

Concise report

Maintenance of physical activity after Internet-based physical activity interventions in patients with rheumatoid arthritis

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Abstract

Objectives. To investigate the maintenance of physical activity 12 months after two 1-year Internet-based physical activity interventions in patients with RA.

Methods. This follow-up study was a randomized comparison of an Internet-based individualized training (IT) and a general training (GT) programme in sedentary RA patients. Outcome measures included physical activity (meeting public health recommendations for moderate physical activity, i.e. 30 min for at least 5 days/week; or vigorous physical activity, i.e. 20 min for at least 3 days/week), functional ability and quality of life (QoL).

Results. Of the 152 RA patients who completed the initial study, 110 (72%) were available at follow-up. At 24 months, the proportions of patients meeting public health recommendations for moderate intensity physical activity were significantly higher compared with baseline in both the IT and GT groups (19 and 24%, respectively, $P < 0.05$), whereas the proportions of patients meeting the recommendation for vigorous activity was only significantly higher compared with baseline in the IT group ($P < 0.05$) but not in the GT group. There were no differences between the IT and GT groups concerning proportions of patients meeting moderate or vigorous physical activity recommendations at 24 months. Apart from a significantly higher RAQoL score in the IT group at 24 months compared with baseline, there were no significant differences within or between the programmes regarding functional ability or QoL.

Conclusion. In RA patients, the effectiveness of both an individualized and a general 1-year Internet-based physical activity programme is sustained with respect to moderate intensity physical activity up to 12 months after the interventions.

Key words: Rheumatoid arthritis, Physical activity, Maintenance, Relapse, Internet-based interventions.

Introduction

Generally, in the general population, regular physical activity has various health benefits such as a reduced

risk of coronary heart disease, diabetes, hypertension and colon cancer [1, 2]. In patients with RA, physical activity has a number of additional, disease-specific benefits such as improved functional ability [3], aerobic capacity, muscle strength and reduction of pain [4]. Despite these proven health benefits, such patients were less physically active than the general population [5–9].

So far, a number of studies evaluating interventions to promote physical activity in patients with arthritis have been published. In a meta-analysis of physical activity interventions for adults with arthritis, including 16 controlled studies specifically for RA, researchers concluded that these interventions have moderate positive effects on physical activity behaviour [10]. A randomized controlled trial compared a 1-year coaching programme with

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Submitted 24 February 2009; revised version accepted 5 August 2009.

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rehabilitation as prescribed in patients with early RA showed no differences in reaching a healthy physical activity level (≥ 30 min, moderate intensity, most days of the week) between the groups directly after the intervention, although the improvements of perceived health status and muscle strength were larger in the intervention group than in the control group [11]. In addition, another randomized controlled trial found that, directly after intervention, a 1-year Internet-based physical activity intervention with the provision of individually tailored supervision, exercise equipment and group contacts was more effective in increasing the level of physical activity than a 1-year Internet-based programme without these additional elements in RA patients [12].

Regarding the maintenance of physical activity after physical activity interventions in RA patients, only a few studies are available and the results are conflicting [13–18]. Thus, the aim of this study was to evaluate whether RA patients could maintain physical activity levels 12 months after finishing two 1-year Internet-based physical activity interventions.

Patients and methods

Study design and subjects

All RA patients who completed a randomized controlled trial comparing two Internet-based physical activity programmes were eligible for the follow-up study at 24 months [12]. The original study, including 160 patients, was performed between 2002 and 2004 in the rheumatology outpatient clinics of three hospitals (Leiden University Medical Center, Haga-Leyenburg Teaching Hospital and Reinier de Graaf Hospital). Inclusion criteria were: RA according to the ACR (formerly the ARA) 1987 criteria for RA [19, 20]; not physically active on a moderate intensity level for 30 min in succession for at least 5 days/week; having a computer with Internet facilities; and able to cycle on a bicycle ergometer. In the present follow-up study, we excluded the two patients who did not meet the public health recommendations on physical activity at a moderate intensity level, but did meet the recommendations regarding vigorous physical activity. Patients were randomized to a general training (GT) group, receiving general information on physical activity by means of a web site and e-mail, or to an individualized training (IT) group, receiving individual guidance by means of a web site and e-mail, a bicycle ergometer and group contacts. The training program of the GT group as well as the training program of the IT group have a total duration of 12 months. The medical ethics committees in all three participating centres approved the initial study and the follow-up study, and patients gave consent to both studies.

