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The effect of a conservative versus an aggressive-progressive exercise programme on chronic low back pain and disability

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Abstract

Thirty-two (N= 32) full-time working subjects between the ages of 20 and 55 years participated in a 12-week exercise intervention study. Subjects were randomly divided into a control group receiving conservative exercises and *low intensity back school* and an experimental group receiving aggressive-progressive exercises and *high intensity back school*. Pain and disability were measured with the Visual Analog Scale (VAS) and the Oswestry Disability Index (ODI). The ODI is used to determine the impact of low back pain on the activities of daily living. Results showed that both groups improved significantly from baseline, but there was no significant difference between the groups. The experimental group improved from 54.44 to 17 and the control group improved from 52.57 to 13.40 for the VAS and from 23.72 to 8 for the experimental group and from 20.7 to 11.00 for the control group for the ODI respectively. The results from the experimental group were compared to results from similar studies to obtain an indication of results achieved versus those achieved in developed countries. In conclusion, the VAS and ODI results achieved by the South African subjects were equal to or better than those achieved by patients in developed countries.

Keywords: Low back pain, disability, aggressive-progressive exercise, stabilization exercises.

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Introduction

Low back problems are a common pandemic disorder, and are traditionally diagnosed on the basis of the most common characteristic, pain (Goldby, Moore, Doust & Trew, 2006). Although always considered a symptom of some other type of disease or disorder, in recent times, pain has been regarded as a disease in itself, with its own set of consequences that involve the sensory, emotional and cognitive systems in some form or other (Meyer, 2007).

Pain is not always an indication of underlying problems. The multifactorial nature of low back problems is generally not understood, and this misconception is reflected in the large variety of treatments available, ranging from medically-oriented invasive treatments such as injection therapy and surgery to more psychological approaches such as behaviour-oriented approaches (Van Tulder, Ostelo, Vlaeyen, Linton, Orley & Assendelft, 2001; Staal, Rainville, Fritz, van Mechelen & Pransky, 2005). It has been suggested that the origin of pain in chronic low back problems is largely unknown, and that effective treatment and diagnosis is difficult without more research into the basic functioning of the pain system and its effects on the well-being of the individual as a whole (Kääpä, Frantsi, Sama & Malmivaara, 2006).

Disability and loss of productivity caused by low back pain continues to rise, contributing to a substantial economic burden that exceeded nearly $25-$50 billion due to direct and indirect costs annually in the United States (Frymoyer & Cats-Baril, 1991; Frymoyer, 1992). Productivity losses are estimated to be around $28 billion (Rizzo, Abbott & Berger, 1998). Health care costs among individuals with low back pain are also 60% higher than among those people without low back pain (Luo, Pietrobon, Sun, Liu & Hey, 2004).

Back pain is the second leading cause of primary health care consultation in the United Kingdom (Deyo & Phillips, 1996). Low back pain incurs billions of dollars in medical expenditure in the USA each year and this is a trend that will continue to rise in the future (Childs, Fritz, Flynn, Irgang, Johnson, Majkowski & Delitto, 2004).

The economic burden of low back problem is of particular concern for poorer nations such as those in Africa where already restricted health care funds are directed towards epidemics such as HIV and AIDS and funding to deal with musculoskeletal problems is virtually absent (Walker, 2000). It has been suggested that most of the research on low back pain has been conducted in the developed world that does not have the same social and economic conditions as those in Africa and other developing nations (Worku, 2000). Racial, economic and social homogeneity are not features of Africa, which is considered a developing continent (Louw, Morris & Grimmer-Somers, 2007). It has therefore been suggested that genetic diversity and differences in social structure and hierarchy, as well as economic differences between the developed and developing nations may underlie reported disparity in both the prevalence and the impact of low back pain in developing nations (Louw *et al.*, 2007). A systematic review of the global prevalence of low back pain by Walker (2000) identified that of the 56 studies included, only 8% were conducted in developing countries, with only one study conducted in Africa. Since then more studies on low back pain in Africa were conducted (Galukande, Muwazi, & Mugisa, 2005; Sikiru & Shmaila, 2009; Abdulrahman, El-Sayed, Hadley, Tessema, Tegegn, Cowan & Galea, 2010). The lack of information on the prevalence and impact of low back pain in developing countries is therefore a significant shortcoming (Walker, 2000; Gilgil, Kacar, Bütün, Tuncer, Urhan, Yildirim, Sünbüloglu, Arikan, Tekeoglu, Öksüz, & Dündar, 2005), particularly as it is predicted that the greatest increase in the prevalence and impact of low back pain in the next decade will be in developing nations (Louw *et al.*, 2007; Sikiru & Shmaila, 2009).

