Journal of Psychosomatic Research, Vol. 34, No. 3, pp. 327-337, 1990.
Printed in Great Britain.
0022-3999/90 $3.00 + .00


# PSYCHIC EFFECTS OF PHYSICAL TRAINING AND RELAXATION THERAPY AFTER MYOCARDIAL INFARCTION

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(*Received 22 March* 1989; *accepted in revised form* 1 *December* 1989)

**Abstract**—The psychological impact of exercise training and relaxation therapy was investigated in 156 myocardial infarction patients. They were randomly assigned to either exercise plus relaxation and breathing therapy (Treatment A: $n = 76$) or exercise training only (Treatment B: $n = 80$). Patients in Treatment A improved on three out of eight psychological measurements (anxiety, well-being, feelings of invalidity). No change was demonstrable in Treatment B. The difference between the treatments was significant for wellbeing ($p < 0.005$).

Physical outcome, measured by exercise testing was positive in about half of the patients (Treatment A: 55%, Treatment B: 46%). A negative outcome occurred less in Treatment A ($p < 0.05$). Training success was not associated with psychic benefit. The association differed for the two treatments. It was concluded that exercise training was effective for some but not for all cardiac patients, and that a psychic effect of exercise could not be demonstrated. Relaxation therapy enhanced physical and psychic outcome of rehabilitation.

## INTRODUCTION

CARDIAC rehabilitation studies often report psychological benefit of physical training: patients are highly motivated and they feel more self-confident [1–5]. Psychological measurements, however, do not always support those findings [2, 4]. In six controlled studies [2, 6–10] a variable and modest psychic effect of exercise for coronary patients was found. Moreover, increased physical fitness is not consistently associated with psychological benefit [7, 9, 11–13]. Although physical training is frequently used [14], the questions arise whether exercise is an adequate treatment and whether it is crucial to obtain a physical training effect. Possibly, the psychological value of rehabilitation depends more upon other factors, for instance the social context of a programme [7, 11, 15] or on the interaction of exercise with a more psychological treatment [12, 16].

In this study the effect of relaxation and breathing therapy in addition to physical training is investigated. Several studies have demonstrated psychic effect of relaxation therapy in cardiac patients, as a part of a behavioural treatment [8] or as an independent treatment [17–21]. Some authors consider it useful for all patients to acquire relaxation skills [21, 22], others assume that only some persons need to learn it [23]. The utility of this therapy is seen in its explicit psychophysiological nature. It is acceptable to cardiac patients, because it utilizes movements and 'exercise', but the emphasis is on learning more adequate ways of handling tensions and efforts, and on experiencing inner quiet. Thus, the combination of exercise and relaxation may induce greater or different psychic changes than exercise only.

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The questions to be studied are first, whether exercise training or relaxation therapy improve psychic functioning, and if so, whether relaxation therapy has any incremental value to exercise as a sole treatment; second, whether psychic benefit is associated with a successful training outcome and if so, whether this association differs between the two forms of treatment.

## PATIENTS AND METHODS

### *Patients*

Cardiac patients are referred after discharge from several hospitals, to the regional rehabilitation center at St. Joannes de Deo Hospital, Haarlem, The Netherlands. A total of 156 myocardial infarction patients were eligible for the study and were randomly allocated to two treatment protocols. Patients who needed individual (psychosocial) help in addition to exercise training were excluded. There were no age limits. Median age was 56 yr, ranging from 36 to 76 yr. Only nine women were referred for rehabilitation. Table I summarizes the clinical data at entry to the trial for the two randomized groups.

### *Procedure*

In order to study the incremental effect of relaxation and breathing therapy, patients were randomly allocated to either of the two treatment protocols. Randomization was done after the intake interview for the rehabilitation programme and after informed consent. Patients who needed individual help were referred for relaxation therapy or psychosocial counselling and were excluded from the study. Graded exercise testing was performed, and self-administered questionnaires were completed by the patients, before and after rehabilitation.

