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The effect of chronic low back pain on daily living and fear-avoidance beliefs in working adults

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Abstract

Low back pain (LBP) has become one of the most influential musculoskeletal diseases of modern society. Exercise has been shown to be very effective in the treatment of chronic low back pain (CLBP). The goal of the study was to test the effect of two exercise intervention programmes (conservative and progressive-aggressive programmes) for 12 weeks on CLBP and their impact on the activities of daily living, and fear avoidance beliefs about physical activities and work-related activities. In total 22 participants were recruited for the study and randomly assigned to one of two exercise groups: 11 participants in the conservative exercise group and 11 in the progressive-aggressive group). The Oswestry Disability Index (ODI), the Functional Rating Index (FRI), and the Visual Analogue Scale (VAS) for pain measurement was completed by the participants pre- and post-test. There were no statistically significant differences at the 5% level between the conservative and progressive-aggressive programmes. In conclusion, the results from the present study indicate that both types of programmes have shown to be very effective in the improvement of daily living and fear avoidance beliefs. On the basis of the magnitude of improvement, an aggressive-progressive exercise programme may be a little more effective than a more conservative exercise programme.

Keywords: Disability, chronic low back pain, daily living, absenteeism, working status, fear avoidance beliefs.

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Introduction

Chronic pain often persists long after the tissue trauma that triggered a painful response has healed and may be present in the absence of any recognized ongoing tissue damage (Holdcroft & Jagger, 2005) and has been recognized as a dysfunctional response. This response mostly does not warn the individual of underlying disease or injury that will trigger an aversion response and has, accordingly, been widely acknowledged as a disease in its own right (Meyer, 2007; Niv & Devor, 2007). Burton (2005) reported that in most cases, pathology cannot be directly linked to pain and the tendency is to make either a diagnosis that is descriptive of symptoms or a diagnosis of nonspecific low back pain (LBP) (Deyo, 1994). This painful response can then cause secondary consequences, such as disability and high financial cost, which are more problematic than the pain itself (Staal, Rainville, Fritz, Van Mechelen & Pransky, 2005). In South Africa, around R1.2 billion is spent each year on back-related problems (SAPA, 2009).

The prevalence of chronic disabling low back pain (CLBP) resistant to conservative treatment is increasing, and has substantial economic and social consequences (Maestretti, Reischl, Jacobi, Wahl, Otten, Bihl & Balague, 2011), and therefore it makes LBP a leading cause of disability in the industrialized world (Shaw, Tveito, Woiszwillo & Pransky, 2012). Pain can be caused not by only acute or chronic injuries of the spine, but by other structures of the spine such as facet joints. Furthermore, degenerative processes and protrusions are very common and mostly do not cause symptoms (Zechmeister, Winkler & Mad, 2011). Most LBP conditions are mainly characterized by hypertrophied arthritis of the facet joint that results in lumbar instability in mainly the sagittal plane (Cansever, Civelek, Kabatas, Yilmaz, Caner & Altinörs, 2011). Whole body alignment produces "*articular*" LBP (Datta, Lee, Falco, Bryce & Hayek, 2009), and the prevalence of chronic disabling LBP resistant to conservative treatment is increasing (Maestretti et al., 2011).

