretched arm at shoulder height that one can reach without moving his/her feet. (ii) Timed Up & Go Test (TUG)¹⁴. The test begins with the patient sitting in a chair, then standing up, walking three meters, turning around, walking back, and ending when the patient sits down again. The test is timed in seconds, while the patient performs the test from the beginning to the end. The time taken to complete the task is strongly correlated to level of mobility.

For self-perception of benefits, the questionnaire Foot Health Status Questionnaire (FHSQ-Br) was applied¹⁵. The FHSQ-Br is a validated tool that measures the level of foot health status in relation to factors regarding the quality of life and lifestyle. It has been used to investigate the outcome of foot surgery and foot interventions. After patients completed the questionnaire, the scores were obtained on a scale from 0 (poorest health) to 100 (best possible health).

For the applied interventions, exercise programs addressing G1 and G2 were composed of functional rehabilitation exercises and self-care information. Foot exercises emphasized alignment, joint mobility and muscular synergy. Balance training was carried out with trunk

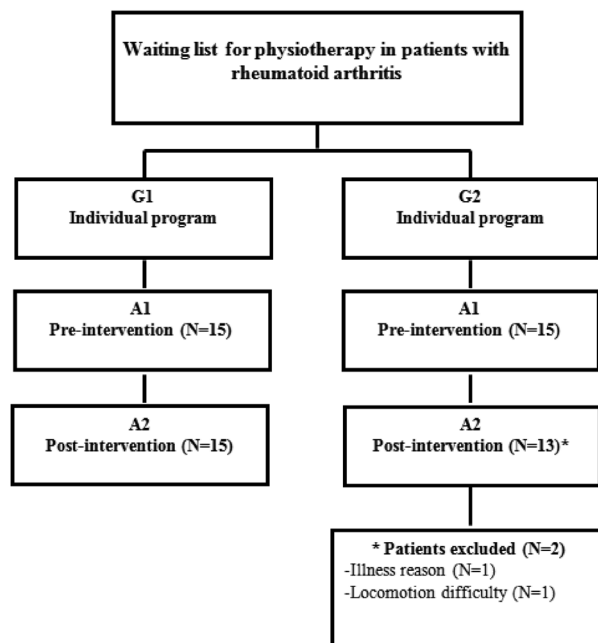


Fig. 1. Study outline diagram
Group 1: Individual exercise program. Group 2: Group exercise program. A1: Pre-intervention, A2: Post-intervention, 30 days after A1.

control, and mobility in activities of daily living was included. Both programs were applied in two weekly sessions of 60 minutes each, over four weeks. The programs were composed of Part A: foot self-care, Part B: foot training, Part C: balance training and Part D: mobility training. The program was delivered on an individualized basis for G1 and in groups for G2. For both groups, the sessions comprised exercises of Part A to Part D with progressive difficulty throughout the treatment.

In G1, the emphasis and progression of the exercises were applied according to the patient's performance. The patient was assisted individually under direct supervision of the physiotherapist.

In G2, patients received practical training for exercises and orientation on how to perform them correctly. During the treatment, patients received a handout listing the exercises and orientations, developed especially to be performed in a home setting. The exercises took into consideration an easy way of learning and accomplishing the tasks, in addition to safety during execution so as not to put the patient at excessive risk of pain, falls or articular overload.

The programs are shown in Fig. 2.

RESULTS

Socio-demographic and clinical characteristics are shown in Table 1. Considering the characteristics, groups were homogeneous, except for G2 which revealed to be older ($p=0.016$) and with lower body weight ($p=0.011$) when compared to G1.

All participants used their medications for controlling the disease, prescribed by their rheumatologists. During the period of this study, none of the patients showed modifications in response to this conduct.

There were no differences between the two groups in all the variables analyzed in A1.

Table 2 shows median and interquartile ranges for both groups in pre- and post-intervention assessment for all the variables.

Table 3 shows median and interquartile range for both groups in pre- and post-intervention assessment for each domain in the FHSQ-Br.

DISCUSSION

The majority of the studies on RA, address muscular strength, joint mobility or orthotics as rehabilitation models. Our study addressed exercise programs and orientation of foot self care and progressive exercise to improve balance and mobility, which was delivered in group or individualized; exercises programs was planned to be also executed during usual daily movements for example, going up and down the stairs, sitting down and getting up and housekeeping activities. Considering physical limitations of this chronic condition the possibility to practice the exercises in daily movements may be strongly beneficial to RA patients.

This study showed improvements in both groups in regards to pain, balance, mobility and perceived benefits in patients with RA. Individual exercise programs applied to G1 patients led to significant improvement in the variables related to pain (NRS), balance (BBS), functional mobility (TUG) and in four out of ten FHSQ-Br domains. Group exercise programs applied to G2 patients led to significant improvement in the variables related to pain (NRS), balance (BBS) and in eight out ten FHSQ-Br domains.

