Research Letter

Title: Exercise Based Cardiac Rehabilitation: Is a Little Encouragement Enough?

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INTRODUCTION

Since the publication of the first systematic review in the late 1980's [1] the efficacy rationale for cardiac rehabilitation (CR) has evolved from a singular outcome of all-cause mortality to additional multiple outcomes including cardiac mortality, quality of life (QOL), aerobic fitness, cost-effectiveness and cost savings in the form of preventing hospital re-admissions [2]. In the past decade, the case for the efficacy of reduced all-cause mortality has been challenged [3,4] but two questions arise around this matter; firstly, has some of the effective potency of exercise-based CR been lost due to the much more aggressive nature of modern cardiovascular health promotion and standards of medical, pharmacological and surgical interventions being much improved [5]? Secondly, has the fidelity in research trials and in practice of an appropriate dose of the exercise been achieved, especially in those reports that have challenged the efficacy of CR [4]? In light of these questions, there has been a contemporary move to substantiating the efficacy of CR based on reduced hospital re-admissions, healthcare costs, and QOL [2]. Given that a number of reviews, letters to editors, post-hoc trial and audit data analysis have raised the question of exercise programme dose fidelity [6,7], the aim of the current study was to investigate the influence of exercise fidelity on measures of aerobic fitness (incremental shuttle walk test/ISWT and heart rate walking speed index/HRWSI), when patients were actively encouraged to achieve exercise intensities above 50% HRR.

METHODS

Following NHS ethics approval, patients from an existing CR programme were recruited to a group receiving either the normal exercise supervision (non-encouraged) (32 Male: 62.2 ± 11.7 yrs; 9 Female, 66.7 ± 7.8 yrs) or those receiving verbal encouragement to achieve an intensity >50% HRR (verbally encouraged) (9 Male: 66.9 ± 11.2 yrs; 2 Female: 72.5 ± 20.5 years) to ensure patients were exercising well within the prescribed intensity guidelines [8]. The

verbal encouragement was provided by a member of the research team at each of the aerobic exercise stations in sessions 2 (wk 1), 6 (wk 3) and 11 (wk 6). Patients in both groups completed the ISWT pre- and post-programme. In addition to distance covered, changes in aerobic fitness were assessed using the HRWSI [9]. The HRWSI aims to show improvements in aerobic fitness more objectively through a lower heart rate for any given walking speed; a kind of "cardiac economy" which is independent of the distance walked. During all sessions, continuous heart-rate monitoring was used to determine HRR via a wireless chest-strap system (Polar RS800CX,Polar Electro, Finland).

RESULTS

At weeks 1, 3 and 6, 36%, 48% and 18%, of participants in the non-encouraged group achieved exercising between 40-70% HRR for 20 mins respectively. Similarly, at these same time points for the verbally encouraged group, 36%, 33% and 57% exercised between 40-70% for 20 or more mins. There were no differences between groups in the time spent exercising <40%, 40-49%, 50-59%, 60-70% and >70% of HRR ($P > 0.05$). On average neither of the groups attained exercising between 40-70% HRR for a minimum of 20 mins during the 6 weeks (Table 1) nor did any group complete an 8-week programme consisting of 16 supervised sessions. However, in the verbally encouraged group, there was a systematic progression of time spent at between 40-70% HRR from 12.4 ± 4.4 mins at week 1 to 18.6 ± 4.1 mins at week 6 (Table 1).

Table 1. Time spent performing exercise in respective HRR ranges in both groups.