Western societies tend to be influenced by worker absenteeism and disability, resulting to very high related economic costs (Andersson, 1999). Burton (2005) reports that many people with back pain episodes usually return to work in due time (Phelps, Vogel & Shellenberger, 2004) but that recurrent and CLBP is considered to be responsible for a large portion of the total number of work absenteeism. Burton (2005) reports that 85% of days lost from work due to back pain is for a short period of time and a return to work in fewer than 7 days is very likely. The other 15% accounts for days missed and the workers are off from work for longer than a month. This has important economic implications, in that patients who are absent from work for more than six months have a 50% chance of returning to work. Being off from work for more than one year results in a 25% chance of returning to work and being off for longer than two years results in less than a 5% chance of returning to work (Bergquist-Ullman & Larsson, 1977). Linton, Boersma, Jansson, Svärd and Botvalse (2005) have shown significant differences concerning key outcome variables of healthcare utilization and work absenteeism. The cognitive-behavioral intervention group and preventive physical therapy group had significantly fewer healthcare visits than did the control group. For work absenteeism, the experimental groups had fewer days during the 12-month follow-up compared to the control group. The risk for developing long-term sick disability leave was more than five-fold higher in the control group as compared with the other two groups. In Canada about 1 out of every 50 Canadians becomes disabled by back pain, while 40% of all absenteeism from the workplace is due to back pain (Kandel, Roberts & Urban, 2008). In the Netherlands, the incidence rate of LBP in the general population is estimated at 10% – 15% (Verkerk, Luijsterburg, Ronchetti, Miedema, Pool-Goudzwaard, Van Wingerden & Koes, 2011). Back pain is never really life threatening, but in 1998 the financial cost in terms of lost productivity, medical bills and workers' compensation benefits was estimated at $50 billion in the United States (Kandel et al., 2008). In 2012 it was shown in an epidemiologic review that more than 25% of adults in the United States have had LBP that increased to 55% when the duration of report was extended to cover the previous year (Gore, Sadosky, Stacey, Tai & Leslie, 2012). LBP is equally common among both genders and has a substantial impact on functioning (Gore et al., 2012).

One of the most important recommendations that has arisen through research is that patients have to resume normal daily activities as soon as possible and also have to be assured of the safety and necessity of return to normal daily activities (Waddell, 1996). It has been recommended that treatment should not focus primarily on pain but rather on the consequences of pain and, as a loss of function, physical inactivity and being absent from work are seen as the primary goals of treatment (Staal et al., 2005). These goals are considered more important during the course of treatment rather than the pain itself, and the reduction of pain should not be seen as the primary goal of treatment. These other goals should rather be actively pursued, even if a drastic reduction in pain levels does not occur initially (Sullivan, 2004). Complete relief from pain is not necessary for one to return to work after a bout of sick leave resulting from LBP (Crombez, Vlaeyen, Heuts & Lysens, 1999; Van Tulder, Malmivaara, Esmail & Koes, 2000), since there seems to be no additional risk to aggravate low back problems when normal daily activities are resumed (Staal et al., 2005). Those who resume normal activities tend to show less work absenteeism (Indahl, Haldorsen, Holm, Reikerås & Ursin, 1998; Hagen, Eriksen & Ursin, 2000).

Exercise as therapy is safe for individuals with back pain because it does not increase the risk of future back injuries or work absence. There is substantial evidence that supports the use of exercise as a rehabilitation modality to improve impairment in back flexibility and strength (Rainville, Hartigan, Martinez, Limke, Jouve & Finno, 2004). Several guidelines recommend that exercise therapy for CLBP is very effective (Van der Velde & Mierau, 2000; Albright, 2001; Krismer & Van Tulder, 2007; Abdulrahman, El-Sayed, Hadley, Tessema, Tegegn, Cowan & Galea, 2010). CLBP seems to share a close relationship with impaired trunk muscle function (Ito, Shirado, Suzuki, Takahashi, Kaneda & Strax, 1996). Full-time workers with recurrent LBP and associated disability have shown a reduction in short-term and long-term disability, as well as a reduction in short-term pain with remedial exercise programmes (Rasmussen-

Barr, Äng, Arvidsson & Nilsson-Wikmar, 2009; Oesch, Kool, Hagen & Bachmann, 2010). Rainville, Carlson, Polatin, Gatchel & Indahl (2000) report that exercise can have a multitude of beneficial effects. An altering of pain attitudes and beliefs as well as an improvement of pain intensity and disability through a desensitization of fear are possible psychological benefits. Therapeutic benefits include the improvement of physical function. The prevention of work-related fatigue and muscle pain are important factors, and this can be achieved by sufficient levels of muscle strength and good physical capacity (Oldervoll, Rǿ, Zwart & Svebak, 2001). Physical therapy is mainly directed at patient education and regular exercise, with the primary goal of preserving spinal flexibility, fitness, preventing postural deformities and improving muscle strength (Valle-Onate, Ward & Kerr, 2012). Exercise rehabilitation for any patient with LBP will include a range of treatments, including physical and educational advice regarding lifestyle factors and general back care. In the case of LBP, the focus is on reducing pain that is debilitating. Postural impairment and restricted movement have been part of CLBP, as seen in many reviews and studies (Sheeran, Van Deursen, Caterson & Sparks, 2013).

