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# A retrospective study of the effectiveness of physical rehabilitation of low back pain patients in a multidisciplinary setting

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***Objective**: To evaluate the effectiveness of physical rehabilitation of low back pain patients in a multidisciplinary setting.*

***Design**: A retrospective study profiled and analysed objective data from patients seen through a rehabilitation program in a private multidisciplinary facility.*

***Patients**: 147 patients with low back pain were analysed.*

***Population**: The sample consisted mainly of patients with motor vehicle accident-related or work-related injuries to the lower back. They ranged from acute to chronic in nature.*

***Main outcome measures**: The primary measures were the Oswestry Pain Disability Index (ODI) and the Pain Visual Analogue Scale. Secondary measures included SLR, sit and reach test, grip strength, leg lift strength and ranges of motion.*

***Results**: The outcome measures used in the study showed statistical significance ($p < 0.05$). Positive clinical trends were shown in pain VAS, ODI, leg lift and sit and reach tests. Ninety percent of patients were cleared to return to work upon discharge from the program.*

***Conclusions**: Further studies of active physical rehabilitation should employ a prospective randomized controlled trial design. The study should also follow up patients to confirm that they have continued to work following discharge from the program. As indicated by*

***Objectif** : La présente étude vise à évaluer l'efficacité des programmes de réadaptation physique menés en milieu multidisciplinaire chez des patients souffrant de lombalgie.*

***Conception** : Il s'agit d'une étude rétrospective dans laquelle ont été analysées des données objectives sur des patients ayant été soumis à un programme de réadaptation mené en milieu privé multidisciplinaire.*

***Patients** : 147 patients souffrant de lombalgie ont fait l'objet d'une évaluation.*

***Population** : L'échantillon se composait surtout de patients souffrant de lombalgie à la suite d'un accident d'automobile ou de blessures subies en milieu de travail. La lombalgie était aiguë ou chronique.*

***Principaux outils de mesure** : Deux principaux outils de mesure ont servi à évaluer les résultats : l'indice d'Oswestry (ODI) et l'échelle analogique visuelle (VAS). L es mesures secondaires comprenaient l'élévation des jambes tendues, l'épreuve d'atteinte des orteils en position assise, la force de préhension, la force d'élévation des jambes et l'amplitude des mouvements.*

***Résultats** : Les mesures ont révélé des résultats statistiquement significatifs ($p < 0,05$). Des améliorations cliniques ont été observées dans l'évaluation de la douleur sur la VAS, l'ODI, l'élévation des jambes et l'épreuve d'atteinte des orteils en position assise. Quatre-vingt-dix pour cent des patients ont été déclarés aptes au travail après avoir suivi le programme.*

***Conclusion :** Il faudrait poursuivre l'évaluation de la*

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*the statistical analysis provided by this study, a minimum sample size of 53 subjects per intervention group would be required.*
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KEY WORDS: multidisciplinary, rehabilitation, outcomes, low back pain.

*réadaptation physique active au moyen, cette fois, d'une étude prospective, contrôlée sur échantillon aléatoire. L'étude devrait également comporter un volet de suivi pour s'assurer que les patients continuent bel et bien à travailler après la fin du programme. Comme l'indique une analyse statistique fournie dans l'étude, chaque groupe de traitement devrait compter au moins 53 patients.*
(JACC 1999; 43(2):89–103)

MOTS CLÉS : milieu multidisciplinaire, réadaptation, résultats, lombalgie.

## Introduction

Lost productivity due to low back pain results in major costs to employers and the economy.[1–8] Lengthy times-to-recovery result in additional costs to the health care system and ultimately to the taxpayer.[2,9–12] With both the Canadian economy and health care system suffering financial constraints, lowering these costs is currently a real concern and high priority amongst governments and employers.

The objective of this study is to retrospectively examine the effectiveness of a multidisciplinary physical rehabilitation program. The results will be compared with other studies on rehabilitation programs found in the literature, and added to the information base regarding physical rehabilitation in general. Another objective of this study is to create a sample size estimate for future research in this area.

The null hypothesis for this study is that the time and degree of recovery for patients in a multidisciplinary physical rehabilitation setting is not statistically significantly different from that in traditional rehabilitation programs ($p < 0.05$).

Of the 64 potentially relevant articles that were cited in a search of the Medline (1990 to 1995) and Index of Chiropractic Literature, 29 studies could be dismissed as not directly concerned with the rehabilitation of low back pain.[1,4,6–8,13–36] Several studies reported success with their rehabilitation,[2,10,28,37–40] but sample sizes were small[10,28,39] and drop-out rates were sufficiently problematic[2,28,39,41] to cast doubt on whether these success rates apply to typical low back pain patients. Some of the studies did not involve randomized controlled trials,[28,37,39,40,42] or did not involve an interdisciplinary approach with active physical rehabilitation.[37,42] In other recent studies it has been found that in order to prevent back pain from becoming disabling, an interdisciplinary approach is required.[43] It has also been found that lower cost secondary rehabilitation can be effective, and high cost tertiary care may be unnecessary, if deconditioning, severity of physical symptoms, surgical equivocation, or psychosocial barriers to recovery are not present.[44] Frost et al.[45] found that moderately disabled patients with chronic low back pain who attend a back school and fitness program benefit more in the short and long term than patients who attend a back school and exercise independently at home.

