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Return-to-Work (RTW) of Patients after Lumbar Surgery

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ABSTRACT

Background: Return to work (RTW) after lumbar surgery due to a work-related injury poses a challenge internationally. Work hardening is used as an intervention for acute and chronic lower back pain (CLBP), but it is not necessarily used in post-operative treatments. Method: The RTW rate of an experimental group (Group A) of unskilled labourers was compared with that of a control group (Group B) of unskilled labourers. Group A received multidisciplinary intervention, including a work hardening programme with ergonomic adaptations, while Group B received only physiotherapy after surgery as a multidisciplinary team was not available. A RTW questionnaire was used as an outcome measure for both groups. During the multidisciplinary intervention, the improvement of pain and functionality of patients from Group A were also evaluated from the pre-operative state to 24 weeks post-operatively with the Visual Analogue Scale (VAS) and the Oswestry Disability Index (ODI) as additional outcome measures. Results: There was a positive tendency to successful RTW after work hardening for Group A, but no statistical significance between Groups A and B. The improvement of pain and functionality in Group A was highly significant from time of surgery to six months post-operatively. Conclusion: Work hardening was found to have a positive tendency towards ensuring RTW for work-injured patients after lumbar surgery, with a highly significant effect on pain and functionality.

Key words: Work hardening; work-injured patients; lumbar surgery; return to work (RTW); multidisciplinary approach

Introduction

The researcher's private practice (occupational therapy) is involved in a multidisciplinary rehabilitation team that uses a bio-psychosocial approach in treating patients with back problems pre- and post-operatively. The initial referrals for occupational therapy requested work assessments to support the decision for medical boarding as the patients were not re-integrated in the open labour market two years after surgery. The increasing referrals for the purpose of medical boarding motivated the researcher to request early referrals to assess the patients' physical, psychosocial and work abilities and inabilities as well as their adherence to back care principles in their personal, social and vocational lives. Subsequently a multidisciplinary team was formed to consider how this situation could be addressed within a comprehensive multidisciplinary team. It was felt during clinical practice that fewer patients were medically boarded and more patients re-integrated into the open labour market after participating in the comprehensive multidisciplinary rehabilitation programme that incorporated work hardening intervention in RTW, and thus the need to investigate the effectiveness of this programme on a scientific basis arose.

Literature Review

Work-related lower back injuries of people who perform manual unskilled work are a common occurrence internationally with a significant negative impact on return to work (RTW). Unskilled workers often become unemployable after a work-related injury[1, 2] with the effect that such an injury not only has an impact on the worker and his/her family, but also on the broader economy. Back pain, due to work-related injuries, is the second largest cause of leave of absence (sick leave) in the USA[3] and back pain was listed as the cause of approximately 150 million days of total working capacity lost in the UK in 1993[4]. A more recent study by Martin et al.[5: 659] found that "these trends resulted in an estimated 65% inflation-adjusted increase in the total national expenditure of adults with spine problems" from 1997 to 2005. Few studies indicate the prevalence of lower back injuries in the workplace in South Africa, but it seems that the prevalence of lower back pain (LBP) in countries on the African continent correlates with that found in studies in developed countries[6]. It is estimated that 30 000 South Africans suffer daily from back and neck problems, of whom 10% will become chronic. The compensation costs for LBP in South Africa in 2000 were calculated to be in the equivalent of approximately 20million US dollars[7].

Between 5% and 20% of patients with Chronic Lower Back Pain (CLBP) will require surgery[8-10]. McGregor, Dicken and Jamrozik[9: 50] are of the opinion that "the optimal post-operative management of patients undergoing spinal surgery may make a significant contribution to improving the long-term outcome of these operations" and they further concluded that "it seems unlikely that differences between procedures have contributed importantly to the range of practice regarding post-operative management"[9:49]. It is therefore not anticipated that the outcome of RTW will be influenced by surgeons from different geographical areas, performing lumbar surgery.

Lower back disorders are associated with work-related lifting and forceful movements, awkward postures, driving (especially truck driving) and exposure to whole body vibrations (WBVs)[3, 11, 12]. The patients from both groups in this study are manual unskilled workers, comprising of: maintenance workers; carpenters; agricultural labourers, mainly in vineyards; truck drivers, who are also required to load the freight; ambulance personnel; and general labourers, who are required to do lifting. Although all these physical components and demands of work have an impact on back pain, evidence suggests that psychosocial aspects also influence the workers' quality of life, including their personal, social and vocational life[13-16]. Hoogendoorn et al[13] found in a systematic review of the psychosocial factors at work and in private life that the risk factors for back pain include not only loading on the spine but also psychosocial work characteristics which contribute to low job satisfaction. In this respect "red flags" and "yellow flags" are widely used to categorise those suffering from CLBP[17]. Red flags like trauma, weight loss, history of cancer, steroid use, patients over the age of 50 years, severe persisting night pain or increased pain on lying down are seen as risk factors indicative of surgery. Yellow flags like perception of pain; emotional shifts like depression; behaviour; family, work and compensation issues; misunderstanding of diagnoses and treatment are seen as those psychosocial factors impacting on CLBP. However, Shaw et al.[18] and the "Decade of the Flags" Working Group[18] separated the yellow flags into two additional categories, namely "blue flags" ("individual perceptions about work") and "black flags" ("actual workplace conditions"), which influence back disability (see *Figure 1*).

