Exercise Versus Hypnotherapy in Coronary Rehabilitation

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SUMMARY Over a two year period a group of 31 post-myocardial infarction patients were subjected to an exercise rehabilitation program of gradually increasing intensity and duration. At the same time a group of 14 similar patients were given a non-active program utilizing the teaching of autohypnosis to achieve a more relaxed lifestyle. Individuals were randomly allocated to each group.

Only those exercisers capable of achieving and maintaining a heavy training program showed tangible gains of cardiorespiratory fitness in all parameters measured. Those who achieved a moderate level of training showed improvement in some indices, but regressed in others; their overall improvement was no better than the inactive group.

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THE CURRENT incidence of coronary atherosclerosis is a matter of great concern to all health workers. Three out of every ten deaths in the middle-aged male are due to a 'heart attack'. In the United States alone, 165,000 persons under 65 die from coronary heart disease each year[18] and the death toll appears to be increasing.[1]

Assuming that the patient does not die within the first two days of attack (and there is a 50 percent chance[14] that he will) then there remains at least a 25 percent chance of a further attack over the next five years.[16] In one follow-up study, the average life expectancy following the first myocardial infarction was eight years.[12] Many of those who survive a first attack never return to work[19] and the economic loss to both family and nation is enormous.[16,6]

Unfortunately, the factors thought to be associated with the rising incidence of this disease are an integral part of modern life. Physical inactivity, obesity and cigaret smoking have been suggested as possible culprits,[10] while elevated serum cholesterol and hypertension are two other predisposing factors brought out in the Framingham study.[11] The specific focus of this paper is upon the need for physical exercise. Here, there is much suggestive evidence. Epidemiological studies show that the incidence of myocardial infarction is two to three times less in those members of the population whose work involves physical activity.[8] Workers such as Hellerstein[9] from the U.S.A., Brunner[12] from Israel, and Rechnitzer[16, 17] from Canada have suggested that a graded physical exercise program reduces the risk of recurrences in 'post-coronary' patients. Whether any beneficial changes that occur with training reflect structural alterations in the heart or periphery,[7] or whether they reflect functional neurohumoral adjustments[15] is uncertain.

Those familiar with training are impressed not only by the physiological changes which occur, such as a reduced heart rate, an increased aerobic power and an increased stroke volume,[22] but also by the marked increase of general well-being. Is this change of mood a direct effect of training or is it a 'spin-off' from extraneous factors in a group program? Patients attending for rehabilitation usually show a moderation of smoking, eating and drinking habits. Furthermore, psychological support is derived from fellow patients, physicians, and paramedical personnel. Such factors have a greater influence than is commonly acknowledged and may indeed play the major role in the average post-coronary exercise program.

Method

The authors proposed to define the psychological supportive effect more closely and to specify the intensity of exercise needed to improve cardiac function. Accordingly a study was designed whereby patients recovering from coronary thrombosis were allocated randomly to one of two groups. One group was offered a rehabilitation program based on the teaching of relaxation through autohypnosis. Hypnosis was chosen because it was the antithesis of physical activity and it had sufficient attraction for the patient to retain his interest over the period of the study.

All patients were referred by their physicians not less than two months following a clearly diagnosed myocardial infarction. The study was limited to males under the age of 65, and by deliberate exclusion no patient had overt psychological problems, heart failure, heart block, or marked irregularity of cardiac rhythm.

Of 56 patients, 45 completed all tests in the study. Because of the difficulty in handling large numbers in the hypnotherapy classes, the allocation was on a two to one

basis, giving a final total of 31 in the exercise group and 14 in the hypnotherapy group. The physical characteristics and overall clinical status of both groups were similar, as shown in Tables 1 and 2. When first seen, about half of the patients were not undertaking any physical activity apart from normal office work; the remainder were walking timidly over distances of half a mile or less.

