Increased Pain Tolerance as an Indicator of Return to Work in Low-Back Injuries After Work Hardening

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Key Words: injured worker • rehabilitation

Objective. This study examined retrospective data from a multidisciplinary work-hardening program that compared patients who did and did not return to work after low-back injury. The objective of this study was to identify differences between these groups to better guide work-hardening programs and return-to-work decisions.

Method. Retrospective data from patients with low-back injuries (n = 115) who participated in a northern California work-hardening program were analyzed. Using two-way analysis of variance, male and female patients who did and did not return to work were compared.

Results. No significant differences were found between men and women for any of the variables studied. Patients who did and did not return to work were not significantly different in age, length of injury, and subjective pain at the beginning or end of the work-hardening program or in activity tolerance (p = .08). Patients who returned to work perceived a significantly (p ≤ .05) greater improvement in pain tolerance by the end of the work-hardening program than those who did not return to work.

Conclusion. The results of this study suggest that rehabilitation emphasis should not be placed on the reduction of subjective pain but, rather, on strategies to cope with existing pain while improving functional ability.


Determining whether a patient is able to return to work after an occupational low-back injury can be a difficult decision, particularly if the person has been off work for a long period. Studies have shown that the longer a person is off work due to injury, the less likely that person will return to work (McGill, 1969; Milhous et al., 1989; Waddell, 1987), especially when the person is being compensated financially. Additionally, age, gender, and time from injury to therapeutic intervention have all been examined as predictors of return to work (Ash & Goldstein, 1995; Beissner, Saunders, & McManis, 1996; Caruso, Chan, & Chan, 1987; Hazard et al., 1989; Hildebrandt, Pfingsten, Saur, & Jansen, 1997; Niemeyer, Jacobs, Reynolds-Lynch, Bettencourt, & Lang, 1994). Frequently, however, physicians and other health care providers will ask the patient whether he or she feels ready to return to work, and the response is often based on the patient’s pain. Patients with back injuries frequently have pain that lasts beyond the expected level and duration of the healing process (Vasudevan & Lynch, 1991); they often have no demonstrable objective cause for the pain (Nachemson, 1983); and they have no anatomically verifi-
able lesion (Haig & Penha, 1991). Physicians and other members of the health care team often become frustrated when attempting to decide whether persistent pain complaints should delay return to work. Should the determination of whether a patient is able to return to work be based on self-reported pain levels or on other factors?

Several studies have examined subjective pain levels as they relate to return-to-work rates. Roland and Morris (1983) found that self-reports of pain were actually better predictors of return to work than length of time off work. Lefort and Hannah (1994) found in their prospective clinical study of persons with low-back injuries that the return-to-work group showed significant improvement in pain measures, whereas the group that did not return to work showed no change in pain. Alternatively, Hazard, Bendix, and Fenwick (1991) noted that although initial patient self-reports of pain intensity in a 3-week functional restoration program were lower for program graduates than for dropouts, the self-assessments did not predict eventual return to work. Likewise, Ambrosius, Kremer, Herkner, Dekraker, and Bartz (1995) showed that the group that had the greatest decrease in pain after a work-hardening program had a slightly lower return-to-work rate than the group who had no significant change in pain level. These studies indicate that pain level may not be the best indicator in return-to-work decisions.

The purpose of this study was to examine differences between patients with low-back injuries who eventually returned to work and those who did not return to work. In particular, we wanted to determine whether a relationship existed between subjective pain level, pain tolerance, and activity tolerance and return to work among patients who participated in a work-hardening program. Additional factors examined were gender, age, length of time since injury, and length of time spent in the work-hardening program.

Method

Sample

All data used in this study were analyzed retrospectively from records of patients with low-back injuries \( n = 115 \) referred to a work-hardening program in northern California from March 1989 to August 1996. They were referred to the program by various sources, including physicians, rehabilitation nurses, insurance companies, and employers. At the time of referral to the program, all had been off work for 2 months or more since injury or surgery. For acceptance into the work-hardening program, patients were required to be ambulatory and authorized to attend by their workers’ compensation insurance carrier. All patients were entitled to workers’ compensation benefits. Data from patients referred to the work-hardening program for reasons other than low-back injury were excluded from the study \( n = 117 \).

Work-Hardening Program

The work-hardening program used a multidisciplinary approach for treating injured workers. The treatment staff was made up of an occupational therapist, physical therapist, vocational counselor, psychologist, and workroom foreman, with the occupational therapist and physical therapist working full time with the patients. Both the occupational therapist and the physical therapist were involved with the initial intake evaluation, daily activity schedules, case management, and discharge planning. The physical therapist instructed patients in daily low-back exercises and injury-prevention training, whereas the occupational therapist worked with patients in pain-management techniques and supervised individual work-simulation activities. Patients were expected to attend the work-hardening program 5 days a week for 6 hours per day.