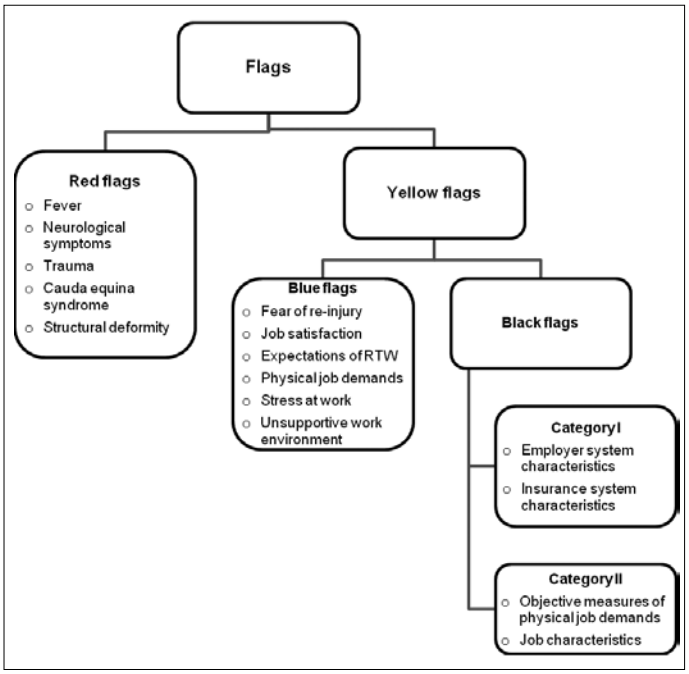

Figure 1: The flag system

Research into LBP includes investigation of non-surgical intervention strategies[19-22], systematic reviews[23-25] and post-operative management[9, 26-28], among others, as well as the comparison of non-surgical and post-operative interventions[8, 29]. However, few intervention programmes seem to include work hardening. Booysen[19] in his study on vocational rehabilitation concluded that work hardening should form part of disability management programmes and Johnson et al.[30] found work hardening to be an effective intervention. Kornblau[31] is of the opinion that work hardening can bridge the gap between rehabilitation and re-entry into the workplace. Work hardening, which can improve occupational performance, can be defined as follows:

"[A] structured, individualised, productivity-oriented program that provides the participant with simulated or actual work tasks that are structured and graded progressively to increase psychological, physical, and emotional tolerance and improve endurance and general productivity" [31:277].

Research done on work hardening focused mainly on workplace intervention and/or an ergonomic programme for patients with back pain and not after lumbar surgery[22, 24, 32]. In the 1980's two research studies[33, 34] were published and more recently Cole et al.[35] used a work conditioning/hardening programme after lumbar fusion, using physical demand level (PDL) of work as an outcome measure instead of RTW as an outcome measure. It, therefore, seems that research focusing on the effectiveness of a multidisciplinary rehabilitation programme, including work hardening, for post-lumbar surgery work injured patients in terms of RTW is warranted.

Work hardening forms an integral part of the multidisciplinary programme because lumbar-surgery patients RTW only three months post-operatively and the longer that the worker is absent from work, the more difficult it is to reintegrate him/her into the workplace[32]. The ultimate goal of rehabilitation in terms of RTW has always been to return the injured worker to productive employment.

Young et al.[36] in their conceptualisation of RTW, discuss the process as being "a development and dynamic process involving multiple phases and encompassing a range of actions and related outcomes" [36: 558]. RTW as defined by the multidisciplinary team and applied in this study refers to the successful re-integration of the patient in his/her previous job three months after lumbar surgery and the retention of work at six months after lumbar surgery.

Methodology

The goal of the current study was to determine the effectiveness of a comprehensive multidisciplinary rehabilitation programme for patients who had lumbar surgery due to work-related injuries, in terms of their return to work (RTW) and retention of work six months after their surgery. The programme included work hardening and the effect of this all-inclusive programme, in terms of the findings obtained from a group of such patients, was compared with the findings obtained from a control group that did not participate in the programme due to living in another geographical region where post-operative care of a multidisciplinary approach did not exist.

