Relaxation as a technique to enhance outcomes from cardiac rehabilitation

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Purpose of the presentation

• Define relaxation therapy
• Describe controlled studies
• Systematic review of outcomes
• Propose guidelines for implementation

Review of Relaxation Therapy for cardiac patients

In collaboration with

Adrian A White,
University of Exeter
(until september 2003)
Physical training and relaxation therapy in cardiac rehabilitation assessed through a composite criterion for training outcome

Jan van Dixhoorn, MD, Hugo J. Duivenvoorden, PhD, Hans A. Staal, MD, and Jan Pool, MD Haarlem and Rotterdam, The Netherlands

156 MI patients
random assignment

exercise    exercise + relaxation
Relaxation format

- 6 one hour sessions, individual
- With the aid of EMG Biofeedback
- Instructions for passive relaxation, supine
- Small movements and breathing instruction
- Sitting and standing positions
- Manual techniques

Physical Outcomes

- More pronounced training bradycardia
- No effect on blood pressure or maximal watts
- Remarkable reduction of exercise induced ST-abnormalities (> 2 mm)
- Composite criterion: training failure occurred less often
**Effect of Relaxation Therapy on Cardiac Events After Myocardial Infarction: A 5-Year Follow-Up Study**

Jan J. van Dixhoorn, MD, PhD, * and Hugo J. Duivenvoorden, PhD.


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**Relaxation therapy for rehabilitation and prevention in ischaemic heart disease: a systematic review and meta-analysis**

Jan van Dixhoorn, Adrian White

Relaxation Therapy (RT)

- **Primary relaxation skills** = training
  
  *ability for internal self-regulation of tension*

- **Secondary Relaxation skills** = discussion
  
  *application in daily life: recognizing cues for increase and decrease of tension, dealing with tension, when to practice*

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**Primary relaxation skills**

- focus on internal state,
- using posture, breathing, muscle relaxation or small movements, attention, images or verbal formulas, or biofeedback
- to induce a temporary change in mental or physical tension state
- which is concretely perceptible and may become a *new internal reference*
Effect of primary on secondary skills

- Awareness of stressors: more realistic of nature and costs, more detailed and precise
- Dealing with stressors: finding new ways, creating and utilising moments of rest and recovery

Full relaxation therapy (RT)

- includes primary and secondary skills
- provides supervised practice
- is a form of stress management
- individualizes stress coping based on personal relaxation experiences
Relaxation therapies

• All forms include cognitive restructuring:
  – importance of regular relaxation practice
  – effects of stress

Relaxation instruction
• Abbreviated: 3 hours or less of instruction
• Full: > 3 hours of instruction
• Expanded: full RT + specific cognitive treatment

Abbreviated RT

• Once or twice supervised instruction
• Unimodal= one form of instruction
• Taperecorded or written instructions
• Urge to practice daily
• Provide a logbook of practice
• Discuss experiences with daily practice
Full RT

- Series of supervised practice sessions (9 hours, on average)
- Several instruction forms (multimodal)
- Emphasis on mastery of technique and increasing sensitivity to tension and relaxation signals (no tape)
- Discuss application in daily life, before, during or after stress

Expanded RT

- Discussion group format, about 11 hours
- Regular supervised relaxation instruction
- Sometimes with tape or written instructions
- Specific cognitive treatment:
  - Risk factors, illness, lifestyle
  - Psychological themes: depression, anger, hostility, Type A, time urgency
Reviews of stress management for cardiac patients

- Linden et al, 1996: ‘Psychosocial interventions’ or ‘stress management’
- Dusseldorp et al., 1999 ‘Psychoeducational programs’
- Several studies include relaxation
- Psychosocial treatment is effective, but it is unclear which component is effective

Purpose of present review of RT

- Does RT improve outcome better than usual care, with or without exercise rehabilitation?
- Is there any longterm benefit?
- Does the effect vary with the extent of RT?
Inclusion criteria for review