### *Measurements*

*Psychological questionnaires.* (1) The Heart Patients Psychological Questionnaire (HPPQ), constructed to measure the well-being of cardiac patients [24], consists of four scales: (a) well-being, 12 items (score range 12–36) including e.g. 'I feel at ease nowadays', I feel healthy'; (b) subjective invalidity, 12 items (score range 12–36) including e.g. 'I could do a lot more work formerly', 'I don't have enough stamina'; (c) displeasure, 10 items (score range 10–30), including e.g. 'I'm often out of sorts without knowing why'; (d) social inhibition, six items (score range 6–18), including e.g. 'I don't like having a lot of people around me'. All answers have to be given on a three-point scale: true/?/untrue. (2) Anxiety was measured by STAI in two aspects: state and trait anxiety [25]. For each of them there are 20 items which have to be answered

TABLE I.—BASE-LINE CLINICAL DATA

| Variable | Treatment A | Treatment B | *p* |
|---|---|---|---|
| No of cases | 76 | 80 | |
| Age (yr) | 55.4 (8.2) | 55.7 (8.1) | ns |
| Males | 71 (93) | 76 (95) | ns |
| Working | 50 (66) | 51 (64) | ns |
| Married/partner | 69 (91) | 74 (93) | ns |
| Infarction size | | | |
| Unknown | 4 (5) | 4 (5) | |
| Small | 20 (26) | 27 (34) | ns |
| Medium | 27 (36) | 22 (27) | |
| Large | 25 (33) | 27 (34) | |
| Anterior infarction | 29 (38) | 24 (30) | ns |
| Mild heart failure | 14 (18) | 13 (16) | ns |
| Post-infarction angina | 28 (37) | 25 (31) | ns |
| Medication on discharge: | | | |
| Beta blockers | 20 (26) | 25 (31) | ns |
| Diuretics | 27 (36) | 20 (25) | ns |
| Anti-anginal | 13 (17) | 18 (23) | ns |
| Start of physical training | | | |
| (weeks after hospital discharge) | 4.8 (2.8) | 5.2 (2.1) | ns |
| Maximum work load (Watt) | 136 (24) | 132 (21) | ns |

Data are reported as events and percentage of cases or as means (SD).

on a four-point scale (score range 20–80). (3) Sleeping habits, consisting of questions about hours of sleep and day-time rest and about sleep quality, measured with a 10-item questionnaire [26]; answers are given as yes/no (score range 0–10), e.g. 'I often wake up during the night'. (4) Functional complaints, a 25-item questionnaire constructed to measure complaints, often mentioned by cardiac patients but not typical of angina pectoris; the frequency is indicated on a three point scale: often/sometimes/never (score range 25–75). Examples are: 'Inability to breathe in fully', 'Pain in the chest, especially when I sit quietly'.

*Exercise testing.* A graded exercise test was performed on a bicycle ergometer (Monark). The test started with a 1-min period of cycling at 60 cycles a minute with zero load, then for 2 min at 60 Watt. The test was continued by increasing the workload with 30 Watt every 2 min until symptoms limited the patient to continue or until the physician terminated the test. The occurrence of angina pectoris, ST-abnormalities and severe dysrhythmias were noted. ST-abnormalities were mostly ST depressions greater than 2 mm, horizontal or downsloping. A bipolar ECG was recorded during the last half-minute before the work load was increased. Blood pressure was measured by cuff sphygmomanometry before the test and directly after maximum work load. The cardiologist was blind to the treatment condition of the patient.

*Treatment programmes*

Rehabilitation consisted of a programme of exercise training plus relaxation training (Treatment A) or of exercise training only (Treatment B). Thus, all patients followed the same physical conditioning programme. This consisted of five weeks interval training, once a day for half an hour, on a bicycle ergometer. Training was done in groups of four patients supervised by two physical therapists. Each patient was exercised up to 70% of the peak heart rate attained at pre-training exercise testing (Karvonen method).