In South Africa, the cost and impact are also high. The prevalence of low back pain in South Africa has been reported to be around 63,9% (Van Vuuren, Becker, van Heerden, Zinzen & Meeusen, 2005), compared to 84% in developed countries (Walker, 2000; Simmonds & Dreisinger, 2003). Sick leave taken because of back pain costs companies around R1.2 billion a year, being second only to flu. Approximately 6.4% of all sick leaves taken are flu-related, according to SAPA (2009), thus contributing to the strain placed on the economy and subsequently on the health care system (Burton, 2005).

Due to limited research into low back problems in South Africa the true impact of low back pain on the economycannot be ascertained. The aim of this study was to measure pain and disability variables in South African patients who present with chronic low back pain, and to draw comparisons with similar studies done in developed nations.

Methods and materials

Subjects

Thirty-two subjects between the ages of 20 and 55 years voluntarily participated in the study. All subjects were screened by a medical specialist before participation. Both male and female subjects were used and all subjects were employed full time. To be eligible to participate in the study subjects must have back pain for longer than 12 weeks, but subjects who had previous spinal surgery, discogenic disease and those suffering from neurological symptoms were excluded. Subjects also signed an informed consent form that explained all the procedures involved. The study was approved by the Ethics Committees of both the Faculty of Humanities and the Faculty of Health Sciences at the University of Pretoria.

Testing protocol

Pain and disability were measured by means of specific questionnaires. The selected questionnaires are used extensively in low back pain and physical therapy studies, because they are valid, reliable, repeatable, sensitive to change and correlate well with other instruments (Heymans, de Vet, Bongers, Knol, Koes & van Mechelen, 2006; Kääpä *et al.*, 2006; Goldby *et al.*, 2006). The questionnaires which were completed pre- and post-test by both groups included the following tests:

Visual Analogue Scale (VAS) for Pain: The VAS 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. Subjects had to indicate how they would rate their own pain by indicating it on the scale (Ostelo &

de Vet, 2005). A score is presented out of a 100 being maximal (Kankaanpää, Colier, Taimela, Anders, Airaksinen, Kokko-Aro & Hänninen, 2005).

Oswestry Disability Index (ODI): The ODI is used to assess subjects with low back pain 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 used condition-specific outcome measures for spinal disorders, which are not considered to be life threatening (Carreon, Glassman & Howard, 2008; Mehra, Baker, Disney & Pynsent, 2008). Each section is scored on a 0-5 scale, with 5 representing the greatest disability and 0 representing no disability at all with regard to activities of daily living (Ostelo & de Vet, 2005; Mehra *et al.*, 2008).

Exercise Programmes

The intervention used in this study consisted of two separate exercise programmes. The first programme involved the control group. This group received an exercise programme that was considered to be conservative in nature. The subjects completed the programme twice a week with a session lasting approximately 35-40 minutes. This programme remained unchanged throughout the 12-week intervention timeframe. It included exercises that were based on stabilization principles, McKenzie Extension exercises and the traditionally used stretches for low back (Combrink & Krüger, 2007).

The second programme included the experimental group and was considered more aggressive, both in terms of the exercises performed and the intensity of the programmes (Simmonds & Dreisinger, 2003) (see Table 1 for intensity, workload and volume).

Table 1: The progressive-aggressive programme for the experimental group (Weeks 1-4)

Exercise	Sets	Reps
Cycling:	5min, Level 2 (43-55 watt)	
Hamstring Stretch with Foot Flexion:	3 each leg	20
Side Lying Quadricep Stretch:.	3 each leg	12 sec.
Lat Pulldown to the Front:	3 men = 3 plates (12 kg); women = 2 plates (7 kg).	15
Side Bridging (on Knees):	3 each side	15 sec.
High Cable Horizontal Adduction (Downwards):	3 each arm	15
Hip Lifts with Feet on Bench:	3	15
Alt Superman on Stability Ball:.	3	6 each side (12 total)
Abdominal Crunches (Feet on Bench):.	3	20
Weeks 5-8:		
Exercise	Sets	Reps
Cycling:	5 min. Level 3 (65-75 watt)	
Hamstring Stretch with Step-off:.	3 each leg	12;12;