• Presence of myocardial ischemia / cardiac pathology

• Only risk factors: excluded

Inclusion criteria for review

• Measuring recovery in time
• Only momentary effects: excluded
  e.g. stress of procedures like angiography
  e.g. immediate effects during hospitalisation for mi or cabg (nurse studies, n=6)
Inclusion criteria for review

• RT was the primary intervention
• RT as component of multimodal treatment: excluded
  
  e.g. Alteration of Type A behavior
  e.g. Lifestyle Heart Trial (Ornish et al)
  e.g. The Heart Manual and Angina Management Programme (Lewin et al.)

Inclusion criteria for review

• RT was the primary intervention
• Stress management without RT skills: excluded
  
  e.g. Ischemic Heart Disease Life Stress Monitoring Program (Frasure Smith et al.)
• Studies of the relaxing effect of music: excluded
Inclusion criteria for review

- Sufficient data
- Outcome without quantitative information for pooling: excluded
  
  *e.g. Langosh et al (1982), Cunningham (1980), Krampen & Ohm (1984)*

27 controlled studies

- RT: Abbreviated: n=6
  - Full RT: n=13
  - Expanded RT: n=8
- Random assignment: n=13
- Control treatment includes exercise: n=7
- Patients: post MI: n=15; and/or post surgery or PTCA: n=12; angina pectoris only: n=4
### Abbreviated relaxation

<table>
<thead>
<tr>
<th>Author(s)</th>
<th>Intervention</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hase &amp; Douglas, 1987</td>
<td>Relaxation training</td>
</tr>
<tr>
<td>Munro et al., 1988</td>
<td>Relaxation therapy</td>
</tr>
<tr>
<td>Amarosa-Tupler, 1989</td>
<td>Stress management</td>
</tr>
<tr>
<td>Gallagher et al., 1997</td>
<td>Stress management</td>
</tr>
<tr>
<td>Collins &amp; Rice, 1997</td>
<td>Relaxation intervention</td>
</tr>
<tr>
<td>Wilk &amp; Turkoński, 2001</td>
<td>Progressive muscle relaxation</td>
</tr>
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</table>

### Full relaxation therapy

<table>
<thead>
<tr>
<th>Author(s)</th>
<th>Intervention</th>
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<tbody>
<tr>
<td>Kavanagh et al, 1970</td>
<td>Hypnosis</td>
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<tr>
<td>Polackova et al, 1982</td>
<td>Autogenic training</td>
</tr>
<tr>
<td>Bohachick, et al 1984</td>
<td>Relaxation training</td>
</tr>
<tr>
<td>Baer et al, 1985</td>
<td>Stress management</td>
</tr>
<tr>
<td>Ohm, 1987</td>
<td>Relaxation training</td>
</tr>
<tr>
<td>Van Dixhoorn, et al, 1991</td>
<td>Relaxation therapy</td>
</tr>
</tbody>
</table>
### Full relaxation therapy

<table>
<thead>
<tr>
<th>Winterfeld, et al, 1993</th>
<th>Autogenic training</th>
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</thead>
<tbody>
<tr>
<td>Nelson, et al, 1994</td>
<td>Stress management</td>
</tr>
<tr>
<td>Zamarra, et al, 1995</td>
<td>Transcendental meditation</td>
</tr>
<tr>
<td>Luskin, et al, 2002</td>
<td>Stress management</td>
</tr>
<tr>
<td>Kanji, et al, 2004</td>
<td>Autogenic training</td>
</tr>
<tr>
<td>Del Pozo, et al, 2004</td>
<td>Biofeedback</td>
</tr>
</tbody>
</table>