Research Design

A quantitative method was used by comparing the data obtained from an experimental group (Group A) consisting of 30 patients, with those obtained from a control group (Group B) consisting of 20 patients, in an experimental group design[37, 38]. The effect of the multidisciplinary team approach, including work hardening in terms of RTW, which was applied to the patients from Group A, was compared to the non-team approach available to the patients in Group B. The matching criteria included amongst others age, gender, type of surgery, PDL of work and the nature of injury on duty. A prospective study design was chosen, so that the experimental group could be assessed at regular intervals and the inclusion of a control group would strengthen the evidence. The patients of both groups were selected by means of a non-randomised opportunity sampling method according to the inclusion and exclusion criteria presented and although "randomised double-blind studies are considered to represent the best available evidence"[39:275], in the practice of evidence-based medicine Manchikanti and Pampati concluded that "any systematic type of allocation will yield valid results with similar groups of patients with or without randomisation"[39: 283]. Patients of Group A were selected in line with their being referred to the researcher by an orthopaedic surgeon, and the control group was selected from a neighbouring town approximately 80 kilometers away. The patients from the control group were treated by different surgeons who refer their patients for physiotherapy treatment only while the patients are still in hospital. A multidisciplinary team does not exist in this town and on discharge the patients received physiotherapy on a need-to basis. These orthopaedic surgeons did not deem it necessary to refer their patients to occupational therapy.

Inclusion Criteria

- Patients who had undergone lumbar surgery, including fusion, discectomy or lumbar disc replacement. Patients in need of further surgery were included in the study in order to re-integrate them to the workplace.
- Labourers of working age who perform manual work.
- Persons who, despite sustaining a back injury at work, retained their job.

Exclusion Criteria

- Persons with CLBP without surgery.
- Persons who had discograms or rhizotomies, as these procedures are non-surgical pain procedures for persons with CLBP.
- Persons who were laid off work due to non-medical reasons, or workers who absconded or failed to report for duty.
- The "red flag" conditions, such as acute infections of the back; cauda equina syndrome; malignancy of the spine; progressive neurological deterioration; and unstable back conditions, for example major fractures or unstable spondylolisthesis with neurological compromise.

Procedure

The study was conducted in the setting of the private practices of the multidisciplinary team comprising the referring orthopaedic surgeon, who is a specialist in spinal surgery; a general medical practi-

Table 1: Comprehensive multidisciplinary rehabilitation programme

INTERVALS	DOCTOR & NURSE*	OCCUPATIONAL THERAPIST	PHYSIOTHERAPIST	BIOKINETICIST
Within one week pre-op	Nurse performs VAS & ODI	No intervention	No intervention	No intervention
During stay in hospital	Surgery and daily ward rounds	Provision of back care principle booklet and discussion and demonstration of the principles applicable to activities relating to daily living	Mobility training regarding turning in bed, getting into/ out of bed, walking	No intervention
3 weeks	No intervention	Assessments using VAS & ODI to identify and address problems regarding pain management and adherence to back care principles Addressing of questions and fear of movement Supply of advice on use of cushions and/or chairs	Exercise & stretching programme Treatment of muscle spasms	No intervention
6 weeks	Follow-up with X-rays	Follow-up from previous visit (VAS & ODI)	Follow-up from previous visit	No intervention
12 weeks (daily intervention for 5 days)	Follow-up with X-rays	VAS & ODI assessments Work-hardening intervention, including practice of postures during simulated work tasks Addressing of life skills, work ethics and the anatomy of the back in group discussions Establishment of contact with the employer to recommend reasonable accommodation, where applicable	Adaptation of exercise programme, increasing of mobility and assistance of biokineticist in gym	Focus on endurance, use of treadmill and power plate.
16 weeks **RTW**	Follow-up in regards to RTW	VAS & ODI assessments Work visit to ensure that the recommended reasonable accommodation is carried out and to advise both the patient and the employer on-site	Follow-up on general fitness	No intervention
24 weeks	Follow-up with X-rays	VAS & ODI assessment Completion of questionnaires completed by both the patient and the employer	Follow-up on general fitness	No intervention

* The doctor and nurse will continue with follow-up visits at 9 months, 12 months, 18 months and 24 months.

tioner, an occupational therapist (researcher); a physiotherapist and a biokineticist. The treatment of the experimental group of patients (Group A) working as unskilled labourers, was followed up by the occupational therapist and physiotherapist at the following intervals post-operatively: 3 weeks; 6 weeks; 16 weeks; and 24 weeks. At these follow-up visits the physiotherapist monitored and adapted their exercise programme, apart from their manual therapy, while the occupational therapist provided the patients with a booklet on back care principles, monitored their pain and addressed their management, tolerance and perception of pain. All the patients in Group A were admitted to a rehabilitation facility at 12 weeks post-operatively for a week of intensive rehabilitation. During this week their health and wellness were monitored by a general practitioner who specialises in rehabilitation. The programme consisted of daily sessions with the physiotherapist (focusing on core stabilising, muscle strengthening and flexibility), the biokineticist (in the form of gymnasium-based exercises addressing endurance levels) and the occupational therapist (in the form of work hardening on the application of back care principles in graded work-related tasks, using a cognitive behavioural approach to address pain and disability as well as work site visits and recommendations regarding ergonomic modifications). (See *Table 1*).

