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Health characteristics and muscle strength in patients with severe pain in the neck versus low back: Are they separate entities?

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Abstract

Introduction Chronic low back pain (LBP) and chronic neck pain (NP) are common musculoskeletal disorders with big socioeconomic consequences worldwide. Recent evidence shows that patients with LBP and NP report similarities in terms of the comprehensive biopsychosocial symptom picture. However, it is unclear if chronic NP and chronic pain LBP constitute separate entities in terms of muscle strength and health characteristics.

Multidisciplinary treatment (MDT) has in recent years become a common rehabilitation method and has been used in treatment to target the multifactorial cause of pain. The objective of this study was to investigate differences between patients with LBP versus NP in muscle strength and health characteristics. A second objective was to investigate acute effects of a three-week MDT on self-rated health, fear avoidance beliefs and numerical pain rating scale.

Methods Eighty-seven patients (56 with severe chronic LBP and 31 with severe chronic NP) referred to a three-week MDT at the Department of Physical Medicine and Rehabilitation, St. Olav's Hospital, Trondheim University Hospital, Trondheim, Norway volunteered to participate in the study. Data collection included objective measurements in grip strength and cervical strength, and subjective measurements which was obtained with a questionnaire.

Results The comparison of the two patient groups showed that the patients with LBP had a significantly higher body mass index (BMI) than the patients with NP. Although there was no difference in cervical strength between the groups, patients with NP reported significantly higher pain levels during maximal voluntary isometric contraction in neck flexion and neck extension. The NP group also tended to have a higher comorbidity in terms of number of pain sites than the LBP group. Analysis of acute MDT effects showed no differences between groups in terms of self-rated health, fear avoidance beliefs and numerical pain rating scale.

Conclusion The results from the current study indicate no major differences in health characteristics between patients with severe chronic LBP and NP. A short-term MDT program seems to have similar effects in these patient groups.

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Table of contents

Introduction	1
Methods and materials	4
Participants and recruitment process	4
Inclusion and exclusion criteria for the LBP study	4
Inclusion and exclusion criteria for the NP study	5
Treatment intervention.....	5
Physical exercise program.....	5
Test procedure.....	6
Anthropometric measurements	6
Grip strength.....	6
Isometric neck flexion and extension.....	7
Subjective measurements	7
Statistics and analysis	8
Results	10
Baseline characteristics.....	10
Change from baseline to post test.....	10
Discussion	13
Conclusion	15
References	16

Introduction

Chronic musculoskeletal pain constitutes major health challenges worldwide. A study by Kinge and colleagues reported non-specific chronic low back pain (LBP) followed by non-specific chronic neck pain (NP) as the most common musculoskeletal disorders in the general population in Norway [1]. For those affected, it may have severe consequences on health related quality of life in terms of disability, reduced work ability, social withdrawal and high medical expenses. Lifestyle factors such as smoking, sleep problems, obesity and physical inactivity are well established risk factors for both LBP and NP [2-4].

Chronic musculoskeletal pain is defined as persisted pain for three months or longer [5]. The pathophysiology of chronic pain is complicated, and many theories of the neurobiological chronic pain mechanisms has been discussed in literature. Nevertheless, it has commonly been suggested that the chronicity may be explained by alterations of nociceptors in the central nervous system or peripheral nerves [6, 7]. It has also been suggested that chronic musculoskeletal pain may have a genetic heritability component [8, 9]. Twin studies indicate that individuals with a general vulnerability for development of chronic musculoskeletal pain may develop the disorder when one or more of the established risk factors are present in an individual [9, 10]. Environmental exposures such as prolonged negative stress has also been suggested as an important contributor to the development of chronic pain [11].

The spine is a complex anatomical structure constructed to allow a large range of movements while providing strength, stability and flexibility. In principle, any of the structures of the spine that receive innervation from sensory fibres could be a source of pain. This could arise from muscles, joints and the intervertebral discs. A possible cause of persistent pain in the low back or neck is radiculopathy triggered by a compressed nerve caused by a herniated disc, or other tissue damage or disease such as degenerative disease, spondylolisthesis and facet joint osteoarthritis. Pain with no visible signs of tissue damage and such are defined as non-specific pain. About 85% of patients with LBP who seek help in primary care have non-specific LBP [12].