### Expanded relaxation

<table>
<thead>
<tr>
<th>Valliant &amp; Leigh, 1986</th>
<th>Relaxation training</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bundy et al, 1994</td>
<td>Psychological treatment</td>
</tr>
<tr>
<td>Turner et al, 1995</td>
<td>Stress management</td>
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<tr>
<td>Trczienicka-Green &amp; Steptoe, 1996</td>
<td>Stress management</td>
</tr>
<tr>
<td>Blumenthal et al, 1997</td>
<td>Stress management</td>
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<tr>
<td>Appels et al, 1997</td>
<td>Psychological intervention</td>
</tr>
<tr>
<td>Bundy et al, 1998</td>
<td>Stress management</td>
</tr>
<tr>
<td>Cowan et al, 2001</td>
<td>Psychosocial nursing therapy</td>
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</table>
Outcome measurements

- **Physiological**: resting heart rate & blood pressure, heart rate variability, maximum watts, serum cholesterol, HDL
- **Psychological**: anxiety, depression
- **Cardiac**: angina pectoris, arrhythmia, ischemia (ST)
- **Function**: return to work (at six months)
- **Cardiac events**: up to five years follow-up
Continuous measurements

Weighted mean difference (WMD):

Pre-post difference of treatment group, minus pre-post difference of control group, in units of relevant measurement

Standardised mean difference (SMD) = ‘effect size’,

to compare between different measurements

dividing by pooled standard deviation

> 0.2 – 0.5: small effect

0.5 – 0.8: moderate effect

> 0.8: large effect

Resting heart rate: clear, small effect

7 studies, 381 patients
WMD = -3.8 bpm, p<0.01 (smd=0.29)
Exercise as control (3 studies) : -4.3 bpm
Abbreviated RT (2 studies): -8.5 bpm

In another 3 studies insufficient data, two of which found positive effect
**Blood pressure: No effect**

10 studies, 773 patients

WMD systolic = -0.4 mmHg, ns (smd=-.05)

WMD diastolic = -0.13 mmHg, ns

Abbreviated RT (n=4): 5.5 mmHg SBP

Full/expanded RT (n=6): -2.8 mmHg SBP

*Statistically non significant*

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**Heart rate variability: small effect**

3 studies, 168 patients

SMD = 0.35, p<0.05

All three full RT

In two studies 3 months follow-up:

SMD= 0.58 (p<0.001), moderate effect
Maximum Watts: *clear effect*

4 studies, 168 patients  
SMD = 0.44, p < 0.01  

*effect size: small*  
2 studies expanded RT, 2 studies full RT  
*two studies with exercise as control condition excluded*

Serum lipids: *partial, small effect*

3 studies, 527 patients  
Total cholesterol: WMD = -0.08, ns, (smd: -.1)  
HDL: WMD = 0.06, p < 0.01 (smd: 0.23)  

*clinically insignificant*  
2 studies expanded, 1 study abbr. RT
Anxiety state: *small, reliable effect*

13 studies, 1185 patients

SMD state anxiety: -0.35, p < 0.001

*Effect size small, statistically highly significant, no heterogeneity between studies*

Exercise as control condition (n=4): -0.31

Abbreviated RT (n=4): -0.09 *no effect*

Full RT (n=6): -0.54, *moderate effect*

Expanded RT (n=3): -0.23, *small effect*

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Depression: *unreliable effect*

9 studies, 957 patients

SMD: -0.48, p < 0.05

*Effect size small, statistically significant, strong heterogeneity between studies*

Excluding two studies with low internal validity and positive outcome removes heterogeneity:

SMD = -0.14, ns
Angina Pectoris: clear effect

4 studies, 565 patients
SMD : -0.60, p < 0.001
Effect size moderate, statistically highly significant
Reduced frequency of attacks
Abbreviated RT (n=1): smd= -0.26, p<0.02
Expanded RT (n=3): smd= -0.79, p<0.001