Outcome assessments

Measurements for the follow-up study were carried out at 24 months (12 months after the intervention) by means of questionnaires.

Physical activity. Physical activity was measured according to the proportion of patients meeting public health recommendations for physical activity [21]. For this purpose, two questions were posed. First, the participants were asked how many days a week they were physically active at a moderate intensity level for 30 min in succession, with physical activity at a moderate intensity level being defined as any form of physical activity that causes a small increase in breathing or heart rate (such as brisk walking, vacuuming or gardening) in the past 3 months. Second, participants were asked how many days a week they were physically active at a vigorous intensity level for 20 min in succession, with physical activity at a vigorous intensity level being defined as any activity that causes a large increase in breathing or heart rate (such as running, aerobics or heavy yard work) in the past 3 months. Based on these questions, the proportions of patients meeting the moderate and vigorous recommendations for physical activity were calculated.

Functional ability. Functional ability was assessed with the HAQ [22]. The HAQ covers 20 activities of daily living in eight dimensions, with the score of each activity ranging from 0 (without any difficulty) to 3 (unable to do). The total HAQ score is the average score of the eight dimensions [ranging from 0 (best possible function) to 3 (worst possible function)].

Quality of life (QoL). QoL was measured with the RAQoL questionnaire, consisting of 30 items with a yes/no (1/0) response format [23]. The overall score is the sum of the individual item scores, with a lower score indicating better QoL (range 0–30). In addition, a validated Dutch version of the RAND 36-Item Health Survey (SF-36) (RAND) was used, which included eight subscales [24]. Each subscale generated a score from 0 to 100, with higher scores indicating better health. The RAND can be converted into two summary scales: the physical and mental component summary scale.

Health care. Any changes in medication (DMARDs or NSAIDs, or both), the application of corticosteroid injection or surgery during the 12 months of follow-up were retrieved from the medical records. In addition, the use of health-care services and visits to various health professionals over the past 3 months were recorded via a questionnaire at 24 months.

Statistical analysis

Differences in the baseline characteristics, amount of physical activity, functional ability and QoL between the patients who did and who did not participate in the follow-up study were computed by means of the Mann–Whitney U or chi-squared test.

For physical activity, the proportions of patients meeting the moderate and vigorous recommendations at 24 months were computed. Proportions within the IT and GT groups were compared between baseline and 24 months, between 12 and 24 months and between the

two groups at 12 and 24 months with chi-squared and McNemar tests, where appropriate.

For continuous outcome measures, the median [interquartile range (IQR) expressed as the net result of 75th percentile minus 25th percentile] was computed. Follow-up values are given as the mean change scores from baseline with the 95% CI. Differences between time points between and within the IT and GT groups were computed by means of Mann–Whitney U and Wilcoxon signed rank tests, where appropriate.

To investigate whether the baseline and change scores of the HAQ, RAQoL and RAND-36, and change in medication and use of health care were associated with the achieved physical activity level, we compared these variables between patients meeting the public health recommendations for moderate physical activity at 24 months with those who did not, and between patients who met this recommendation at one or more of the time points during the intervention or follow-up with those who did not. For this purpose, the Mann–Whitney U or chi-squared test was used when appropriate.

For all analyses, a P value of ≤ 0.05 was considered statistically significant. All data were analysed using SPSS version 14.0 software (SPSS, Chicago, IL, USA).

Results

Patient characteristics

Of the 152 RA patients who completed the 12-month interventions, 110 eligible patients filled in the follow-up questionnaires at 24 months (Fig. 1). The 110 responders did not differ from the non-responders ($n=40$) for socio-demographic or disease characteristics, physical activity levels, functional ability and QoL at baseline or at 12 months (data not shown).

In the baseline characteristics of the 110 participants in the follow-up study, their median (IQR) age was 50.6 (13.1) and 51.0 (10.9) years, duration of RA 8.0 (8.1) and 5.9 (12.4) years and BMI 25.7 (5.5) and 24.9 (6.7) in the

IT and the GT groups, respectively. In the IT and GT groups, 43 (77%) and 40 (74%) patients were females; those with co-morbidity 26 (46%) and 20 (37%); living alone 10 (18%) and 7 (13%); and gainfully employed 32 (57%) and 31 (57%), respectively. No statistical differences were found in the baseline characteristics between the IT and GT groups

Physical activity, functional ability and QoL

Table 1 shows the proportions of patients being physically active at a moderate and vigorous intensity level and the results for functional ability and QoL at 0, 12 and 24 months in the IT and GT groups.