A study by Vernon et al.[42] on chiropractic rehabilitation of spinal pain patients described an active rehabilitation program which demonstrated high levels of clinical improvement and patient satisfaction. However comparisons to this study are limited since it investigated all regions of the spine, whereas the present study focused on low back pain patients which used an interdisciplinary approach.

Because the issue of the effectiveness of interdisciplinary rehabilitation programs for low back pain has not been adequately addressed by the literature, our study endeavors to undertake a retrospective preliminary comparison of an interdisciplinary active physical rehabilitation program with traditional rehabilitation programs.

## Definition of terms

*Low back pain* can be defined as pain, ache, or discomfort experienced in the lumbar or sacral regions of the back with or without radiating pain.[46]

*Acute Injury* refers to a problem which has a rapid onset, short course (< 4 weeks), and pronounced symptoms.

*Sub-acute condition* refers to a disease or pathological process, intermediate in character between acute and chronic (4 to 12 weeks).

*Chronic injury* refers to a problem which persists for more than three months (> 12 weeks).

*Interdisciplinary/multidisciplinary team* refers to an assembly of professionals (Chiropractors, Medical Doctors, Psychologists, Kinesiologists, Physiotherapists, and Occupational Therapists) who work together to solve problems beyond any one discipline's specific knowledge base.[21] It involves communication and coordination among team members to achieve comprehensive rehabilitation of the patient.[47]

*Rehabilitation* is a progressive, dynamic, goal-oriented and often time-limited process which enables an individual with an impairment to identify and reach his/her optimal physical, mental, cognitive, functional and/or social and economic status.[29]

*Illness behaviour* is a sick role the patient may adopt to express his/her own perception of disturbed health.[34] It involves preoccupation with pain. Illness behaviour is often reinforced by concern from a spouse or physician, as well as secondary gain and return to an unpleasant work situation.[10]

*Impairment* – any loss or abnormality of psychological, physiological or anatomical structure or function.[62]

*Disability* – any restriction or lack (resulting from impairment) of ability to perform an activity in the manner or within the range considered normal for the human being.[62]

## Methods

### *Design*

This pilot study utilized a preliminary retrospective cohort design using a sample size of one hundred and forty-seven (147) patients in the interdisciplinary treatment group. A power analysis was performed post data-gathering to determine if this sample size had 80% power; and if not, what the minimum sample size would have to be in order to yield 80% power at the 0.05 significance level.[3]

### *Sample profile*

The sample consisted mainly of patients with motor vehicle accident-related and industrial accident-related injuries to the lower back. They ranged from acute to chronic in nature. The inclusion criteria used in this study required patients who had received a minimum of four weeks of active treatment at the North York Rehabilitation Centre.

### *Description of the program*

The four phase physical rehabilitation program was comprised mainly of supervised active progressive exercise and patient education. The exercise program involved stretching, aerobic conditioning and strengthening. Patient education was ongoing throughout all four phases. The main goals of the program were to achieve full functional recovery, return to work or normal ADL and prevent patient deconditioning and chronic pain. During Phase 1, all patients still received some **passive** treatments which may have included soft tissue therapy, Chiropractic manipulative therapy, electrotherapy, and/or ultrasound/TENS. The **active** program in Phase 1 consisted of cardiovascular exercise (i.e., treadmill or stationary bicycle) and a comprehensive stretching program. Phase 2 began approximately one to two weeks into the program, which included the above but added some isometric strength training. Initially, the patients began with resistive tubing exercises, isometric exercises, and gradually progressed to resistive weight training (Phase 3). The educational component taught patients contemporary rehabilitation principles, such as the difference between "hurt versus harm", proper back education, postural sparing techniques, independent pain coping strategies, relaxation exercises, and the importance of leading an active lifestyle. Phase 4 consisted of a continuation of the previous phases with the introduction of sports specific training or work conditioning/ simulation.

Most if not all of these patients were initially treated with passive forms of treatment which included: chiropractic adjustments, massage therapy, physiotherapy and/ or acupuncture. The treatment duration and frequency was typically four weeks, three to five times per week. The frequency of passive treatment was decreased as the patient's activity level was increased. The phases of this program are in keeping with current trends in active physical rehabilitation. The active rehabilitation program was prescribed by either a chiropractor or physiotherapist. The