The definition of LBP is localized pain between the gluteal folds and the 12th rib, and leg pain caused by low back problems [13]. NP has a more unknown origin and has a wide description in terms of definitions in literature. Nevertheless, Hoy and colleagues defined NP as pain in the neck with or without referred pain in one or both upper limbs [5]. It has also been described as widespread sensation of pain and tenderness in the skin, ligaments and

muscle in the shoulder and neck area [14]. Several epidemiological studies report NP to be more common in women than men [15-18].

Based on findings in epidemiological studies, it is suggested that LBP and NP share several common risk factors and symptoms [19]. Thus, it may be hypothesised that these two disorders express a common vulnerability for the development of persistent spinal pain [20, 21]. Individuals suffering from chronic musculoskeletal pain often report pain in more than one site [22-24] and evidence show that multisite widespread pain is common in individuals with chronic LBP and NP [25]. Also, a study by Williams and co-workers suggested that non-specific LBP or NP have common associated factors based on the theory that chronic pain in the spine is a part of a somatic dysfunction and should be evaluated as one functional unit [26]. A comparison of patients with chronic LBP and NP in Germany showed that there were no major significant differences between the two groups in sociodemographic variables, pain, other general comorbidities, occupational characteristics, psychological issues and functional status. However, to our knowledge, there are few studies who has aimed to compare patients with LBP versus NP. To gain more knowledge about possible similarities between patients with severe LBP and NP could provide important information about how to design interventions programs for these patients.

Physical exercise is commonly used as a core component in treatment and rehabilitation of musculoskeletal disorders [27]. Several randomized control trials investigating physical exercise as treatment intervention has been conducted to determine possible effects [28]. Physical exercise is also suggested as a possible modifying factor of the established risk factors [29-32]. Some recent studies suggest that systematic progressive resistance training is particularly effective in rehabilitation of patients with LBP and NP [29, 33-35]. Physical exercise alone may however, not be sufficient, as the cause of prolonged pain is likely to be multifactorial. Waddell and co-workers suggested a clinical model for LBP, which claimed that rehabilitation should be conducted in agreement to a biopsychosocial model [27].

MDT has in recent years become a common approach in rehabilitation of patients with LBP [27, 36, 37] and NP [38, 39]. MDT allows targeting the multidimensional aspect of pain causality; as chronic musculoskeletal pain may be explained by not just the physical condition of an individual but also the psychosocial condition. MDT consists of a collaboration between professional health workers such as physicians, social workers and physiotherapists. Recently, it has been common to implement back and neck schools in MDT, i.e., an education based group therapy where the intention is to, among other factors, reduce fear avoidance beliefs.

Fear avoidance beliefs among patients with severe pain in the low back and neck are common [40] and has in research been assessed as a predictor of future disability and work loss for both patient groups [41, 42].

The current study utilise data from two ongoing randomized controlled trials (RCT) that investigates the effect of progressive strength training in patients with severe pain in the low back or neck. The primary objective of the current study is to compare health characteristics and muscle strength between patients with severe LBP and NP. A second objective is to investigate whether the acute effect of a three-week multidisciplinary intensive rehabilitation program differs between the groups in terms of a possible change in self-rated health, fear avoidance beliefs and pain.

Methods and materials

Participants and recruitment process

Twenty-seven male patients and 29 female patients with severe LBP, and 9 male patients and 22 female patients with severe NP from 21 to 61 years of age referred to the Department of Physical Medicine and Rehabilitation, St. Olav's Hospital, Trondheim University Hospital, Trondheim, Norway volunteered to participate in the study. Recruitment of participants was provided by the clinic. First, patients underwent a clinical examination by a medical doctor to determine if patients met the inclusion criteria. At the first consultation, eligible participants were informed of the study and asked to reply on an invitation for participation after three days. Inclusion and exclusion criteria was in accordance to the two large studies this study is a part of (the LBP Study and the NP Study). The studies were approved by the Regional Committee for Ethics in Medical Research (no.: 2014/1157). All participants signed a consent form before the execution to confirm the participation in the study. After evaluation, patients were placed in the appropriate rehabilitation program depending on the primary site of pain. Furthermore, participants were randomized to either an exercise group with progressive resistance training and MDT or an exercise group with regular physical activity and MDT. The MDT groups at the clinic included up to 10 patients.