All patients were treated at the same work-hardening facility in northern California. The physical space consisted of a 2,000-sq ft warehouse-like area with a variety of job-related simulations; an adjoining 2,000-sq ft gym shared with traditional outpatient occupational and physical therapy services; and a smaller room used for multiple purposes, including classes, intake and exit conferences, stretching exercises, and lunch. Additionally, an outside area was used for simulating outdoor activities, including gardening and various types of materials handling.

Treatment consisted of job-specific work simulations, physical conditioning, and education. Work simulations were set up to match activities that injured workers did on the job. For example, an old, unused car was a permanent fixture at the facility and provided a simulation station for automechanics. Injured electricians worked on wiring while in a crawl space under a mock-up framed structure built in one corner of the workroom. Grocery store workers restocked mock grocery items on shelving set to varying heights. The facility also had a telephone pole installed in the outside area behind the building for climbing activities for linemen. Each day began with a 1-mile group warm-up walk around the facility, which was followed by stretching exercises for the lower extremities and low back as well as floor exercises, such as abdominal strengthening. Much of the day was scheduled for work-simulation activities. One-hour classes on the anatomy of the spine, proper posture, body mechanics, and pain and stress management were also provided during the course of the week. These classes were taught by the occupational and physical therapists and involved slides, handouts, lectures, and group discussions. The patients spent the final hour of the day performing aerobic and strengthening exercises in the gym. An aerobic period of 20 min to 30 min included activities on a treadmill, stair stepper, and stationary bicycle. Eagle® and Nautilus® exercise equipment was used for the strengthening exercises.

Each patient’s treatment plan was individualized on
the basis of injury, job description, and case goals. The primary goal for treatment was to facilitate safe return to the workforce. The program helped to identify whether a patient had the functional capacity to return to a previous job or whether limitations in functional abilities required that the patient return to alternate work.

Data Collection
At the time of referral, each patient participated in an intake evaluation that consisted of a questionnaire to be completed by the patient, an interview with one of the staff members, a physical assessment, and a functional abilities assessment. The questionnaire collected information on age, gender, date of injury, education, occupation, job description, and psychosocial-related topics. In addition, the patient completed a pain drawing to indicate where he or she felt pain. The interview portion of the evaluation collected information about the patient’s medical history and the present injury. During this time, the patient was asked to report current pain level using a simple numerical scale from 0 to 10 with verbal expressions as anchors. On the pain level scale, 0 was equivalent to no pain and 10 was equivalent to excruciating pain. The pain level scale was similar to category ratio scales used to measure perceived exertion and perceived pain (Borg, 1990; Borg, Holmgren, & Lindblad, 1981). The physical assessment followed the interview to establish general range of motion, strength, and sensation. Functional abilities testing established the patient’s baseline capacities for 16 physical demands, including lifting, carrying, standing, walking, and other tasks generally evaluated in work-hardening programs.

On the day of discharge from the program, each patient completed an exit questionnaire that again asked for a current self-rating of pain level using the pain level scale. Additionally, the patient was asked to rate on a scale of 0% to 100% improvement in pain tolerance and activity tolerance since starting the work-hardening program. Pain tolerance was defined as the ability to continue work despite the presence of pain symptoms. Activity tolerance was defined as an increase in the amount of work or non–work-related activities that the patient could tolerate at the end of the work-hardening program compared with the start of the program.

Return-to-work status was determined by contacting the patients at 1, 6, 12, and 24 months after discharge from the program. If the patient had returned to work either part time or full time to either the original or an alternative job at the time of the follow-up phone calls, the patient was considered to have successfully returned to work. The date of return to work was then recorded in the patient’s chart. After this point, no further contact was made with the patient. For those patients who successfully returned to work, the average time from discharge from the work-hardening program to return to work was 4 months. After 24 months, no further follow-up phone calls were made to patients.

Statistical Analysis
Retrospective data were analyzed using a two-way analysis of variance (ANOVA), with gender as one independent factor and work status (did not return to work vs. returned to work) as the other. Dependent variables included age, length of injury, days spent in the work-hardening program, pain level at the start and end of the program, and pain tolerance and activity tolerance. All data are presented showing means and standard errors of the mean.

Results

Overall Participant Characteristics
The age of the patients in the work-hardening program ranged from 19 years to 61 years (M = 37.8 ± .9 years). The average length of time since injury was 274 ± 24 days. Patients spent an average of 12.6 ± .5 days in the work-hardening program. Little overall change in pain level from the start to the end of the work-hardening program was reported, with average pain ratings (on a scale of 1 to 10) of 4.1 ± .2 at the start and 4.2 ± .2 at the end of the program. Overall, by the end of the work-hardening program, pain tolerance improved 35.5 ± 2.4%, and activity tolerance improved 43.3 ± 2.6%.

