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Original Articles

A Clinical Trial on High Potency Mineral Supplementation and its Affect on Post Traumatic Clinical Depression

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ABSTRACT

Background: Mild clinical depression has been reported in patients who have suffered automobile trauma. Treatment to address this particular symptom has been poorly reported or measured.

Objective: To determine whether a specific supplement will effect patterns of post traumatic depression.

Design: Non-Randomized, 1-period, 1-condition clinical study.

Setting: Private Practice facility.

Patients: 7 men and women who each reported some depression following automobile trauma.

Measurements: Mental Intake Questionnaire.

Results: The average intake score on the Mental Questionnaire was 27 on intake and 15.1 on exit showing a definite improvement.

Limitations: The study included only 7 people, was not random, did not limit or measure variables of other treatment.

Conclusions: Specialized enhanced bioavailability of mineral and vitamin supplements may improve perceived symptoms of post traumatic depression.

INTRODUCTION

Hypothesis: Oral supplementation of high dosage, enhanced bioavailability, broad spectrum minerals and vitamins reduces the symptoms of clinical depression in patients who have had recent trauma.

This study was not considered by an IRB. Continued investigation is suggested. The supplementation for the study was provided by The Personal Injury and Industrial Accident Clinic of Holladay, Utah and was obtained

from Truehope CNE of Canada. Patients who were being treated with the supplements voluntarily provided outcome measurements. None of the subjects was paid to participate in the study.

REVIEW OF THE LITERATURE

There are many studies on clinical depression, anxiety and other forms of mental health disorders using a variety of individual elements and some variety of combinations. We found five published studies using the same supplement source that we used.

We reviewed the study by Bonnie J. Kaplan, Phd, Improved Mood and Behavior During Treatment with a Mineral-Vitamin Supplement: An Open-Label Case Series of Children. This was published in the Journal of Child and Adolescent Psychopharmacology Volume 14, Number 1, 2004. Mary Ann Liebert, Inc. Pp. 115-122. This study considered 9 children with mood disorders and related mental diagnoses. They followed at least 8 weeks of treatment using the supplement. Results were reported in terms of effect size at 80%.

In the Journal of Clinical Psychiatry, 62:12 December 2001, authors Bonnie J Kaplan, Ph.D, and J. Steven A. Simpson Ph.D in the article Effective Mood Stabilization With a Chelated Mineral Supplement: An Open-Label Trial in Bipolar Disorder, we discovered considerable evidence for mood stabilization using broad spectrum nutritional interventions.

We considered the commentary by Charles W. Popper MD – Do Vitamins or Minerals (apart from Lithium) Have Mood Stabilizing Effects? He comments on the trials he conducted on 22 patients who met the clinical criteria for Bipolar disorder. 19 of these showed improvement after being on the supplementation for 6-9 months.

We were able to discover that FDA approved double blind studies are being slated at Harvard and at the University of Calgary.

Miles Simmons MD reports in the Journal of Clinical Psychiatry, 64:3 March 2003 that he had 12 of 19 patients with bipolar disorder show marked clinical improvement after using the same formulae described by Kaplan after 10 weeks of use.

Scott Shannon, MD, in Integrative Psychiatry of March 2006 describes his experience with pediatric bipolar disorders. He reports that Medication naïve children respond more quickly and perhaps more completely to EM Power Plus (CNE) intervention for PBD

CURRENT RESEARCH

A trial was designed to measure the improvement of certain symptoms relative to and consistent with the diagnosis of clinical depression in patients who had recently suffered vehicular trauma. Patients who had been involved in such trauma within the past year and who had reported symptoms consistent with the diagnosis of clinical depression were notified of the project and invited to participate. Other providers of physical medicine were notified as well and encouraged to have patients with similar unresponsive conditions inquire. All patients admitted to the study had a history of persistent symptoms relative to the diagnosis with multiple episodes of health care experiences and with limited success.

METHODS

A single questionnaire was used to compute an intake score for each patient. The questionnaire has four sections; Depression – 16 questions; Attention Deficit Disorder – 7 questions; 16 Panic an anxiety questions; and 10 obsessive compulsive questions. Each question is rated by the patient at 0, 1, 2 or 3 points depending on

the severity of the symptoms described. This outcome assessment form may be somewhat new to musculoskeletal practitioners and so I have included the section dealing with depression here.

NAME: **DATE:**
Date of Birth: **M/F**

Self Score **0 = Not at all 1 = Just a little 2 = Somewhat 3 = Very much**

Symptoms	**Score**
Feeling worthless, helpless or hopeless	
Sleeping more or less than usual	
Eating more or less than usual	
Hard to concentrate or decide	
Loss of interest in hobbies or activities	
Avoiding other people	
Overwhelming feelings of sadness	
Loss of energy, feeling very tired	
Thoughts of death or suicide	
An excessively high or elated mood	
Unreasonable optimism or poor judgment	
Hyperactivity or racing thoughts	
Talkativeness / rapid speech / incoherent	
Irritability	
Extremely short attention span	
Rapid shifts to rage or sadness	

The score was computed using the formula, the sum of the total score from each question for the relative section. In the depression section, there was a total of 48 possible. Categories of severity were created as follows from least to worst: 0-12 = not admitted into the study; 13-24 = mild; 25-36 = moderate; and 37-48 = severe. Dosage for treatment was assigned to each category as 4 per day, 8 per day, 12 per day and 16 per day respectively. All groups were assigned a loading dose for 14 days initially and then assigned the category dose thereafter.

Protocols were determined based on total intake score and ranged from 4 capsules daily to 16 capsules daily. Some patients were allowed to take BID and some TID. No distinctions were measured for the BID and TID group differences.

Intervention

The supplement was manufactured and distributed under the name CNE at the time of this trial. It consisted of 36 minerals, vitamins, amino acids and antioxidants, in quantities that are higher than a person's usual level of

daily dietary intake. The available formulation can be found on the manufacturer's web site: www.truehopecne.com

Intake Data

In this study, there were 5 females and 2 males ranging in age from 19-64. The range in chronicity for depression was 9 months to 7 years. Exclusion criteria included, those who altered or ceased taking the dosage assigned before one of the 30, 60 or 90 reporting periods had been completed and anyone whose intake score was 12 or less.

Measurement of Outcomes

Intake measurements were taken from the Mental Intake Assessment Form (Hardy, 2000). Each item was scored and the total recorded and compared to the exit scores. For this project, no objective tests were obtained on intake or exit, only this standardized outcomes assessment tool. Repeat questionnaires were performed at 30, 60 and 90 days.