In a systematic review by Van Middelkoop, Rubinstein, Kuijpers, Verhagen, Ostelo, Koes and Van Tulder (2011), pain intensity and disability were significantly reduced by exercise therapy. In clinical practice it is noted that patients behave differently with exercise intervention, because of different diagnoses and attitudes. Sheeran et al. (2013) study showed that exercise intervention aimed at correcting the patient's posture that matched specific control impairment produced statistical and clinical improvements in disability and pain. According to Overdevest, Luijsterburg, Brand, Koes, Bierma-Zeinstra, Eekhof, Vleggeert-Lankamp and Peul (2011), conservative treatment must be the first option in rehabilitation. Exercise rehabilitation after back pain is usually aimed at reducing the risk factors and minimizing recurrences. More aggressive intervention is needed if the pain becomes constant and chronic. Cognitive intervention and exercise seem to help patients overcome their psychological barriers to pain and be more physically active (Keller, Brox, Gunderson, Holm, Friis & Reikerås, 2003), as well as have a positive effect on patients' ability to cope with pain (Arnold, 2008).

The purpose of this study was to investigate the effect of pain on working status and disability and investigate the effect of two structured exercise intervention programmes on disability due to CLBP.

Methodology

Participants

Selection for this study was done by randomisation. Advertisements were placed in local newspapers as well as on local radio. Referrals by general practitioners were also used. Potential subjects were then contacted by telephone and sent all of the required paperwork by e-mail or fax. Twenty-two male and female full-time employed participants (n=22) between the ages of 20 and 55 years voluntarily participated in the study. All participants were screened by a medical specialist before participation to confirm their back problems. Participants with back pain for longer than 12 weeks were included in the study. However, those with previous spinal surgery, suffering from discogenic disease as well as neurological symptoms, pregnant and with disability were excluded. All participants were fluent in English. Participants were given an informed consent form to sign that explained all of the procedures involved. The study was approved by the Ethics Committee of the Faculty of Humanities at the University of Pretoria.

Measuring instruments

Pain and disability were used as variables and were measured by means of specific questionnaires. The selected questionnaires are used extensively in LBP and physical therapy studies, because they are valid, reliable, repeatable, sensitive to change, and they correlate well with other instruments (Kääpä, Frantsi, Sama & Malmivaara, 2006; Goldby, Moore, Doust & Trew, 2006). These tests are briefly described below.

Oswestry Disability Index (ODI)

The Oswestry disability index is used to assess participants with LBP to determine its impact on the activities of daily living (Fairbank & Davies, 1980). This instrument is a self-administrated questionnaire and one of the most commonly recommended condition-specific outcome measures for spinal disorders, which are not life threatening (Carreon, Glassman & Howard, 2008; Mehra, Baker, Disney & Pynsent, 2008). The ODI is also used to measure condition-specific outcomes and it includes 10 sections of LBP induced disability in daily functions and leisure-time activity. The ODI also assesses limitations in activities of daily living (Fairbank & Davies, 1980; Ostelo & De Vet, 2005; Mehra et al., 2008). Each section is scored on a 0-5 scale, with 5 representing the greatest disability and 0 representing no disability (Ostelo & De Vet, 2005; Mehra et al., 2008).