In the exercise group, preliminary laboratory testing established suitable target pulse rates. Participants were taught to take their carotid pulse at designated intervals throughout each training session. Activities included walking, combinations of walking and jogging, and running. Patients worked out five times a week and a diary of daily activities was kept.

The hypnotherapy group was instructed in autohypnosis. Induction by eye fixation supplemented by deep breathing was followed by suggestions aimed at relief of anxiety, tension and depression. A normal life was encouraged but deliberate exercise was prohibited.

Patients were given nine physiological assessments over the two years of study. Measurements included weight, skinfold thicknesses,[23] grip strength, exercise electrocardiograms and assessment of aerobic power.

ST segment depressions were measured manually and also by means of an electronic averaging device.[3] Exercise testing was carried out on a bicycle ergometer using a progressive sub-maximal test; work loads of three minutes duration were carried to a final loading that was about 75 percent of aerobic power.[24] Oxygen consumption was measured by a standard open circuit method[22, 24] in the final minute at each intensity of exercise, and maximum oxygen consumption from the Astrand nomogram.[2, 20]

Progress

Attendance of both exercise and hypnotherapy groups was very good, and the patients and their wives were uniformly enthusiastic about their treatment. No serious cardiac symptoms were encountered amongst the exercisers but a number of patients reported minor aches, stiffness or limb pain. It was necessary to reduce temporarily the intensity of training for two patients with transitory recurrence of back problems, one case of achilles tendonitis, as well as one metatarsal and one fibular stress fracture.

At the end of the first year, both groups had apparently improved in cardiorespiratory fitness.[13] In the exercise group, the predicted aerobic power increased by 20 percent, the resting pulse rate decreased and there was a suggestion of a rise in both the maximum cardiac stroke volume and the grip strength. More surprisingly, the hypnotherapy group showed a similar increase in predicted aerobic power and a similar decrease in resting pulse rate. The only differences from the exercise group were a smaller increase in grip strength and a slight decrease rather than an increase in the average maximum cardiac stroke volume. The majority of patients who initially had marked ST depression during exercise showed some improvement, and this was equally true of the exercise and the hypnotherapy groups. Nevertheless, we are satisfied that the hypnotherapy group did not deliberately exercise. On the scale of

"They're off". Cardiac patients starting on a long distance road run. Note resuscitation truck in background, and therapists with 'walkie-talkie' transmitters on bicycles.

TABLE 1

Physical Characteristics of Participating Patients

Mean ± SD of Data, Compared with Values For Normal, Healthy, Middle-aged Men Living in Toronto Area[16]

	Exercise Group	Hypnotherapy Group	Healthy Middle-aged Men
Age (Years)	48.6 ± 6.6	48.1 ± 6.6	44.7
Height (CM)	172.6 ± 7.1	173.4 ± 7.4	170.4
Weight (KG)	73.7 ± 7.7	72.1 ± 8.3	71.5

TABLE 2

Severity of Clinical Condition: Comparison of Exercise and Hypnotherapy Groups

	Exercise (N = 31)	Hypnotherapy (N = 14)
Time after coronary attack		
2 - 4 months	9	8
4 - 6 months	4	3
6 - 10 months	10	2
> 10 months	8	1
Stay in hospital		
1 - 2 weeks	11	2
3 - 4 weeks	17	10
5 - 6 weeks	2	1
Not hospitalized	1	1
Liability to angina	18/31	3/14
Previous coronary episodes	5/31	4/14

TABLE 3

Incidence of Factors Which Might Affect Aptitude For Training

	Severe Angina	Hyper-tension	Arrhythmias	Over 50 years
High Mileage (N = 12)	1	1	1	0
Low Mileage (N = 19)	11	6	6	11
Hypnotherapy (N = 14)	4	3	2	3

Cooper[5] their average weekly activity score was no more than five points. One might wonder whether normal daily activity could have brought about a conditioning effect, but from previous studies of habitual activity in Toronto this is highly unlikely.[21]