The control group (Group B) comprised patients from a neighbouring town, working as unskilled labourers. Group B did not participate in the comprehensive multidisciplinary rehabilitation programme due to circumstances beyond the control of the researcher but they did receive rehabilitation from a physiotherapist. One practice of two surgeons from the neighbouring town consented to their patients forming the control group (Group B) in the study. Employers and patients of Group B were contacted telephonically and the RTW questionnaires were sent via fax or email.

Data Collection

The improvement of pain management, endurance, mobility and functionality of the patients of Group A were also assessed by using the Visual Analogue Scale (VAS) and the Oswestry Low Back Pain Questionnaire from which the Oswestry Disability Index (ODI) was derived. Patients completed the forms in either English or Afrikaans. The VAS and ODI were used at specific intervals to monitor the patients' recovery in terms of pain and functionality. The ODI[26, 28, 29, 40-42] and VAS[9, 21, 30, 42,43] of which the validity and reliability have been established, internationally, are among the questionnaires that are most frequently used by doctors, physiotherapists and occupational therapists as assessment measurements for patients with back pain. Fairbank and Pynsent[40] found that various studies confirmed the validity and reliability of the ODI 2.0 version. Although the reliability of the VAS has not been established among South African populations with limited education, the patients from Group A were trained in understanding the VAS from their first consultation and as they documented their pain on regular intervals the VAS scores were accepted as an outcome measurement.

The VAS and the ODI were used pre-operatively and at 6 weeks, 16 weeks and 24 weeks to capture the recovery of Group A[37]. A RTW questionnaire was used to compare the RTW rate attained by Group A and Group B. Prior to the development of the RTW questionnaire for the current study, a literature search was conducted, and various questionnaires were assessed for possible use in the study. However, as no questionnaire was found appropriate to determine the success of RTW for lumbar surgery work injured patients after interventions, including work hardening, by a multidisciplinary team, Woodward and Chambers'[44] guidelines were followed in the development of the RTW questionnaire. The topics of the RTW questionnaire addressed those occupational factors which were identified as "blue flags" and "black flags"[18], and consisted of: the patient's absenteeism; productivity; work performance; job modification; the ergonomic requirements of the patient's job; and those emotional problem areas influenced by chronic pain and which contribute to successful RTW[45, 46], such as motivation, concentration and emotional status. Closed questions were used, since such questions were previously deemed more suitable for use in medical surveys and epidemiologic studies and the quick coding method chosen required a minimal amount of detail[44]. Categorisation of six questions (less than 30% of the day, 50% of the day, more than 65% of the day) were selected in accordance to Matheson's[47] categorisation of the physical demand characteristics/physical demand levels (PDL's) of work.

The RTW questionnaire was distributed to the employers of those patients who formed part of groups A and B, as well as to the patients themselves at 24 weeks post-operatively. The questionnaire was intended to determine the success of the individual patient's reintegration into the workplace and the retention of work 24 weeks after lumbar surgery.

At the six months assessments, the patients of Group A as well as their employers completed separate questionnaires with regards to the workers successful re-integration in the work place. Once the patients of Group B were identified by the orthopaedic surgeons in the neighbouring town, the questionnaires, including cover-letters explaining the reason and aim of the study, were either faxed or posted to the patients and their employers.

Data Analysis

The data analysis was conducted using MS EXCEL and NCSS programs. The Wilcoxon Rank Sum Test was used to compare the demographic data from the RTW questionnaire in terms of age, gender, type of surgery and RTW rate, pertaining to Groups A and B to determine whether the demographic differences would have an impact. Spearman Correlations Section (Pair-Wise Deletion) was used to analyse the effect of the work-hardening programme on pain and functionality of Group A by using the VAS and ODI. The Chi-square test was used to analyse all non-parametric variables obtained from the RTW questionnaire in terms of the patients' of both groups such as absenteeism; productivity; work performance; job modification; the ergonomic requirements of the patient's job; and those emotional problem areas influenced by chronic pain, such as motivation, concentration and emotional status.

Ethical Considerations

In addition to obtaining the signed informed consent of the participants in accordance to the guidelines of the Ethical Committee for Human Research at the University of Stellenbosch, and ethical clearance was obtained from the Committee for Human Research at the University of Stellenbosch.

Results

The results were analysed from two angles: a) comparisons between the experimental Group A and the control Group B; and b) comparisons within Group A regarding the improvement of pain and functionality.