Relaxation training was given once a week in six individual sessions of 1 hr each, by five specially trained therapists. Three of them were psychologists, one a medical doctor and one a physical therapist. They did not participate in the exercise programme.

Several procedures for active and passive relaxation were employed, centering around a respiratory technique. This is described in detail elsewhere [27, 28]. In short, EMG Feedback of the frontalis muscle is used for muscle relaxation and for monitoring unnecessary inspiratory effort. The patient learned to observe and elicit a 'shift' in the respiratory pattern, such that inspiration expanded both the lower abdomen and the costal margin, expiration was moderated and slow. Manual technique was applied to elicit breathing movements which involve the trunk as a whole and require less effort. This was practised first in the supine, relaxed position, but later also sitting and standing ('active relaxation'). The patient was asked to practice at home, as a daily routine, and when experiencing chest discomfort. Care was taken to introduce relaxation as a normal part of the routine rehabilitation procedure, rather than special psychological help. The treatment itself was presented in a neutral fashion: emphasizing the technical and physical aspects of relaxation, its utility in dealing with daily stress, and providing a rationale in the form of the biofeedback instrumentation and breathing 'exercises'. The therapists were aware, however, that this was a strategy to facilitate possible psychotherapeutic implications of the treatment. Each session the patient was asked to express his experiences with relaxation.

*Data analyses*

Statistical tests were performed on the measurements separately, using nonparametric tests. Wilcoxon's rank sum test was applied to repeated measurements of ordinal level, and Mann–Whitney $U$ test for independent samples of ordinal level (Treatments A and B). Repeated measurements of a nominal nature were tested with McNemar's test for change, whereas comparison between independent samples was done with chi square analysis. If the data consisted of more than two categories, chi square analysis for trends was done.

*Training benefit.* In order to get a single measure indicating the efficacy of physical training, the measurements obtained at exercise testing pre and post training were integrated into a composite criterion. Using this criterion, patients were trichomotized as follows: (a) patients with little or no change, (b) patients who improved ('training success') or (c) patients who deteriorated ('training failure'). The procedure is described elsewhere [29]. In short, the measurements were ranked into four levels according to their clinical relevance, (1) signs of cardiac dysfunction (ST-abnormalities, angina pectoris, serious dysrhythmias), (2) exercise tolerance (change $\geq$ 30 Watt), (3) heart rate at highest common work load (change $\geq$ 10% of initial value), (4) systolic blood pressure response (change $\geq$ 12 mm Hg). At each level a patient could be assigned to success or failure when a positive or negative change in the particular measurement had occurred. For cardiac signs a negative change had priority over a positive one. Levels two to four represented physical fitness. Dropouts were included and classified as far as possible on the basis of the reason for not completing the programme. Patients who stopped the training because they resumed their normal daily activities were considered successful; patients who stopped the training for cardiac reasons were considered a failure; patients who stopped for other reasons were assigned to 'no change'. Thus, all randomized subjects could be classified.

*Psychic and somatic function.* In order to obtain a clear-cut picture of the relation between physical and psychological benefit the psychological questionnaires were grouped into two sets, labeled 'PSY' and 'SOM'. PSY represented psychic aspects and consisted of anxiety-state, anxiety-trait and depression, SOM represented somatic aspects, consisting of subjective invalidity, sleep quality and functional complaints. The scores on the questionnaires were standardized as follows: the pre-post changes were expressed as a percentage of their possible change, which is the difference between the initial score and the minimum score in the case of decrease and the maximum score in the case of an increase. PSY and SOM were each computed as the summed percentage change on three questionnaires. Pre-post change on the scale 'well-being' of the HPPQ was treated as a separate indicator of psychic outcome (WELL).

As a kind of exploration and for reasons of simplicity the scores of PSY, SOM and WELL were dichotomized as positive or negative change on the basis of which patients could be classified as PSY = + or PSY = −, SOM = + or SOM = − and WELL+ or WELL−. Combining with the dichotomized training outcome resulted in four outcome categories, indicating the concurrence of physical and psychological outcome, for PSY, SOM and WELL. The purpose was to investigate the distribution of the individual patients among these categories.