We suspect that the 'tranquilizing' effect of our relaxation techniques accounts for the lowering of both resting and exercise pulse rates, possibly through a decreased secretion of catecholamines, both generally and at times of specific physical and emotional stress. The lower exercise pulse rate would in turn account for the gain in predicted aerobic power. Assuming this to be so, then autohypnosis would have improved cardiorespiratory efficiency much as in the exercise group, although the latter patients would have achieved their gains the 'hard way'. As for the changes in the ST segment of the electrocardiogram, these could indicate either an improvement of myocardial perfusion or a diminution in the work of the heart over the course of the program. In those patients who showed dramatic improvement, a specific effect of therapy seems likely.

However, in the average patient of either group, we are probably looking at the natural history of the disease; irrespective of therapy, vascularization of the myocardium tends to be restored and there is an associated improvement in the behavior of the ST segment of the electrocardiogram.

Results

In the light of the first year's experience, the same groups were maintained for a second year, with the difference that the intensity and duration of the training sessions for the exercise group were progressively increased. We introduced long and relatively slow endurance running, aiming at a mileage of 20 to 30 miles per week. The average patient covered three to four miles on each of four days per week together with an eight to ten mile run at the weekend, adopting a pace of nine to ten minutes per mile; some men

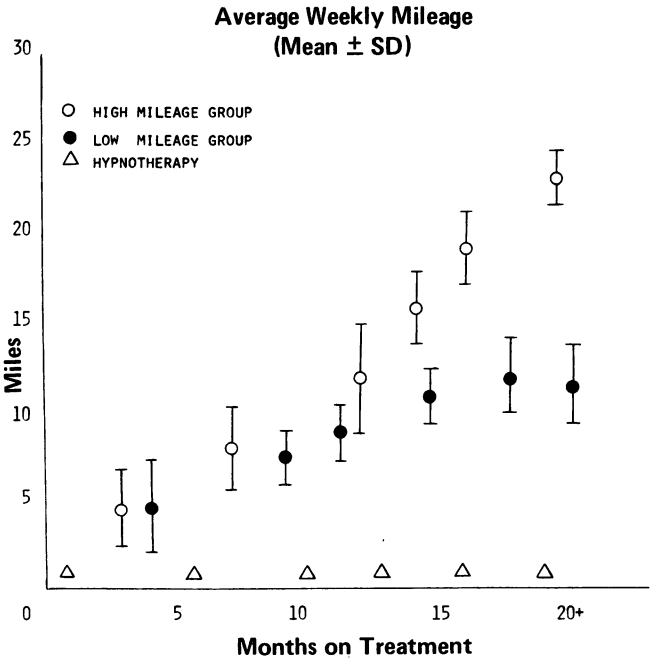

Fig. 2. Average weekly mileage attained over 2 years by the 'high level' training group (○, 20+ miles), the 'low level' group (●, 10-12 miles), and the hypnotherapy group (△, non-active group).

progressed to a pace of eight minutes per mile or even better. Such a training regime would be considered rigorous even for healthy middle aged men. Complete medical precautions were taken at all times and a mobile truck containing emergency equipment and a resuscitation team accompanied the men on the long runs; walkie-talkie equipment served to maintain contact between the runners, therapists on bicycles, the emergency truck and the Rehabilitation Centre, as seen in Fig. 1. There were no accidents. Some of the men reached a level where they were able to participate in quite stressful public events, including a 12 mile relay race to raise funds for the Canadian Olympic Team, and an indoor track meet where they ran a two mile demonstration 'race'. Since then, four of these men were part of a group of seven Toronto Rehabilitation Centre "cardiacs" who successfully completed the 1973 Boston Marathon.