Gender and Work Status Findings
The results of the two-way ANOVA with gender and work status (did not return to work, returned to work) as independent factors are presented in Table 1 and Figure 1. Note that no main effects for gender for any of the variables studied were found, indicating that men and women had similar characteristics before the work-hardening program and responded similarly to the program. Additionally, no main effects for work status were found for age, length of injury, days spent in the work-hardening program, or change in pain level from the start to the end of the program. This finding indicates that both groups had similar average ages, lengths of injury, and days spent in the work-hardening program (see Table 1). Interestingly, measurements of pain levels for the group that did not return to work and the group that did return to work showed virtually no change from the start of the program to the end of the program (see Figure 1a). Pain tolerance, however, showed significant (p ≤ .05) improvement by the end of the program for the group that returned to work (see Figure 1b). Activity tolerance also improved in the group that returned to work (p = .08) but not significantly (see Figure 1c). Finally, no significant interaction effects were found between gender and work status.

Discussion
The purpose of this study was to examine the differences between patients with low-back injuries who did and did
not return to work after a work-hardening program. In particular, we wanted to determine whether a relationship existed among subjective pain level, activity tolerance, and pain tolerance and return to work. When comparing the group that returned to work with the group that did not, no significant differences were found due to age, gender, length of injury, days spent in the work-hardening program, or change in pain level between the start and end of the program. Activity tolerance showed greater improvement in the group that returned to work, but the change was not significant \( (p = .08) \). Changes in pain tolerance after the work-hardening program were found to be significant \( (p \leq .05) \) when comparing patients who returned to work with those who did not.

Our results indicate that age and gender were not predictors of return to work. These findings are consistent with those of Ash and Goldstein (1995), Hildebrandt et al. (1997), and Niemeyer et al. (1994) but differed from those of Beissner et al. (1996), Hazard et al. (1989), and Caruso et al. (1987). Beissner et al. and Hazard et al. found that older patients (i.e., 50–60 years of age) were less likely to return to work after injury than their younger counterparts (i.e., 19–30 years of age). The mean age of the patients in our study was in the mid to high 30s (see Table 1), indicating that age may not be a factor in determining return to work when the injured worker’s age falls between young and old. Beissner et al. found that women were initially more likely to return to work up to 3 months after completing a work-hardening program. However, this difference was not apparent 1 year after completing the program. Caruso et al. also found that women were more likely to return to work immediately after a work-hardening program. In our study, we considered return to work up to 2 years after completing the work-hardening program successful, with the mean time to return to work for our sample being 4 months. Our results did not show any gender differences in return to work rates, indicating that at 4 months post–work-hardening program, gender may not play a role as a predictor of return to work.

Our finding that length of time in a work-hardening program was not a predictor of return to work is consistent with research by Beissner et al. (1996) and Niemeyer et al. (1994). Several studies also backed our finding that length of injury was not a significant factor in determining return-to-work rates (Ash & Goldstein, 1995; Beissner et al., 1996; Hazard et al., 1989; Hildebrandt et al., 1997; Lancourt, 1992; Peterson, 1995; Table 1

### Table 1: Descriptive Statistics of Participants in a Work-Hardening Program

<table>
<thead>
<tr>
<th>Variable</th>
<th>Women</th>
<th>Men</th>
<th>Women</th>
<th>Men</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of participants</td>
<td></td>
<td>28</td>
<td></td>
<td>48</td>
</tr>
<tr>
<td>Age (years)</td>
<td>37.9 ± 2.7</td>
<td>39.3 ± 2.0</td>
<td>35.7 ± 2.2</td>
<td>38.0 ± 1.1</td>
</tr>
<tr>
<td>Length of injury (days)</td>
<td>268 ± 70</td>
<td>295 ± 52</td>
<td>240 ± 30</td>
<td>280 ± 42</td>
</tr>
<tr>
<td>Time in program (days)</td>
<td>13 ± 1</td>
<td>13 ± 1</td>
<td>12 ± 1</td>
<td>13 ± 1</td>
</tr>
<tr>
<td>Pain level*</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Start of program</td>
<td>4.2 ± 0.6</td>
<td>4.0 ± 0.4</td>
<td>5.0 ± 0.5</td>
<td>3.7 ± 0.3</td>
</tr>
<tr>
<td>End of program</td>
<td>4.5 ± 0.6</td>
<td>4.5 ± 0.5</td>
<td>4.7 ± 0.5</td>
<td>3.8 ± 0.3</td>
</tr>
<tr>
<td>Pain tolerance (% improvement)</td>
<td>24.2 ± 5.6</td>
<td>26.8 ± 3.8</td>
<td>39.1 ± 5.0*</td>
<td>42.0 ± 4.1*</td>
</tr>
<tr>
<td>Activity tolerance (% improvement)</td>
<td>33.1 ± 7.4</td>
<td>38.4 ± 5.4</td>
<td>40.0 ± 5.0</td>
<td>51.0 ± 4.0</td>
</tr>
</tbody>
</table>

Note. Values presented as means ± standard errors of the mean.