## RESULTS

A total of 156 myocardial infarction patients were admitted to the study (Treatment A: 76, Treatment B: 80). There were no differences between the two treatment groups in base-line clinical data (see Table I). Three patients had previous coronary artery grafting, 16 patients had experienced recurrent infarction and 26 patients had a history of angina pectoris. Classification of infarction size was according to the peak serum enzyme levels. In most hospitals, an infarction is classified as small when the serum glutamic–oxaloacetic transaminase (SGOT) level is elevated, but remains below 60 U/l, whereas the infarction is classified as large when SGOT levels rise above 120 U/l. In 47 patients the infarction was classified as small, in 49 patients as medium and in 52 as large. In eight patients the enzyme levels were not available. In-hospital signs of heart failure (hypotension, cardiothoracic ratio >50%, pulmonary congestion) were present in 27 patients (17%). Assessment of ventricular function was not performed routinely in the participating hospitals. About two-thirds of the patients worked. The treatment programme started on the average in the fifth week after hospital discharge.

### *Training outcome*

A total of 139 patients completed the exercise programme (Treatment A: $n = 67$; Treatment B: $n = 72$). There were no significant differences in exercise parameters between the treatments before rehabilitation. Maximum work load increase after training was small but statistically significant for both treatments (Treatment A: 5%, Treatment B: 6.4%). An increase of at least 30 Watt was present in 39 (28%) patients and a similar decrease in seven patients (5%). Heart rate reduction after training was more pronounced for Treatment A at all levels of effort. The difference between treatments did not reach significance. For 20 patients (14%) heart rate at highest common work load was reduced more than 10% of the initial value, whereas it was increased for eight patients (6%). The average changes in blood pressure were negligible and did not differ between treatments. However, 31 patients (22%) had a reduced systolic blood pressure at highest common work load (more than 12 mm Hg lower) and 23 patients (17%) had an increased pressure. Thus, there was a moderate effect on physical fitness (higher work load, lower heart rate and blood pressure response at a given work load). Some patients clearly improved, whereas a minority deteriorated.

ST-abnormalities were present in 44 patients at the initial stress test (Treatment A: 24; Treatment B: 20). After training, they disappeared in half the cases in Treatment A and in only four patients for Treatment B, whereas they appeared anew in only one patient in Treatment A and in five patients in Treatment B. The difference between treatments was significant ($p < 0.02$). Angina pectoris at stress testing was present in 18 patients (nine in both treatments). It disappeared in four patients in treatment A and in six in Treatment B, but appeared in one patient in Treatment A and in three in Treatment B. Serious arrhythmias were present in 14 patients and remained stable, except for one patient in Treatment B, who developed complex ventricular arrhythmia during training.

Following the composite criterion, the signs of cardiac dysfunction had priority over measurements of physical fitness. In addition, patients who dropped out of the study were classified on the basis of the reason for not completing the programme. Two patients felt good enough to resume full activity; they were considered a successful outcome (both in Treatment A). Nine patients had to stop for cardiac reasons (Treatment A: $n = 3$, Treatment B: $n = 6$) and they were considered a negative outcome: three patients had coronary artery bypass operations, two developed arrhythmias, three were readmitted to hospital for unstable angina pectoris and one patient died. Six patients stopped for non-cardiac reasons (Treatment A: $n = 4$, Treatment B: $n = 2$); they were considered neutral with regard to physical outcome. Thus, according to the 'intention to treat principle', all randomized patients could be classified. A successful outcome was present in 42 patients in Treatment A (55%) and in 37 patients in Treatment B (46%). A negative outcome was present in 15 patients in Treatment A (20%) and in 27 patients in Treatment B (33%), whereas 19 patients did not change in Treatment A (25%) and 16 in Treatment B (21%). Thus, in Treatment A the overall outcome is shifted more to the positive side. The difference between treatments is almost significant ($p = 0.09$). A substantial number of patients has a training 'failure'. The odds for a negative outcome, however, are higher for Treatment B (odds ratio: 2.07; 95% confidence interval: 1.002–4.28; $p < 0.05$).