As the second year progressed, it became obvious that not all of the exercisers could achieve the high level of training demanded. While 12 of the 31 were averaging 25 to 30 miles a week at a pace of eight to ten minutes per mile the remainder were averaging no more than 12 to 14 miles per week at a pace of 12 minutes per mile, as seen in Fig. 2. Many cardiologists would consider this latter level quite adequate 'exercise'. However, the differential in the intensity of training was reflected in the gains of cardio-respiratory fitness. The high mileage group showed marked improvement over their first year scores for aerobic power, together with full correction of ST segmental depression at both the same workload and the same pulse rate (see Figs. 3, 4, and 5).

In contrast, the 12 to 14 miles per week group did not show any further improvements in strength, aerobic power or exercise electrocardiograms. In fact they fared about the same as the hypnotherapy group, who by and large merely maintained the progress they had made in the first year.

It should be noted that the level of activity needed to markedly improve strength, cardiorespiratory fitness, and the ECG response to exercise far exceeded that normally

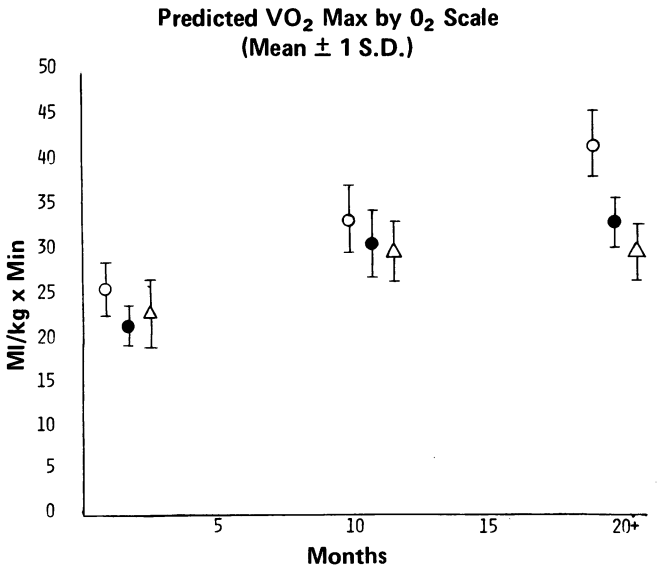

Fig. 3. Aerobic power as predicted by oxygen scale of Astrand nomogram,[22, 23] for the three groups.

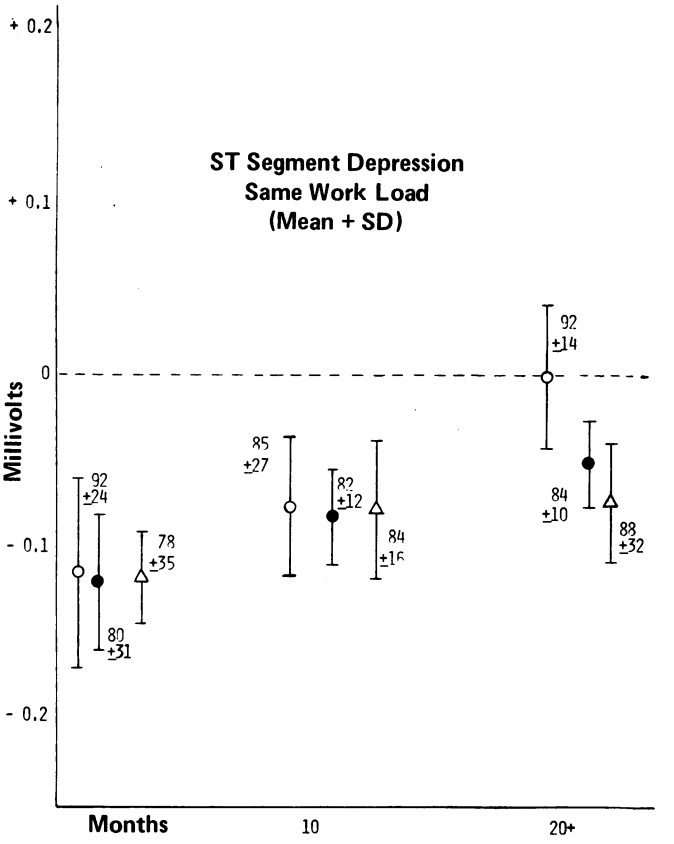

Fig. 4. ST segmental depression at approximately the same work load (watts). Numbers at side of bar indicate work loads at time of measurement.