DESIGN AND PROCEDURE

Patients who had automobile trauma within the past 18 months were informed of the study and invited to participate if they were currently exhibiting any of the symptoms listed in the form above. The experimental nature of the treatment was described to each. Patients who qualified to enter into the study were measured and instructed in the daily dosage recommendations based on the severity of their relative intake score. 100% compliance was expected from each subject accepted into the study in order to optimize the statistical analysis.

The specific treatment protocol was determined by the doctor after assessing the intake questionnaire.

Proper patient instruction on taking the supplements was consistent with all subjects accepted into the study.

RESULTS

Withdrawals

Five patients were withdrawn from the study. All five patients were unable to comply to a self rated level of not less than 75%.

Completer Analyses

For the seven patients who completed the study (defined as taking the supplements as recommended for 90 days) paired *t* tests (using the intake and exit data only) revealed significantly lower scores after treatment for depression.

At study entry, the average score was over 27 with male patients averaging 24 and female patients averaging 29.2. After 90 days, the compliance level was 92.1 on a self rated scale and the outcome score average for the group was 15.1 with male patients averaging 15 and female patients averaging 15.2.

The effect sizes were calculated by taking the mean difference divided by the standard deviation of the difference scores as suggested by Cohen (1988). Using Cohen's formula, the effect size was large (more than 0.8572)

Depression Study Results

	Averages	92.1	27.7	26.9	21.6	15.1	0.5
Patient	Gender	Compliance	Intake Score	30 Days	60 Days	90 days	% Improved
1	Female	100	30	29	18	8	0.73
2	Female	100	34	30	25	12	0.65
3	Female	95	28	27	23	11	0.61
4	Male	100	17	17	12	6	0.65
12	Female	75	26	27	28	29	-0.12
13	Male	75	31	33	25	24	0.23
14	Female	100	28	25	20	16	0.43

Adverse Effects
Adverse effects were minimal. Only two patients reported mild indigestion for the first two days. No other adverse effects were reported during the study.

DISCUSSION

In this open-label study of a broad based nutritional supplement, the results demonstrated statistically significant improvements. The effect size was very large. Five patients did not complete the study due to the inability to comply. They reported no adverse effects.

It is interesting to note that the measured results parallel the patient's own rating of compliance in all but one case. Only one patient who completed the study did not show improvement. Females were more compliant than male patients. Little improvement was seen in any patient during the first 30 days and most of the improvement noted occurred in the last 30 days. There is improvement exhibited in the symptoms leading to the diagnosis of depression in 6 out of 7 patients. This represents an 86% rate of improvement. This correlates almost exactly with the other studies reviewed above. The average improvement of all patients including the one who did not measure any improvement was around 50%.

CONCLUSIONS
Factors such as the enhanced bioavailability of this vitamin and mineral supplement produces measurable change in symptom patterns perceived by patients with depression following automobile trauma. This model is offered for other studies which are encouraged.

REFERRENCES
1) Improved Mood and Behavior During Treatment with a Mineral-Vitamin Supplement: An Open-Label Case Series of Children -Journal of Child and Adolescent Psychopharmacology -Volume 14, Number 1, 2004
2) Nutritional Approach to Bipolar Disorder - Journal of Clinical Psychiatry - 64:3, March 2003
3) Treatment of Mood Lability and Explosive Rage with Minerals and Vitamins: Two Case Studies in Children -Journal of Child and Adolescent Psychopharmacology
Volume 12, Number 3, 2002
4) Journal Publication Summary: Journal of Clinical Psychiatry Articles - December 6, 2001 Edition
5) Rheumatologist Dr. Liam Martin has treated all sorts of painful joint and muscle problems in his patients over the past 20 years.
6) Achenbach TM: Manual for the Child Behavior Checklist/4-18 and 1991 Profile. Burlington (Vermont), University of Vermont, 1991.
7) Benton D, Cook R: The impact of selenium supplementation on mood. Biol Psychiatry 29:1092-1098, 1991.
8) Benton D, Donohoe RT: The effects of nutrients on mood. Public Health Nutr 2:403-409, 1999.