Inclusion and exclusion criteria for the LBP study

Inclusion criteria for the LBP study was patients referred to the clinic with non-specific LBP for >3 months or recurrent (≥ 2 periods with duration ≥ 4 weeks the past year), pain intensity >4 on numerical pain rating scale (0-10), and 16-70 years of age. Exclusion criteria was severe somatic condition (e.g., cancer, inflammatory rheumatic disease, severe osteoporosis), psychiatric condition that impairs group functioning, insufficient comprehension of Norwegian language to participate in group sessions and fill out questionnaires, drug or alcohol abuse, ongoing compensation claim or applying for disability pension due to LBP, participation in high-intensity resistance training on a regular basis for the last six months, contra-indications for high-intensity strength training (e.g. shoulder complications) and awaiting surgery of the lumbar spine.

Inclusion and exclusion criteria for the NP study

Inclusion criteria for the NP study was patients referred to the clinic with non-specific NP for >3 months or recurrent (≥ 2 periods with duration ≥ 4 weeks the past year, pain intensity >4 on numerical pain rating scale (0-10), and 16-70 years of age. Exclusion criteria was severe somatic condition (e.g., cancer, inflammatory rheumatic disease, severe osteoporosis), psychiatric condition that impairs group functioning, insufficient comprehension of Norwegian language to participate in group sessions and fill out questionnaires, ongoing compensation claim or applying for disability pension due to NP, drug or alcohol abuse, participation in high-intensity resistance training on a regular basis for the last six months, contra-indications for high-intensity resistance training (e.g. shoulder complications) affecting the ability to participate in training and awaiting surgery of the cervical area.

Treatment intervention

All patients participated in separate groups for three weeks of MDT, one NP group and one LPB group. For NP patients the program included four full rehabilitation days in week one and three, and for LPB patients – five full rehabilitation days in week one and three. For both groups, there was no group sessions in week two, but patients were encouraged to practice what they had learned the first rehabilitation week. Included in the MDT – patients participated in two individual consultations with physicians; one in week one and an additional in the end of week three, one with a social worker in week one and individual conversations with physiotherapists by requests. In addition, patients received two lectures and several group reflections in basic neck and back anatomy, aspects in relation to coping with pain and stress, physical activity and setting goals. The aim of the group reflection was to reduce fear avoidance beliefs, become more aware of their condition as well as to share their own thoughts and experiences of their everyday life with the disorder.

Physical exercise program

In addition to the MDT program mentioned above, patients in the LBP group and the NP group was placed into either a progressive resistance-training group or a general physical exercise group. For the progressive resistance group, they exercised three times a week in accordance to the recommended introduction training for populations with musculoskeletal pain [43] and the guidelines by the American College of Sports Medicine [44]. The training program consisted of full-body exercises, and for both the LPB and the NP group it included

lateral pulldown, unilateral shoulder abduction, reversed flies, unilateral rows, flies and stiff-legged deadlifts. In addition, squats were included in the LBP group, and neck flexion and extension in the NP group. All exercises were conducted in 15-20 repetitions each session. For patients in the general physical exercise group, patients in the NP group conducted four training sessions in week one and three training sessions in week three, and the LBP group conducted four training sessions in week one and five training sessions in week three. The sessions for both the LBP group and NP group consisted of general physical exercise e.g. endurance training, ball playing, stretching, body awareness and relaxation techniques, circle training and low-intensity resistance exercises. Moderate and high-intensity strength training was not included in the training sessions. Patients was also encouraged to stay physically active at home, and was offered a specific home-based training program based upon each individuals' interests and needs.

Test procedure

All participants were instructed of the test procedure prior to the test. Participants was instructed to take off their shoes, and keep them off throughout the entire session.

Anthropometric measurements

BMI was assessed at baseline. BMI is an individual's weight in kilograms divided by the square of height in meters (weight (kg)/height (m)²). Body weight was measured by The Bosch Personal Scale PPW33000 (kg), and height (m) was measured using a wall mounted stadiometer.