Moderate physical activity level. At 24 months, the proportions of patients meeting the recommendation for physical activity at a moderate intensity level were similar in both groups ($P=0.366$). In comparison with baseline, these proportions were significantly higher in both the IT group [n (%) = 10 (19%); $P < 0.05$] and in the GT group [n (%) = 13 (24%); $P < 0.001$]. In comparison with 12 months, this proportion had decreased at 24 months in the IT group, whereas at that time point an increase was seen in the GT group. However, neither of these differences reached statistical significance ($P=0.206$ and 0.083, respectively).

Six patients (11%) in the IT group and four (7%) in the GT group were meeting the moderate recommendation for physical activity at a moderate intensity level at both the 12- and 24-month time points ($P=0.509$).

Vigorous physical activity level. In comparison with baseline, at 24 months a significant increase in the proportion of patients meeting the vigorous physical activity level was found in the IT group [n (%) = 4 (7%); $P < 0.05$] but not in the GT group [$n=1$ (2%); $P=0.317$]. In comparison with 12 months, the proportion of patients meeting the vigorous physical activity level decreased significantly in the IT group at 24 months [$n=16$ (30%); $P < 0.001$], but not in the GT group [$n=5$ (9%); $P=0.059$].

Fig. 1 Flow diagram of the trial and follow-up studies.

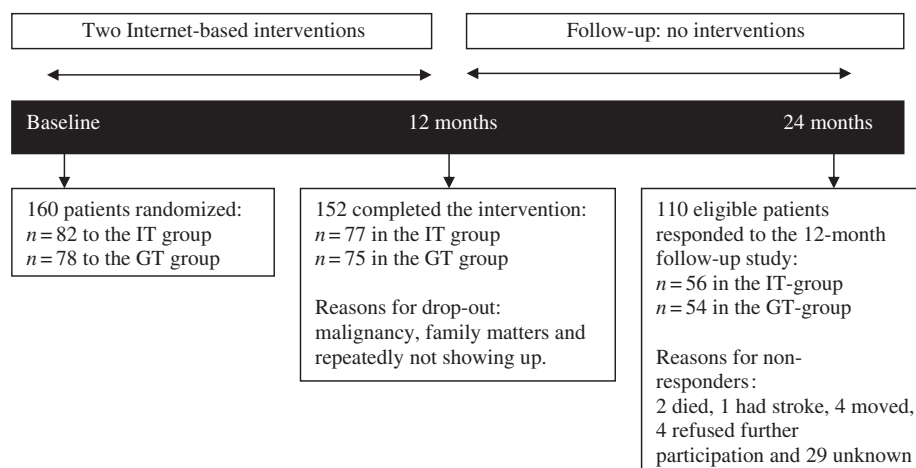


TABLE 1 Number (%) of RA patients physically active for 30 min in succession for at least 5 days/week, number (%) of RA patients vigorously active for 20 min in succession for at least 3 days/week, functional ability and QoL