9) Benton D, Griffiths R, Haller J: Thiamine supplementation mood and cognitive functioning. Psychopharmacology (Berl) 129:66-71, 1997.
10) Benton D, Haller J, Fordy J: Vitamin supplementation for 1 year improves mood. Neuropsychobiology 32:98-105, 1995.
11) Burlingame GM, Wells MG, Hoag MJ, Hope CA, Nebeker RS, Konkel K, McCollam P, Peterson G, Lambert MJ, Latkowski M, Ferre R, Reisinger CW: Administration and Scoring Manual for the YOQ 2.0. Stevenson (Maryland), American Professional Credentialing Services, 1998.
12) Carroll D, Ring C, Suter M, Willemsen G: The effects of an oral multivitamin combination with calcium, magnesium, and zinc on psychological well-being in healthy young male volunteers: A double-blind placebo-controlled trial. Psychopharmacology (Berl) 150:220-225, 2000.
13) Cohen J: Statistical Power Analysis for the Behavioral Sciences, 2nd ed. Hillsdale (New Jersey), Lawrence Erlbaum, 1988.
14) Dubovsky S, Thomas M, Hijazi A, Murphy J: Intracellular calcium signaling in peripheral cells of patients with bipolar affective disorder. Eur Arch Psychiatry Clin Neurosci 243:229-234, 1994.
15) Dunlop WP, Cortina JM, Vaslow JB, Burke MJ: Meta-analysis of experiments with matched groups or repeated measures designs. Psychol Methods 1:170-177, 1996.
16) Gesch CB, Hammon SM, Hampson SE, Eves A, Crowder MJ: Influence of supplementary vitamins, minerals and essential fatty acids on the antisocial behaviour of young adult prisoners. Randomised, placebo-controlled trial. Br J Psychiatry 181:22-28, 2002.
17) Hoffer A: Vitamin B-3 and Schizophrenia. Kingston (Ontario), Quarry Press, 1999.
18) Kaplan BJ, Crawford SG, Gardner B, Farrelly G: Treatment of mood lability and explosive rage with minerals and vitamins: Two case studies in children. J Child Adolesc Psychopharmacol 12:203-218, 2002.
19) Kaplan BJ, Simpson JS, Ferre RC, Gorman CP, McMullen DM, Crawford SG: Effective mood stabilization with a chelated mineral supplement: An open-label trial in bipolar disorder. J Clin Psychiatry 62:936-944, 2001.
20) Maes M, Vandoolaeghe E, Neels H, Demedts P, Wauters A, Meltzer HY, Altamura C, Desnyder R: Lower serum zinc in major depression is a sensitive marker of treatment resistance and of the immune/inflammatory response in that illness. Biol Psychiatry 42:349-358, 1997.
21) Mash EJ, Terdal LG: Assessment of child and family disturbances: A behavioral-systems approach. In: Assessment of Childhood Disorders. Edited by Mash EJ, Terdal LG. New York, Guilford Press, 1997, pp 3-68.
22) Nemets B, Stahl Z, Belmaker RH: Addition of omega-3 fatty acid to maintenance of medication treatment for recurrent unipolar depressive disorder. Am J Psychiatry 159:477-479, 2002.
23) Peet M, Horrobin DF: A dose-ranging study of the effects of ethyl-eicosapentaenoate in patients with ongoing depression despite apparently adequate treatment with standard drugs. Arch Gen Psychiatry 59:913-919, 2002.
24) Popper CW: Do vitamins or minerals (apart form lithium) have mood-stabilizing effects? [commentary]. J Clin Psychiatry 62:933-935, 2001.
25) Richardson AJ, Puri BK: A randomized double-blind, placebo-controlled study of the effects of supplementation with highly unsaturated fatty acids on ADHD-related symptoms in children with specific learning difficulties. Prog Neuropsychopharmacol Biol Psychiatry 26:233-239, 2002.
26) Sandstead HH, Penland JG, Alcock NW, Dayal HH, Chen XC Li JS, Zhao F, Yang JJ: Effects of zinc and other micronutrients on neurophsychologic performance and growth of Chinese children. Am J Clin Nutr 68:470S-475S, 1998.
27) Schoenthaler SJ, Bier ID: The effect of vitamin-mineral supplementation on juvenile delinquency among American schoolchildren: A randomized, double-blind placebo-controlled trial. J Altern Complement Med 6:7-17, 2000.
28) Simmons M: Letter to the editor. J Clin Psychiatry 64:338, 2002.
29) Young RC, Biggs JT, Ziegler VE, Meyer DA: A rating scale for mania: Reliability, validity and sensitivity. Br J Psychiatry 133:429-435, 1978.
30) Alpert JE, Mischoulon D, Nierenberg AA, et al. Nutrition and depression: focus on folate. Nutrition 2000;16:544-546.
31) Fava M, Borus JS, Alpert JE, et al. Folate, vitamin B12, and homocysteine in major depressive disorder. Am J Psychiatry 1997;154:426-428.

32) Howell GA, Welch MG, Frederickson CJ. Stimulation-induced uptake and release of zinc in hippocampal slices. Nature 1984;308:736-738.
33) Dyck RH, Cynader MS. Histochemical localization fo synaptic zinc in the developing kitten visual cortex. J Comp Neurol 1993;329:53-67.
34) Sandstead HH, Frederickson CJ, Penland JG. History of zinc as related to brain function. J Nutr 2000;130:496S-502S.
35) Vlachova V, Zemkova H, Vyklicky L Jr. Copper modulation of NMDA responses in mouse and rat cultured hippocampal neurons. Eur J Neurosci 1996;8:2257-2264.
36) Olvares M, Uauy R. Copper as an essential nutrient. Am J Clin Nutr 1996;63:791S-796S.
37) Hollmann M, Heinemann S. Cloned glutamate receptors. Annu Rev Neurosci 1994;17:31-108.
38) Martin SJ, Grimwood PD, Morris RGM. Synaptic plasticity and memory an evaluation of the hypothesis. Annu Rev Neurosci 2000;23:649-711.
39) Caddell JL, Graziani LJ, Wiswell TE, et al. The possible role of magnesium in protection of premature infants from neurological syndromes and visual impairments and a review of survival of magnesium-exposed premature infants. Magnes Res 1999;12:201-216.
40) Maes M, D'Haese PC, Scharpe S, et al. Hypozincemia in depression. J Affect Disord 1994;31:135-140.
41)Maes M, Vandoolaeghe E, Neels H, et al. Lower serum zinc in major depression is a sensitive marker of treatment resistance and of the immune/inflammatory response in that illness. Biol Psychiatry 1997;42:349-358.
42)Walsh WJ, Isaacson HR, Rehman F, et al. Elevated blood copper/zinc ratios in assaultive young males. Physiol Behav 1997;62:327-329.
43)Toren P, Eldar S, Sela B-A, et al. Zinc deficiency in attention-deficit hyper-activity disorder. Biol Psychiatry 1996;40:1308-1310.
44) Arnold LE, Votolato NA, Kleykamp D, et al. Does hair zinc predict amphetamine improvement of ADD/hyperactivity? Int J Neurosci 1990;50:103-107.
45) Arnold LE, Pinkham SM, Votolato N. Does zinc moderate essential fatty acid and amphetamine treatment of attention-deficit/hyperactivity disorder? J Child Adolesc Psychopharmacol 2000;10:111-117.
46) Linder J, Brimar K, Granberg PO, et al. Characteristic changes in phychiatric symptoms, cortisol and melatonin but not prolactin in primary hyper-parathyroidism Actra Psychiatr Scand 1988;78:32-40.
47) Okamoto T, Gerstein HC, Obara T. Psychiatric symptoms, bone density and non-specific symptoms in patients with mild hypercalcemia due to primary hyperparathyroidism: a systematic overview of the literature. Endocrinology 1997;44:367-374.
48) Helmeste DM, Tang SW. The role of calcium in the etiology of the affective disorders. Jap J Pharmacol 1998;77:107-116.
49) Michelson D, Stratakis C, Hill L, et al. Bone mineral density in women with depression. N Engl J Med 196;335:1176-1181.
50) Coelho R, Silva C, Maia A, et al. Bone mineral density and depression: a community study of women. J Psychosom Res 1999;46:29-35.
51) Benton D, Donohoe RT. The effects of nutrients on mood. Public Health Nutr 1999;2:403-409.
52) Hurtado EK, Claussen AH, Scott KG. Early childhood anemia and mild or moderate mental retardation. Am J Clin Nutr 1999;69:115-119.
53) Nelson C, Erikson K, Pinero DJ, et al. In vivo dopamine metabolism is altered in iron-deficient anemic rats. J Nutr 1997;127:2282-2288.
54) Weiser M, Levkowitch Y, Neuman M, et al. Decrease of serum iron in acutely psychotic schizophrenic patients. Int J Neurosci 1994;78:49-52.
55) Levine J, Rapoport A, Mashiah M, et al. Serum and cerebrospinal levels of calcium and magnesium in acute versus remitted schizophrenic patients. Neuropsychobioloby 1996;33:169-172.
56) Schaefer AL, Jones SDM, Stanley RW. The use of electrolyte solutions for reducing transport stress. J Anim Sci 1997;75:258-265.
57) First MB, Spitzer RL, Gibbon M, et al. Structured Clinical Interview for DSM-IV Axis I Disorders (SCID-I) Washington, DC: American Psychiatric Press: 1997.
58) Hamilton M. A rating scale for depression. J Neurol Neursurg Psychiatry 1960;23:56-62.