Grip strength

Figure 1 illustrates the grip strength test. Grip strength was measured by a hand held dynamometer (JAMAR hydraulic hand dynamometer, model J00105) [45] measured in Newton (N). During testing, participants was instructed to sit on a stool with their back against the wall with the elbow joint positioned in a 90-degree flexion and the upper arm alongside truncus. The dynamometer was regulated to the second narrowest handle position for all participants. Participants was instructed to squeeze the dynamometer as hard as they could until the force started to decline. The test was performed two times. A third test was performed if there was a >10% difference between the two first. Mean value of the trials was used in the analysis. The hand dynamometer has good reliability and validity [46].

Isometric neck flexion and extension

Figure 2 illustrates the neck extension and flexion test. Neck strength was measured through maximal voluntary isometric contraction of the cervical flexors and extensors by a hand held dynamometer (MicroFET 2 Manual Muscle Tester) and was measured in Newton (N). For the neck flexion participants was instructed to sit on a stool with their arms down and the back of the head against the wall. The test leader stood in front holding the dynamometer against the participants' forehead, right above the eyebrows. Participants was instructed to press their head forward and chin towards the chest. Further, they were instructed to press as hard as they could until they heard the stop signal from the dynamometer. The test leader counted for each trial with "one, two and push! Push! Push!". The test was performed three times. For the neck extension, participants were instructed to lie down on a bench with their stomach towards the bench and their hands down. The test leader stood in front, holding the dynamometer on the back of their head, at the crossover point between the ears. After each trial both for the neck flexion and extension, the participant was asked a question about perceived exertion and perceived pain on the BORG CR10 [47]. The mean of the three trials was used in the analysis.

Subjective measurements

After both the baseline and post-test, each participant received a questionnaire to fill in after the objective measurements. The included variables were 1) Education level (primary school/middle school, or higher education). The variable "higher education" was used for the analysis in this study, 2) relationship status (married/live-in partner, single or divorced) where "in a relationship" was used for the analysis in this study (a combination of married an live-in partner), 3) Disability pension status, which was assessed through check boxes "yes/no", 4) Self-rated health was measured through the question "how is your health at the moment?" with response options 1 (poor), 2 (not so good) 3 (good) and 4 (very good) [48] 5) Duration of pain, with optional boxes "3 to 6 months", "1-2 years" and "2 years or more", 6) Pain medications last week with a "yes/no" response, 7) Pain in other body parts illustrated with a figure of a body in which the participant were to point out specific pain sites besides the neck or low back, included head, shoulder, upper back, chest, elbow, stomach, hand, ankle/foot and hip/thigh, respectively [49], 8) Numerical pain rating scale, an 11-point scale which describes pain intensity where 1-3/4 is slight pain, 3/4 to 6/7 is moderate pain and 7-10 is severe pain. Part 1 with the question "mark the number that best indicates how severe your pain is right now" was used in this study. The NP-group answered for their NP, and the LBP-group

answered for their LBP. This scale has good validity and reliability [50] and 9) The fear avoidance beliefs questionnaire part 1 is a questionnaire consisting of 16 questions scaled from 0 to 6. Question 1-5 regarding physical activity was used in the analysis. The NP-group answered for their NP, and the LBP-group answered for their LBP. The scale is commonly used to assess fear avoidance beliefs among patients with musculoskeletal disorders. The fear avoidance beliefs total score for part 1 is 24. Evidence from similar studies shows good validity and reliability [51-53].

Statistics and analysis

Statistical analysis was done in Excel 2016 and IBM SPSS Statistics 21. All variables were tested for normality with a Shapiro Wilk normality test. For the variables that was non-normally distributed the Mann Whitney u-test was used for group comparisons. These variables were gender, perceived effort and perceived pain in both flexion and extension in BORG CR10 respectively. An independent samples t-test (parametric) was used for the comparison of the two patient groups for normally distributed variables. i.e., age, height, weight, BMI and numerical pain rating scale. A chi square test was used to determine whether there was a significant difference between the whole distribution between the groups for categorical variables, i.e., educational level, relationship status, work status, duration of pain, fear avoidance beliefs, and use of pain medications last week. An independent samples t-test was used to analyse if Δ -change in self-rated health, fear avoidance beliefs and numerical pain rating scale differed between groups. Level of significance was set at α 0.05 for all analysis.