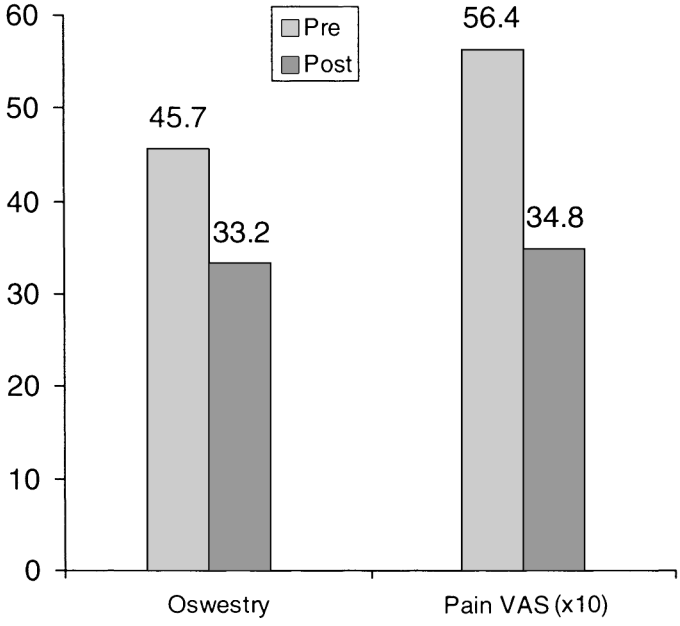


**Figure 1**
**Pre- and Post-Program Pain Score Averages**

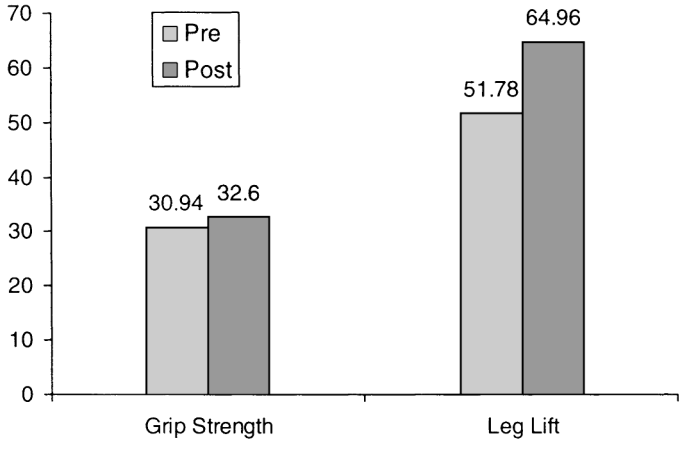


**Figure 2**
**Pre- and Post-Program Strength Averages**

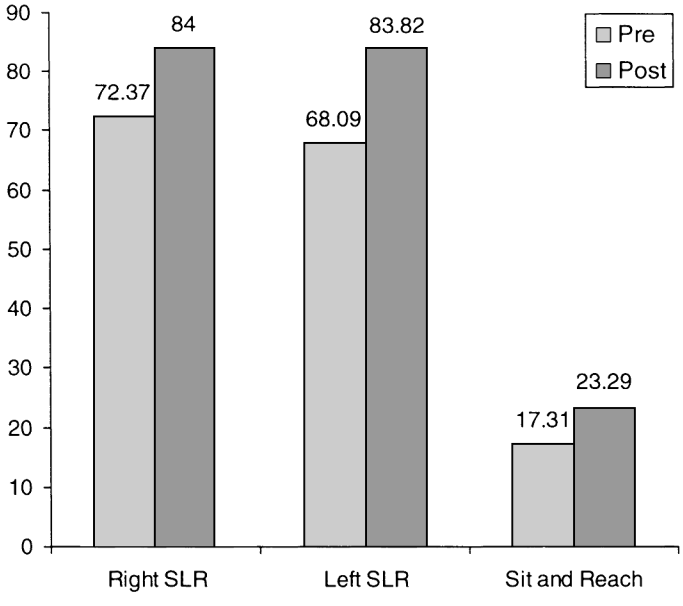


**Figure 3**
**Pre-and Post-Program Averages for Patient Flexibility**

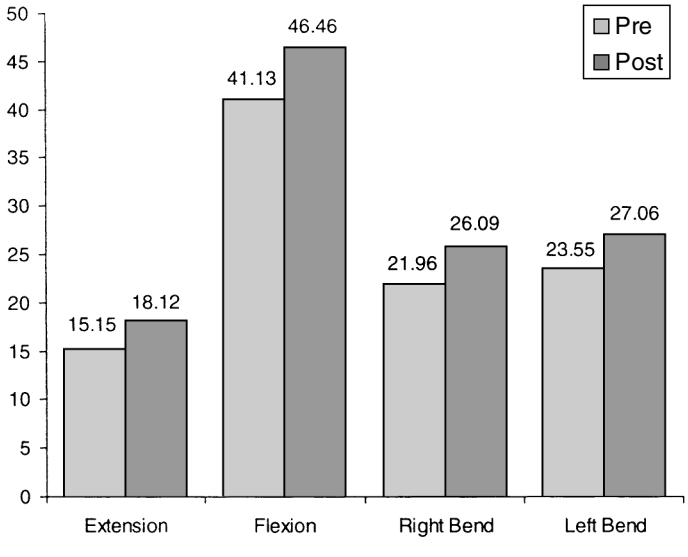


**Figure 4**
**Pre- and Post-Program Range of Motion Averages**

exercise portion of the program was directly supervised by a kinesiologist. The multidisciplinary team consisted of a chiropractor, physiotherapist, kinesiologist, occupational therapist and a behavioural therapist (Masters in psychology).

### *Outcome measures*

Several outcome measures were used, including: measuring strength, flexibility, as well as subjective measures for assessing changes in quality of life and pain.[48] Pain VAS and the Oswestry Disability Index have been shown to be acceptably reliable subjective measures.[49–52]

Straight Leg Raising has also demonstrated acceptable reliability as a diagnostic tool.[53] Other variables such as age, sex, third party payer, length of time since injury, and length of time in treatment will be studied.

Lumbar range of motion was measured using a digital Dualer inclinometer. This provides a simple technique for assessing ranges of motion.[56] The same apparatus was used to measure SLR. The accuracy and repeatability are ± 1°.

