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SCAN

Lucas SCHROOTS

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PHTX544 Foundations of Mechanical Diagnosis and Therapy

Hello Otago

I couln□t get the full text of the articles below as the E journals were not available of those years!

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Greetings from sunny Austria!

EMBASE Long AL. Donelson R. The centralization phenomenon: Its usefulness as a predictor of outcome in conservative treatment of chronic low back pain (A pilot study). [Journal: Article] Spine. Vol. 20(23)(pp 2513-2521), 1995.
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SPINE Volume 20, Number 23, pp 2513–2521

The Centralization Phenomenon

Its Usefulness as a Predictor of Outcome in Conservative Treatment of Chronic Low Back Pain (A Pilot Study)

Audrey L. Long, BSc PT, Dip MDT

Study Design. Two-hundred-forty-three patients with chronic low back pain were studied in a prospective comparative survey to determine whether the "centralization phenomenon" was associated with outcome after an interdisciplinary work-hardening program.

Objective. The hypothesis was that patients who demonstrated centralization during initial mechanical assessment would have better outcomes than noncentralizers.

Summary of Background Data. Overall, subjects had decreased pain intensity ratings (mean 10%), increased lifting ability (6–8 kg), and a 59.2% return-to-work rate at a mean of 9.7 months follow-up.

Methods. Patients were classified as either centralizers or noncentralizers, based on results of their initial assessment. Changes in pain ratings, one-time maximal weights lifted, Oswestry scores, and return-to-work status were compared between groups.

Results. The centralizers reported significant decreases in their maximum pain ratings (centralizers, 16%; noncentralizers, 6%) and had a higher return-to-work rate (centralizers, 68%; noncentralizers, 52%) than the noncentralizers.

Conclusion. Centralization can help identify subgroups within the population with chronic low back pain and could be a useful goal setting and case management tool in the rehabilitation of low back pain. [Key words: centralization phenomenon, chronic low back pain, outcome prediction, rehabilitation, work hardening] **Spine 1995;20:2513–2521**

The centralization phenomenon (CP) was first observed by Robin McKenzie in 1956 and has gained wide acceptance as a basis for evaluating and planning treatment of patients with low back pain, with or without referred leg symptoms. Centralization can be observed during a mechanical evaluation protocol of the patient, as outlined by McKenzie.[7,18] The location of the most distal symptom is recorded and monitored during a series of standardized repeated movements. The CP is considered to be present when the most distal symptom is relocated to a more proximal (i.e., more central) location during the evaluation. The often-observed rapid change in symptomatology has been embraced with enthusiasm by many clinicians and warrants further investigation.

There are two reasons why a physical therapist may assess a patient for the presence or absence of the CP. First, the presence or absence of centralization is used as a basis for treatment planning in the McKenzie system. Movements or activities that improve (centralize) symptoms are emphasized, and those that provoke (peripheralize) symptoms are avoided. Second, clinical observations indicate that patients who demonstrate the CP respond more favorably in rehabilitation than their "chronic" counterparts.

Predictors of outcome are needed to help allocate strained healthcare resources. Cost effectiveness could be improved by identifying better means of selecting the patients who would maximally benefit from an interdisciplinary rehabilitation program.

Despite the increasing clinical use of McKenzie procedures for mechanical diagnosis and treatment of spinal disorders, little research has been conducted to validate the clinical predictive usefulness of the CP. In a retrospective study by Donelson et al,[9] the CP was shown to be a reliable predictor of outcome after conservative treatment in a population of patients with acute low back and radiating leg pain. The main purpose of the present study was to replicate Donelson et al's findings in a prospective design using a sample of patients with chronic low back pain. It was predicted that patients who can centralize symptoms will have better outcomes in rehabilitation.

Methods

Subjects. The Columbia Rehabilitation Centre is a privately owned interdisciplinary rehabilitation facility. All subjects were receiving compensation, the majority from the Workers' Compensation Board (98%). The remainder were receiving compensation from private insurance companies. Clients were screened medically and psychologically before they entered the program. Subjects were excluded if they presented with: serious neurologic deficits (e.g., surgical candidates), serious comorbid conditions (e.g., unstable angina, uncontrolled hypertension), excessive substance abuse, excessive hostility, or a refusal to consent to treatment. Psychometric tests included

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Device status category: 1.

the Coping Strategies Questionnaire, SCL-90-R, Oswestry Index, Beck Depression Inventory, Sickness Impact Profile, and the McGill Pain Questionnaire. These tests were used to guide treatment, not as exclusion criteria. Subjects not excluded were entered into a work-hardening program consisting of physical therapy, exercise conditioning, work simulation, education, and psychological intervention.