	Baseline	12 months	24 months
Moderate activity for 30 min in succession for at least 5 days/week			
IT group, <i>n</i> = 54, <i>n</i> (%)	0	14 (26)**	10 (19)*
GT group, <i>n</i> = 54, <i>n</i> (%)	0	7 (13)*	13 (24)**
<i>P</i> -value IT vs GT group ^a		0.138	0.366
Vigorous activity for 20 min in succession for at least 3 days/week			
IT group, <i>n</i> = 54, <i>n</i> (%)	0	20 (37)**	4 (7)*
GT group, <i>n</i> = 54, <i>n</i> (%)	0	6 (11)*	1 (2)
<i>P</i> -value IT vs GT group ^a		0.003	0.158
Functional ability by HAQ score ^b			
IT group, <i>n</i> = 55	0.75 (1.00)	−0.09 (−0.18, −0.01)*	−0.04 (−0.14, 0.07)
GT group, <i>n</i> = 53	0.75 (0.69)	−0.08 (−0.17, 0.01)	−0.03 (−0.13, 0.07)
<i>P</i> -value IT vs GT group ^c		0.841	0.809
QoL by RAQoL score ^b			
IT group, <i>n</i> = 55	10.0 (9.5)	−1.5 (−2.51, −0.42)*	−1.3 (−2.58, 0.03)*
GT group, <i>n</i> = 53	10.0 (9.0)	−0.8 (−1.72, 0.08)	0.2 (−1.32, 0.89)
<i>P</i> -value IT vs GT group ^c		0.196	0.481
QoL by RAND-36 score			
Physical summary scale ^b			
IT group, <i>n</i> = 55	55.0 (41.9)	5.0 (0.4, 9.5)*	5.2 (−0.3, 10.6)
GT group, <i>n</i> = 54	54.7 (34.9)	4.2 (−0.6, 9.0)	1.7 (−3.2, 6.5)
<i>P</i> -value IT vs GT group ^c		0.941	0.667
Mental summary scale ^b			
IT group, <i>n</i> = 55	75.3 (25.6)	1.16 (−4.0, 6.3)	4.9 (−0.03, 9.8)
GT group, <i>n</i> = 54	73.1 (30.5)	0.06 (−4.3, 4.4)	2.7 (−2.6, 7.9)
<i>P</i> -value IT vs GT group ^c		0.924	0.990

^aBetween-group differences were analysed with the chi-square test and within-group differences with the McNemar test. ^bBaseline values are given as the median [IQR (expressed as the net result of 75th percentile minus 25th percentile)]. Follow-up values are given as the mean (95% CI) change from baseline values. ^cBetween-group differences were analysed with the Mann–Whitney U-test and within-group differences with the Wilcoxon test. **P* < 0.05 vs baseline. ***P* < 0.001 vs baseline.

Three patients (6%) in the IT group and zero patients in the GT group were meeting the recommendation for physical activity at a vigorous intensity level both at 12- and 24-month time points (*P* = 0.080).

Functional ability and QoL. At 24 months, there were no statistically significant differences between the two groups in the HAQ, RAQoL or RAND-36 physical and mental summary scales. At 24 months, the HAQ score and the RAND-36 physical and mental summary scales did not change significantly as compared with baseline within both groups. In the IT-group, however, the RAQoL score was significantly lower at 24 months than at baseline, whereas in the GT group no significant change of the RAQoL was seen. None of the differences between 12 and 24 months was statistically significant in either group.

No statistically significant differences were found in the baseline values or the change scores of the HAQ, RAQoL and RAND-36 or the baseline DAS28 scores between patients who did and who did not meet public health recommendations at 24 months or at any time point during the initial and follow-up studies. However, overall, a trend towards a greater improvement was seen for all

variables in the patients who became physically active than in those who did not (data not shown).

Health care. There were no significant differences in the proportions of changes in medication, IA injections or surgery in the follow-up period or health care usage over the past 3 months between patients who did and who did not meet public health recommendations on physical activity at a moderate intensity level at 24 months (data not shown). The same results were obtained for the comparison of medical treatment and health care use between patients who did and who did not meet physical activity recommendations at any time point during the initial and follow-up studies.

Discussion

This study shows that 12 months after completing two Internet-based physical activity programmes, significantly more RA patients were physically active at a moderate intensity level than at baseline in both groups. The effect on the proportion of patients meeting the recommendations on physical activity at a vigorous intensity level was only sustained in the intervention group; however,

the proportion of patients meeting these criteria at any time point was, overall, very small (<36%).

Six studies reported follow-up after a physical activity intervention in patients with RA [13–18], two of which reported their outcomes as proportions of patients performing specific physical activities [13, 14]. One of these studies was a randomized controlled trial comparing a 6-week self-management programme with no intervention [13]. In this study, 12 months after intervention, the percentage of RA patients performing flexibility and strengthening exercises increased significantly compared with baseline in the intervention group (an increase of 73–84% engaging in flexibility exercises and 55–67% in strengthening exercises; both $P < 0.001$), whereas no significant changes were found in the control group [14]. A second randomized controlled trial, compared a 9-day multidisciplinary programme aimed at increasing physical activity with no intervention, showed that 12 months after the intervention, the percentage of RA patients performing regular gymnastics was significantly higher compared with baseline in the intervention group (an increase of 18–45%, $P < 0.001$), whereas no significant changes were found in the control group [13]. In both these studies and our study, 12 months after the intervention the increase in the rate of physically active people was ~20%. The comparison is, however, hampered by differences in the patient population (the present study only included sedentary RA patients, whereas in the two other trials a considerable proportion of patients were already exercising at baseline). Moreover, the studies varied with respect to the nature of the intervention and the measurement of physical activity.