*Psychic outcome*

Out of 139 patients who completed the programme, two did not complete the questionnaires. Thus, measurements were available from 137 patients (Treatment A: 66, Treatment B: 71). Table II shows that anxiety-trait did not change after rehabilitation; a reduction in anxiety-state appeared in Treatment A ($p < 0.05$), but not in Treatment B. The difference between treatments was not significant.

TABLE II.—PRE-TEST VALUES AND CHANGES (PRE-POST DIFFERENCES) IN ANXIETY FOR TREATMENTS A ($n = 66$) AND B ($n = 71$)

| | Pre-test $\bar{x}$(SD) | Change $\bar{x}$(SD) | Within treatment significance |
|---|---|---|---|
| Anxiety state | | | |
| Treatment A | 37.6 (9.2) | −2.4 (9.0) | $p < 0.05$* |
| Treatment B | 34.7 (10.2) | −0.6 (7.2) | ns |
| Anxiety trait | | | |
| Treatment A | 37.4 (8.9) | −0.7 (8.0) | ns |
| Treatment B | 35.3 (10.0) | −0.2 (5.9) | ns |

*Between treatment significance: ns.

TABLE III.—PRE-TEST VALUES AND CHANGES (PRE-POST DIFFERENCES) IN SOMATIC FUNCTIONS FOR TREATMENTS A ($n = 66$) AND B ($n = 71$)

| | Pre-test $\bar{x}$(SD) | Change $\bar{x}$(SD) | Within treatment significance |
|---|---|---|---|
| Sleep quality | | | |
| Treatment A | 7.3 (2.5) | 0.03 (1.9) | ns |
| Treatment B | 7.5 (2.5) | 0.14 (2.0) | ns |
| Sleeping hours | | | |
| Treatment A | 7.2 (1.3) | 0.06 (1.0) | ns |
| Treatment B | 7.3 (1.2) | 0.09 (1.0) | ns |
| Daytime naps (quarter hours) | | | |
| Treatment A | 2.5 (2.1) | 0.1 (1.6) | ns |
| Treatment B | 2.8 (2.3) | −0.8 (2.3) | $p < 0.01$* |
| Functional complaints | | | |
| Treatment A | 35.0 (5.9) | 0.5 (4.9) | ns |
| Treatment B | 35.0 (8.4) | 0.4 (3.5) | ns |

*Between treatment significance: $p < 0.05$, two-tailed.

Table III shows the outcome on somatic aspects. On the average, sleeping quality and sleeping hours were fairly good before and after rehabilitation. Treatments did not differ in this respect. Prior to rehabilitation most patients took a nap at noon (Treatment A: 73%, Treatment B: 66%). Daytime naps decreased considerably for Treatment B ($p < 0.005$), whereas they remained the same in Treatment A. The difference between the treatments was significant ($p < 0.05$). Functional complaints slightly increased after training in both treatment groups.

The HPPQ (Table IV) showed a clear improvement in well-being for Treatment A ($p < 0.0001$), whereas patients in Treatment B did not feel better. The difference between treatments was significant ($p < 0.005$). Feelings of invalidity were reduced for Treatment A ($p < 0.01$), but not for Treatment B. The difference between treatments was not significant. With regard to displeasure and social inhibition, changes were negligible.

Thus, three out of eight measurements of psychological function showed an improvement for Treatment A, whereas for patients in Treatment B no change was demonstrable in this respect.