Participation in this program lasted an average 5 days per week for 11 weeks (range, 1–18 weeks).

A consecutive sample of 243 clients, whose chief complaint was low back pain with or without referred leg symptoms, were assessed for entry into the work hardening program during a 10-month period. Twenty (8.2%) of the clients initially assessed did not enter the program for physical or psychological reasons. As a result, the available sample was reduced to 223.

Procedures. The 223 clients in the sample were randomly assigned to one of four physical therapists trained in the McKenzie Institute method of assessment, which is described elsewhere (therapist training: 1A, 2C, and 1D levels).[7,18] At the time this study was conducted (1991–1992), the defendable levels of documented expertise in the McKenzie method (i.e., credentialing exam and diploma course) were not available in Canada. Briefly, a series of repeated movements were performed according to the McKenzie protocol.[18] After each set of movements, data regarding changes in symptom location were recorded with emphasis on the most distal symptom. Based on this assessment, each patient was classified as either a centralizer or a noncentralizer. To be classified as a centralizer, the most distal symptom must have abolished during the repeated movement tests. It was not necessary for all lower extremity symptoms to have abolished.

Data Collection. On the day of the initial assessment, physical therapists classified the client as either a centralizer or a noncentralizer based on their response to a mechanical assessment, as just described.

The therapist also recorded the location of the symptoms on a pain diagram. The location of symptoms was coded by applying an overlay similar to that used by Donelson et al[9] (Figure 1). The pain site code determined by this method was used only as a dependent variable to help describe the clinical presentation of the population and to enhance the ability to generalize the results of this study to other populations.[15,23] Pain diagrams were completed at the following points in the program: week 1, week 4, week 8, and at discharge. The diagrams helped determine when centralization occurred, if it did not occur on the initial assessment, and also indicated whether symptoms had centralized by the time of discharge.

Outcome Measures. Outcome measures were collected by staff who did not know whether the client had been classified as a centralizer or noncentralizer. The following four types of outcome measures were used.

1. Subjective pain ratings. Pain ratings were obtained at admission and discharge. Clients were asked to rate their subjective pain intensity numerically on the NRS-101 numerical rating scale of 0 to 100.[13] "0" represented no pain at all and "100" was the worst pain they could imagine. On each occasion, clients were asked to rate their maximum, minimum, and average pain intensity over the preceding week.
2. Lifting capacity. Four standard lifts from the client's admission and discharge functional capacity assessment were recorded. These were the one-time maximal lifts (in kilograms) performed for the following: power lift from the floor, power lift with handles 8 inches off the floor, lift from knuckle to shoulder height, and lift from shoulder to above shoulder height.
3. Oswestry score. Oswestry scores were collected at the time of initial assessment, discharge, and 2-year follow-up.[10]
4. Return-to-work status at 9-month and 2-year follow-up. Initially, return-to-work information was requested via a mailed survey. This was followed by a phone survey for clients who did not respond to the questionnaire. Clients were asked at the 9-month and 2-year follow-up whether they were working. If they were not working, clients were asked to give reasons for having not re-entered the workforce.

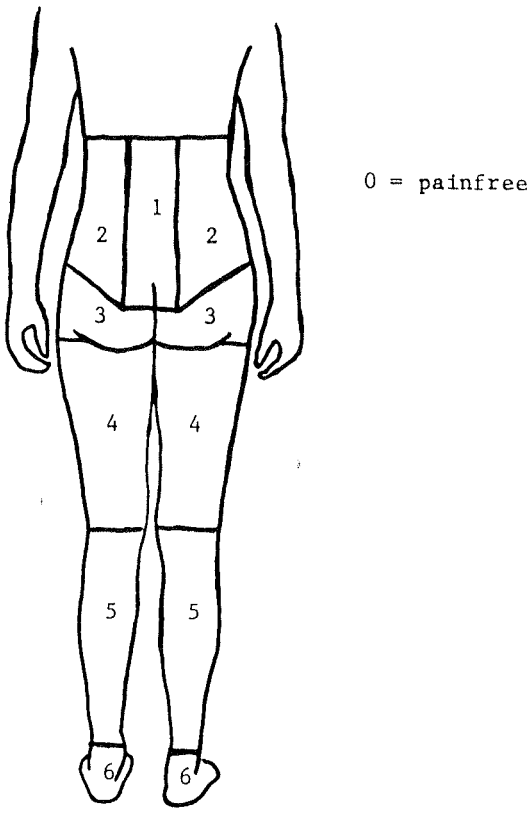

Figure 1. Overlay for pain diagram that was used to code the most distal symptom location.