Exercise	Sets	Reps
		12
Side Lying Quadriceps Stretch:.	3 each leg	12 sec.
Lat Pulldown to Front:	3	25
One arm DB Row:	3 each side men 5 kg, women 2 kg.	15
Side Bridging (on Feet):	3 each side	15 sec.
Low Cable Shoulder Flexion (Straight Arm):	3 each arm	15
Ball Squat Against Wall:	3	15
Hip Lifts (Feet on Ball):.	3	15
Alt Superman (Sweeping Hand on Floor Upon Return and Up Again):	3	6 each side (12 in total)
Abdominal Crunches (Feet on Stability Ball):	3	25
Week 9-12:		
Exercise	Sets	Reps
Cycling:.	5 min. Level 4 (75-94 watt)	
Periformis Stretch:	2	30 sec.
Rotation Stretch:	2	30 sec.
Side Lying Quadriceps Stretch:	2	30 sec.
Lat Pulldown to Front: Repetitions were again 15.	3 men = 4 plates (15 kg); women = 3 plates (12 kg).	15
High Cable Pulldown to Opposite Hip with Both Arms:	3 each side	15
Seated Cable Row:	3 men = 2 plates (10 kg); women = 1 plates (5 kg).	15
Ball Squat Against Wall (With Weight):	3 men = 3 kg dumb bells women = 1.5 kg dumb bells.	15
Side Bridging (on Feet, Lifted Side):	3 each side	12
Hip Lifts With One Leg at a Time (Feet on Bench): of	3 each leg	10
Alt Superman:	3	6 each side (12 in total)
Abdominal Crunches (Lying on Ball):.	3	30

The subjects completed the programme in three four-week cycles. After each cycle the programme was progressively more difficult. The programme was also completed twice per week with a session lasting for approximately 45-60 minutes. 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.

Back School

Both groups received a copy of an information booklet. The conservative exercise group only received the document to read. This is referred to as *low-intensity back school*. The experimental exercise group also received the booklet and one-on-one educational sessions. This is referred to as *high-intensity back school*. It took place after the training sessions and lasted between 5-10 minutes each.

Statistical Analysis

Descriptive statistics, a medium for describing data in manageable forms (Babbie, 1992), were used in the present study. Descriptive statistics were undertaken by means of the Mann-Whitney test and the Wilcoxon signed-rank test.

Results

Table 2 shows the results of the Visual Analogue Scale (VAS) pre-test and post-test values of the control group and the experimental group. In both the experimental and control groups, the VAS score improved significantly from pre-test to post-test. However, there was no significant difference ($p>0.05$) between the post-test scores of the control and experimental groups, although slightly greater improvements were found in the control group than the experimental group.

Table 2: Descriptive statistics for pain between the control and experimental groups

Component	Test	Mean	Standard Deviation	Asymp.Sig (2-tailed)
Experimental Group	Pre-Test	54.44	18.23	0.004
VAS Pain	Post-Test	17.00	18.75	
Control Group VAS	Pre-Test	52.57	19.36	0.005
Pain	Post-Test	13.40	11.46	

Table 2 shows the results from the disability testing as measured by the Oswestry Disability Index (ODI). There was a significant improvement in disability levels for both the experimental \and the control groups. The experimental group showed a slightly greater, but not significant improvement than the control group. Standard deviation scores showed a very large difference since pain and subsequent perceived disability owing to the pain is a very subjective experience and can be influenced by a subject’s pain threshold (Treede, Kenshalo, Gracely & Jones, 1999).

Tables 4 and 5 show comparative results for pain and disability levels as measured by the VAS pain scale and the Oswestry Disability Index.

Table 3: Descriptive statistics for disability between the control and experimental groups

Component	Test	Mean	Standard Deviation	Asymp.Sig (2-tailed)
Experimental Group	Pre-Test	23.72	8.57	0.006
ODI	Post-Test	8.00	7.38	
Control Group ODI	Pre-Test	20.07	7.73	0.008
	Post-Test	11.00	6.20	

These tables show results obtained in similar studies conducted in Sweden, Australia, Finland, Norway and the United Kingdom, which were seen as developed countries. There results exercise interventions and some form of cognitive outcome measurement, were compared to those achieved in the present study. These results show post-test results from the exercise groups of the selected studies.

Results concerning pain, as indicated by the VAS scale, are equal to or lower than scores achieved in the countries mentioned above. In the present study the VAS was 17, compared to 48.7, 32.7 and 17 in those countries. Disability levels as measured by the ODI scale, seem to be much lower in the present study than in others. In the present study the ODI was 8, compared to 13, 15, 20.9, 29.7, and 31 in these countries.