TABLE IV.—PRE-TEST VALUES AND CHANGES (PRE-POST DIFFERENCES) IN HPPQ FOR TREATMENTS A ($n = 66$) AND B ($n = 71$)

| | Pre-test $\bar{x}$(SD) | Change $\bar{x}$(SD) | Within treatment significance |
|---|---|---|---|
| Well-being | | | |
| Treatment A | 25.7 (7.2) | 4.5 (6.7) | $p < 0.001$* |
| Treatment B | 27.5 (7.1) | 1.1 (7.2) | ns |
| Subjective invalidity | | | |
| Treatment A | 25.5 (6.1) | −1.8 (5.3) | $p < 0.01$** |
| Treatment B | 24.6 (6.1) | −0.8 (4.3) | ns |
| Displeasure | | | |
| Treatment A | 15.7 (4.1) | −0.6 (3.8) | ns |
| Treatment B | 16.0 (4.1) | −0.3 (4.8) | ns |
| Social inhibition | | | |
| Treatment A | 10.9 (3.1) | −0.1 (1.8) | ns |
| Treatment B | 11.3 (2.8) | −0.1 (2.3) | ns |

Between treatment significance: *$p < 0.005$, two-tailed; **ns.

*Association of psychic change with training benefit*

Since some patients did not complete all questionnaires, the compound scores on PSY and SOM were available for a smaller number of patients (Treatment A: $n = 62$; Treatment B: $n = 67$). Classifying patients into four categories, on the basis of presence or absence of training success on the one hand, and positive or negative psychic change on the other, the concurrence of psychic and physical outcome was investigated. Table V shows multiple comparisons of positive vs negative psychic effect for the two treatments separately. In all instances, more patients improved than deteriorated: the odds for psychic improvement vs deterioration were $>1$. In most instances, twice as many patients improved: the odds were $\geqslant 2$.

However, the odds for psychic benefit were not higher for patients with training success, compared to those without success. In only two comparisons the odds ratio was $>1$, but not significantly. In the other comparisons the odds for psychic benefit were actually smaller for patients with training benefit. Two odds ratio's approached significance ($p < 0.10$): fewer patients with training benefit experienced improved somatic function in Treatment A or improved well-being in Treatment B, than patients without training benefit. it can be concluded therefore, that a successful training outcome does not imply psychic benefit.

Next, the odds for psychic benefit were compared between Treatments A and B. Two significant differences were found. In Treatment A patients without training benefit improved more in somatic function ($p < 0.05$) and patients with training success more often had an increased sense of well-being ($p < 0.002$), than patients in Treatment B. Therefore, when relaxation was added to exercise training, the physical outcome had a different psychic implication.

## DISCUSSION

*Physical outcome*

Most cardiac rehabilitation programmes use physical exercise, mainly in the form of aerobic conditioning. Although the primary goal of exercise is increasing physical fitness, it is expected to boost morale and contribute to recovery of the acute cardiac illness. Nevertheless, it is worthwhile to investigate whether intensive training actually

TABLE V.—CHANGES ON PSY, SOM AND WELL ACCORDING TO PHYSICAL OUTCOME FOR TREATMENTS A AND B

| | Training successful | | | Training unsuccessful | | | |
|---|---|---|---|---|---|---|---|
| | PSY = + | PSY = − | Odds | PSY = + | PSY = − | Odds | Odds Ratio (95% CI) |
| Treatment A | 25 | 13 | 1.9 | 18 | 6 | 3.0 | 0.64 (0.18–2.29) |
| Treatment B | 22 | 11 | 2.0 | 24 | 10 | 2.4 | 0.83 (0.26–2.65) |
| | SOM = + | SOM = − | Odds | SOM = + | SOM = − | Odds | Odds Ratio (95% CI) |
| Treatment A | 20 | 15 | 1.3 | 21 | 5 | 4.2 | 0.32 (0.08–1.18)† |
| Treatment B | 22 | 10 | 2.2 | 17 | 16 | 1.06* | 2.07 (0.67–6.48) |
| | WELL = + | WELL = − | Odds | WELL = + | WELL = − | Odds | Odds Ratio (95% CI) |
| Treatment A | 34 | 4 | 8.5 | 23 | 5 | 4.6 | 1.85 (0.37–9.40)† |
| Treatment B | 19 | 16 | 1.2** | 28 | 8 | 3.5 | 0.34 (0.11–1.06) |