Comparisons between Groups A and B in terms of RTW

Demographic data

The demographic data from both groups were obtained from the patients' medical records, which were made available by the orthopaedic surgeons. The Wilcoxon Rank Sum Test was used to compare the demographic data, with no statistically significant differences being found between the data obtained from groups A and B in terms of age, gender, type of surgery and RTW rate ($p<0.05$), though a statistically significant difference was found in the amount of sick leave of Group A, taken from date of surgery to RTW, but with a higher RTW as a result (see *Table II*). It seems that members of the control group (Group B) returned to work earlier than did members of Group A. The RTW rate compared between the two groups was not significant (p-value = 0.28), but the difference found in the percentages relating to RTW [Group A (22/30) = 73%; Group B (11/20) = 55%] suggested a positive tendency towards the success of the multidisciplinary approach, including work-hardening. Although the odds ratio of 2.25 for RTW is not significant (with the level of significance being calculated as < 1), such a finding correlates with findings obtained in a systematic review by Schonstein et al.[46] of the odds ratio for RTW, which ranged between 0.7 and 4.5. As can be

Table II: Demographic characteristics of groups A and B

	Group A	Group B	*p-value*
Number of participants	n = 30	n = 20	
Average age (years)	41.86	44.45	0.318
Gender:			
Male	27 (90%)	16 (80%)	
Female	3 (10%)	4 (20%)	
Return to work	22 (73%)	11 (55%)	0.28
Sick leave (months)	4.45	2.27	0.001

Note: Values are average, n (%) of the raw data.
Significant level is set as p-value < 0.05.

seen in *Table II*, 73% of the patients in Group A returned to work at 4.45 months post-operatively on average, as they were only enrolled in the work-hardening programme at three months post-operatively. In comparison, 55% of the patients in Group B returned to work at 2.27 months post-operatively, having only received minimal, rather than multidisciplinary, rehabilitative interventions. No statistically significant difference was found in the comparison between the findings of groups A and B in terms of the types of surgery undergone. This correlates with research studies[9, 48, 49], as "it seems unlikely that differences between procedures have contributed importantly to the range of practice regarding post-operative management"[9:49]. Robertson and Jackson found "that patients undergoing two-level fusion did no worse that[n] those patients undergoing single-level fusion"[50:187].

Results obtained from the RTW questionnaire

The questionnaire was aimed at comparing the perceptions of both the patient and the employer regarding the performance of the patient in the workplace and therefore patients and employers of both groups completed the questionnaire. It was noted that only one of the patients differed from his employer regarding their perceptions of the patient's performance since RTW, but as the majority was similar, this was not taken into consideration. The results of the RTW questionnaire are discussed in terms of occupational factors ("blue flags"), such as the PDL (type of work); the reasons for non-RTW; absenteeism; emotional problem areas influenced by chronic pain; physical work demands; and job modifications/adaptations.

Physical Demand Levels (PDL) of work:-

The risk of back problems heightens with the increase of spinal load and working for long hours in awkward positions can also lead to back problems. The job descriptions of patients from both groups included amongst others truck drivers, general workers (farm, abattoir, municipality), bricklayer, ambulance person, truck/bus driver, store-man, stock controller, machine operator, salesman, maintenance worker, carpenter and cleaner. According to the "Dictionary of Occupational Titles"[52] and Matheson's[47] physical demand characteristics of work (see *Table III*) these jobs were categorised as light, medium, heavy or very heavy work. Chi-squared analysis was used in comparing the PDLs of work between the two groups. The *p*-values for both groups were not significant (Group A: p-value = 0.173; Group B: p-value = 0.0893). *Table IV* shows the distribution of the physical demand level of work performed by members of groups A and B, in terms of their RTW rate. The different geographical areas from which the patients originated might have had an effect on the RTW rate of the participants in this study, in terms of the PDL of work performed. For example, the patients from the control group who did not RTW performed very heavy work, including working as general workers and agricultural labourers in the vineyards.

Reasons for non-RTW:-

Patients and employers of both groups who did not RTW completed only two questions in terms of RTW. The questions concerned were: a) Has the patient returned to work?; and b) If not, why? The options for non-RTW that were provided on the questionnaire were: 'resigned'; 'dismissed due to misconduct/fired'; 'retrenched'; 'medically boarded'; and 'pensioned'. Eight of the patients of Group A did not RTW of which two were dismissed due to misconduct (fired) and two were retrenched due to the work places closing down. Of the rest, two were medically boarded and two resigned despite numerous efforts to re-integrate them into the work place. Some of them had low expectations of their RTW, as well as explicitly stating that they had no intention to RTW. Fear-avoidance behaviour and catastrophising also had a negative impact on their recovery and subsequent non-RTW. This effected their cooperation during the programme. Nine patients of Group B did not RTW of which two were medically boarded, two were fired, four were retrenched and one resigned.

Absenteeism:-

Patients and employers of patients in groups A and B who completed the RTW, answered the questions regarding the months absent for the period from surgery to RTW (see *Table II*), as well as the amount of absenteeism (in terms of number of days) since resuming work. The information obtained from both the employers and the patients from both groups was exactly the same. The sick leave period of those patients in Group A was longer than that for the patients in Group B, as patients from Group A were only enrolled in the work-hardening programme at three months after surgery.