Table 4: Results from previous studies as compared to those of the present study for pain as measured by the VAS scale

Present Study (Africa)	Norway	Finland	Sweden
	Brox, Sorensen, Friis, Nygaard, Indahl, Keller, Ingebrightsen, Eriksen, Holm, Koller, Riise & Reikerås (2003)	Arokoski, Valta, Kankaanpää & Airaksinen (2004)	Rasmussen-Bar, Äng, Arvidsson & Nilsson-Wikmar (2009)
17	48.7	32.7	17

Table 5: Results from previous studies as compared to those of the present study for disability as measured by the ODI scale

Present Study (Africa)	Sweden	Australia	Finland	Norway	UK
	Rasmussen-Bar *et al.* (2009)	O'Sullivan, Phyty, Twomey & Allison (1997)	Kääpä *et al.* (2006) Arokoski *et al.* (2004)	Brox *et al.* (2003)	Goldby *et al.* (2006)
8	13	15	20.9 / 20,8	29.7	31

Discussion

Exercise therapy has been reported to be successful in the treatment of chronic low back pain (Friedrich, Gittler, Arendasy & Friedrich, 2005; Hayden, van Tulder, Malmivaara & Koes, 2005; Krismer & van Tulder, 2007). Specifically, any exercise that increases functionality and gives the subject a feeling of self-control is effective in treating chronic low back pain (Petersen, Kryger, Ekdahl, Olsen & Jacobsen, 2002). Stabilisation exercises have been shown to have the most promising results on low back pain levels (Van Vliet & Heneghan, 2006; Tsao & Hodges, 2008).

Exercise programmes that contain functional exercises, which involve both the local and global musculature combined with some form of cognitive intervention have proved to generate even better outcomes (Bergmark, 1989). Combining stabilization exercises and functional exercises in a programme to manage chronic low back pain, which is supported in the literature, is thus recommended. However, the exercise programme has to be sensibly developed and some form of progression is recommended, as shown in the results of the present study.

These results indicate that an aggressive-progressive exercise programme may be more effective than more conservative exercises in the treatment of chronic low back pain. Both types of programmes have proved very effective in the treatment of chronic low back pain in the present study, as well as in the literature (Van der Velde & Mierau, 2000; Friedrich *et al.*, 2005). However, more aggressive types of training programmes that involve more functional muscle groups have been suggested in the literature for the treatment of chronic low back pain (Petersen *et al.*, 2002; Ostelo, de Vet, Waddell, Kerckhoffs, Leffers & van Tulder, 2003) owing to the need to improve overall functionality and decrease disuse as a consequence of pain, as pain itself is not regarded as the limiting factor in chronic low back pain cases (Staal, Hlobil, van Tulder, Waddell, Burton, Koes & van Mechelen, 2005). However, the present study failed to directly measure functional activities and the influence of chronic low back pain on these activities. Self-reported questionnaires such as the Oswestry Disability Index measure functional activities only indirectly, and thus data on the improvement of functional activities can only be estimated. The present study was thus limited in that it only tested self-reported pain and disability scores.

Pain (VAS) and disability (ODI) scores as a result of chronic low back pain in South Africa as represented in the present study seem to compare well with those conducted in developed nations (Tables 3 and 4). VAS pain scores are similar to or better than those of developed nations, and disability scores as measured by the Oswestry Disability Index, are better than those of developed nations. This phenomenon is difficult to explain, as the same questionnaires were used in all of the studies. A possible hypothesis about this could be that the economic and social situation in South Africa is very different from that in more developed countries. In view of the high levels of unemployment and the high cost of private medical aid systems, funds to pay for low back pain treatment are much more limited. This suggests that patients have to pay for treatment themselves without any government support, because funds are being allocated to HIV/AIDS instead (Walker, 2000). This could theoretically motivate patients to improve much quicker by working harder and more dedicated, both physically and mentally, because of limited resources and a limit to the amount of treatment that they can afford. In a way, patients therefore may feel more empowered to manage their back pain in less time and with limited help (Petersen *et al.,* 2002). However, research is needed to confirm or refute this hypothesis.

The present study also seems to suggest that an exercise programme consisting of abdominal stabilization exercises combined with exercises for functional muscle groups (gluteus maximus, quadriceps muscle group, and upper body exercises) has proved effective in the management of chronic low back pain. Although the self-reported questionnaires are very valid, repeatable and reliable (Heymans *et al*., 2006; Kääpä *et al.*, 2006; Goldby *et al.*, 2006), they fail to directly measure the impact of low back pain on functional tasks such as getting up from either a seated or lying position or carrying a heavy object from point A to point B. Future studies of this kind have to include some form of functional activity measurements that include tasks of daily living. It is also important that these activities are capable of being improved by exercise.

Conclusion

The results achieved in the present study seem to suggest that patients suffering from chronic low back pain and associated disability in South Africa tend to achieve better results than those included in similar studies in the mentioned developed countries. This could be ascribed to the different social and economic conditions in South Africa, but much more research is needed to confirm this. Indeed, subjects in the present study reported working long hours (8-14 hours per day). This could suggest that this specific population group that includes all chronic low back pain sufferers may not be as impaired as they perhaps believe themselves to be. This makes functional training even more important, specifically to ensure that these patients maintain their working status, because withdrawal from the workforce will lead to rapid deterioration and an increase in pain and disability (Staal *et al*., 2005).

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