Psychophysical capacity in non-specific chronic low back pain
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Chapter 7

General Discussion and Conclusions
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The aims of this thesis were to develop and test relevant outcome measures for cognitive somatic rehabilitation of non-specific chronic low back pain (CLBP) patients and to gain insight in the effects of a cognitive somatic rehabilitation program. This thesis focuses on aerobic capacity, psychophysical capacity and perceived disability of non-specific CLBP patients. In this chapter the main findings of our research are reviewed and the directions for further research are given.

To evaluate cognitive somatic rehabilitation it is recommended to use not only questionnaires but also objective tests to obtain a more comprehensive picture of the non-specific CLBP patient [1, 2]. The most commonly used objective tests are maximal or submaximal exercise tests with a fixed increasing workload. Both tests measure the aerobic capacity. These tests are not always valid for non-specific CLBP patients because a considerable number of these patients can not complete the test due to pain or other symptoms. Therefore it is not clear whether non-specific CLBP patients actually suffer from reduced aerobic capacity. Maximal or submaximal tests may become valid after rehabilitation because the mean aerobic capacity in non-specific CLBP patients improves during rehabilitation, and most patients are able to perform the test after rehabilitation [3]. The results of this thesis indicate that the developed LBM-based Åstrand submaximal bicycle test is reliable, feasible and therefore more suitable for non-specific CLBP patients than the commonly used tests, because the predefined workload increase is individually tailored. Using this test we found that non-specific CLBP patients actually do suffer from a reduced aerobic capacity and have an increased body fat percentage compared to healthy subjects. The basic assumption of the cognitive somatic rehabilitation is that reconditioning is attributable to functioning. This means that when functioning including physical activity of daily living (PAL) is increased due to rehabilitation aerobic capacity will automatically also recover [4]. The LBM-based Åstrand submaximal bicycle test is useful as assessment before rehabilitation and as outcome measure of rehabilitation. Therefore we recommend using this test in non-specific CLBP patients.

Physical capacity tests give information about objective physical capacity and not about the perceived physical effort [5]. In non-specific CLBP patients physical capacity is often reduced and the perception of physical effort is increased as compared to healthy subjects while performing similar PAL. To reduce these restrictive factors of performing PAL in non-specific CLBP patients physical capacity and perceived physical effort are both important in cognitive somatic rehabilitation [6]. Therefore we developed the psychophysical
lifting capacity tests. In this psychophysical test, the patient is in control and determines which termination effort is acceptable [7]. In case of the psychophysical static lift capacity test the patient is asked to pull up a horizontal bar connected to a force transducer measuring the vertical static force in Newton. The patient is instructed to stop the test when the acceptable maximal effort (AME) is reached [7]. In case of the psychophysical dynamic lifting capacity test the patient performs four lifts from table to floor vice versa within 20 seconds. Stepwise, after each session, during 20 seconds rest, weights increase by 4.5 kg for men and 2.25 kg for women. The test is terminated when the acceptable maximal effort (AME) is reached or when 85% of maximum age related heart rate is reached. After each test a Borg score for perceived effort is recorded. The psychophysical lifting capacity is calculated by the formula AME divide by the perceived effort expressed in Newton/Borg. The rehabilitation professional can determine whether the perceived effort score of the patient agrees with the AME. So a high psychophysical capacity reflects low to normal perception relative to the actual AME; a low psychophysical capacity reflects a high perceived effort relative to the actual AME. In case of a low psychophysical capacity cognitive somatic rehabilitation is focused on education to gain insight into perception of physical symptoms that occur during exposure of physical activities and to learn to react appropriately to these physical symptoms [8,9]. This leads to reducing perceived disability of activities of daily living (ADL), improvement of functioning including PAL and thereby to reconditioning. Using these tests we found that psychophysical static and dynamic lifting capacities are significantly different between non-specific CLBP patients and healthy subjects except for the psychophysical static arm lift. The same outcome between the patients and the healthy subjects might be expected because the lower back is not loaded during the psychophysical static arm lift test and non-specific CLBP patients do not experience arm or neck pain. Chapter 4 of this thesis shows that psychophysical lifting capacity tests are reliable and useful as assessment before rehabilitation and also to evaluate the effect of cognitive somatic rehabilitation. Therefore we recommend using psychophysical static trunk lift, static leg lift and dynamic lifting capacity tests in non-specific CLBP patients. Cognitive somatic rehabilitation is aimed to improve the patient’s ability to solve the problem at hand on the basis of the patient’s skills, physical capacity and knowledge to react appropriate to physical symptoms [8,9]. The hypothesis related to the cognitive somatic rehabilitation was that appropriate perception of physical symptoms may reduce perceived disability of ADL and improve functioning including PAL, aerobic capacity and physical capacity [8,9]. Chapter 5 and 6 of this thesis showed that cognitive somatic rehabilitation
reduced perceived disability of ADL measured with the Roland Morris Disability Questionnaire (RMDQ). This reduction was clinically relevant, because the reduction was more than 30% from baseline and the effect size was 1.35. [10,11]. We also found in chapter 5 that functional status measured with the RAND-36 improves significantly in non-specific CLBP patients after the cognitive somatic rehabilitation. These findings confirm that cognitive somatic rehabilitation focusing on appropriate reactions to physical symptoms improves perceived disability of ADL and improves functioning.