59) Young RC, Biggs JT, Zieler VE, et al. A rating scale for mania: reliability, validity and sensitivity. Br J Psychiatry 1978;133:429-435.
60) Overall JE, Gorham DR. The Brief Psychiatric Rating Scale. Psychol Rep 1962;10:799-812.
61) Calabrese JR, Suppes T, Bowden DL, et al. A double-blind, placebo-controlled, prophylaxis study of lamotrigine in rapid-cycling bipolar disorder. J Clin Psychiatry 2000;61:841-850.
62) Kowatch RA, Suppes T, Carmody TJ, et al. Effect size of lithium, divalproex sodium, and carbamazepine in children and adolescents with bipolar disorder. J Am Acad Child Adolesc Psychiatry 200;39:713-720.
63) Tohen M, Jacobs TG, Grundy SL, et al. Efficacy of olanzapine in acute bipolar mania: a double-blind, placebo-controlled study. Arch Gen Psychiatry 2000;57:841-849.
64) Hoffer A. Vitamin B-3 and Schizophrenia. Kingston, Ontario: Quarry Press; 1999:160.
65) Stoll AL, Severus E, Freeman MP, et al. Omega 3 fatty acids in bipolar disorder: a preliminary double-blind, placebo-controlled trial. Arch Gen Psychiatry 1999;56:407-412.
66) Meyers DG, Maloley PA, Weeks D. Safety of antioxidant vitamins. Arch Intern Med 1996;156:925-935.
67) Miller DR, Hayes KC. Vitamin excess and toxicity. In: Hathcock JN, ed. Nutritional Toxicology. New York, NY: Academic Press;1982:81-116.
68) Omaye ST. Safety of megavitamin therapy. Adv Exp Med Biol 1984;177:169-203.
69) Yang G, Ge K, Chen J, et al. Selenium-related endemic diseases and the daily selenium requirement of humans. World Rev Nutr Diet 1988;22:98-152.
70) Hunt CD, Stoecker BJ. Deliberations and evaluations of the approaches, endpoints and paradigms for boron, chromium and fluoride dietary recommendation. J Nutr 1996;126(9 suppl):2441S-2451S.
71) Berrenttini W. Diagnostic and genetic issues of depression and bipolar illness. Pharmacotherapy 1995;15:69S-75S.
72) Mayer AB. Historical changes in the mineral content of fruits and vegetables. Br Food J 1997;99:207-211.

ATTRIBUTION

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CASE MANAGEMENT STRATEGIES CHRONIC PAIN SYNDROMES

Appendix: http://www.dcorthoacademy.com/e-Journal/June06Appendix.pdf

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Identification and Outcome Management Strategies of the Chronic Pain Patient (SG Yeomans, DC, FACO)

Why is a chronic pain patient so unique? Can we identify the patient at risk of a prolonged recovery on the first visit? Why is this important? What changes in our clinical management are necessary when managing a chronic pain patient? The objective of this article is to review the subjective and objective tools or methods that can be utilized to help identify on day one, the patient that is at risk of a prolonged recovery; those that present with "yellow Flags."

Yellow flags are subjective and objective clinical findings, which represent "caution" and include both physical as well as psychosocial risk factors whereas "red flags" represent a potential emergency and are dangerous physical risk factors. The identification of "Red Flags" should lead to prompt appropriate medical intervention while identification of "Yellow Flags" should lead to appropriate cognitive and behavioral management (Bigos 1994). Immediate recognition of these findings is essential to a successful outcomes management process as the risk of prolonged recovery is more likely in the patient the presents with "yellow flags."

Kendall described "Yellow Flags" as factors that enhance the risk of developing, or perpetuating long-term disability and work loss associated with low back pain (Kendall, 1997). Two key outcomes are described when assessing the presence of Yellow Flags:

- A decision as to whether more detailed assessment is needed (psychosocial)
- Identification of any salient factors that can become the subject of specific intervention, thus saving time and helping to concentrate the use of resources

Because Red and Yellow Flags are not exclusive, a patient may require concurrent intervention of both. The following are various subjective and objective outcomes management strategies that can be utilized when assessing patients for prolonged recovery risk or yellow flags.

Linton recently reported the results of a comprehensive evaluation of background, individual and workplace psychological risk factors to investigate their relationship with spinal pain (Linton, 2005). Participants included workers randomly selected from the general population, where 372 had not experienced pain during the past year, and 209 had experienced considerable pain problems. A cross-sectional comparison of these groups using multivariate statistics indicated that the most potent risk factors were:

- Psychological distress (odds ratio=13.2)
- Poor function (odds ratio=6.4).

Much smaller levels of risk were found for perceived workload, gender and foreign birth. Those participants with no pain were followed for one year to determine development of a spinal pain problem. Although few participants developed a significant pain problem, the prospective analyses showed that the following produced the highest odds ratios:

- Psychological distress (odds ratio=2.2)

- Catastrophizing (odds ratio=3.0)
- Workload (odds ratio=2.3).

Taken together these results underscore the need for a multidimensional view of the development of pain disability. Moreover, individual psychological factors such as distress and catastrophizing as well as work place factors like work load were found to be highly related to the development of back pain in a sample of workers from the general population. Because psychological variables were relevant very early on, these factors are important targets for early chronic pain identification in prevention programs.