■ Results

Based on the results of the initial mechanical assessment, each of the 223 subjects was classified into one of two groups—105 centralizers or 118 noncentralizers.

Demographics

Univariate tests were conducted to determine whether the two groups differed significantly regarding demographics variables (Table 1). To account for the higher probability of a Type I error with multiple univariate

Table 1. Population Demographics (n = 223)

	Centralizers n = 105	Noncentralizer n = 118
Sex		
Male	64.0%	74.2%
Female	36.0%	25.8%
Mean (±SD) age (yr)	38.2 ± 10.4	39.3 ± 9.9
Diagnosis		
Stenosis	0.0%	0.4%
Fractures	1.8%	3.0%
Postoperative	10.1%	12.1%
Mechanical low back pain*	88.1%	84.8%
Mean (±SD) duration of symptoms (mo)	7.2 ± 6.4	8.8 ± 9.2
History of a previous back injury†	35.7%	51.5%
Referral source		
WCB	99.1%	97.7%
Private insurance	0.9%	2.3%
Mechanism of injury	80.2%	64.6%
Mechanical injuries (*e.g.*, pushing, pulling, lifting, and bending)		
Impact injuries (falls or collisions)	19.8%	35.4%

Probability level was adjusted to .007 to correct for Type 1 errors. All *P* values were nonsignificant (>.007).
SD = standard deviation.
* A broad diagnosis that includes a variety of nonsurgical soft tissue injuries.
† 43.6% of all subjects reported a previous back injury. Among these, the average time since the original injury was a mean of 7 years (range, .43–23.85 yr). (Level of functioning during this time was not recorded—*e.g.*, client may have been off work 1 week or a number of years.)

tests, the probability level was corrected to .007. The two groups did not differ on the demographic variables listed in Table 1.

The pain site code provides a score for describing symptom location (Figure 1). The two groups did not differ significantly in terms of pain location on initial assessment (Table 2).

Multivariate analysis of variance of the initial psychometric test scores revealed no significant differences between the two groups (Hotelling T value, .07131; F = 1.299; $P = .241$; Table 3). Because of a lack of proficiency with English, psychometric data were not available for some subjects (9.9% of the centralizers and 6.8% of the noncentralizers).

Subjects were classified into groups of occupations with similar types of job duties. The centralizers and the noncentralizers did not differ in terms of their types of occupations ($x^2 = 7.41$, $P = .285$; Table 4).

The following results were demonstrated.

Table 2. Admission Pain Site Codes

Pain Site Code	Centralizers (%)	Noncentralizers (%)
0 = painfree	2.0	0.0
1 = central low back pain	7.9	3.4
2 = unilateral	5.0	17.1
3 = buttock	8.9	13.7
4 = thigh	24.8	17.9
5 = calf	18.8	12.0
6 = foot	32.7	35.9

$P > .05$.

Table 3. Admission Psychometric Test Scores*

Test	Centralizers	Noncentralizers	Entire Sample
Coping strategies questionnaire			
Catastrophic	8.77 ± 6.62	10.41 ± 7.07	9.64 ± 6.89
Praying and hoping	13.64 ± 8.53	12.81 ± 7.25	13.20 ± 7.86
Pain behavior	18.25 ± 5.89	18.28 ± 5.91	18.26 ± 5.88
Control over pain	3.17 ± 1.22	2.96 ± 1.37	3.06 ± 1.30
SCL-90-R (GSI)	59.28 ± 10.08	61.97 ± 9.22	60.72 ± 9.69
Oswestry index	35.14 ± 11.58	39.31 ± 13.61	37.37 ± 12.84
Beck depression	8.47 ± 5.21	10.65 ± 7.57	9.63 ± 6.65
Sickness Impact Profile	14.51 ± 6.47	17.94 ± 8.22	16.35 ± 7.63
McGill Pain Questionnaire	20.98 ± 12.38	23.16 ± 11.67	22.14 ± 12.02

GSI = Gobal Severity Index.
All values are means ± standard deviations.
Multivariate test for significance: F = 1.299, $P = .241$.
* 7.8% of the population was excluded because of insufficient English skills for completing the questionnaires.