The question arose: which determinants explain these beneficial effects. Chapter 6 of this thesis showed that improvement in psychophysical lifting capacity is determinant for the reduction of perceived disability of ADL in non-specific CLBP patients after a cognitive somatic rehabilitation. The patients improved in psychophysical lifting capacity because their perceived effort decreased and their AME increased. The psychophysical lifting capacity is calculated by the formula AME divided by the perceived effort. The reduction of the perceived effort reflects a more appropriate perception of the increased AME which contributes to a reduced perceived disability of ADL. The decreased perceived effort of the increased AME intervenes and breaks the vicious circle of the patient and improves functioning and thereby automatically improves aerobic and physical capacity. Improvements of the aerobic and physical capacity improve by this means also functioning. Chapter 5 and 6 of the thesis confirms that the aerobic capacity and physical capacity significantly increased. The improvement in aerobic capacity and physical capacity could not be attributed to physiological training principles by the rehabilitation program, because therefore frequency of rehabilitation sessions should be at least 3 times per week were we had less than once per week [12]. This supports the assumption of the cognitive somatic rehabilitation that reconditioning is attributable to functioning including PAL. Therefore we recommend in chapter 6 that rehabilitation of non-specific CLBP patients should focus on improving psychophysical capacity by education of appropriate perception of physical symptoms rather than solely focusing on physical or aerobic capacity by physiological training principles. Future research should investigate whether cognitive somatic rehabilitation increases PAL.

Methodological considerations
Design and patient samples: The study presented in chapter 2 is based on a historical cross-sectional design and patients were compared with historical data of healthy controls. However, in cross-sectional designs cause effect relationships can not be determined. In the reliability studies presented in chapter 3 and 4 patients were recruited from the waiting list, possibly decreasing the generalizibility of the
conclusions, because the patients were motivated to do the tests twice. The healthy controls were all students recruited from the Institute for Human Movements Sciences of the University of Groningen and were all young and motivated, which possibly influence the interpretations of the comparison with the patients. In chapter 5 we chose for a quasi-experimental design with a waiting list control group therefore the conclusions must be regarded with some caution.

Measures: In the studies in this thesis, measurements instruments were used that are not commonly used in studies on patients with non-specific CLBP. We chose these measures, because they fitted our construct better compared to techniques already used.

Despite the weaknesses, the current studies are notable for several reasons. First, a particular strength in this thesis is that the measurements specifically have been developed for use in samples of non-specific CLBP patients in rehabilitation. Second, no study could be found in which change in psychophysical capacity are associated with change in perceived disability in non-specific CLBP patients as presented in chapter 5 and 6. Third, a further strength of the studies in this thesis is that, although different research designs were used in chapter 5 and 6, the results of the studies were similar, corroborating and strengthening the findings.

**Conclusions**

The general conclusion of this thesis is that the study generates strong evidence for using the combination of aerobic capacity, psychophysical capacity and perceived disability in order to obtain a comprehensive picture of the patient’s limitations and treatment goals in rehabilitation. Clinically, the thesis indicate that rehabilitation should focus on psychophysical capacity and perceived disability of activities of daily living rather than solely on physical capacity and aerobic capacity.

**Recommendations for future research**

Future prospective research should address whether physical activity of daily living actually increases after cognitive somatic rehabilitation, and whether this increase can be attributed to an increased psychophysical capacity. Besides the effect of cognitive somatic rehabilitation on psychophysical capacity and perceived disability, it would also be interesting to conduct more research on the effect of return to work and it’s relation with psychophysical capacity.
Chapter 7

References