An individual may be considered at risk if they have a clinical presentation that includes one or more very strong indicators of risk, or several less important factors that might be cumulative. 'Yellow flags' include factors that have been found to extend resolution beyond the duration of a condition's natural history. A partial list include the following:

- A past history of prior episodes (Hazard, 1996; Cherkin, 1996; Frank, 1996; Burton, 1995),
- Severe pain intensity (Frank, 1996; Cherkin, 1996; Hazard; 1996)
- Duration of symptoms (Von Korff, 1993; Linton, 2000)
- Anxiety (Cherkin, 1996; McMahon, 1997)
- Locus of control (e.g. ability to control or, reduce/help your pain) (Burton, 1995)
- Depression (Cherkin, 1996; Klenerman,1995; Linton; 1997)

SUBJECTIVE METHODS

The most efficient and practical method of identifying the patient likely to contain risk factors of chronicity are the use of questionnaires that a patient can complete when initially presenting to the health care provider. This method is important as it allows the HCP easy access to direct questions to the patient without the risk of alienating the patient. It is important to utilize a questionnaire that includes questions related to psychometric issues such as depression, anxiety, coping, control and others. When a patient reports high scores (such as 5+ on a 0-10 scale) on these questions, the HCP can point to the answered question and reply,

> "I see that you have scored yourself as depressed. Is this something that you have control over or is it something you would like some help with?"

Using this approach works well because it separates the HCP from the patient when asking these sensitive questions by simply pointing out to the patient that they (not you) have admitted psychometric issues exist that may prolong recovery. If the patient responds that they do not have control of the situation and would like help, the HCP can facilitate by making an appointment with a mental health professional. Another benefit of using questionnaires is that many of these tools are quantitative and hence, generate a score, usually a percentage by dividing the patient's score by the maximum possible score times 100. Hence, the tools can serve as a great psychometric outcome measure to determine if benefits or progress is being made.

Tools routinely utilized in outcomes management approaches can also be used to identify patients at risk of a prolonged recovery. These tools include pain drawings, pain scales, and disability questionnaires. In general, due to fear avoidance, low pain thresholds, catastrophization, and chronic behavioral tendencies, look for exaggerated or high scores or ratings on these tools.

The pain drawing tool is a simple approach that can help the HCP identify of the patient at risk of a prolonged recovery. This is basically a picture or outline of the body from the front, back, right and left sides where the patient writes the location on the body figures using specific markings representing a specific quality of pain (numbness, sharp, pins & needles, burning, or tingling). Some pain drawings include a numerical pain scale usually located at the bottom of the pain drawing. There are several approaches available to quantify or score a pain drawing which are discussed elsewhere (Yeomans, 2000). A simple and more practical qualitative approach is to review the completed pain drawing looking for exaggerated findings such as any markings on the outside of the body figures, markings on more than one extremity or body regions, and/or multiple/different

quality markings used. In general, a pain drawing that includes writing on the outside of the body and when most of the body areas are marked, is an indicator of a potential chronic pain behavioral patient.

The Quadruple Visual Analogue Scale (QVAS) is another tool used to assess the pain domain along with the pain drawing. Since pain is a primary reason for patients to present to HCP, especially in a neuromusculoskeletal specialty area such as chiropractic, pain management or the reduction of pain is a primary focus for obtaining high levels of patient satisfaction. Therefore, tracking it's frequency, intensity, duration, and localization is very important. There are four questions that are needed to be asked to properly address this domain. These questions are scored on a 0-10 scale (0 = no pain and 10 = the most severe pain) and are as follows:

1) What is your pain level RIGHT NOW?
2) What is your pain level ON AVERAGE (most of the time)?
3) What is your pain level AT BEST (or, how close to 0 is your pain level at best)?
4) What is your pain level AT WORST (or, how close to 10 is your pain level at its worst)?"

The percentage of awake hours and the duration of time the patient perceives their best and worst pain level can also be asked, which helps in understanding how often the patient experiences their best and worst pain levels as well as the recovery time after the maximum pain is perceived. Since pain is usually exaggerated in the catastrophizing patient, scores of 7-10/10 for all four questions should alert the HCP of a patient at risk of a prolonged recovery. In the Triple VAS (visual analogue scale), Von Korff recommends taking the sum of questions 1, 2, and 4 together, divide by 3 to obtain an average, and then multiplying that number times 10 to obtain a single 0-100 scaled number (Von Korff, 1992, 1993). He then defines pain as "Low intensity" with scores ≤50 and "High intensity" at >50. Hence, by using this lower cut-off approach (a cut-off of 5/10 or 50/100 rather than 7/10 or 70/100), more subjects will be identified as suspect for chronic pain behavior (higher sensitivity but lower specificity).

The Bournemouth Questionnaires include two "hybrid" tools as Back and Neck versions are available (Bolton 1999, 2001). These two questionnaires are unique in that they cover the following three domains (hence the term "hybrid"):

1) Pain (one question: average pain level)
2) Activity intolerance (3 questions: activities of daily living – recreational/social/family, and work activities)
3) Psychometric (3 questions: depression, anxiety, locus of control)

This tool consists of a total of 7 questions of which each are scored on a 0-10 scale. To score the questionnaire, the patient's total score (numerator) is divided by the total possible score (denominator; 70 if all 7 questions are answered; subtract 10 for each unanswered question from the denominator of 70) and then multiplied by 100 to equal a specific percentage of disability. For example, if a patient's total is 35, the formula is: 35/70 x 100 = 50%. Though no "severity scale" or disability definition exists in the literature, cut-offs of 50% or 70% disability could be utilized, similar to Von Korff's approach with the Triple VAS. This would allow the HCP to categorize those patients at risk of prolonged recovery (scores >50), with the understanding that this approach has not been clearly reported in the literature for condition-specific or hybrid questionnaires. In general, high scores on other condition-specific disability tools such as the Oswestry Low Back Disability Questionnaire (Fairbank 1980) and / or Roland-Morris Questionnaire (Roland 1983) may be also indicative of chronic pain behavior, but there are no psychometric questions specific to depression, anxiety, locus of control, coping, etc. included in these two tools. Hence, the Bournemouth Questionnaires, in this author's opinion, is a better choice when trying to identify patients at risk of chronicity or prolonged recovery as questions specific to depression, anxiety and locus of control can be specifically assessed and discussed with patients using the approach previously described. When the scores of the three psychometric questions are high, especially after repeated use, it is recommended by this author that administration of psychometric specific tools such as a Modified Zung Depression Inventory or Beck's Depression Index be considered and arrangements for a psychometric evaluation be strongly considered.

For addition information regarding "yellow flags," please refer to Chapters 8, 10 and 21 (Yeomans, 2000) as well as Craig Liebenson's text (Liebenson 2006).