1. Pain intensity ratings. A multivariate analysis of variance revealed a significant overall reduction over time for all subjects in maximum (F = 23.75, $P < .001$) and average pain ratings (F = 11.76, $P < .001$), and an increase in minimum pain ratings (F = 5.41, $P < .05$; Table 5). A significant change over time for maximum pain ratings was demonstrated for the centralizers compared with the noncentralizers (F = 4.65, $P < .05$; Figure 2). Thus, regardless of classification as a centralizer or noncentralizer, subjects reported significant reductions in maximum and average pain intensity after participating in the work-hardening program. Centralizers reported a greater decrease in their maximum pain intensity scores compared with noncentralizers.
2. One-time maximal lifts. Multivariate analysis of variance revealed that all subjects increased their lifting ability on all four lifts at discharge regardless of grouping (lift no. 1: F = 54.57, $P < .001$; lift no. 2: F = 71.59, $P < .001$; lift no. 3: F = 97.19, $P < .001$; lift no. 4: F = 97.62, $P < .001$; Table 6). There was

Table 4. Classification of Occupations (Centralizers [C], n = 105; Noncentralizers [NC], n = 118)

1. Jobs involving sitting, driving, and vibration exposure (*e.g.*, truck or bus driver, heavy equipment operator)
   C = 10.8% NC = 16.7%
2. Jobs requiring lifting, carrying, transferring of humans (*e.g.*, registered nurse, aide, paramedic, rehabilitation worker)
   C = 17.1% NC = 9.8%
3. Relatively sedentary jobs (*e.g.*, clerk, receptionist, bookkeeper)
   C = 7.2% NC = 5.3%
4. Jobs requiring repetitive hand work (*e.g.*, meat cutter, distillery worker, assembly worker)
   C = 4.5% NC = 3.0%
5. Heavy lifting, material handling, and manipulation (*e.g.*, welder, mechanic, steel worker, framer, roofer)
   C = 43.2% NC = 38.6%
6. Jobs with a lot of standing, walking, lifting and carrying (*e.g.*, courier, bakery clerk, waitress, janitor)
   C = 17.1% NC = 29.6%

Table 5. Admission and Discharge Pain Intensity Ratings

Pain Intensity	Centralizers		Noncentralizers		All Subjects	
	Admission	Discharge	Admission	Discharge	Admission	Discharge
Maximum*	68.07 ± 27.41	52.27 ± 29.60	70.86 ± 21.94	64.75 ± 28.60	69.54 ± 24.42	58.87 ± 29.65
Minimum*	16.34 ± 16.83	19.08 ± 21.38	28.15 ± 22.62	33.31 ± 24.94	22.58 ± 20.89	26.61 ± 24.32
Average*	38.66 ± 19.83	30.09 ± 22.73	46.63 ± 20.06	43.19 ± 24.79	42.88 ± 20.33	37.02 ± 24.65

All values are means ± standard deviations.
* NRS-101 scores reported over the preceding week.
For centralizers versus noncentralizers—maximum: F = 4.65, $P < .05$; minimum: F = 0.51, $P > .05$; average: F = 2.15, $P > .05$.

no significant difference between groups for centralizers versus noncentralizers for weights lifted on assessment compared with discharge.

3. Change in Oswestry scores. As shown in Table 7, the entire sample had a statistically significant improvement in Oswestry percentage scores during their stay in the program (F = 6.11, $P = .016$). However, there was no significant difference between the centralizers and noncentralizers regarding the amount of improvement (F = .03, $P = .9730$). There was no significant change in the Oswestry score between discharge and follow-up (Table 7). A comparison of admission, discharge, and 2.2-year follow-up is shown in Table 7. The improvement in Oswestry scores found at discharge was not lost over the 2.2-year follow-up period.

4. Return-to-work status at 9-month and 2-year follow-up. None of the 223 subjects was working at the time of the initial assessment. One-hundred-sixty-six clients (74%) were located at the time of follow-up a mean of 9.7 months after discharge from the program (range, 2.9–18.4 months). The rate of follow-up was similar in each group (centralizers, 74.2%; noncentralizers, 74.6%). Of the subjects contacted, 59.2% reported they had returned to work after the program. There was a significant difference between centralizers and noncentralizers regarding return-to-work status ($x^2 = 4.49$, $P = .034$). Regarding return to work after the program, 68.4% of the centralizers and 52.2% of the noncentralizers reported that they had done so. The two groups also differed significantly in the reasons they gave for not working at the time of initial follow-up ($x^2 = 14.70$, $P < .05$; Table 8).