Table III: Physical demand characteristics of work

Physical demand level	OCCASIONAL 0–33% of workday	FREQUENT 34–66% of workday	CONSTANT 67–100% of workday	Typical Energy Required
Sedentary	4.55 kg	Negligible	Negligible	1.5 – 2.1 METS
Light	9.07 kg	4.55 kg Walk/stand/push/pull of arm/leg controls	Negligible Push/pull of arm/leg controls, while seated	2.22 – 3.5 METS
Medium	22.68 kg	9.07 kg	4.55 kg	3.6 – 6.3 METS
Heavy	45.36 kg	22.68 kg	9.07 kg	6.4 – 7.5 METS
Very heavy	Over 45.36 kg	Over 22.68 kg	Over 9.07 kg	Over 7.5 METS

Table IV: Distribution of Physical Demand Levels (PDL's) of work

		LIGHT (n)	MEDIUM (n)	HEAVY (n)	VERY HEAVY (n)	TOTAL
Group A	**RTW**	3	14	4	1	**22**
	NON-RTW		4	2	2	**8**
Group B	**RTW**		3	2	6	**11**
	NON-RTW				9	**9**

It thus seems that the patients from Group B, who did not receive multidisciplinary interventions, including work-hardening, returned to work earlier than did those in Group A. However, the RTW rate of the former was not as high as that of the latter.

Emotional problem areas influenced by chronic pain:-

Patients and employers were asked to comment on the patient's punctuality; whether he/she could finish the work on time and cope with the required workload; the degree of job satisfaction obtained (was the employer satisfied with the patients work? was the patient satisfied with his/her work?); as well as the degree of endurance, concentration, self-control and helpfulness exhibited in the workplace. All such factors are influenced by chronic pain, which might have a negative impact on RTW[14]. No significant difference was detected between the findings in relation to groups A and B. The results from the RTW questionnaire regarding emotional problem areas influenced by chronic pain can be seen in *Table V*.

Table V: RTW of groups A and B: emotional problem areas influenced by chronic pain

	Group A %		Group B %	
QUESTION	**Yes**	**No**	**Yes**	**No**
Satisfactory performance	81.8	18.18	81.8	18.18
Punctuality	90.9	0.45	100	0
Finishing on time	81.8	18.18	81.8	18.18
Handling of workload	72.72	27.27	81.8	18.18
Endurance	77.27	22.72	72.72	27.27
Concentration	81.8	18.18	81.8	18.18
Self-control	72.72	27.27	90.9	9.1
Helpfulness	81.8	18.18	100	0

Table VI: Job modifications/adaptations

TYPE OF MODIFICATION/ ADAPTATION	Group A (n)	Group B (n)
More rest periods	2	3
Extra help/assistance	6	3
Altered shifts/working hours	–	1
Changed postures	3	1
Alternative job	4	–
Apparatus/instruments (ergonomic adaptations)	4	–

Physical work demands:-

No significant difference was found between the findings for groups A and B in terms of lifting, walking, working in forward bent positions, or using the upper limbs with or without machinery.

Job modifications/adaptations:-

The questionnaire used makes provision for patients and employers to comment on modifications/adaptations made to accommodate the patient, such as additional rest periods; extra help/assistance; shifts; postures; alternative jobs; and modifications/adaptations to apparatus/ instruments (ergonomic adaptations) (see *Table VI*). The provision of additional rest periods would reduce the length of time that a patient has to spend working in awkward postures. If a person after lumbar surgery has to handle heavy items, he would need extra help/assistance. Modifications/adaptations can also be made in length of shifts or working hours to enable the patient to re-integrate into the workplace gradually. Awkward postures can be modified or adapted by ensuring that the patient complies with the correct back care principles. Modifications/adaptations to apparatus/instruments (ergonomic adaptations) are done to prevent working in awkward postures and include altering the height of work surfaces; providing extra work surfaces; providing a perching chair; providing hoists or trolleys; and reshaping the apparatus/instrument, or its handles, used. If the patient cannot be re-integrated back in his previous job, an alternative job is recommended. Job modifications/adaptations are recommended by the occupational therapist as a standard procedure after the completion of the work-hardening programme.

Fourteen of the 22 patients from Group A and 9 of the 11 patients from Group B, who returned to work, underwent job modifications/adaptations, as shown in *Table VI*. As no recommendations by an occupational therapist were made for the patients from Group B, it is assumed that the modifications/adaptations were made by the employers on their own. Of interest is the fact that eight patients from Group A could RTW without the need of job modifications/adaptations.

Comparison within Group A in terms of Pain and Functionality

While on the programme the patients from Group A were assessed in terms of the improvement of their pain and functionality by using the VAS and the ODI. The VAS is scored on a 10cm line where 0 = no pain and 10 = worst pain imaginable and then converted to percentage. The VAS scores indicate the effectiveness of the patients' management of their pain. Percentages of between 0 and 30% are aimed at, as this is generally accepted as normal[9]. The patients' improvement in their functionality in terms self-care activities, as well as in walking, sitting, standing, sleeping, sexual activity, social and recreational activities and driving are determined by the ODI. According to McDowell and Newell, ODI "scores from 0 to 20 represent minimal disability, 40 to 60 represent severe disability and score of 60 and over indicate that the patient is severely disabled by pain in several areas of life"[42:359] and thus a score between 0 and 20 will indicate that the multidisciplinary rehabilitation programme is also effective in addressing the patients' pain and functionality. Spearman Correlations Section (Pair-Wise Deletion) was used to analyse these scores. Highly significant correlations (p-value < 0.05) were found within the VAS and the ODI sections at six weeks post-operatively, as well as between the VAS and ODI.