Two questions regarding depression were evaluated in a recent study (Arroll, 2003). The responses from 2 questions regarding depression were collected and studied from 421 patients from 15 general practices in New Zealand. They reported a sensitivity and specificity of 97% (95% confidence interval, 83% to 99%) and 67% (62% to 72%), respectively. The likelihood ratio for a positive test was 2.9 (2.5 to 3.4) and the likelihood ratio for a negative test was 0.05 (0.01 to 0.35). Overall, 37% (157/421) of the patients screened positive for depression. The two questions reported are:

1. *During the past month have you often been bothered by feeling down, depressed, or hopeless?*

2. *During the past month have you often been bothered by little interest or pleasure in doing things?*

These questions could easily be inserted into a patient intake form, past history form, review of systems form or current complaint form and used as screening questions, from which psychometric specific tools for depression/anxiety (such as Beck's Depression Inventory, Modified Zung) could then be utilized.

The Yellow Flag Questionnaire was designed to identify patients at risk of prolonged recovery (Yeomans, 2000; Liebenson, 2006). This tool was created after an extensive literature search followed by a collection of questions commonly utilized in various tools concerned with yellow flags that were previously published. There are four categories of "yellow flags" that are evaluated: 1) pain; 2) psycho-social; 3) function; 4) fear-avoidance, which are individually scored by adding the 0-10/10 patient scores from each of the four categories. A total score is then calculated by adding the total scores from the four categories and the final score is utilized to place patients into mild, moderate or severe levels of prolonged recovery risk. This tool can help to identify the patient that is at risk of prolonged recovery as well as follow their outcomes during active care intervention.

The Patient's Global Impression of Change (PGIC) has been used primarily as a research tool to determine the minimum clinically important change for various OA questionnaires (see appendix 7). Though this tool was not designed to be used in a clinical setting or, as an important screen for identifying patient's at risk of a prolonged recovery, it has been used by this author in a clinically setting with both objectives being accomplished. Since the strategy of using outcome measures is to identify plateaus in care and determine whether the treatment plan is meaningful in terms of outcome, simply asking the patient if they have improved with the treatment intervention and to the extent seems logical (face-validity). These tools simply ask the patient to rate the level of improvement, no change, or worsening of their condition. One method is the use of a 0-10 VAS where the lowest three level scores or, 0, 1, and 2 of the 0 to 10 scale, represent responses that are statistically significant of a satisfying outcome. Midrange scores 5/10 represents "no change" and 10/10 represents worsening of the condition (Bolton 2004).

Treatment Strategies for patients presenting with "Yellow Flags"

First and foremost is the patient obtains an adequate psychosocial evaluation by a mental health expert. Allied health care management strategies include, but are not limited to pharmaceuticals, counseling (in or out patient), and others). When the patient responds that they are already under allied health care for their psychometric diagnoses, the HCP should emphasize active care strategies that encourage self-management and minimizes dependency on HCPs and their respective facilities. While numerous studies demonstrate the effectiveness of cognitive-behavioral strategies (Fordyce 1986; Lindstrom 1992; Frost 2000; Klaber Moffet 1999; Pincus 2002), simpler re-activation approaches have been reported as all that may be required. Mannion reported that in three different active care approaches where none of them included of psychological or cognitive-behavioral approaches, all psychological variables related to self-report of pain and disability improved after intervention (Mannion 2001). Getting the patient back to work, sports, and a basically, a "normal" lifestyle / ADL's can be accomplished by "proving" to the patient that they can do regular activities, often in spite of continued pain.

This may be the most important management strategy available but this can only be accomplished with an active care approach.

Objective Outcomes Assessment For Chronic Pain Patients

The term "objective" applies to doctor-driven data whereas the term "subjective" refers to patient-driven information. There are many excellent quantitative outcomes oriented tests that are available for the HCP to utilize. These tools should be compared to the subjective information and the scores obtained from the various OA forms discussed thus far. This section will discuss many objective methods of obtaining outcomes oriented data. A more in depth review of this subject is available elsewhere (Yeomans, 2000; www.yeomansdc.com).

With respect to chronic pain, a hallmark or feature of this disorder is fear/pain avoidance. Hence, the chronic pain patient is often hesitant or outright resistive to performing some of the more challenging functional tests. Therefore, the key to success is 1) be patient and, 2) go slow so as to avoid exacerbations, as exacerbations only reinforce the patient's negative beliefs that exercise/activity is harmful and should be avoided.

Palpation

The Soft Tissue Tenderness Grading Scheme is an objective pain scale that the HCP can utilize during palpation (Hubbard 1993). This scale is based on the HCP's observation of the patient and rates the patient's pain reaction or behavior during palpation. The amount of pressure utilized is 4 kg, which is the amount of pressure needed to alter the color (blanch) of the nail bed during palpation. There are four grades of which the first grade requires a verbal response from the patient as to whether there is palpatory pain as a visual cue is often not present (i.e., no facial grimace, withdrawl, etc.). Grades II – IV are observable by the HCP. Grade II is usually an organic response, or not exaggerated while Grade III can be difficult to differentiate between organic vs. non-organic. Grade IV is clearly a non-organic response to the palpatory examination. Correlating this with a patient-subjective pain rating is very helpful. Table 6 summarizes the Soft Tissue Tenderness Grading Scheme (Hubbard, 1993).

Table 6. Soft Tissue Tenderness Grading Scheme (Hubbard, et al.)

Grade I	Mild tenderness to moderate palpation (a verbal response is often needed).
Grade II	Moderate tenderness with grimace &/or flinch to moderate palpation.
Grade III	Severe tenderness with withdrawal (+"Jump Sign")
Grade IV	Severe tenderness with withdrawal (+jump sign) to non-noxious stimuli (i.e. superficial palpation, pin prick, gentle percussion)*

* In non-injured tissue, this is a sign of neuropathic or non-organic pain.

Physical Performance

The Quantitative Functional Capacity Evaluation (QFCE) is a collection of physical performance tests that can be utilized as a measuring tool to assess if a patient is progressing, not changing, or worsening with any form of treatment or active care / rehab approach (see Appendix 8). The criteria used when reviewing the literature included, 1) published in a peer-reviewed journals, 2) valid, reliable, safe, and practical criteria applied, 3) low-tech/low-cost tests, and 4) the inclusion of normative data to compare patients against.