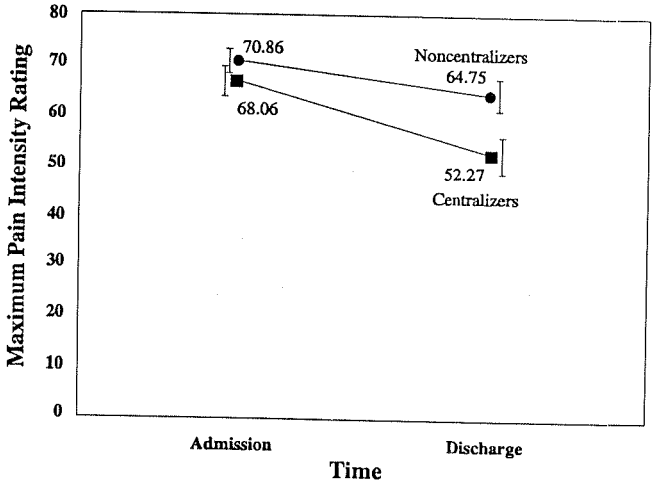

Figure 2. Between-group differences for changes in maximum pain intensity ratings at admission and discharge.

If subjects reported their reason for not working was that they were seasonal workers or that work was not available, these data were added to the numbers who were working and the percentages of those fit to work were recalculated. The noncentralizers changed little (53% fit to work), while 72% of the centralizers could be described as fit to work.

The second follow-up was completed at a mean of 2.2 years post-discharge (range, 1.8–3.2 years). Fifty-three percent of the sample was located at this time. The rate of follow-up was similar in each group (centralizers, 49%; noncentralizers, 55%). Five subjects (2% of the sample) refused to answer questions because they were involved in litigation or the appeal process with the Workers' Compensation Board. Sixty-three percent of the sample contacted reported they were working. Although the trend found at 9 months (more centralizers working than noncentralizers) still existed, the difference was no longer statistically significant ($x^2 = .915$, $P > .05$). 71.4% of the centralizers and 62.7% of the noncentralizers reported they were working.

A fit-to-work figure also was calculated for the 2.2-year follow-up, as just described. This resulted in a fit-to-work rate of 76% for the centralizers and 71% for the noncentralizers.

■ Discussion

Demographics

Centralizers and noncentralizers did not differ significantly in terms of demographics, pain location (pain site code), or psychometric test scores, indicating that the groups compared were similar. The finding of significant differences in outcome between two otherwise similar groups within the larger classification of chronic pain syndrome suggests that centralization can be used to identify different subgroups who may have different prognoses or require different treatment approaches. These questions cannot be answered by the present

Table 6. Weight Lifted on Admission and Discharge

	Centralizers		Noncentralizers		All Subjects	
Lift* No.	Admission	Discharge	Admission	Discharge	Admission	Discharge
1	12.75 ± 9.45	18.11 ± 11.08	12.11 ± 9.01	13.65 ± 12.39	12.44 ± 9.22	18.38 ± 11.70
2	17.19 ± 11.32	25.43 ± 14.55	15.48 ± 10.33	24.50 ± 14.77	16.35 ± 10.86	24.97 ± 14.62
3	16.41 ± 8.79	22.71 ± 9.67	15.36 ± 6.88	21.69 ± 9.15	15.89 ± 7.89	22.21 ± 9.40
4	13.62 ± 8.26	19.79 ± 9.31	13.75 ± 7.55	19.59 ± 6.91	13.69 ± 7.89	19.69 ± 9.43

All values are means ± standard deivations, in kilograms.
* These are one time maximal lifts. No. 1: Power lift from the floor. No. 2: Power lift with handles 8 inches off the floor. No. 3: Lift from knuckle to shoulder height. No. 4: Lift from shoulder to above shoulder height.
Admission to discharge differences, centralizers versus noncentralizers, $P > .05$.

study, but the findings here suggest these hypotheses are worthy of further investigation.

Pain Intensity Ratings

Mean pain ratings across both groups decreased after participation in the work-hardening program. Centralizers had a greater decrease in maximum pain ratings. It is clinically helpful to be able to identify individuals more or less likely to change their pain ratings. This information is important in successful rehabilitation goal setting. Should clients be attempting to lower pain levels, or are goals based on pain reduction unrealistic? For many in this population, the focus should be on teaching strategies to help subjects cope with existing pain, and goals should be focused more on functional gains. It has been shown that physical performance can increase without a change in pain experience.[21] Those who present as noncentralizers appear to fall into the latter group.