†$p < 0.1$, two-tailed. *Odds Ratio A vs B: 3.9 (1.06–15.6), $p < 0.05$, two-tailed.
**Odds Ratio A vs B: 7.2 (1.9–30.0), $p < 0.002$, two-tailed.

meets its goal. In this study, only half of the patients showed improved physical condition, and a substantial minority deteriorated. In the absence of a control group who did not follow exercise training, it is uncertain to what extent the outcome can be attributed to training. Yet, it is clear that a daily exercise programme was not effective for all patients [30, 31]. It is intriguing that relaxation improved effectiveness of training [17]. In our opinion, therefore, exercise should be applied selectively and rehabilitation should include more treatment modalities than only exercise training.

*Psychic effect of exercise*

There was no evidence of psychological benefit of exercise. On the average, patients who performed exercise training solely did not show change on any of the psychological measurements after rehabilitation. Moreover, patients who showed a positive training outcome did not have more psychic benefit than those without training success. On the contrary, there was a tendency to a negative association: more patients without training success improved psychically. It is concluded therefore, that a psychic effect of exercise training for coronary patients could not be demonstrated. Physical benefit does not imply psychic effect.

The lack of psychic effect of exercise training conflicts with clinical impression but is in concordance with other studies [2, 8, 15]. Several factors have been mentioned as an explanation. For instance, patients who are motivated to join a rehabilitation programme may already feel well enough and have little possibility for improvement. The 'over-cautious' and anxious patient may not be inclined to participate. Mayou therefore 'recommended to direct rehabilitation efforts towards selection of sub-groups of patients who would benefit most' [2]. Another possible explanation is that standard questionnaires are not sensitive or specific enough to reflect the recovery process of the coronary patient [3, 8, 32]. The questionnaire 'HPPQ', designed specifically to measure well-being of cardiac patients, did show somewhat greater changes than a standard questionnaire for anxiety (STAI). Still, it may be necessary to use questions in which the patient recognizes his concerns more directly, as for instance in 'morale' [9], or in 'self-efficacy' [32].

In our opinion, the main conclusion should be that rehabilitation is effective for some cardiac patients, but not for others [2, 30, 31]. The rehabilitation programme should be tailored to the psychic and physical condition of the individual. Group averages mask the fact that some patients benefit considerably, while others are less suitable for a particular programme. Moreover, both physical and psychological criteria should be applied to evaluate rehabilitation. This results in at least four categories of outcome. The distribution of patients among these categories in this study is shown in Table VI. About half of all patients experienced physical benefit, but only one-third improved both physically and psychically. This means that although training was physically effective, it was not always a sufficient treatment in psychological respect. On the other hand, many patients (26%–36%) without physical benefit still felt better. For them, intensive training was therefore inappropriate. Yet, they could benefit psychically from rehabilitation. Possibly, less strenuous exercises, relaxation therapy, group education sessions, a more psychological treatment or a combination of these would have been more indicated. Alternative rehabilitation forms seem particularly indicated for patients who have a negative outcome in both respects. Their percentage is lower (8–10%) when

TABLE VI.—COMBINED PSYCHIC AND PHYSICAL OUTCOME OF REHABILITATION (PERCENTAGE OF PATIENTS) FOR TREATMENTS A AND B.

| | Treatment A ($n = 62$) | Treatment B ($n = 67$) |
|---|---|---|
| TB = + and PSY = +/SOM = + | 40%/32% | 33%/34% |
| TB = + and PSY = −/SOM = − | 21%/25% | 16%/15% |
| TB = − and PSY = +/SOM = + | 29%/34% | 36%/26% |
| TB = − and PSY = −/SOM = − | 10%/8% | 15%/25% |

TB: Training successful ( = +) or unsuccessful ( = −).
PSY: change on psychic aspects positive ( = +), or negative ( = −).
SOM: change on somatic aspects positive ( = +), or negative ( = −).

relaxation is added than it is when exercise is the only treatment (15–25%). Thus, relaxation reduced the occurrence of training failures as well as the percentage of subjects without training success and without psychic benefit. It would be interesting to investigate the effect of exercise forms, where skills in psychophysiological self-regulation are the purpose [33–35], rather than aerobic conditioning.