Patients from G1 received similar treatment to those in G2, however, the progression was applied according to the patient's performance, always under direct and individual supervision of the physiotherapist. Many researchers believe that a program of balance and mobility needs to be individually tailored because older people vary considerably in their physical capacity and health in response to exercise. These authors suggest a list of strategies to improve balance that can be integrated into the participant's everyday activities¹⁶.

In G2, some factors can improve perceived benefits, better perception and acknowledged improvement. Activities carried out in groups allow higher socialization, entertainment and contact with people who suffer from the same limitations caused by RA, thus improving motivation towards exercise practices¹⁶.

The effectiveness of individual and group exercise therapy for patients with knee or hip osteoarthritis were shown to be beneficial¹⁷, corroborating with our findings that there is no evidence of the superiority of one modality (individual or group) over the other. Our study also revealed that both programs are beneficial to RA patients.

Another important aspect to consider is that our RA patients, who rely on public healthcare, often report pain, physical limitation, and financial and transportation burdens to reach rehabilitation centers. With regard to that, illustrative handouts, including orientations and a few sessions of physiotherapy, play an important role and can potentially help to decrease trips to the hospital, to remember medical recommendations and to improve functional activities^{9, 18, 19}.

About the exercise programs applied in G1 and G2, we believe that interventions for mobilizing toes and feet articulations were crucial for treating issues of balance, especially functional mobility. The movements of segments were transferred to functional movements, such as sitting and getting up, and going up and down the stairs, observed and oriented to be performed with body alignment and in the correct movement plane and axis.

In order to maintain feet articulation intact and performing its functions, daily prevention and feet care are necessary². This information has been confirmed through the improvements reported in our study. A manual therapy is a technique that helps to restore proper functions and movements²⁰.

Part A – Foot Self-care

1- Self-care

- Feet hygiene and moistening to prevent infections and sensorial facilitation.
- Adequate choice of shoes to control excessive local pressure and generate comfort to the feet.
- Adequate treatment for callosities.
- Tactual stimulation at plantar region with cotton, soft brush and soft textured ball to stimulate sensorial perception and facilitate muscular response.

2- Feet alignment

- General manipulation of feet tissues.
- Manual articular traction for longitudinal alignment of the toes.
- Podalic bandage for alignment of plantar adipose tissue.

Part B – Foot Training

3- Feet muscles training

- Training feet intrinsic muscles.
- Training feet intrinsic muscles associated with feet and ankle movements.
- Functional training emphasizing muscular resistance during feet movement.

Part C – Balance Training

4- Lower limbs training

- Neuromuscular facilitation technique to stimulate muscular synergies and functional mobility.
- Lower limbs strengthening exercises.

5- Trunk training

- Exercises for lumbar erector muscles.
- Trunk control exercises to facilitate reach and handling activities.

6- Sensorial integration

- Standing exercises with eyes opened and closed.
- Exercises using stable and unstable surfaces.

Part D – Mobility Training

7- Functional reach training

- Training of reaching movements in different directions.

8- Walking training

- Gait training: phases of gait and weight shifting.
- Walking training using visual and somatosensorial distractors.

9- Functional training

- Exercises emphasizing activities performed on a daily basis applying all the requirements obtained in previous exercises, e.g.: going up and down the stairs, sitting down and getting up, using feet stabilizers and muscular synergy to control lower limbs and trunk.
- Exercises emphasizing housekeeping activities, e.g.: doing the dishes, sweeping the floor and picking up objects off the floor.

General Orientations: In all sessions the patients were oriented how to perform the exercises and self-care at home.

Fig. 2. Individual and group exercise program of functional rehabilitation exercises and self-care information

The Wilcoxon signed-rank test was applied to verify the effect of programs comparing the results between A1 and A2 in both groups. A p-value <0.05 was considered statistically significant.

This study has some limitations. Considering the chronic conditions and functional limitations of the patients, these programs can assist the physiotherapist in treatment of RA patients, however, it is difficult to define the moment in which new motor acquisitions were already assimilated and learned by patients. Follow-up of this study is necessary in order to assess the effectiveness of the programs following the end of the intervention. Finally, our sample was not large enough and it is possible that some differences are beneath the analysis performed.

Considering the chronic conditions and functional limitations of the patients, these programs can assist the physiotherapist

Table 1. Socio-demographic and clinic characteristics of RA patients (n=28)