The greater decrease found in maximal pain intensity ratings in the centralizers likely reflects reduction in pain increases commonly referred to as "flare-ups." Reducing the intensity of these episodes likely represents improved pain control. Prevention of these incapacitating episodes stabilizes pain, so that subjects will report their pain is staying at a level they "can handle" (i.e., more consistent demonstration of functional abilities).

Minimal pain intensity ratings increased slightly in the centralizers and noncentralizers. This may reflect the increased activity level required in the program compared with pre-program activity levels.

One Time Maximal Lifting Capacity

Four different lifting measures were chosen because lifting ability is one of the most common limitations for returning to employment. No between-group differences in lifting abilities were found between the centralizers and noncentralizers. This appears to contradict the finding of higher return-to-work rates in the centralizers because those who return to work also may be those who are more able to lift. However, there are several limitations to using these lifts as an outcome measure. One-time maximal lifts do not take into account tolerance for lifting on a repetitive basis. Perhaps other measures of function would have provided more useful information (e.g., aerobic capacity, tolerances to more specific job duties, or repetitive lifting ability). In addition, the subject's effort on the final assessment also may have been biased for a number of reasons, including: motivational factors, fear of re-injury, and a learning effect because the clients had worked with the equipment for many weeks.

Table 7. Mean (± Standard Deviations) Oswestry Percentage Scores—Initial, Discharge, and Follow-up

	Initial	Discharge	2 yr
Centralizers	31.00 ± 12.37	24.24 ± 16.22	23.35 ± 17.18
Noncentralizers	40.61 ± 14.00	32.36 ± 16.80	32.36 ± 22.46
All Subjects	36.24 ± 13.79	28.24 ± 16.89	27.79 ± 20.32

Initial to discharge: $F = 37.43$, $P = .0000$.
Discharge to follow-up: $F = .04$, $P = .8337$.
No between-group interactions: $F = .03$, $P = .9730$.

Oswestry Scores

It was expected that the between-group differences found in the maximum pain ratings and the return-to-work rates would be reflected by corresponding changes in the Oswestry score. However, the centralizers did not have a greater improvement in Oswestry score than the noncentralizers. This may correspond to the finding of no significant group differences for average or minimal pain ratings. The Oswestry is a reflection of perceived

Table 8. Reasons Given for Not Working—Centralizers and Noncentralizers

	9.7 mo		2.2 yr	
	Centralizers n = 33	Non-centralizers n = 52	Centralizers n = 16	Non-centralizers n = 23
Further healing of injury	15	35	7	9
Retraining or upgrading	2	9	2	1
Work not available*	6	5	1	4
New injury	2	2	2	2
Seasonal work*	3	0	1	1
Not specified	5	1	3	6
"Fit to work"	72%	53%	76%	71%

* These individuals were likely "fit to work," but did not have jobs at the time of follow-up. These numbers have been added to the returned-to-work rates to give a percentage of those who perceive themselves to be "fit to return to work."

disability. It is not unusual that perceptions contrast with objective functioning (e.g., return to work). Perhaps the CP reflects a factor that correlates to maximum pain ratings and return-to-work rates that is different from factors measured by the Oswestry score. The changes in Oswestry scores shown in Table 7 reflect that benefit resulted from the work-hardening program in both groups. The benefits of the program appeared to be maintained over the 2-year period after treatment.

Return to Work

Seventy-four percent of the population was located for follow-up at 9.7 months, and 52% at 2.2-year follow-up. Although these are less than ideal follow-up rates recommended for treatment trials, two points are important here. First, compensation subjects are difficult to track. In fact, they often are excluded from or are a smaller portion of the subjects in many studies. However, they are an important group to study because they are responsible for the majority of costs.[23] Second, the present study is best described as a comparative survey. This design falls short of being a treatment trial for a number of reasons. Centralizers were not randomly assigned to different treatment trials, nor were the noncentralizers. There was no control group and no manipulation of variables, and the multidisciplinary treatment setting precluded any presumptions about which aspect of treatment was responsible for the different outcomes observed.

However, now that the CP appears able to identify subgroups within the chronic pain population, treatment trials are the next logical step in identifying the most effective treatment protocols for each group. To assess the effects of different treatments, each group would need to be randomly assigned to different treatment protocols, as was the case in a study by Delitto et al.[5]

Return-to-work rates of 59% at 9.7 months and 63% at 2.2 years in this chronic population is a substantial change from the trend identified by the Quebec Task Force study.[23] Subjects in that study who remained off work longer than 6 months (7.4%) were unlikely to return to work. The data needed to measure the fiscal implications of these data were not available. The question of cost savings between centralizers and noncentralizers could not be calculated, but would be helpful in future studies to determine how much of a difference in return-to-work rates produce meaningful cost savings. That the difference in return-to-work rates between centralizers and noncentralizers decreased between 9 months and 2 years suggests that the noncentralizers take longer to return to work or to classify themselves as fit to work. More information would be needed to determine the fiscal implications of this trend.