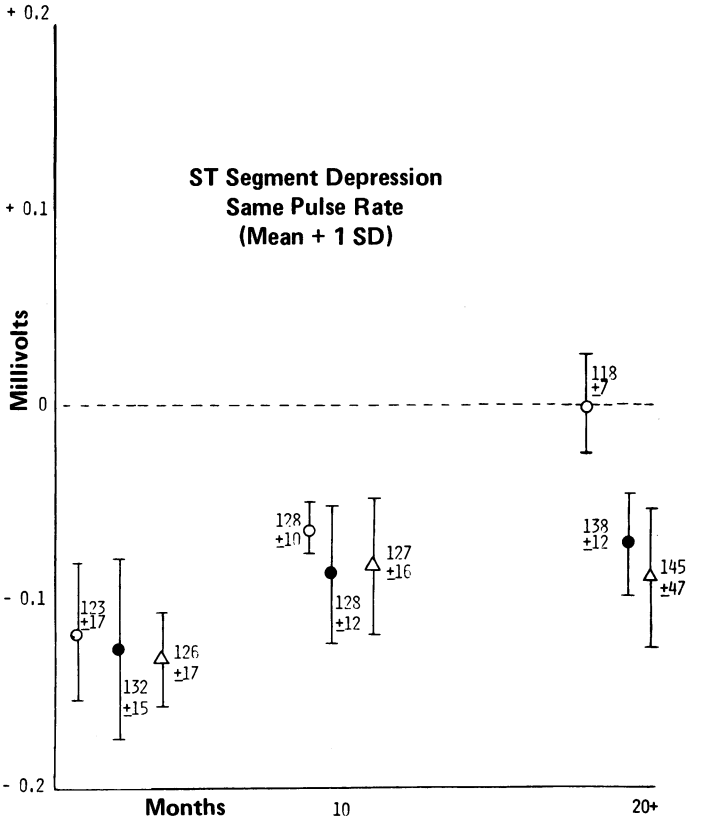

Fig. 5. ST segmental depression at approximately fixed pulse rate. Numbers at side of bar indicate pulse rates at time of measurement.

prescribed in the post-coronary rehabilitation program. Furthermore, it occurred towards the end of a two year training period; a factor to be considered by those who feel that a 12 or even eight week training program is of value.

Those who could not achieve a high mileage seemed 'physiologically' older. All were over the age of 50, and many also had such complications as intractable angina and diastolic hypertension. (Table 3). Whether the age factor is merely an association, or whether it indicates that older post-coronary patients are physiologically incapable of benefiting from a heavy training regime, we cannot say. It may be that the 'over 50' is less motivated to avoid a recurrence; his financial and domestic responsibilities are frequently less than his 40 year old fellow patient, and he may not be so willing to sacrifice his social obligations for frequent training sessions. This is a matter we are presently investigating. Meanwhile, if intensive training is precluded because of age or the extent of disease, it might be well to consider less time-consuming and safer techniques which encourage general relaxation. ◀

References

1. ANDERSON, T., LE RICHE, W. H.: Ischaemic heart disease and sudden death 1901-1961. Brit. J. Prev. Soc. Med. 24; 1-9 (1970).

2. ASTRAND, P. O., RYHMING, I.: A nomogram for calculation of aerobic capacity (physical fitness) from pulse rate during sub-maximal work. J. Appl. Physiol. 7; 218-221. (1954).