Figure 1. Picture of the grip strength test. The picture illustrates all positions of the test.



Figure 2. Pictures of the neck flexion/extension test. A) represents the neck flexion test and B) represent the neck extension test, respectively.

Results

Baseline characteristics

Baseline characteristics of the two patient groups are presented in Table 1. Overall, there were no major differences between patients with severe LBP and NP. For the demographic variables there was a difference between groups in both weight and BMI. An unequal distribution of men and women was also present with relatively more men and less women in the LBP group compared to the NP group. Although there was no difference in cervical muscle strength, patients with NP reported higher levels of pain during maximal isometric voluntary neck flexion and extension compared to the LBP group. Further, - relatively more patients in the NP group received disability pension than in the LBP group. Also, number of pain sites tended to differ between groups with NP patients being more bothered by musculoskeletal comorbidity.

Table 2 presents the baseline distribution of present pain sites within the LBP and NP groups. Among the patients with LBP about 71% reported more than one pain site. The corresponding number among the patients with NP was 74%. In the LBP group, 35% of the patients also reported NP, while 38.7 % of the NP patients also reported LBP. Overall, patients with NP were more bothered with pain in the upper body with significant group differences in the prevalence of headache, shoulder pain, elbow pain, and hand pain. For the remaining body parts, pain was equally prevalent in the two groups.

Change from baseline to post test

The three-week baseline to post intervention effect between the LBP-group and the NP-group are presented in table 3. For the fear avoidance beliefs score, there was a tendency of a difference between the LBP and the NP group where the LBP group had a higher decrease in Δ -change. No significant differences were found between the patient groups in fear avoidance, pain or self-rated health.

Table 1. Baseline characteristics of patients with severe pain in the low back and neck.

Variables	LBP (n=56)	NP (n=31)	P-value	
Demographics				
Age (years), mean \pm SD	44.8 \pm 11.9	47.7 \pm 8.9	0.65	(t)
Height (m), mean \pm SD	1.74 \pm 0.09	1.70 \pm 0.09	0.15	(t)
Weight (kg), mean \pm SD	89.4 \pm 18.2	77.1 \pm 18.2	<0.001	(t)
BMI, mean \pm SD	29.3 \pm 5.0	26.5 \pm 5.0	<0.001	(t)
Men/women (%)	27/29 (48/52)	9/22 (29/71)	0.08	(m)
Muscle strength				
Grip strength (N), mean (95% CI)	356 (3.3-3.9)	334 (3.0-3.8)	0.39	(t)
Neck extension (N), mean (95% CI)	172 (1.5-1.9)	167 (1.4-1.8)	0.72	(t)
Perceived exertion (0-10) ^a	9.1 (8.5-9.7)	9.0 (8.6-9.4)	0.78	(m)
Perceived pain (0-10) ^a	1.3 (0.5-2.1)	3.2 (2.3-4.1)	<0.001	(m)
Neck flexion (N), mean (95% CI)	130 (1.1-1.4)	124 (1.0-1.4)	0.63	(t)
Perceived exertion (0-10) ^a	8.8 (8.3-9.3)	8.6 (8.1-9.1)	0.50	(m)
Perceived pain (0-10) ^a	1.6 (2.3-2.3)	3.7 (2.7-4.7)	<0.001	(m)
Sociodemographic health characteristics				
In a relationship, n (%)	45 (83.3)	24 (77.5)	0.50	(χ)
Working full time ^b , n (%)	35 (63.6)	13 (43.3)	0.46	(χ)
Higher education ^c , n (%)	21 (42.8)	10 (38.4)	0.67	(χ)
Disability pension, n (%)	1 (1.9)	5 (20)	0.05	(χ)
Self-rated health (1-4), mean (95 % CI)	2.1 (1.9-2.3)	2.1 (1.9-2.3)	0.64	(χ)
Musculoskeletal symptoms and fear avoidance				
Duration of pain, n (%)			0.70	(χ)
3-6 months	10 (17.8)	8 (25.8)		
1-2 years	23 (41)	12 (38.7)		
>2 years	22 (39.2)	11 (35.4)		
Pain medications last week, n (%)	29 (53.7)	17 (56.6)	0.79	(χ)
Number of pain sites (0-12), mean (95% CI)	3.0 (2.5-3.5)	3.9 (2.9-4.9)	0.08	(t)
Numerical pain rating (0-11), mean (95% CI)	4.7 (4.2-5.2)	4.6 (4.0-5.2)	0.98	(t)
Fear avoidance beliefs (0-24), mean (95% CI)	9.6 (7.9-11.3)	8.5 (6.4-10.6)	0.57	(t)