Functional rating index (FRI)

The Functional Rating Index is an instrument purposely designed to quantitatively measure the participant's perception of function and pain of the spinal musculoskeletal system in a clinical setting. The FRI was developed to provide an assessment instrument that has clinical value and quantifies the patient's current state of pain and dysfunction. The FRI contains 10 items that assess both pain and function of the spine. Of these 10 items, 8 refer to activities of daily living and two refer to two different attributes of pain. Pain and the loss of function in spinal conditions are better to use in many spinal conditions since its combination of the two factors. By using a 5-point scale for each item, the patient ranks his or her perceived ability to perform a specific task and/or the quantity of pain at the present time ("*right now, at this very moment*") by selecting one of the five response points that are anchored by polarized statements (0 = no pain or full ability to function; 4 = worst possible pain and/or unable to perform this function at all). For scoring purposes, the 10 items of the FRI were totalled according to the responses given, divided by the total possible points available and then multiplied by 100 to produce a percentage value. The range of possible scores is zero percent (no disability) to 100 percent (severe disability).The higher the score the higher the perceived pain and dysfunction (Feise & Menke, 2001).

The Visual Analogue Scale (VAS) for Pain Measurement

The Visual Analogue Scale consists of a single 100 mm line across the surface of a page. On the left side of the line no pain is indicated, while maximal amount of pain is indicated on the right hand side of the line. Participants had to indicate how they would rate their own pain by indicating it on the scale (Ostelo & De Vet, 2005). A score is presented and 100 is maximal. The VAS is a participative measurement of the intensity of LBP (Kankaanpää, Colier, Taimela, Anders, Airaksinen, Kokko-Aro & Hänninen, 2005). Pain intensity is a quantitative estimate of the severity or magnitude of perceived pain (Ostelo & De Vet, 2005). The VAS is a standardized instrument used to measure pain intensity with a high test-retest reliability of $r>0.95$ (Wewers & Lowe, 1990). It also has high criterion-related validity with established instruments (Wewers & Lowe, 1990).

Exercise programmes

Both groups completed the questionnaires pre- and post-exercise. The intervention used in this study consisted of two separate exercise programmes. The first programme was the control group (n=11). This control group received an exercise programme that was considered to be conservative. The participants completed the programme twice per week for approximately 35-40 minutes. This programme remained unchanged throughout the 12-week intervention timeframe. The second programme for the experimental group (n=11) was considered more aggressive in terms of the exercises performed as well as the intensity of the programs. The intensity of the programme was increased every four weeks. The programme was completed twice per week with a session lasting for approximately 45-60 minutes, along with the Back School session. This programme included stretching exercises and also gymnasium-based exercises performed on the resistance exercise equipment for functional muscle groups of the upper back, hips, arms and legs. Every exercise session was recorded and participants had to complete the entire programme for 12 weeks and not lasting more than 16 weeks, for 24 sessions. All sessions were supervised by a qualified biokineticist. The time period for each group was different in that the duration of the programme was considered part of the intensity factor that was different for each group, since it is the programme as a whole that is being investigated and not individual exercises. All participants performed exactly the same exercise programme. Participants were requested not to perform any other types of exercises as these could interfere with the rehabilitation exercises. The educational sessions took place after the training sessions. The educational sessions lasted between 5-10 minutes each. The topics contained in the back school document were discussed more in depth with the participants on an individual basis. The back school document served to provide education and understanding of living with chronic LBP and thus provides a large part of the biopsychosocial approach, focusing on education. Both groups received an information booklet to read before the start of the programme (Billson, 2009).

Statistical analysis

Descriptive statistics were used for the minimum and maximum scores, mean scores and standard deviations. Descriptive statistics were measured by means of the Mann-Whitney test and the Wilcoxon signed-rank test (Babbie, 1992)

Results

Table 1 displays the descriptive statistics per group on pre-test measurements.