\*Scale of 1 (no pain) to 10 (excruciating pain).

\*Significant \( (p \leq .05) \) main effect for work status.

![Figure 1](1) Changes in (a) perceptions of pain levels, (b) percent improvement in pain tolerance, and (c) percent improvement in activity tolerance in men and women who did and did not return to work after a work-hardening program. Note. WH=work hardening; RTW = return to work. *Significantly different \( (p \leq .05) \) from patients who did not return to work.
Robert, Blide, McWhorter, & Coursey, 1995). In our study, the average length of injury before the work-hardening program was 8.7 months for the group that returned to work and 9.4 months for the group that did not return to work. This indicates homogeneity between our groups. The length of injury of our sample was similar to that of the Robert et al.’s (1995) and Hildebrandt et al.’s (1997). Why some researchers have found length of time off work as a predictor of return to work and others have not is unknown. However, the type of work-hardening program may play a role.

Although subjective pain is often used as an important factor in making return-to-work decisions, our study showed that pain level was not a factor in determining return-to-work status. Rather, pain tolerance, and activity tolerance were more important factors in determining whether a patient with a low-back injury returned to work. This finding indicates that perhaps rehabilitation emphasis should not be placed on the reduction of subjective pain but on strategies to cope with existing pain while improving functional ability. Although other researchers have found that self-reports of pain are good predictors of return-to-work outcome (Hildebrandt et al., 1997; Lefort & Hannah, 1994; Roland & Morris, 1983), many cite patients’ perceptions of their functional abilities as being critical to their ability to return to work rather than their overall pain levels (Callahan, 1993; Deardorff, Rubin, & Scott, 1991; Fordyce, Roberts, & Sternbach, 1985; Keane & Saal, 1991; Long, 1995; Rainville, Ahern, Phalen, Childs, & Sutherland, 1992).

Multidisciplinary programs, such as work-hardening and functional restoration programs, may be of benefit in helping the patient identify and resolve issues that often contribute to reports of high pain levels and disability exaggeration. Contributing factors to disability exaggeration may include fear of reinjury, overly protective spouses, physician warnings against painful activity, sick role familiarity, anxiety, and depression. These factors may lead patients to unconsciously overreport symptoms or perform poorly on functional tests (Hazard et al., 1991). Additionally, many patients’ perceptions of their disabilities may represent an avoidance strategy that is influenced by the patient’s belief about the severity of the disease, by the belief that pain represents tissue damage, and by concern about receiving adequate treatment (Waddell, Newton, Henderson, Somerville, & Main, 1993).

Work-hardening and functional restoration programs focus on functional retraining of patients and often include counseling that may be of benefit in addressing these underlying patient concerns. The work-hardening program in which the patients in this study participated emphasized individual patient—therapist interactions that encouraged patients to address issues specifically dealing with return-to-work barriers, such as unrealistic expectations of treatment results (“I need to be 100% cured before I return to work”) or financial gain (“I will get retrained and make more money in my new job,” “The longer I am off work, the larger the workers’ compensation settlement will be”). Hazard et al. (1991) emphasized that by integrating components stressing cognitive behavioral therapy into treatment programs, a patient’s feelings of helplessness can be reduced and feelings of competence increased, leading to greater return-to-work success independent of any changes in a patient’s overall pain level. Indeed, numerous studies have addressed the helpfulness of work-hardening and functional restoration programs in addressing both physical and nonphysical barriers that injured workers face (Brever & Storms, 1993; Burke et al., 1994; Edwards et al., 1992; Greenberg & Bello, 1996; Hazard et al., 1989; Hazard et al., 1991; Hildebrandt et al., 1997; Mayer et al., 1987; Mitchell & Carmen, 1990; Niemeyer et al., 1994; Ricke, Chara, & Johnson, 1992). By de-emphasizing impairment and subjective pain levels and addressing unresolved issues and helping patients refocus on improving their pain tolerance and performance of functional tasks, multidisciplinary programs can play an important role in maximizing injured workers’ potential for being able to return to work.

The decision about whether a patient is ready to return to work is complex and involves many variables. Traditionally, the health care community and patients have tended to fixate on the goal of pain relief as a measure of improvement. Our study suggests that although physicians, occupational therapists, physical therapists, and other health care providers should not discount pain self-reports, the rehabilitation focus should not be on pain levels but on improving pain tolerance and activity tolerance. Our study, however, is limited by its retrospective nature, which does not allow for control of the variables measured. Future prospective research with greater internal validity should be conducted to examine further the role that pain tolerance and activity tolerance play in successful return to work. ▲

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References