Variable	Standard group not receiving encouragement				Group receiving encouragement				P value
	Week 1 (n = 33)	Week 3 (n = 29)	Week 6 (n = 28)	Mean	Week 1 (n = 11)	Week 3 (n = 9)	Week 6 (n = 7)	Mean	
<40% HRR[1] (mins)	12.5 ± 11.3	7.3 ± 9.3*	10 ± 10.0*	9.3 ± 2.1	14.7 ± 13.7	9.8 ± 10.4*	10.4 ± 11.4*	11.6 ± 2.2	0.29
40-49% HRR (mins)	6.6 ± 5.3	6 ± 5.4	6.2 ± 6.2	6.3 ± 0.2	5.5 ± 5.4	5.1 ± 4.9	8.3 ± 5.5	6.3 ± 1.4	0.86
50-59% HRR (mins)	4.5 ± 4.2	5.1 ± 4.4	3.2 ± 3.2	4.3 ± 0.8	4.3 ± 4.5	4.9 ± 4.8	6.6 ± 4.0	5.3 ± 1.0	0.95
60-70% HRR (mins)	3 ± 4.2	4.5 ± 5.6	3 ± 3.2	3.5 ± 0.7	2.6 ± 3.3	4.5 ± 4.4	3.7 ± 2.8	3.6 ± 0.8	0.64
>70% HRR (mins)	3.4 ± 4.6	5.7 ± 8.0	6.4 ± 9.3	5.2 ± 1.3	3.1 ± 7.0	5.8 ± 8.9	2.4 ± 5.6	3.8 ± 1.5	0.9
Total exercise time 40-70% HRR (mins)	14.1 ± 4.6	15.6 ± 5.1	12.4 ± 4.2	14 ± 4.6	12.4 ± 4.4	14.5 ± 4.7	18.6 ± 4.1	15.2 ± 4.4	0.8
% and number of participants 40-70% HRR overall	36, 12	48, 14	18, 5	34	54,6	67,6	71,5	64	n/a

[1] HRR, Heart rate reserve
Data is presented as mean ± SD.
P values represent between group differences
* Significantly different compared to week 1

ISWT distance walked improved in both groups compared to baseline where the verbally encouraged group increased by 186.4 ± 28.9 m and the non-encouraged group by 138.2 ± 98.7 m ($P < 0.01$). These improvements were, however, not significantly different from one another ($P > 0.05$). The change in HRWSI in the verbally encouraged group (-0.35 ± 1.4 beats per 10m walked) were significantly greater than the non-encouraged group (+0.54 ± 0.68 beats per 10m walked) ($P = 0.016$) but neither group showed a significant decrease compared to baseline ($P > 0.05$).

DISCUSSION

This study showed that some encouragement was not enough to get the verbally encouraged group to attain a minimum of 20 mins at 40-70% HRR per session. As verbal encouragement was only given during 3 sessions (25% of the programme duration), it is not known whether, in the remaining 75% of the exercise sessions, the patients were exercising at 40-70% HRR for 20 mins, but it is assumed unlikely. However, unlike the non-encouraged group, those patients who were verbally encouraged, did show a systematic progression of increased duration of 4 mins between 40-70% HRR at the end of week six. Whilst there were improvements in performance in the ISWT test (increased walking distance), with no improvement in HRWSI, this was likely due to familiarisation/motivation or confidence in performing the tests and not a physiological adaptation [9].

Given that the required fidelity of this CR programme was not achieved, in terms of little or no difference in aerobic fitness as a result of a lower-than-recommended exercise dose, it would appear that the expected exercise potency was not achieved. If this programme does represent the general pattern of delivery of other UK programmes [4,10], then it highlights both the need for exercise practitioners to spend more time encouraging patients to attain the minimum intensity/duration guidelines (20 mins at 40-70% HRR) and service-provision to

better ensure this occurs on three or more times per week [8]. This programme offered two sessions per week, with a recommendation that patients attain their third dose of 20 mins in their own time. However, it is unknown if this was monitored by the CR team.

Considering that previous trials have questioned the efficacy of CR to promote improvements in mortality [3,4] but have not reported fully on the fidelity of the exercise programmes, this study demonstrates that when fidelity is monitored and not achieved, it is unlikely that aerobic fitness of the patients will improve.

In conclusion, verbally encouraging patients to exercise above 50% HRR on few infrequent occasions meant that patients did not achieve the recommended exercise dose of 20 mins minimum at 40-70% HRR. However, compared to those who were not encouraged, the encouraged group showed a progression in the length of time exercising in the "right" intensity from week 1 to week 6. We propose that with more frequent encouragement this may succeed to achieving the required exercise dose in each training session. This needs to be tested by a suitable powered RCT.

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