Table 1: Descriptive statistics per group on pre-test measurements

Group		n	Min	Max	Std Dev
Experimental	Age	11	18	57	10.35
	Weight (kg)	11	50	131	26.99
	Height (cm)	11	155	195	12.90
	BMI (kg/m^2)	11	19	36	5.97
	Hours worked / day	11	5	15	2.57
	Time spent driving (min)	11	0.4	1800.0	494.97
	Valid N (listwise)	11			
Control	Age	11	22	56	11.02
	Weight (kg)	11	59	106	14.37
	Height (cm)	11	152	190	10.76
	BMI (kg/m^2)	11	20	36	3.94
	Hours worked / day	11	3	16	2.79
	Time spent driving (min)	11	0.0	1800.0	480.73

There were significant improvements for the VAS, ODI as well as for the FRI in the control group (Table 2). Lower mean scores indicate an improvement in these values. The goal of the VAS pain scale is to get the scores as close as possible to 10. The scores indicates a level of tolerable pain that a person in theory can live with and is considered a minimum for success (Wewers & Lowe, 1990).

Table 2: Results of the pre-test and post-test in the control group

	Mean	Standard deviation	Asym. Sig (2-Tailed)
VAS Pre-test	52.57	19.35	0.005
Post-test	13.40	11.46	
ODI Pre-test	20.07	7.73	0.008
Post-test	11.00	6.20	
FRI Pre-test	32.29	7.56	0.005
Post-test	13.80	6.23	

VAS = Visual Analogue Scale; ODI = Oswestry Disability Index; FRI = Functional rating index

There were significant improvements for the VAS, ODI as well as for the FRI in the experimental group (Table 3). The scores shows that the experimental group also achieved significant improvements from baseline to outcome.

Table 3: Results of the pre-test and post-test in the experimental group

	Mean	Standard deviation	Asym. Sig (2-Tailed)
VAS Pre-test	54.44	18.23	0.004
Post-test	17.00	18.75	
ODI Pre-test	23.72	8.57	0.006
Post-test	8.00	8.00	
FRI Pre-test	34.61	13.23	0.003
Post-test	10.64	8.69	

VAS = Visual Analogue Scale; ODI = Oswestry Disability Index; FRI = Functional rating index

There were no significant differences between the control (CT) and experimental (Exp) groups for any of the values (Table 4).

Table 4: Post-test results between both groups (CT = Control group; Exp = Experimental group)

	Mean CT Exp	Standard deviation CT Exp	Asym. Sig (2-Tailed)
VAS	13.40 17.00	11.46 18.75	0.944
ODI	11.00 8.00	6.20 8.00	0.305
FRI	13.80 10.64	6.23 8.69	0.415

VAS = Visual Analogue Scale; ODI = Oswestry Disability Index; FRI = Functional rating index

Discussion

Participants reported being affected by their back pain but worked despite their discomfort. The mean score for the ODI in the experimental and control groups were 23.72 and 20.07, respectively during the pre-test (Tables 2 and 3). The scores are classified as being only ‘moderate disability’ (Fairbank & Davies, 1980; Fairbank & Painsent, 2000). People can still function and do daily tasks, but their pain affects them. This would suggest the participants were not disabled by their pain. At post-test, both groups improved significantly on the ODI and scored 'minimal disability' only. In the case of the experimental group it shows a favourable result for the present study, as a lower score shows an improvement in self-reported disability levels. A significant decrease in disability levels, as shown by the ODI and the FRI, demonstrates that an aggressive-progressive exercise programme may also be effective in decreasing levels of self-reported disability. Research has shown the importance of disability levels in chronic pain (Waddell, 1996; Pincus, Burton, Vogel & Field, 2002; Staal et al., 2005), as well as the need to reduce it (Simmonds & Dreisinger, 2003; Sanders, Harden & Vicente, 2005). The control group also showed a good outcome in terms of disability variables. This result shows that a conservative exercise programme is also effective in improving disability due to LBP. It has been reported that physical exercise is recommended to prevent absence due to back pain and the occurrence or duration of further back pain episodes (Burton, 2005). There was no significant differences between the experimental and control groups regarding the ODI (Table 4).