For low back flexibility, the sit and reach test was used. The sit and reach test was performed as described in the Canada Fitness Testing procedure. The mean of the three tests was calculated. The test has been shown to be reliable in measure of flexibility, with an inter-class test-retest agreement coefficient of 0.83.[55]

For grip strength, the Jamar (five position) hand grip dynamometer was utilized. Standardized patient positioning as set forth by the American Society of Hand Therapist was followed.[65] Accuracy was measured at ± 3% with a test-retest reliability (using the Pearson Product Moment Correlation Coefficient) of $r = 80$.[66] Fike et al. concluded that this device was useful for establishing a baseline and for monitoring progress assessments.[67]

Isometric force produced by the musculature of back and leg was tested by the Jamar Back-Leg Dynamometer. It has an accuracy of 100 kg ± 0.5 kg. The leg lift test was performed three times.

Clinical significance was considered to be a change greater than or equal to: 2 cm for pain VAS, 10% for Oswestry Disability Index, 10% of entry level grip strength, 10% of entry level leg lift strength, 20 degrees for straight leg raising, 5 cm for sit and reach, 5 degrees for lumbar extension, 10 degrees for lumbar flexion and 5 degrees for left and right lateral lumbar bending.

Data for the interdisciplinary rehabilitation group was collected from patient files. Since the data collection methods from the Rehabilitation Centre are similar to those in an epidemiological study wherein individual patient names are not recorded, it was not necessary to obtain informed consent from the patients. Data for the control group included summary frequency counts, means and standard deviations obtained from the literature.

### *Clearance for return to work/disability test*

1. A primary health care practitioner (chiropractor) assessed clearance for return to work at the end of the program.
2. The final physical/functional assessments confirmed whether or not the patient was substantially able to perform the essential tasks of their pre-accident occupation or activities of daily living. This was the disability test that was used.

### *Statistical analysis*

These data are both quantitative and ordinal in nature. Therefore, the within treatment group data (i.e. flexibility, strength, and subjective measure of pain and quality of life, etc.) were analyzed using the one-tailed paired *t*-test and Pearson's correlation coefficient. Although a pilot study was not used to determine which direction the samples (positive or negative) would be going, the review of previous data from similar study population allowed us to hypothesize the direction and have allowed us to use this test. However, since some of these data were compared with control data from other studies, the Confidence Interval (95%) calculations for proportions and means were employed for these analyses.

## Results

A total of 147 subjects were considered for this study, 75 (51%) were female and 72 (49%) were male. The average age upon entry into the rehabilitation program was 38.9 years (female average was 38.8, male average was 38.9). For 102 cases the insurance type was recorded: 51 (50%) were motor vehicle accidents (MVA), 41 (40%) were worker's compensation board claims (WCB), and 10 (9.8%) were private patients.

The subjects spent an average of 31.3 days participating in the program for an average of 9.1 weeks. The date of injury was recorded for 79 subjects, with a median of 66 days since injury before entering into the program (the

average was 202.2 days with a standard deviation of 355.8 days). See Table 1. Of these 79 patients, 27 (34.2%) were acute, 17 (21.5%) were sub-acute, and 35 (44.3%) were chronic cases.

Pain and perceived disability were measured with the pain visual analogue scale (VAS)[23,49,54] and the Oswestry Disability Index, respectively, upon entry and discharge from the program. The average VAS was 5.6 cm upon entry into the program ($n = 138$) and 3.5 cm upon discharge ($n = 138$). The average individual change in VAS was a decrease of 2.2 cm ($n = 135$); this decrease was 2.4 cm ($n = 70$) for females and 1.9 cm ($n = 65$) for males. A one-tailed *t*-test proved these results to be statistically significant at the level of $p < 0.01$. The average Oswestry score was 45.7% upon entry into the program ($n = 141$), and 33.2% upon discharge ($n = 138$). The average individual change in Oswestry score was a decrease of 12.9% ($n = 137$). For females this decrease was 14% ($n = 71$) and for males 11.6% ($n = 66$). See Table 2. A one-tailed *t*-test proved these results to be statistically significant at the level of $p < 0.01$. Pearson's correlation factors for pre-VAS and pre-Oswestry, post-VAS and post-Oswestry, VAS change and Oswestry change were 0.5, 0.73, and 0.44, respectively.

Strength was measured using the Jamar Hand Grip dynamometer and the Jamar Leg Lift dynamometer. The average Grip Strength upon entry was 30.9 kilograms (this was an average of each subject who performed three trials) ($n = 133$); and on discharge was 32.6 kilograms ($n = 131$). The average individual grip strength change was an increase of 1.7 ($n = 130$). A one-tailed t-test of pre-program and post-program data was significant at the level of $p < 0.01$. The average leg lift upon entering into the program was 51.8 kilograms ($n = 119$); and 65 kilograms on discharge ($n = 118$). The average individual leg lift strength change was an increase of 13.1 kilograms ($n = 117$); statistically significant at $p < 0.01$. See Table 3. Pearson's Correlation Coefficient for grip strength and leg lift (pre-, post-, and change data) were 0.67, 0.76, and 0.33, respectively.

Flexibility was assessed by using the Straight Leg Raise and the Sit and Reach tests.[55] The average pre-program Straight Leg Raise ($n = 105$) were 72.4° (right) and 68.1° (left). The average post-program results ($n = 104$) were 84° (right) and 83.8° (left). The average individual change ($n = 104$) was an increase of 11.4° (right) and 15.5° (left). These results were statistically significant at $p < 0.01$. Pearson's Correlation Coefficients for the pre- post- and change data of the right and left Straight Leg Raise were 0.78, 0.81, and 0.66, respectively. The Sit and Reach data revealed an average pre-program measure of 17.3 cm ($n = 117$), and a post-program average of 23.3 cm ($n = 118$), with an average increase of 5.8 cm ($n = 117$), statistically significant at $p < 0.01$. See Table 4.