Another four studies were uniformly positive

Effect sizes in 3 reviews

<table>
<thead>
<tr>
<th></th>
<th>Linden</th>
<th>Dusseldorp</th>
<th>RT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Heart rate</td>
<td><strong>-0.30</strong></td>
<td><strong>-0.29</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td>N=354</td>
<td>N=293</td>
<td></td>
</tr>
<tr>
<td>SBP</td>
<td><strong>-0.14</strong>*</td>
<td><strong>-0.16</strong>*</td>
<td><strong>-0.05</strong></td>
</tr>
<tr>
<td></td>
<td>N=298</td>
<td>N=471</td>
<td>N=685</td>
</tr>
<tr>
<td>Cholesterol</td>
<td><strong>-0.95</strong>**</td>
<td><strong>-0.65</strong>*</td>
<td><strong>-0.10</strong></td>
</tr>
<tr>
<td></td>
<td>N=939</td>
<td>N=812</td>
<td>N=527</td>
</tr>
<tr>
<td>Angina</td>
<td><strong>-0.10</strong>*</td>
<td><strong>-0.60</strong>**</td>
<td></td>
</tr>
<tr>
<td></td>
<td>N=2878</td>
<td>N=565</td>
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*P<0.05, **P < 0.01
Effect sizes in 3 reviews

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<th>Linden</th>
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<th>RT</th>
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</thead>
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<tr>
<td>Distress</td>
<td>-0.30**</td>
<td>N=1259</td>
<td></td>
</tr>
<tr>
<td>Anxiety</td>
<td>-0.03</td>
<td>N=2796</td>
<td>-0.35**</td>
</tr>
<tr>
<td>Depression</td>
<td>-0.04</td>
<td>N=3097</td>
<td>-0.48* (-0.14)</td>
</tr>
</tbody>
</table>

* P<0.05, ** P < 0.001

- Psychoeducation and psychosocial treatment reduce risk factors and promote healthy behavior, RT does not
- Psychoeducation does not improve emotional or physical state, RT does
- The effect size of RT and psychosocial treatment (stress management) is equal
Myocardial ischemia: positive effect

4 studies, 255 patients

*ST depression during exercise*
- Kavanagh: average depression reduced
- Zamarra: time of occurrence later
- Van Dixhoorn: less patients with ST> 2mm

*ST depression during ambulatory monitoring*
- Blumenthal: reduced occurrence

Arrhythmia: positive effect

3 studies, 135 patients

Odds Ratio: 0.20, p < 0.001

*Reduction of occurrence, but*

nature of arrhythmia not specified

Abbreviated RT (n=1): OR= 0.42 (at discharge, ns)
Full RT (n=2): OR= 0.19 (six month)

All patients were post-MI, data taken from medical records
Return to work: positive effect

3 studies, 376 patients
Odds Ratio: 1.83, p < 0.01

All full RT. In 2 studies exercise as control
All patients post-MI or CABG, data taken at six month follow-up

Long-term effects on cardiac events

Cardiac death
Myocardial infarction
CABG
Re-PTCA or restenosis

Follow-up period: from six months to 5 years
Cardiac events: positive effect

7 studies, 916 patients
Odds Ratio: 0.39, p < 0.0001

*no heterogeneity between studies*

Exercise as control (n=2): OR = 0.54
Full RT (n=4, 631 patients): OR = 0.48
Random assignment (n=2): OR = 0.43
No abbreviated RT

Cardiac death: positive effect

4 studies, 694 patients
Odds Ratio: 0.29, p < 0.01

*Death occurred much less*

Exercise as control (n=2): OR = 0.47
Full RT: n=3, Expanded: n=1
Random assignment, n=2
Occurrence of death within 2 years
Cardiac death within 2 years

<table>
<thead>
<tr>
<th></th>
<th>treatment</th>
<th>control</th>
<th>period</th>
</tr>
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<tbody>
<tr>
<td>Cowan random</td>
<td>1/67</td>
<td>7/66</td>
<td>2 years</td>
</tr>
<tr>
<td>Nelson</td>
<td>1/19</td>
<td>4/16</td>
<td>6 months</td>
</tr>
<tr>
<td>Ohm</td>
<td>4/197</td>
<td>5/173</td>
<td>6 months</td>
</tr>
<tr>
<td>Van Dixhoorn random</td>
<td>1/76</td>
<td>5/80</td>
<td>2 years</td>
</tr>
</tbody>
</table>

Effect of Relaxation Therapy on Cardiac Events After Myocardial Infarction: A 5-Year Follow-Up Study

Jan J. van Dixhoorn, MD, PhD, * and Hugo J. Duivenvoorden, PhD.