Abbreviations: LBP, low back pain; NP, neck pain; SD, standard deviation; CI, confidence interval; %, per cent; BMI, body mass index; (N), Newton; n, number of participants; t, t-test; m, Mann Whitney u; χ , chi square.

^a Perceived exertion/pain on Borg Scale CR10

^b Percentage in full time job

^c Education on university/college level

Table 2. Baseline distribution of pain sites in patients with severe pain in the neck and low back.

Pain sites	LBP, n (%)	NP, n (%)	P-value
Headache	10 (17.8%)	12 (38.7%)	0.03
Shoulder	10 (17.8%)	15 (53.5%)	<0.001
Upper back	13 (23.2%)	8 (25%)	0.78
Chest	5 (8.9%)	4 (12.9%)	0.56
Elbow	2 (3.5%)	6 (19.3%)	0.02
Stomach	4 (7.1%)	2 (6.4%)	0.90
Hand	3 (5.3%)	7 (22.5%)	0.02
Hip/thigh	21 (37.5%)	10 (32.2%)	0.62
Knee	13 (23.2%)	6 (19.3%)	0.67
Ankle/foot	9 (16%)	6 (19.3%)	0.15

Abbreviations: LBP, low back pain; NP, neck pain.

Table 3. Comparison of the acute treatment effects in patients with severe low back and neck pain. Values are mean \pm SD.

	Baseline	Post-test	Δ -change
Self-rated health (1-4)			
Low back pain	2.1 \pm 0.6	2.4 \pm 0.6	0.3 \pm 0.6
Neck pain	2.1 \pm 0.6	2.3 \pm 0.6	0.1 \pm 0.4
		<i>P</i> -value	0.39
Fear-avoidance beliefs (0-24)			
Low back pain	9.6 \pm 6.3	7.2 \pm 5.5	-2.5 \pm 5.0
Neck pain	8.5 \pm 5.8	8.3 \pm 6.0	-0.5 \pm 5.6
		<i>P</i> -value	0.10
Numerical pain rating (0-11)			
Low back pain	4.7 \pm 1.9	4.2 \pm 2.2	-0.4 \pm 1.9
Neck pain	4.6 \pm 1.7	4.3 \pm 1.9	-0.3 \pm 2.2
		<i>P</i> -value	0.84

Discussion

The present study investigated whether patients with severe chronic LBP versus NP differ in terms of health characteristics and muscle strength. In addition, it was investigated if a three-week MDT program induced different acute effects on self-rated health, fear avoidance beliefs and pain in the two groups. Overall, the results indicated no major differences between the two patient groups; however, it was a tendency that NP patients had more musculoskeletal comorbidity. Moreover, patients with LBP had a higher BMI than the NP patients. As expected, the patients with NP scored higher than the LBP patients on perceived pain during the maximal isometric neck flexion and extension strength test. Additionally, the relative proportion of NP patients that receive disability pension was higher than for the LBP patients. No significant difference was observed between the groups from baseline to post-test in change in self-rated health, fear avoidance beliefs and pain, however the LBP group tended to have a higher decrease in fear avoidance beliefs.

Although the comparison of the distribution of women and men in the two patient groups did not reach significance, there was a strong tendency of relatively more women than men in the NP group compared to the LBP group. This finding can support previous research that women have a higher prevalence of NP than men [15-17]. Further, the difference found in BMI between the groups might be explained by the majority of women in the NP group which would lower the mean BMI because men on average have a higher BMI than women [3]. Nevertheless, in a similar study, Buchner and colleagues showed that LBP patients had a significant higher BMI compared to NP patients. In a clinical context, it may be advantageous to implement a weight reduction program for patients with LBP. Roffey and colleagues found that the severity of pain in the low back decreased in line with weight loss [54]. Although this applied for obese individuals, it is reason to suggest that it may also apply for individuals with severe chronic LBP with BMI classified as overweight.