The ranges of motion of the lumbar spine assessed were extension, flexion, and left and right lateral bending. The ranges of motion were documented using a digital Dualer inclinometer. This provides a simple technique for assessing impairment and measuring progress in the rehabilitation program.[56] Rondinelli et al. determined that inter-examiner reliability of a double inclinometer was moderate (ICCT = 0.83) and inter-examiner reliability was only fair (ICC = 0.69).[63] For the pre-treatment data, the average extension was 15.2° ($n = 98$), flexion was 41.1° ($n = 137$), right bending was 22° ($n = 119$), and left bending was 23.6° ($n = 119$). The post-treatment averages were as follows: extension 18.1° ($n = 100$), flexion 46.5° ($n = 136$), right bending 26.1° ($n = 114$), and left bending 27.1° ($n = 116$). The average individual changes were: extension 3.1° ($n = 98$), flexion 5.4° ($n = 136$), right bending 4.2° ($n = 114$), and left bending 3.5° ($n = 116$). See Table 5. All comparisons of pre- and post- data were statistically significant at the level of $p < 0.01$. Pearson's Correlation Coefficient for comparisons of flexion with Sit and Reach data (pre, post, change) were 0.34, 0.29, and 0.15, respectively.

Return to work or pre-accident activities data shows that of the original 147 subjects that were reviewed, 101 were still considered disabled at the time of the initial functional assessment. Ninety-one of the 101 patients (90.1%) were cleared to return to work, either on a modified or unrestricted basis upon discharge from our program. Forty-six patients were in the program but were not considered disabled as they had already returned to work. These subjects still demonstrated objective signs of impairment (i.e., functional deficits).

A comparison of our data with the literature was achieved by calculating 95% Confidence Intervals and yielded the following results:

The age of our subjects was not different from that reported in the Di Fabio study,[57] but the low back pain duration was less and the pre-treatment Oswestry disability

**Table 1**
**Profile of patients in the program**

| | Entry Age | Days in Program | Program Duration | Days Since Injury |
|---|---|---|---|---|
| Count (147) | 123.00 | 127.00 | 144.00 | 79.00 |
| Median | 37.00 | 27.00 | 8.00 | 66.00 |
| St.Dev | 11.79 | 15.92 | 3.27 | 355.77 |

"Count" represents the number of data entries available for patients in the category (out of a possible 147).

**Table 2**
**Oswestry and Pain Visual Analogue Scale data for patients in the program**

| | Oswestry pre | Oswestry post | Oswestry Change | Pain VAS pre | Pain VAS post | Pain VAS Change |
|---|---|---|---|---|---|---|
| Count | 141.00 | 138.00 | 137.00 | 138.00 | 138.00 | 135.00 |
| Minimum | 2.00 | 0.00 | –64.00 | 0.00 | 0.00 | –8.00 |
| Maximum | 91.00 | 80.00 | 22.00 | 10.00 | 10.00 | 4.00 |
| Median | 47.00 | 32.00 | –12.00 | 5.50 | 3.00 | –2.00 |
| Average | 45.73 | 33.20 | –12.87 | 5.64 | 3.48 | –2.16 |
| St.Dev | 18.46 | 20.92 | 15.30 | 2.45 | 2.53 | 2.42 |

**Table 3**
**Grip Strength and Leg Lift data for patients in the program**

| | GripStrength – pre | Grip Strength – post | Grip Strength Change | Leg Lift pre | Leg Lift post | Leg Lift Change |
|---|---|---|---|---|---|---|
| Count | 133.00 | 131.00 | 130.00 | 119.00 | 118.00 | 117.00 |
| Minimum | 4.60 | 8.00 | –14.60 | 0.0 | 4.0 | –24.0 |
| Maximum | 68.60 | 61.80 | 22.60 | 171.00 | 181.00 | 72.00 |
| Median | 29.50 | 31.00 | 1.80 | 45.00 | 57.00 | 11.00 |
| Average | 30.94 | 32.60 | 1.67 | 51.78 | 64.96 | 13.09 |
| St.Dev | 12.81 | 12.76 | 5.26 | 35.21 | 40.72 | 18.19 |

**Table 4**
**Straight Leg Raise and Sit and Reach Data for the patients in the program**

| | Right SLR – pre | Right SLR – post | Right SLR Change | Left SLR – pre | Left SLR – post | Left SLR Change | Sit and Reach pre | Sit and Reach post | Sit and Reach Change |
|---|---|---|---|---|---|---|---|---|---|
| Count | 105.00 | 104.00 | 104.00 | 105.00 | 104.00 | 104.00 | 117.00 | 118.00 | 117.00 |
| Minimum | 20.00 | 20.00 | –56.00 | 6.00 | 25.00 | –63.00 | 0.00 | 0.00 | –18.50 |
| Maximum | 115.00 | 127.00 | 70.00 | 120.00 | 130.00 | 86.00 | 45.50 | 48.00 | 26.50 |
| Median | 74.50 | 89.00 | 9.00 | 68.00 | 85.00 | 14.00 | 15.75 | 22.50 | 5.00 |
| Average | 72.37 | 84.00 | 11.37 | 68.09 | 83.82 | 15.51 | 17.31 | 23.29 | 5.79 |
| St.Dev | 19.99 | 17.84 | 17.74 | 20.98 | 17.40 | 18.65 | 10.25 | 10.23 | 7.29 |