There are currently 23 physical performance tests that can be performed as a group or individually, in any order. The patient's performance result(s) are then compared to the published normative data and a ratio is used to calculate a percentage of the norm using the following formula:

Formula: **Pt result / Normative data x 100 = ____ %**

Steps: The "paper gymnastics" of reporting the data / documentation include the following steps:

1) Use the 2-page exam form during the QFCE exam
2) A CA can transfer the data to the 1-page summary form
3) Any test that requires the norms to be obtained from a table are inserted in the left column of the 1-page summary form
4) The patient's results are placed in the middle of the 3 columns to the right
5) The patient's result is divided by the normative data that is published
6) The Percentage of the norm is reported in the right hand column
7) Any test < 85% is highlighted and specific exercises are given
8) The test is repeated in 2-4 weeks to determine exercise/rehab benefits

Example: A 48yo Female/blue collar patient completes 6 reps on the repetitive squat test

Normative Data = 19 reps (see table 1 under "Strength & Endurance tests" of Appendix 8

6/19 x 100 = 32% (which is <85% cut off – optional*)

Treatment Plan: Rehab recommendations include Gymball/wall squats (Levels 1-3), lunges, etc.

* As an option the HCP can utilize an 85% of the norm "cut-off". This cut-off may vary depending on the population that is being evaluated. For example, for a college athlete, the use of a 100% cut-off verses for a geriatric patient, a 50% cut-off may be used. The 85% cut-off works well for most patients. If the 85% target is being used, tests that fail to reach the 85% cut-off of the reported normative data are identified as "failed" and specific active care or exercise protocols are prescribed, based on the test results.

Currently, there are 8 tests that measure *strength &/or endurance* which include the following:

1. Repetitive Squat (Gluts/hip extensors and quadriceps femoris)
2. Repetitive Sit-up (Abdominal muscles)
3. Repetitive Arch-up (Back extensor muscles)
4. Static Back Endurance (Back extensor muscles)
5. Horizontal Side Bridge (Quadratus lumborum muscles)
6. Double Leg Lowering (Abdominal muscles)
7. Grip Strength (Jamar hand dynamometer)
8. Cervical spine strength (2 methods: Neck Flexion test, Nexercisor test)

There are eight *flexibility and range of motion* (muscle length) tests that include:

1. Lumbar Spine Inclinometer Examination
2. Cervical Spine Inclinometer Examination
3. Gastrocnemius / Ankle Dorsiflexion Test
4. Soleus / Ankle Dorsiflexion Test
5. Modified Thomas Test (Iliopsoas)
6. Straight Leg Raise (Hamstring)
7. Knee Flexion Test (Quadriceps femoris)
8. Hip Rotation (Internal and External)

There are 5 Non-organic Signs (Waddell Signs)

1. Pain (2 tests) - Superficial and deep
2. Simulation (2 tests) - Axial compression and Trunk rotation
3. Distraction (1 test) - Sitting verses supine SLR
4. Regional neurology (2 tests) - Motor and sensory inconsistencies
5. Exaggeration noted during any part of the examination (1 test)

There is one cardiovascular test

1. Three-minute Step Test

There is one proprioceptive test

1. One-leg balance test

The QFCE starts and ends by obtaining a Pain level ("Right Now" on a 0-10 numerical scale). If all 23 physical performance tests are performed, a 35-45 minute time frame is needed. However, any one or any smaller group of tests can be performed during the patient management process, dependant on the objectives of the particular case. The ICD-9 code 97750 Physical Performance Code is applicable (up to 4 units may be appropriate). The codes 97112 Neuromuscular Re-education, 97110 therapeutic exercise, or 97530 Therapeutic activities can be utilized during the rehabilitation portion of care (1 unit = 15 minutes).

For more information, please refer to chapter 16 in the text (Yeomans 2000), the QFCE DVD and Manual for the proper training procedures for these tests, and/or Phases Rehab software with the QFCE Protocols. See www.yeomansdc.com for details.

REFERENCES

Arroll, B, Khin N, Kerse N. Screening for depression in primary care with two verbally asked questions: cross sectional study.BMJ 2003;327:1144-1146 (15 November), doi:10.1136/bmj.327.7424.1144

Bigos S, Bowyer O, Braen G, et al. Acute low back problems in adults. Clinical Practice Guideline. Rockville, MD: U.S. Department of Health and Human Services, Public Health Service, Agency for Health Care Policy and research, 1994.

Bolton JE, Breen AC. The Bournemouth Questionnaire: a short-form, comprehensive outcome measure. I Psychometric properties in back pain patients. J Manipulative Physiol Ther 1999; 22:503-510.

Bolton J, Humphreys BK. The Bournemouth Questionnaire: A short-form comprehensive outcome measure. II. Psychometric properties in neck pain patients. J Manipulative Physiol Ther 2002;25:141-148.

Bolton J. Sensitivity and Specificity of Outcome Measures in Patients with Neck Pain: Detecting Clinically Significant Improvement. Spine 2004;29(21):2410-2417.

Burton AK, Tillotson K, Main C, Hollis M. Psychosocial predictors of outcome in acute and sub-acute low back trouble. Spine 1995;20:722-8.

Cherkin DC, Deyo RA, Street JH, Barlow W. Predicting poor outcomes for back pain seen in primary care using patients' own criteria. Spine 1996;21:2900-2907.

Fairbank J, Davies J, et al. The Oswestry Low Back Pain Disability Questionnaire. Physiother 1980; 66(18): 271-273.

Frank JW, Kerr MS, Brooker AS, DeMaio SE, Maetzel A, et al. Disability resulting from occupational low back pain. Part 2: What do we know about secondary prevention? Spine 1996;21:2918-2929.

Fordyce WE, Brochway JA, Bergman JA, et al: Acute back pain: A control-group comparison of behavioral vs. traditional management methods. J Behav Med 1986;9:127.

Frost H, Lamb SE, Shackleton CH. A functional restoration programme for chronic low back pain: A prospective outcome study. Physiotherapy 2000;86:285-293.

Hazard RG, Haugh LD, Reid S, Preble JB, MacDonald L. Early prediction of chronic disability after occupational low back injury. Spine 1996;21: 945-951.

Hubbard DR, Berkoff GM. Myofascial trigger points show spontaneous needle EMG activity. Spine 1993; 18:1803-1807

Kendall, N A S, Linton, S J & Main, C J. Guide to Assessing Psychosocial Yellow Flags in Acute Low Back Pain: Risk Factors for Long-Term Disability and Work Loss. Wellington, NZ: Accident Rehabilitation & Compensation Insurance Corporation of New Zealand and the National Health Committee; 1997.