Pain (VAS)

The average pre-operative VAS score was 71%, varying from 40% to 100%, with the final VAS scores at 24 weeks varying from 0% (no pain) to 60%, with an average of 29%, thus indicating a 40% improvement of pain tolerance and pain management. This improvement was found to be statistically significant (p-value of 0.0000) when compared pre-operatively to 24 weeks.

Functionality (ODI)

The average pre-operative ODI scores varied from 28% to 88%, with an average of 46.5%. The average ODI scores at 24 weeks varied from 0% to 46%, with an average of 24.4%, thus indicating an improvement of 52.3%. On average, the patients in Group A showed moderate impairments and significant improvement (p-value = 0.00016) in terms of their functionality at six months post-operatively.

Comparison between VAS and ODI

The absence of significant correlations between the VAS and ODI scores when compared pre-operatively and at six weeks post-operatively shows that the patients' perception of pain did not correlate with their functionality. For example, a patient who plotted his pain at 60%, might score 20% on the ODI, giving the impression that he was not that impaired by his pain, or might plot his pain at 40%, while scoring 60% on the ODI, which would give the impression that his pain was not that severe. However, possibly due to a fear of re-injury, his functionality would be severely impaired. The importance of employing the VAS and the ODI at six weeks might be of interest for the patient, though doing so would not necessarily have statistical significance.

Table VII: Comparison between VAS and ODI in terms of pain and functionality

		VAS				
ODI		**Pre-op**	**6 weeks**	**12 weeks**	**16 weeks**	**24 weeks**
	Pre-op	0.238	0.272	0.853	0.791	0.973
	6 weeks	0.923	0.193	**0.045**	**0.007**	**0.008**
	12 weeks	0.267	**0.0002**	**0.0002**	**0.0167**	**0.0009**
	16 weeks	0.594	**0.002**	**0.0254**	**0.001**	**0.002**
	24 weeks	0.232	**0.000**	**0.000**	**0.001**	**0.000**

Note: p-value (significant values in bold) < 0.05.

As time progressed, a strong correlation can be seen to develop between the scores achieved on the VAS and ODI. The development of such a strong correlation might be due to the patients' participation in the multidisciplinary approach, including work hardening. During work hardening, they learn how to manage their pain, as well as how to continue with their daily activities, in keeping with their implementation of the correct back care principles. Such findings correlate with those obtained for the research conducted by Fairbank et al.[8], who found significant improvement in the ODI scores of patients assigned to undergo surgery (see *Table VII*).

Limitations of the Study

Due to the time constraints imposed on the study, the size of neither group was large enough to achieve statistically significant results although there is a positive tendency towards successful RTW after lumbar surgery. The work related tasks as part of the work hardening, focused on manual handling (lifting and carrying) in different postures and endurance to accommodate the job demands of manual labour. In retrospect, it is also evident that those patients in administrative (sedentary) type of work who sustained work-related injuries, should have been included in the study, as prolonged sitting is seen as a risk factor for LBP[52]. It would therefore be advised that future studies include sedentary work tasks within the work hardening programme. The pain and functionality of patients' from Group B was not assessed using the VAS and ODI as they are not familiar with these measuring instruments and as such comparisons between the two groups with the VAS and ODI was not possible.

Discussion

The objective of the current study was to evaluate the success of a multidisciplinary approach, including work hardening, for lumbar surgery patients who sustained injuries at work, in terms of successful RTW. Various studies had previously been undertaken regarding interventions for acute and chronic low back pain. A systematic review, which was conducted by Schonstein et al.[46] stressed the benefits to be gained from the inclusion of work hardening in such interventions. Evidence from clinical practice indicated that the success rate for RTW for injured workers after lumbar surgery had been unsatisfactory. (The current study compared the outcome of a multidisciplinary approach, including work hardening in the treatment of patients who underwent lumbar surgery, to a control group with no specific intervention.)

The control group (Group B) included the patients of orthopaedic surgeons from a neighbouring town, who received physiotherapy on a need-to basis, but were not involved in a multidisciplinary team approach including a work hardening programme. During the time span of the study 30 patients were enrolled as the experimental group (Group A) and 20 patients for the control group (Group B). Although no statistically significant difference was found between the scores of the two groups, there is a tendency to suggest that the multidisciplinary approach including a work hardening programme, can ensure successful RTW after lumbar surgery. All the patients of Group B who did not RTW performed very heavy work and this could also have influenced the RTW rate.