**Table 5**
**Range of Motion data for patients in the program**

| | Extension pre | Extension post | Extension Change | Flexion pre | Flexion post | Flexion Change |
|---|---|---|---|---|---|---|
| Count | 98.00 | 100.00 | 98.00 | 137.00 | 136.00 | 136.00 |
| Minimum | 0.00 | 5.00 | –18.00 | 5.00 | 12.00 | –26.00 |
| Maximum | 50.00 | 70.00 | 25.00 | 86.00 | 92.00 | 42.00 |
| Median | 15.00 | 16.00 | 3.00 | 42.50 | 48.00 | 6.00 |
| Average | 15.15 | 18.12 | 3.10 | 41.13 | 46.46 | 5.40 |
| St.Dev | 8.76 | 8.78 | 7.37 | 13.37 | 12.10 | 11.31 |
| | **Right Bend pre** | **Right Bend post** | **Right Bend Change** | **Left Bond – pre** | **Left Bond – post** | **Left Bond Change** |
| Count | 119.00 | 114.00 | 114.00 | 119.00 | 116.00 | 116.00 |
| Minimum | 6.00 | 7.00 | –22.00 | 7.00 | 10.00 | –16.00 |
| Maximum | 45.00 | 46.00 | 27.00 | 43.00 | 50.00 | 35.00 |
| Median | 21.00 | 26.00 | 5.00 | 24.00 | 28.00 | 3.00 |
| Average | 21.96 | 26.09 | 4.18 | 23.55 | 27.06 | 3.53 |
| St.Dev | 7.94 | 6.70 | 8.38 | 7.50 | 7.00 | 7.93 |

score was higher. There was no statistical significant difference between the two programs for the change in Oswestry. See Table 6.

When comparing the results of our study's program to the Mayer (1986) study,[39] the confidence interval suggested a statistically significant lower Straight Leg Raise change and Lumbar Extension change in our study. See Table 7.

The Mayer (1987) study,[40] found no statistically significant differences between genders for the outcome measures of extension and flexion, but there was a highly significant difference for duration of injury before entering the program. See Table 8.

Both our study and the Mellin study[58] showed a statistically significant improvement with respect to the extension change, for both males and females. However, the Mellin study showed a greater clinical significance. See Table 9.

When comparing the results of our study's program to the Vernon study,[42] the confidence interval suggested statistically significant lower pain VAS and Oswestry changes in our study. See Table 10.

A sample size estimate was performed (at the power level of 80% and alpha level of 0.05) and revealed that a total of 53 patients would be required for each of the control and program groups for future studies involving a randomized controlled trial design. This estimate is based on all participants in the study including the non-disabled group.

## Discussion

The goal of this study was to describe the outcomes of active rehabilitation in a multidisciplinary setting for acute, subacute and chronic low back injuries. The outcomes measured include decreases in pain measurements and disability indices as well as increases in strength, flexibility, and range of motion which are statistically significant. Return to work clearance was also considered.

The results of the study indicated an average decrease of 12.9% for the Oswestry Disability Index and an average decrease of 2.2 cm for the Pain VAS. Considering clinically significant changes at the level of 10% for the Oswestry Disability scale and 2 cm for the Pain VAS, these show a consistent level of clinical significance. The average Oswestry score upon entry into the program was in the severe disability range (40 to 60%) at 45.7%, while upon discharge from the program the average score was in the moderate disability range (20 to 40%) at 33.2%. We consider this to be a significant clinical improvement. There was a moderate positive correlation between change in Oswestry and pain VAS. As these are both subjective measures of the patient's physical status, one would expect a positive correlation as the patient's perceived level of functional ability is directly reflective of their perceived level of pain. Compared with our 12.9% change in the Oswestry Index, Di Fabio's results[57] showed a decrease of 10% and Vernon's[42] data indicated a decrease of 20.4%. The Di Fabio study had a program duration which was four times longer than our study, and Vernon's average number of days from time of injury to the entry into the program was one quarter of that of this study.

The average individual grip strength change was 1.7 kg and 13.1 kg for the leg lift. These were both statistically significant. There was a mild positive correlation between the changes in these outcomes, however only the leg lift achieved clinical significance. Although grip strength is considered a general indicator of strength, the leg lift was more specific to the low back strength and this explains why there was not a greater correlation between the two outcome measures.

The average increase in the lumbar ranges of motion were as follows: flexion 5.4°, extension 3.1°, left lateral bending 3.5°, right lateral bending 4.2°; and left SLR 15.5°, and right SLR 11.4°. While the changes in these ranges of motion are not considered to be clinically significant, it is important to note that the average discharge range of motion was considered to be within normal limits. Sit and reach flexibility showed an increase of 5.8 cm which was both statistically and clinically significant.