Psychological Treatment of Mental Stress-Induced Ischemia: Five-year clinical and economic follow-up analysis

James A. Blumenthal, Ph.D., Michael Babyak, Ph.D., Jiang Wei, M.D., Christopher O’Connor, M.D., Daniel Mark, M.D., Pamela S. Woodley, FSA, MAAA, Richard J. Irwin, ASA, MAAA, Geoffrey Reed, Ph.D.
Events per group during follow-up

Conclusions

Relaxation Therapy enhances effectiveness of rehabilitation, in a wide range of effects:

*physical, psychological, social and cardiac*

It is an important ingredient of cardiac rehabilitation,

It complements exercise: heart rate, anxiety, return to work, cardiac events
It complements psycho-education:
RT does not or hardly influence risk factors: blood pressure, cholesterol, smoking
Psychoeducation hardly influences emotional state (anxiety, depression)

Smoking before and after MI (%)

Van Dixhoorn, et al.
**Abbreviated Relaxation Therapy**
- Reduces resting heart rate
- small effect on angina pectoris
- no effect on anxiety or depression
- no effect on blood pressure or arrythmia
- No evidence of longterm effect available

**Full or Expanded Relaxation Therapy**
- good effect on resting heart rate, frequency of angina pectoris and anxiety
- no effect on blood pressure, cholesterol
- effect on arrythmia, maximum watts, ischemia
- evidence of longterm effect on return to work, cardiac events, cardiac death
There is little difference between Full or Expanded Relaxation Therapy

There is no evidence for superiority of RT expanded with cognitive treatment

The cognitive implications of full RT may be sufficient for most cardiac patients

Cognitive implications of RT

Healthy respect for rest and need for balance between rest and effort
Respect for body signals of stress and tension
Awareness of ‘cost’ of stress
Differentiating stress signals from cardiac signals
Understanding role of mental factors in physical function
Implementation of RT

*If you use Relaxation Therapy, do it well*

Sufficient time: at least 6-9 hours,
In small groups
Teach different forms
Experienced trainers
Assess mastery
Individual sessions optional

Multimodality of full RT

- Unimodal use of cognitive form (hypnosis, meditation, autogenic training) in 5 studies requires
  on average 19, median 14 hours

- Multimodal treatment (muscle relaxation, attention, small movements, breathing, biofeedback) in 8 studies requires
  on average 9, median 9 hours
Dutch Guidelines for Cardiac Rehabilitation (2004)

- Recommends a full RT program, multimodal, for 9 hours
- In addition to abbreviated, introductory RT as part of the exercise and lifestyle program

- [www.hartstichting.nl](http://www.hartstichting.nl)
- [www.methodevandixhoorn.com](http://www.methodevandixhoorn.com)

Designing instructions

- Reduce traditional methods to their elements or modalities
- Add new modalities
- Create new instructions with different combinations of modalities
Modalities of relaxation

- Attention: active = focussed
  Passive = receptive, listening
- Muscle relaxation (contract/release)
- Movements: small, repetitive
- Breathing: direct and indirect regulation
- Posture: lying (supine, prone), sitting, standing
- Biofeedback (HRV, EMG)

Process model of relaxation

- Offer many modalities, do not stick to a fixed protocol or method
- Find at least one modality that the patient is able to utilize to create a change of tension
- Proceed from there, practice and expand the ability for selfregulation of tension
- Adapt instruction to the patient
- Assess mastery