Return-to-work as an outcome measure has important fiscal implications in this population because all of the subjects were receiving compensation. Although many psychosocial and workforce factors affect return-to-work rates, these factors are expected to be randomly distributed between centralizers and noncentralizers. This strengthens the finding that more centralizers returned to work than noncentralizers. If noncentralizers are less likely to return to work, emphasis on vocational planning early in their rehabilitation may be useful. Conversely, perhaps the best treatment regime for this group has not yet been identified. Obviously, many factors should be considered in case management decisions. The CP may be one important component of a complex decision-making process.

Classification of Centraliser or Noncentraliser

Classification as a centralizer or a noncentralizer was based solely on whether the patient reported that the distal symptom cleared during the initial mechanical assessment. Spratt et al[24] found that "reliabilities for the patient-reported measures (pain location and aggravation) were universally high, as expected, because these ratings required the rater only to correctly hear and code patient responses." They found that "patients reports of pain location were quite stable across examinations." Reliability of pain location also was confirmed by McCombe et al.[16] Kilby et al[12] found the examination of pain behavior and pain response with repeated movement to be reliable. The detection of end-range pain and lateral shift were unreliable and therefore were not included in this study.

Because the classification system used in this study was based solely on whether the patient reported that the distal symptom had cleared during the assessment, the findings of Riddle and Rothstein[22] are not applicable here. Their study found poor interrater reliability based on nine possible classifications (i.e., postural, dysfunction, and seven possible derangement categories).

A review of the data comparing initial and discharge pain site codes suggests that 37.6% of the noncentralizers did centralize some of their symptoms by the time of discharge (decrease in pain site code by at least one category). Therefore, it is recommended that future studies employ therapists with defendable levels of competency (credentialed or diploma level). This will help standardize methods and help with comparisons between future studies. Improved examiner qualifications may affect the ability of the examiners to elicit centralization on initial mechanical assessment, thereby improving predictions, treatment, or outcomes.

Treatment

To-date, several studies have addressed the effectiveness of the McKenzie Treatment approach in more acute populations.[6,8,14,17,19,20,25,26] The present study simply demonstrates the prognostic value of assessing for the CP during an initial assessment in chronic patients without stringent control or manipulation of the treatment intervention used. The results are pragmatic at best. There was no control group and no manipulation of

treatment variables, and multiple variables were possible in this interdisciplinary treatment setting. The treatment that clients received from other departments (medicine, psychology, nutrition, exercise, work simulation, and education) was individualized. Therefore, there probably were many variations in treatment programs. These points are made to enforce the point that this study was not a controlled treatment trial, but rather a pilot study in the format of a comparative survey.

Future studies need to determine through controlled treatment trials how centralizers and noncentralizers compare in terms of their response to different treatments. The study design and results of Delitto et al[5] raise questions about whether outcomes in the present study could have been improved further if treatment variables had been more strictly controlled between groups. Controlling for the effect of McKenzie treatment protocol was not possible in this study. Treatment within the Columbia Rehabilitation Centre work-hardening program is interdisciplinary and individualized. Although the McKenzie method of treatment was generally preferred, therapists had different levels of expertise in the McKenzie techniques and were free to use other treatment techniques. Outcome measures might have been more favorable in the centralizing group had more highly qualified McKenzie therapists been available. It can be hypothesized that movements and positions that created the centralization may be abandoned prematurely by an inexperienced therapist who lacks advanced problem-solving skills or progression techniques.

The Centralization Phenomenon As a Predictor of Outcome

The only other similar study in the literature that looks at the CP in terms of its ability to predict outcome is that by Donelson.[7] In that study, the presence or absence of the CP was determined on the initial assessment. However, it is not clear how centralization was defined (i.e., did all peripheral symptoms have to be abolished or was partial centralization also considered?). In the present study, only the most distal area of symptoms had to be abolished on the initial assessment to classify the client as a centralizer (i.e. the subject demonstrated a preference for movement in a particular direction). Perhaps those subjects who demonstrate complete versus partial centralization have different outcomes. Future studies should record how much centralization occurs at the time of initial assessment (i.e., only the distal symptom clearing versus complete centralization). Pain site codes could be used to quantify the "amount" of centralization on initial mechanical assessment and to record change over time.