There are limitations with this type of study. This was a retrospective study and it lacked a concurrent control group. However, the practicality of a placebo control group is difficult to simulate and is fraught with ethical issues. The fact that a specific comparison group was not utilized is a methodological flaw. The utilization of information of similar programs is not an ideal way of comparing for two reasons. One, these studies also had research errors and therefore could not be considered a "gold standard". Secondly, the groups from the other studies may have had differences from our group demographics. Furthermore, there is an inherent limitation to diagnostic classification as low back conditions are rarely definitive. This

**Table 6**
**A comparison of data from patients in this program with patients in Di Fabio's[57] program**

| | Our Age | Di Fabio Age | Our Duration | Di Fabio Duration | Our Oswestry Change | Di Fabio Oswestry Change |
|---|---|---|---|---|---|---|
| Number | 123.00 | 138.00 | 144.00 | 132.00 | 137.00 | 28.00 |
| Average | 38.87 | 38.00 | 9.10 | 32.00 | –12.87 | –10.00 |
| Standard Deviation | 11.79 | 10.00 | 3.27 | 29.00 | 15.30 | 18.56 |
| Confidence Interval | (–1.8, 3.54) | | (–27.93, –17.87) | | (–10.51, 4.77) | |

**Table 7**
**A comparison of data from patients in this program with patients in Mayer's (1986)[39] program**

| | Our R.SLR Change | Mayer (1986) R.SLR Change | Our L.SLR Change | Mayer (1986) L.SLR Change | Our Ext. Change | Mayer (1986) Ext. Change |
|---|---|---|---|---|---|---|
| Number | 104.00 | 73.00 | 104.00 | 73.00 | 98.00 | 73.00 |
| Average | 11.37 | 19.22 | 15.51 | 20.57 | 3.10 | 6.02 |
| Standard Deviation | 17.74 | 16.54 | 18.65 | 18.08 | 7.37 | 9.93 |
| Confid. Interval | (–13, –2.7) | | (–10.6, 0.48) | | (–5.65, –0.19) | |

**Table 8**
**A comparison of data from patients in this program with patients in Mayer's (1987)[40] program**

| | Our Days Since Injury | Mayer (1987) Days Since Injury | Our Female Ext. Change | Mayer (1987) Female Ext. Change | Our Female Flex. Change | Mayer (1987) Female Flex. Change | Our Male Ext. Change | Mayer (1987) Male Ext. Change | Our Male Flex. Change | Mayer (1987) Male Flex. Change |
|---|---|---|---|---|---|---|---|---|---|---|
| Number | 144.00 | 116.00 | 52.00 | 22.00 | 68.00 | 22.00 | 46.00 | 46.00 | 68.00 | 46.00 |
| Average | 202.19 | 25.00 | 2.52 | 2.60 | 4.63 | 10.00 | 3.76 | 6.00 | 6.16 | 9.40 |
| Standard Deviation | 355.77 | 42.00 | 7.92 | 7.95 | 12.22 | 11.66 | 6.73 | 9.79 | 10.36 | 14.46 |
| Confid. Interval | (118.58, 235.8) | | (–4.16, 4.0) | | (–11.22, 0.48) | | (–5.74, 1.26) | | (–8.19, 1.71) | |

also led to difficulties with analysis of the data. Some patients presented with severe limitations in one outcome measure but no limitations in others. The latter limited the potential to show clinically significant improvements.

There was also a wide variance in the time between injury and entry into the program. Chronic pain patients generally have a poorer prognosis due to psychosocial factors.[59] Approximately 44% of our patients were in the chronic phases of their recovery. Also, all patients were not assessed functionally until having progressed through four to six weeks of chiropractic, massage therapy and/or physiotherapy. Therefore, most patients would have already realized some degree of improvement (both subjectively and objectively) prior to entering the active rehabilitation program. This is one of our criteria before entering our multidisciplinary rehabilitation program. Thus, our results likely would have shown a higher level of improvement if our outcome measures were used right from the beginning of their entry into treatment. This statement is based on the fact that most patients presented in an "acute state" initially. Thus, our treatment protocol usually commenced with reassurance, and some form of pain control. Having said this, our study is also unique in that most patients continued to receive some form of passive treatment (i.e., chiropractic), one to two times per week throughout the duration of the active rehabilitation program. The purpose of the continued passive treatments was to provide a smooth transition from passive to active treatments in their continuum of care. The passive treatments continued to offer increase in tissue elasticity, increase in flexibility, reassurance and pain management. Some people do not like "exercise" or a rehab facility may

**Table 9**
**A comparison of data from patients in this program with patients in Mellin's[40] program**

| | Our Female Ext. Change | Mellin Female Ext. Change | Our Female Flex. Change | Mellin Female Flex. Change | Our Male Ext. Change | Mellin Male Ext. Change | Our Male Flex. Change | Mellin Male Flex. Change |
|---|---|---|---|---|---|---|---|---|
| Number | 52.00 | 87.00 | 68.00 | 87.00 | 46.00 | 98.00 | 68.00 | 99.00 |
| Average | 2.52 | 10.00 | 10.00 | 8.00 | 3.76 | 9.00 | 6.16 | 9.00 |
| Standard Deviation | 7.92 | 11.70 | 12.22 | 16.14 | 6.73 | 10.12 | 10.36 | 13.95 |
| Confid. Interval | (−10.78, −4.18) | | (−7.88, 114) | | (−8.06, −2.42) | | (−6.57, 0.89) | |

**Table 10**
**A comparison of data from patients in this program with patients in Vernon's[42] program**

| | Our VAS Change | Vernon VAS Change | Our Oswestry Change | Vernon Oswestry Change |
|---|---|---|---|---|
| Number | 135.00 | 73.00 | 137.00 | 73.00 |
| Average | −2.20 | −3.30 | −12.87 | −20.40 |
| Standard Deviation | 2.42 | 2.30 | 15.30 | 18.27 |
| Confid. Interval | (0.445, 1.835) | | (2.412, 12.648) | |

not be their typical milieu, so they were eased into our program.