Regarding the VAS pain score, in the experimental group the pre-test measurement was significantly higher than the post-test measurement (Table 2 and Table 3). This is a favourable result for the present research, as a lower score shows an improvement in pain levels. It has been shown that pain elimination is not a primary goal in the treatment of CLBP (Staal et al., 2005). However, considering that the VAS pain score in the present study had decreased significantly within the experimental group demonstrates that an aggressive-progressive exercise programme is effective in treating pain associated with CLBP, since the VAS score was below 30. The control group also showed good improvement in their pain score. It has been proven that conservative exercise programmes are effective in treating LBP (Richardson, Jull, Hodges & Hides, 1999; Hides, Jull & Richardson, 2001). Thus, the results in the present study confirm this view. However, conservative programmes will not necessarily cause improvement in the overall functional status as the more aggressive programmes might have. Again, there was no significant difference between the experimental and control groups regarding the VAS pain score (Table 4). Similar results have been found in a number of studies. Taimela, Diederich, Hubsch and Heinricy (2000) showed a 38% reduction in a physical impairment score after 12 weeks of progressive exercise training, while Risch, Norwell and Pollock (1993) showed a 15% reduction in the physical scale of Sickness Impact Profile. Regarding the Oswestry disability index, van der Velde and Miewrau (2000), Hazard, Fenwick, and Kalisch (1989), Rainville, Jouve, Hartigan, Martinez and Hipona (2002), and Frost, Klaber Moffett and Moser (1995) all showed reductions of 33%, 41%, 28%, and 25%, respectively in the scores after general and active exercise programmes.

Exercise performed in a quota-based manner and performance expectations that are not dependent on pain can function as a fear-desensitizing process.

A quota-based, non-pain-contingent exercise programme can be defined as a method of operant conditioning with the goal of decreasing illness (disability) behaviours and reinforcing wellness (exercise) behaviours (Fordyce, Fowler, Lehmann, Delateur, Sand & Trieschmann, 1973). Fordyce et al. (1973) study showed exercise delivered in a quota-based manner significantly increased activity and exercise tolerance. There was also a decrease in the use of pain medication. Mayer, Gatchel, Mayer, Kishino, Keeley and Mooney (1987) and Hazard et al. (1989) also showed that by using functional restoration programme consisting of quota-based exercises, a significant reduction in disability and a higher rate of return to work after treatment can be achieved. Of interest, functional restoration has been shown to directly influence patients' pain attitudes and beliefs and the magnitude of this influence strongly predicts post-treatment disability (Rainville, Ahem & Phalen, 1993). From 1980 to 2010, multiple additional studies using exercise as the primary mode of treatment have confirmed the results in this study and demonstrated a significant reduction of disability after treatment, presumably in part because of the influence of exercise programmes on these parameters. Because there will be a reduction in absenteeism because of this reduction in disability after treatment, it will possibly lead to financial cost savings. Wright, Lloyd-Davies, Williams, Ellis and Strike (2005) showed that on average the patients who were receiving individual treatment and group exercise programme, took 7 days less off work and this represented a 35% reduction. The estimated cost saving of providing the extra service of a simple back programme ranged between $367 and $850 for each patient. These results indicate that the cost of this active back programme was more than reimbursed as a consequence of an earlier return to work.

It has been suggested that pain levels should not be the only determining factor for treating LBP: functional status too should be considered (Sullivan, 2004; Staal et al., 2005). However, pain levels for the participants are of primary concern, as this was the main reason for all patients to seek treatment for their LBP. The participants reported in open-ended questionnaires at the post-test that they felt that their functional status would improve if their pain levels decreased and that they felt to partake in more activities of daily living as well as recreational activities. Further research is needed to determine if there would be a reduction in disability levels even if pain levels decreased accordingly when participants followed a functional strengthening programme, especially in a South African working environment.

In conclusion, the results from the present study indicate that both types of programmes have shown to be very effective in the improvement of daily living. Based on the magnitude of improvement, an aggressive-progressive exercise programme may be more effective than a more conservative exercises programme.

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