The finding that widespread pain is common in both patient groups is of interest. The fact that the majority in both groups reported pain in more than one site is in line with previous studies [23, 25]. This may also question whether patients with severe LBP and NP represent two separate entities or if they are part of pain continuum where the location of the primary pain sites is “accidental”. Thus, the number of pain sites per se may be more important than the primary pain location. Accordingly, Natvig and co-workers showed that the consequences of having pain in more than the primary site for LBP patients increases the risk of poorer self-reported health and range of other comorbidities [55]. Parts of this can be

reflected in the current study, where the patients self-reported health was classified as “not so good” for both the LBP group and the NP group. Also, Peat and co-workers found that multisite pain is associated with decreased function and increased disability [56]. In the current study, 5% of the NP patients were disability pensioned while only 1% received disability pension in the LBP group. However, this finding should be interpreted cautiously because of the small study sample but may indicate that NP patients, who have more musculoskeletal comorbidity, are at higher risk of disability pension. The fact that the NP group had a higher prevalence of pain sites in the upper body than the LBP group may indicate that co-occurring pain among the NP patients is related to radiculopathy derived from the painful neck. Within the LBP group co-occurring was mainly located to the hip/thigh and may also related a mechanism of referred pain from the low back.

The current study indicated that the two groups had similar muscle strength. As expected, NP patients reported higher level of pain than the LBP patients when performing the maximal isometric neck flexion and extension strength tests. Nevertheless, the average cervical strength was similar between the two groups. When compared to healthy subjects, both groups were equally strong in neck flexion and extension [57] and grip strength [58]. This finding may suggest that pain may not affect the general muscle strength in patients with severe LBP or NP.

There are indications that the effects of the three week MDT program did not differ between patients with LBP versus NP. This could be used as a foundation of further discussion that patients with LBP and NP share common health characteristics also after an intensive treatment intervention. To our knowledge, there are few studies who has aimed to compare patients with LBP and NP after a MDT program. However, Buchner and colleagues found that a three-week MDT did not differ on health characteristics between patients with chronic LBP versus NP on a 6 months follow up [38]. Although this was a prospective longitudinal study on patients with chronic pain it is somewhat similar to findings in this descriptive study.

An apparent strength of the current study is the inclusion of patients with severe pain in the spine. The use of questionnaires to obtain data is both cost and time efficient and the variation of variables of the baseline study provided a relatively broad perspective of the patient characteristics. Additionally, the outcomes in muscle strength provides an insight in the muscle strength of the patients. Also, there are some limitations to the study. Selection bias could occur because of the small sample size. Concerning data analysis, an adjusted stratification on gender might have given a more thorough description of reasons for the

differences in BMI between LBP and NP patients. Outcomes in health characteristics could have been extended with information on other general co-morbidities, physical activity level and occupational information. There is also a chance of response bias. Individuals with several physiological and psychological issues might include earlier aches not related to the LBP or NP. In an epidemiological study done in the US, a question about pain for the last 24 hours or more was assessed. In the question it was stated that the participants should exclude other minor pain or other physiological ailments in the answer [59]. Questions similar to this could alternatively been used in the current study to separate the severity of the primary pain location from possible other sites, and prevent individual interpretation of the questions. It is also important to empathize that the reported duration of pain can be misclassified and may not necessary correspond to the truth, where patients may include other pain in their answer. Thus, there is a possibility that the response may not differ between the two patient groups. Regarding the changes from baseline to post intervention, there are limitations that needs to be discussed. This study investigated only three outcomes on the baseline to post intervention effect. Due to the short duration of the intervention, we only got an insight in acute effects and not changes on a longer follow up. In a clinical setting, results from a longer follow up with more outcomes would be preferable when designing similar intervention programs for patients with LBP or NP.

Conclusion

In conclusion, the findings in the current study indicate that musculoskeletal comorbidity is common among patients with severe pain in the low back and neck. There were no major differences in health characteristics or muscle strength between the groups. A short-term MDT rehabilitation program did not induce different effects on self-rated health, fear avoidance beliefs or pain between in the two groups.

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