One of the basic principles of a good physical rehabilitation program is to focus on function and minimize the patient's pain focused behaviours. The goal is functional restoration and not pain control. It is important to recognize their pain is real, but it should not be a limiting factor in the progression of exercises. In keeping with the World Health Organization's definition of "rehabilitation",[29] our program is time-limited and goal-oriented. Supervision of exercise is important to ensure compliance and proper techniques, but patient education is just as important. It is important to teach clients the difference between hurt vs. harm, postural sparing techniques, proper lifting techniques, independent pain coping strategies and the important benefits of an active lifestyle. A significant number of patients still have residual pain upon being discharged from the program, so it is important to encourage them to implement independent pain coping strategies such as icing, relaxation, stretching and continued exercise. A home exercise program should be provided upon discharge and they should be encouraged to continue exercising independently so they can maintain their functional gains.

One of the most unique features of this study comparing it to others in the literature is that we used an integrated healthcare approach in a multidisciplinary setting. chiropractors, physiotherapists, massage therapists, kinesiologists, occupational therapists, medical doctors, psychologists and behavioural therapists were integrated in one way or another in the care of these patients. As mentioned, the chiropractor or physiotherapist would prescribe the proper active physical rehabilitation program tailor-made for each client. The kinesiologist would supervise each client's exercises, not allowing the ratio of patient to therapist to reach above six to one. The behavioural therapist teaches relaxation exercises over a period of four sessions and ensures clients are benefiting from this form of independent pain coping strategy. A psychologist may be used if the patient is suffering from a significant psychological impairment such as Post Traumatic Stress Disorder, Depression, Anxiety or a Somatoform Pain Disorder. The occupational therapist's role is to provide the client some patient education on pacing, work simplification and energy conservation. They will also liase with the employer and set up a modified return to work plan in conjunction with the health practitioner on file, being cognizant of the worker's physical restrictions. It has been our experience that a successful return to work is optimized if the job is available and the employer is flexible and has modified work available.

Motivation and compliance of the claimant is an issue that may present a challenge to service providers when offering rehabilitation programs in the third party payer arena.[17,34] The majority of the patients in this study are motor vehicle and workers' compensation board cases, and as such, the issue of secondary gain motives should be considered.[12,17,60] Consistency of effort and a significant level of improvement are difficult to demonstrate when patients may be participating in the rehab program for the wrong reasons, i.e., fear losing income replacement benefits or being sent back to work. Furthermore, after showing a considerable level of objective improvement it is not uncommon for some patients to demonstrate a period of regression prior to discharge.[61] Some claimants demonstrate self-limiting pain behaviour in their final functional assessment (which is supposed to demonstrate their functional gains) out of fear of being sent back to work or having their disability benefits discontinued. These factors should be taken into consideration when assessing the effectiveness of active rehabilitation programs for patients with low back pain. Consistency of effort must be assessed whenever functional testing is employed. Coefficient of Variation (C.V.) can be measured in strength testing. Generally a C.V. greater than 15% indicates an inconsistent effort. Therefore, the functional data may not be valid and the results should be interpreted with caution. The C.V. can be assessed with the grip strength (Jamar) testing and the push/pull test using the Chatillon unit. Strength testing is repeated generally three times in order to assess consistency of effort.

The optimal design for assessing the effectiveness of this type of program would be a prospective randomized controlled trial. Studies on the clinical efficacy of active rehabilitation of low back pain could be improved by using a more diverse sample population demonstrating an even distribution of private patients and those involved in the third party payer system. Individual outcome measures could be more accurately assessed in studies that limited the sample to patients with deficits in one particular area, i.e., low back.

Finally, a good physical rehabilitation program must

demonstrate cost effectiveness. Our average active physical rehabilitation program costs between $2,000 to $3,000. This does not include passive forms of therapy or psychology. If an appropriate physical rehabilitation program can return a patient to their pre-accident lifestyle, significant cost savings can be realized. We are cognizant of the notion that our return to work rate seems high. As mentioned, this figure is not the "actual" return to work rate and there was no follow-up 3, 6 and 12 months upon discharge from our program. The real success of a program can more accurately be measured if appropriate follow-up is done. Clinical efficacy can more accurately be determined if survival curves are considered.

## Conclusion

This study has demonstrated statistically significant improvements in the Oswestry Disability Index, Pain Visual Analogue Scale, ranges of motion, and strength measurements were obtained in a multidisciplinary physical rehabilitation program for low back pain claimants. Changes in the Oswestry Disability Index, pain VAS, leg lift, and sit and reach were considered clinically significant. Ninety percent of patients were cleared to return back to work or to their normal daily activities upon completion of our Active Rehabilitation Program. The study only evaluated their ability to return to work. We did not measure whether they actually returned to work or whether they were able to stay at work for a significant length of time. This study tends to support the use of multidisciplinary rehabilitation programs for treatment of low back pain even in the chronic pain population. This study showed positive outcome measures and is cost effective. Most of the population (i.e., 90%) are in a third party payer system, which is typically a challenge to rehabilitate and reach full functional recovery.

Further studies of active physical rehabilitation should employ a prospective randomized controlled trial design. As indicated by the power analysis provided by this study, a minimum sample size of 53 subjects per intervention group would be required. Future studies should have appropriate follow-ups at 3, 6 and 12 month intervals to determine the participants' long term benefits from the treatment intervention.

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