Comparison to Donelson's Study

There are two important differences between the present study and Donelson et al's.[9] First, the present study was prospective, whereas Donelson's was retrospective. Second, their population was relatively acute compared with the population in the present study (Table 9). It was a pleasant surprise that significant differences in decreased maximum pain reports and return-to-work status could be defined among centralizers and noncentralizers in the present study. These findings are clinically important because the present study included only subjects whose history was far outside the natural history for recovery from low back pain episodes.[2,3] Identification of subgroups within the chronic population is needed to improve treatment planning.

Donelson[9] found that the NCs in his population were surgical candidates. However, 11% of both the centralizers and noncentralizers in the present study already had had surgery. The rest had been assessed as nonsurgical candidates by at least one specialist based on a lack of surgical indications. Therefore, entry into an interdisciplinary rehabilitation program was their most recent stop in a long line of failed conservative treatments.

■ Conclusion

The literature is inundated with studies that attempt to identify factors contributing to chronicity.[1–4,11] Future studies with acute or subacute patients should attempt to identify the CP early. Can the CP predict outcomes or the potential for chronicity? How should treatment protocols be optimized to best serve centralizers and noncentralizers? It appears that the location of symptoms, as recorded by pain diagrams, could be useful in these pursuits and in classification of spinal disorders.[3,15,16,18,23]

Table 9. Comparison of Donelson's and Long's Studies

Donelson et al[9]	Long (Present Study)
Initial assessment	
87% reported "rapid centralization"	47% centralized (*i.e.*, the distal symptom abolished)
Subjects with symptoms into the buttock, thigh, or calf	
87 of 225 (39%)	205 of 243 (84.3%); 223 included in study*
Only the 87 were included in the study	
Symptoms present below the knee	
50.6%	48.9%
Average age	
37 yr (range, 17–65 yr)	39 yr (range, 18–63 yr)
Sex	
42.5% male, 57.5% female	69.6% male, 39.4% female
Length of time since onset of symptoms	
60.9% <4 wk	Average, 8.79 months; range, .8–192.5 mo
17.2% <12 wk	
21.8% >12 wk (up to ?)	
History of a previous back injury	
Not stated	43.6% reported a previous history of back injury
Percent off work due to low back pain	
42.5%	100%
Therapist level of training	
Not stated	McKenzie course levels 1A, 2C, 1D (4 PTs)

* 20 subjects (8%) were assessed, but were not suitable for entry into the program because of major physical or psychological reasons.

Clients who demonstrated the CP had greater decreases in maximum pain intensity scores and better return-to-work rates than those who did not demonstrate centralization. The fiscal implications of this finding need to be assessed. The presence or absence of this phenomenon could help the rehabilitation process by assisting in appropriate goal setting and identifying individuals most likely to succeed in rehabilitation. This information could help improve early case management. It may not be fair to paint all patients with the same "chronic" brush. Identification of subgroups is needed to establish the bases of treatment trials aimed at identifying which treatment protocols are most effective in each group.

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Point of View

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One of the greatest needs in caring for low back pain is to identify reliable, relevant prognostic signs. This well-done prospective study documents the value of identifying whether referred pain can be centralized. Although treatment in this work-hardening program did not emphasize those spinal movements/positions that centralized an individual's pain during the McKenzie assessment, centralizers nevertheless had superior outcomes over noncentralizers. As the author points out, the literature supports that centralizers have an even higher recovery rate if treatment focuses on the specific directional exercises that centralized an individual's pain while temporarily avoiding spinal movements/positioning in the peripheralizing direction. Centralizing pain may well imply a "reversibility" of the actual pain generator.

We routinely assess chronic patients using psychology, radiology, electrodiagnostics, strength testing, conditioning, etc., searching for relevant prognostic factors and guidance for treatment selection. Should we not also routinely evaluate the mechanical element of a chronic patient's complex presentation, looking for centralization? Also, given the findings of this study, is it not possible that significant chronicity could be prevented by evaluating all acute patients for the presence of pain centralization? An improved prognosis for acute centralizers might be anticipated with a sharp decrease in the use of unnecessary diagnostic and ineffective therapeutic interventions by emphasizing treatments that rapidly centralize and abolish symptoms.

In this study of chronic patients, centralizers were common (43%). As the author points out, more experienced mechanical evaluators may have identified an even higher percentage of centralizers with a good prognosis. Some of the so-called noncentralizers who experienced superior recoveries may have been unidentified centralizers.