The reasons for the non-RTW of certain members of groups A and B were: resigned; dismissed (fired); retrenched; and medically boarded. The reason for the two patients from Group A being dismissed (fired) was due to misconduct, and not due to their back problems. Two of the patients in Group A could not RTW, and were retrenched, due to their workplaces closing down. The rest of those who did not RTW either resigned, or were medically boarded, due to psychological reasons[46] such as fear-avoidance behaviour and catastrophising. In a systematic review of psychological factors as predictors of chronicity/disability, Pincus et al. quoted Sullivan et al. on catastrophising being "an exaggerated orientation towards pain stimuli and pain experience"[14: E117]. This was observed during the week of work hardening and despite the group sessions, some patients also had low expectations of their RTW, as well as explicitly stating that they had no intention to RTW. Due to such psycho-social reasons, these patients did not fully cooperate in their own treatment, despite the various attempts made to ensure their RTW, including the mediation efforts made by their employers, who proposed making certain job modifications.

A questionnaire, which was developed to evaluate the RTW rate, focused on occupational factors ("blue flags" and "black flags"), such as absenteeism; job modifications; emotional problem areas relating to CLBP; and physical aspects, such as loading and lifting as the risk of back problems heightens with the increase of spinal load and working for long hours in awkward positions can also lead to back problems[3, 20, 53]. No significant difference was found between the scores of the two groups involved in the study. Patients from both groups might comply with work demands, especially if job modifications/adaptations were made[46].

The patients from Group A were additionally evaluated in terms of the improvement of their pain and disability, by means of applying the VAS and ODI at regular intervals. No significance was found between the pre-operative and six-week post-operative scores obtained by means of both of the measuring instruments, but from twelve weeks onwards post-operatively the patients' improvement was highly significant on the scores obtained by means of the application of both the VAS and the ODI.

Conclusion

The literature search conducted for rehabilitation programmes after lumbar surgery due to a work-related injury revealed various intervention programmes as RTW poses a challenge internationally. A systematic review of multidisciplinary rehabilitation for CLBP included functional restoration, cognitive behavioural treatment, psycho-social interventions, exercise, massage and hydrotherapy, but no work hardening programmes[25]. The intensive rehabilitation programme that Fairbank et al.[8] and Brox et al.[26] used, included intensive physical therapy and the principles of cognitive behaviour therapy, but no occupational therapy with the emphasis on work hardening. In their systematic review, Elders et al.[23] found few studies that assessed the outcome RTW after ergonomic intervention and Ostelo et al. concluded that "future research should focus on what the exact content of treatment programs should be and how they should be implemented in daily practice"[28:217]. Loisel et al.[22] developed a model of back pain management, including both the physical capacities of, and the work demands made in, situations where ergonomic solutions were used to modify work tasks to enable successful RTW. However, no specific programme could be found which focused on a multidisciplinary approach, including work hardening with RTW as an outcome measure. This research attempted to comply with the recommendations of Ostelo et al.[28] and Franche et al.[24] to provide the content of a treatment programme and the implementation thereof, by focusing on the application of work hardening intervention, including ergonomic adaptations, within the comprehensive multidisciplinary programme.

Although there are no significant statistical data to uphold the proposed hypothesis, due to the insufficient numbers of patients in both the groups, there was a tendency to suggest that the multidisciplinary approach, including work hardening, had a positive effect on the RTW rate, as 73% of the patients of the experimental group could successfully RTW, in comparison with 55% of the control group. Although the patients of both groups also differed in terms of the surgical procedures that they underwent, studies indicated that various interventions/techniques do not have an impact on the outcome of post-operative management[9,48,52].

As the patients from both groups differ in terms of physical demand level of work due to different geographical regions, it can be recommended that the study should be expanded to other regions to include a wider range of type of work that patients have to perform. The broadening of the study in this way should help to determine the degree of effectiveness which might be obtained by adopting a multidisciplinary approach that includes work hardening. Future studies should also include a one year post-operative follow-up of the patients concerned to determine the level of retention of work.

The patients from Group A benefited from the work hardening programme, as their levels of pain tolerance, pain management and functionality showed significant improvement. However, issues of work expectations, RTW coordination, goal-setting and career advancement should be included in future studies[2, 48] as pain-related fear-avoidance behaviour and catastrophising are recognised as risk factors, which might exacerbate the development of chronic pain and the subsequent negative RTW[14].

Significance of Study

The positive tendency towards the effectiveness of the comprehensive multidisciplinary rehabilitation programme, including work hardening, can be recommended as an essential component of post-lumbar surgery rehabilitation in accordance with international research[22, 24, 28], as it:

- Contributes to a base of clinical outcome evidence and provides feedback to referring doctors.
- Can be used to motivate patients to comply with therapy.
- May contribute to the Compensation Commissioner about the results may aid future decision making regarding optimum treatment or medical boarding of patients and it can further reduce expenditure[2, 4, 5, 7].

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