In the four studies including a follow-up of a physical activity intervention using continuous outcome measures for physical activity [15–18], in general a trend towards the maintenance of physical activity levels after 4- to 48-month follow-up was seen; only one study showed the achieved physical activity level decreased 12 months after the intervention.

In the lack of long-term effectiveness of physical activity interventions on functional ability and QoL, our findings are in concordance with some studies in RA patients [14, 16]. However, in some follow-up studies, the improvement of functional ability was maintained [13, 15, 17]. Again, comparisons between studies are difficult due to the variety in patient selection, interventions and outcome measures used. The lack of effectiveness of the physical activity programs on functional ability or QoL could probably be explained by other factors, for example the duration of the intervention. Perhaps a longer duration of the interventions and/or follow-up are required for an effect on functional ability or QoL.

Regarding the maintenance of physical activity interventions that are delivered by means of the Internet, no studies about RA patients are available for comparison. In healthy adults, a randomized controlled trial comparing two 12-week Internet-based physical activity interventions, consisting of weekly e-mail messages including a walking programme, one general programme

and one individualized programme comprised a 12-month follow-up [25]. In concordance with the results of our study, this study showed that the total time spent walking per week was significantly higher at 12-month follow-up as compared with baseline, with no differences between the two interventions. These results suggest that with a relatively simple Internet-based physical activity, health gains could be achieved in ~20% of the subjects. A substantial proportion of patients neither increased their physical activity levels at all during the initial and follow-up studies nor increased with the general or with the individual intervention. A challenge for the future will be to identify those sedentary persons for whom a general Internet-based intervention is sufficient and those who will need more intensive guidance by changing their physical activity behaviour, either by an Internet-based intervention or by using other means of delivery.

Our analysis, and that of other studies as well, was based on comparisons of proportions of patients. With regard to the level of individual patients, in our study, 11 and 7% of the patients in the IT and GT groups, respectively, were physically active according to the recommendation for physical activity at a moderate intensity level at both 12 and 24 months. This indicates that patients are switching their physical activity level at various time points, which was also seen in a previous study [14], in which 40 and 70% of the RA patients maintained their flexibility and strengthening exercises after a 12-month follow-up, 10 and 25% began performing these exercises (again) and 2–5% stopped.

However, these data should be interpreted with care as in that study, as well as in ours, patients were asked about their physical activity level over the last week [14] or past 3 months [12], so that their response might not have represented the whole time frame between the various measurement points. Asking patients about their physical activity behaviour in periods prior to >3 months might, however, introduce recall bias. The accurate and valid measurement of physical activity, either by questionnaires or by performance measures such as pedometers, is still a major challenge in health promotion [26, 27]. Another limitation of the present study was that about a quarter of the initial patient population was not available for follow-up, limiting the generalizability of the results. Furthermore, a measurement for disease activity was not included, since this follow-up study was a home-based survey and disease activity needs to be done in the clinical setting. Therefore, to what extent the changes in the level of disease activity could have influenced the level of physical activity remain unknown.

In conclusion, our study shows that the impact of 12-month Internet-based physical activity interventions on physical activity at a moderate intensity level is sustained 12 months after the intervention in RA patients. The provision of tailor-made physical activity interventions, varying in their duration, frequency, intensity and mode of delivery, according to the needs of individual patients is a challenge for the future. Future research should also explore the role of the various professionals involved in

the treatment of RA patients, including rheumatologists, clinical nurse specialists, physical therapists and rehabilitation specialists in guiding patients to achieve and maintain physical activity at the level of public health recommendations.

Rheumatology key message

- The level of physical activity is sustained 12 months after Internet-based physical activity intervention in RA patients.

Acknowledgement

The authors are indebted to all patients who participated in this study.

Disclosure statement: The authors have declared no conflicts of interest.

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