3. BLACKBURN, H.: Computer analysis of electrocardiograms. The Ernst Simonsson Conference. Thomas, Springfield, Ill. (1971)

4. BRUNNER, D.: Active exercise for coronary patients. Rehab. Record p. 29. (September 1968).

5. COOPER, K. H.: Aerobics. Evans, N.Y. (1968).

6. DEBAKEY, M. E. Chairman: The President's Commission on Heart Disease, Cancer and Stroke. Report to the President, Vol. 2. U.S. Government Printing Office, Washington D.C. (1965).

7. ECKSTEIN, R.: Effect of exercise and coronary artery narrowing on coronary collaterals. Cerc. Res. 5; 230. (1957).

8. FOX, S. M., SKINNER, J. S.: Physical activity and Cardiovascular health. Amer. J. Cardiol. 14; 731-746. (1964).

9. HELLERSTEIN H. K.: Exercise therapy in coronary disease. Bull. N.Y. Acad. Med. 44; 1028-1047 (1968).

10. JONES, R. J.: Atherosclerosis. Proceedings of the Second International Symposium. Springer-Verlag, New York, N.Y. (1970).

11. KANNEL, W. B.: Habitual level of physical activity and risk of coronary heart disease. The Framingham study. In the proceedings of International Symposium on Physical Activity and Cardiovascular Health. Canad. Med. Ass. J. 96; 811-812. (1967).

12. KATZ, L. N., COLE, D. R., SINGIANE, E.: The long term prognosis following myocardial infarction. J. Lab. Clin. Med. 42; 825 (1953).

13. KAVANAGH, T., SHEPHARD, R. J., PANDIT, V. and DONEY, H.: Exercise versus hypnotherapy in the rehabilitation of the coronary patient. Arch. Rehab. Med. 51, 578-587 (1970).

14. MCNEILLY, R. H., PEMBERTON, J.: Duration of last attack in 998 fatal cases of coronary artery disease and its relation to possible cardiac resuscitation. Brit. Med. J. 3; 139-142 (1968).

15. RAAB, W.: Prevention of ischaemic heart disease. Thomas, Springfield, Ill. (1966).

16. RECHNITZER, P. A., PAIVIO, A., RICKARD, H. A., and YUHASZ, M. S.: Long term follow-up study of survival and recurrence rates following myocardial infarction in exercising subjects and matched controls. Med. & Science in Sports, 3,c. (1971).

17. RECHNITZER, P. A., YUHASZ, M. S., PAIVIO, A., RICKARD, H. A., and LEFCOE, N. M.: Effects of a 24-week exercise program on normal adults and patients with previous myocardial infarction. Brit. Med. J. (i) 734-735 (1967).

18. RICE, D. P.: Estimating the cost of illness. Amer. J. Publ. Health. 57; 424-440 (1967).

19. ROSENBAUM, F. F., and BELKNAP, E. L.: Work and the heart. Hoeber, New York, N.Y. (1959).

20. SHEPHARD, R. J.: Computer programmes for solution of the Astrand nomogram. J. Sports. Med. & Fitness, 10; 206-210 (1970).

21. SHEPHARD, R. J.: Normal levels of activity in Canadian city dwellers. Canad. Med. Ass. J. 97; 313-318 (1967).

22. SHEPHARD, R. J.: Endurance fitness. University of Toronto Press (1969).

23. SHEPHARD, R. J., JONES, G., ISHII, KANEKO, M., and OLBRECHT, A. J.: Factors affecting body density and the thickness of subcutaneous fat. Data on 518 Canadian city dwellers. Amer. J. Clin. Nutrit. 22; 1175-1189 (1969).

24. WEINER, J. S., and LOURIE, J. A.: Human biology. A guide to field methods. Blackwell Scientific Publications, Oxford, U.K. (1969).

QUOTE

I enjoy convalescence. It is the part that makes the illness worthwhile.

George Bernard Shaw (1856-1950) in
Back to Methusaleh, Pt. II,
"Gospel of the Brothers Barnabas".