It is remarkable that the association between psychic and physical outcome differed for the two treatments. It signifies that relaxation somehow influences the psychological impact of exercise, possibly providing a more favourable context [17], promoting self-efficacy [32] or a sense of personal control [12].

*Psychic effect of relaxation therapy*

When individual breathing and relaxation therapy was combined with exercise training, improvement was shown in three out of eight measures: anxiety and feelings of invalidity decreased, well-being increased. The patients had been randomly assigned to either of the two treatments. The results cannot be explained by differences in clinical base-line characteristics. It can be concluded therefore that relaxation therapy enhances the psychic effect of rehabilitation. Nevertheless, the changes were modest and the effect of relaxation therapy was smaller than expected. In addition to the above-mentioned explanations, another reason is that patients who needed individual treatment were excluded from the study. The percentage of these patients was small in the beginning, but increased in the latter phase of the study, when more patients were being referred for relaxation therapy after intake interview. The differences between the treatments became less outspoken than at an earlier analysis [28]. Other reasons could be that six sessions were not sufficient for all patients to master relaxation or that the relationship of the patient with the relaxation therapist did not always acquire the necessary quality. In fact, almost half of the patients (44%) achieved good relaxation ability within six sessions and these patients showed unmistakable improvement on all psychological measurements [36]. Finally, the exercise training may have counteracted the effect of relaxation for some patients because the emphasis on effort and force is antagonistic to the nature of relaxation.

In future research these issues should be taken into account; for instance, taking mastery of the relaxation technique as a criterion to terminate the therapy rather than a fixed number of sessions.

No improvement of sleeping quality was found, which was expected as a result of relaxation [23]. Most patients seemed to sleep rather well and without the extended duration of nocturnal sleep (up to 9 hr) which has been reported [37] among patients soon after myocardial infarction. About three-quarters of the patients took a daytime nap, confirming the finding of Van der Sluijs [37]. Patients who learned to relax continued doing so, whereas patients who did exercise training only took fewer daytime naps after rehabilitation. The reason for this difference is not obvious. It seems improbable that relaxation induces fatigue, but patients may learn to take more heed of the need to rest and not interpret that as weakness or invalidity. Or, they may have become used to a daytime rest to practice relaxation.

There was not any indication that relaxation had negative effects [38]. The emphasis on body awareness may sensitize patients to inner body events, including symptoms. Effort and control issues are among the most frequently hypothesized causes of relaxation induced anxiety: the need to remain in control and the belief in effortful strategies as a means to that end. Both apply to cardiac patients. Exercise training confirms these strategies, whereas relaxation challenges them and asserts that control may be achieved relatively effortless or even elude those who make effortful attempts to attain this [38]. Although the idea of 'effortless control' may be expected to evoked resistance [39], the actual treatment appeared to be agreeable and to appeal to most patients [22]. A similar experience is described by Sime, who added relaxation to an exercise training programme. He met at first resistance, but soon relaxation became the 'highlight' of the rehabilitation programme [39].

## CONCLUSION

This study indicates that breathing and relaxation therapy is useful to enhance psychic benefit of rehabilitation and to modify physical exercise. The focus on aerobic power, or as Nixon puts it, 'the dogged repetition of mindless exercise' is not the only option available [34]. Body awareness, resulting from the emphasis on coordination, relaxation, flexibility and breathing, is just as important for cardiac patients. Relaxation is a psychophysiological procedure, and particularly suitable to bridge the gap between soma and psyche in a rehabilitation programme. It is a treatment modality in its own, but it can be integrated in an exercise programme as well as in psychological ways of treatment. It will enhance the value of the former and probably lower the threshold for accepting the latter to the patient.

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