Variables		Group 1	Group 2
N		15	13
Age (years)	Mean ± dp	54.3 ± 9.28	62.5 ± 4.35
Gender	Female, N (%)	11 (73.3%)	13 (100.0%)
	Male, N (%)	4 (26.7%)	0 (0%)
Weight (kg)	Mean ± dp	70.9 ± 12.7	60.7 ± 10.01
Schooling	Illiterate, N (%)	1 (6.7%)	0 (0.0%)
	1° degree, N (%)	9 (60.0%)	6 (46.2%)
	2° degree, N (%)	3 (20.0%)	4 (30.8%)
	3° degree, N (%)	2 (13.3%)	3 (23.1%)
Marital status	Single, N (%)	2 (13.3%)	4 (30.8%)
	Married, N (%)	10 (66.7%)	4 (30.8%)
	Divorced, N (%)	3 (20.0%)	1 (7.7%)
	Widowed, N (%)	0 (0.0%)	4 (30.8%)
Work situation	Active, N (%)	2 (13.3%)	0 (0.0%)
	Inactive, N (%)	4 (26.7%)	5 (38.5%)
	Retired, N (%)	9 (60.0%)	8 (61.5%)
Duration of disease (years)	Mean ± dp	13.3 ± 4.98	22.9 ± 15.05
Functional classification	I, N (%)	1 (6.7%)	2 (15.4%)
	II, N (%)	6 (40.0%)	4 (30.8%)
	III, N (%)	8 (53.3%)	7 (53.8%)
Deformities	N (%)		
Hallux valgus		5 (33.3%)	8 (61.5%)
Claw/hammer toe		7 (46.7%)	7 (53.8%)
Flat foot		8 (53.3%)	5 (38.5%)
Cavus foot		3 (20.0%)	0 (0.0%)
Collapse of the transverse arch		8 (53.3%)	10 (76.9%)
Drift of plantar pad		9 (60.0%)	9 (69.2%)
Overlapping fingers		6 (40.0%)	3 (23.1%)
Forefoot abduction		0 (0.0%)	0 (0.0%)

Table 2. The median and interquartile range for A1 and A2 in G1 and G2 showed by the Wilcoxon test for Numerical Rating Scale, Berg Balance Scale, Functional Reach and Timed Up & Go

Variables	G1 (Individual exercise program)			G2 (Group exercise program)		
	A1	A2	p	A1	A2	p
	Median (IQR)	Median (IQR)		Median (IQR)	Median (IQR)	
NRS (score)	5 (4)	3 (3)	0.002	6 (3.5)	5.5 (4)	0.012
BBS (score)	51 (5)	55 (3)	0.002	48 (10)	53 (3)	0.002
FR (centimeter)	26.7 (9.5)	28.7 (10.4)	0.008	14.87 (6.0)	17.5 (8.0)	0.390
TUG (seconds)	11.0 (3.4)	8.6 (2.9)	0.001	12 (2.4)	11.8 (2.6)	0.377

G1: Group 1; G2: Group 2; NRS: Numerical Rating Scale; BBS: Berg Balance Scale; FR: Functional Reach; TUG: Timed Up & Go Test; IQR: interquartile range; A1: pre-intervention; A2: post intervention, 30 days after A1

Table 3. The median and interquartile range for A1 and A2 in G1 and G2 showed by the Wilcoxon test for perceived benefits

FHSQ-Br (score)	G1 (Individual exercise program)			G2 (Group exercise program)		
	A1	A2	p	A1	A2	p
	Median (IQR)	Median (IQR)		Median (IQR)	Median (IQR)	
FP	43.8 (36.9)	60.6 (30.0)	0.015	41.9 (35.6)	54.4 (36.6)	0.013
FF	50.0 (31.3)	62.5 (56.3)	0.230	50.0 (31.3)	75.0 (37.5)	0.005
S	8.3 (33.3)	25.0 (41.7)	0.012	8.3 (25.0)	0.0 (33.3)	0.467
FGH	25.0 (25.0)	25.0 (17.5)	0.062	12.5 (25.0)	25.0 (35.0)	0.001
FGHI	34.3 (30.8)	43.3 (20.0)	0.039	30.8 (14.4)	46.3 (31.7)	0.004
GH	40.0 (30.0)	30.0 (40.0)	0.300	60.0 (50.0)	50.0 (45.0)	0.377
PA	33.3 (27.8)	50.0 (27.8)	0.092	38.9 (22.2)	50.0 (44.4)	0.014
SC	62.5 (25.0)	75.0 (50.0)	0.123	62.5 (37.5)	75.0 (25.0)	0.001
V	43.8 (25.0)	50.0 (12.5)	0.054	50.0 (28.1)	62.5 (46.9)	0.125
HI	44.6 (15.4)	48.8 (22.8)	0.111	51.2 (24.3)	62.9 (29.4)	0.015

G1: Group 1; G2: Group 2; FHSQ-Br: Feet Health Status Questionnaire; FP: feet pain; FF: feet function; S: shoes; FGH: feet general health; FGHI: feet general health index; GH: general health; PA: physical activity; SC: social capacity; V: vigor; HI: health index; IQR: interquartile range; A1: pre-intervention; A2: post-intervention, 30 days after A1

in treatment of RA patients, however, it is difficult to define the moment in which new motor acquisitions were already assimilated and learned by patients. Follow-up of this study is necessary in order to assess the effectiveness of the programs following the end of the intervention.

Exercise programs delivered on an individual basis or in groups are beneficial and can be used in rehabilitation of patients with RA. Although both groups presented objective improvements, patients treated in groups showed better perception of the benefits.

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