Klaber Moffet J, Torgerson D, Bell-Syer S, Jackson D, Llewwlyn Phillips H, et al. A randomized trial of exercise for primary care back pain patients: Clinical outcomes, costs and preferences. British Medical Journal 1999;319:279-283.

Klenerman l, Slade P, Stanley I, et al. The prediction of chronicity in patients with an acute attack of low back pain in a general practice setting. Spine 1995;20:478-84.

Liebenson C (editor). Rehabilitation of the Spine – A Practitioner's Guide. 2nd edition. Lippincott (2006). www.lww.com

Lindstrom A, Ohlund C, Eek C, et al. Activation of subacute low back patients. Physical Therapy 1992;4:279--293.

Linton SJ. Do psychological factors increase the risk for back pain in the general population in both a cross-sectional and prospective analysis? Eur J Pain. 2005 Aug;9(4):355-61.

Linton SJ, Andersson T. Can chronic disability be prevented? A randomized trial of a cognitive-behavioral intervention for spinal pain patients. Spine 2000;25:2825-31.

Linton SJ, Hallden K. Risk factors and the natural course of acute and recurrent musculoskeletal pain: Developing a screening instrument. ed. Jensen TS, Turner JA, Wiesenfeld-Hallin Z. Proceedings of the 8th World Congress on Pain, Progress in Pain Research and Management, Vol 8; IASP Press, Seattle, 1997.

Mannion AF, Junge A, Taimela S, Muntener M, Lorenzo K, Dvorak J. Active therapy for chronic low back pain. Part 3. Factors influencing self-rated disability and its change following therapy. Spine 2001;26:920-929.

McMahon MJ, Gatchel RJ, Politan, PB, Mayer TG. Early childhood abuse in chronic spinal disorder patients: A major barrier to treatment success. Spine 1997;22:2408-2415.

Pincus T, Vlaeyen JWS, Kendall NAS, Von Korff MR, Kalauokalani DA, Reis S. Cognitive-behavioral therapy and psychosocial factors in low back pain: Directions for the future. Spine 2002;27:E133-E138.

Roland M, Morris R. (1983a) A study of the natural history of back pain: Part I: Development of a reliable and sensitive measure of disability in low-back pain. Spine 8:141-144.

Roland M, Morris R. (1983b) A Study of the Natural History of Low Back Pain, Part II. Spine; 8(2): 145-150.

Von Korff M, Ormel J, Keefe F, Dworkin SF. Grading the severity of chronic pain. Pain 1992;50:133-149.

Von Korff M, Deyo RA, Cherkin D, Barlow SF. Back pain in primary care: Outcomes at 1 year. Spine 1993; 18:855-862.

Yeomans S (editor). The clinical application of outcomes assessment. Appleton & Lange, 2000. [contact the author directly for text: 920-748-3644; www.yeomansdc.com]

Chronic Pain Syndromes

It has been generally believed that most back pain patients will recover from acute episodes and that only a minority become chronic. Since it is considered very difficult to treat the chronic patient, emphasis has been placed on prevention and prediction of who will become chronic. Bolton asks, "can an accurate prediction be made of a patient's prognosis early enough to take preventive action." (1). The chronic or chronic bound patient requires a far more complex biopsychosocial approach than the simple acute patient. The biopsychosocial model recognizes that low back pain (LBP) symptoms are influenced by factors other than anatomical or physiological parameters. LBP has biological, psychological & social aspects (2). Patients prone to chronicity can be identified by the presence of the following features (3):

- Past history of >4 episodes - history
- Longer than 1 week of symptoms before Dr. visit - history
- Severe pain intensity - >50% on VAS (4)
- Pre-existing structural path related to symptoms - history, imaging RCGP (5):
- Work loss in last year - history
- Radiating leg pain - history, pain diagram
- + SLR - ortho/neuro exam
- Signs of nerve root involvement - ortho/neuro exam
- Reduced trunk strength/end - Alaranta tests (QFCE tests)
- Poor physical fitness - aerobic capacity test (3-minute step test)
- Self-rated health poor - SF-36
- Heavy smoking history - history
- Psychologic distress/depression - SF-36, SCL-90, Becks, Zung
- Illness behavior - Waddell's Non-organic signs
- Low job satisfaction - Work APGAR
- Heavy occupation – Job Demands Questionnaire
- Alcohol, marital, financial problems - history
- Adversarial med-legal - history

In a 1996 study Cherkin reported that only 46% of patients presenting to a primary care clinic were symptom-free after 7 weeks (6). However, 29% had a poor outcome even 1 year later. Indeed, the chronic or at least the recurrent pain patient may be far bigger a problem than previously believed. Cherkin summarized the following predictors of a poor outcome - sciatica, depression, and job dissatisfaction. In an exhaustive review of the literature Frank, et al. concluded that the following factors were most significant in predicting outcome - previous history of low back problems, severe acute pain, and sciatica (7). According to North American Spine Society (8),"Many pts who do not respond to non-operative treatment within 4-6 months have a history of

significant psychosocial disorders, limited compliance, and inhibition physical function as evidenced by pain sensitivity, nonorganic signs, and demonstrated deficiencies in physical and functional capacity testing." The AHCPR - P91(B) concluded, "In a patient with acute low back symptoms and no evidence of serious underlying spinal pathology, the inability to regain tolerance of required activities may indicate that unrealistic expectations or psychosocial factors need to be explored before considering referral for a more extensive evaluation or treatment program" (9). A number of factors can be summarized as being predictive of a disability prone patient (10). These include:

- Symptom magnification
- Pain avoidance behavior
- Psychological distress
- Job dissatisfaction
- Anxiety
- Treatment dependency
- Catastrophizing as a coping strategy
- Pending litigation

To identify abnormal illness behavior consider the following instruments:

- SF-36
- SCL-90
- Beck Depression inventory
- Hamilton Rating Scale for Depression
- Zung Self-Rating Depression Scale
- Waddell's Non-Organic Signs
- Fear Avoidance Beliefs Questionnaire
- Depression, anxiety, locus of control questions of the Bournemouth Questionnaires

REFERENCES

1) Bolton, JE. Evaluation of treatment of back pain patients: Clinical outcome measures. Eur J of Chir 1994;42:29-40

2) Fordyce WE (Ed), Back pain in the workplace: Management of disability in nonspecific conditions. International Association for the Study of Pain. Seattle: IASP press 1995.

3) Haldeman S, Chapman-Smith D, Petersen DM. Frequency and duration of care. In Guidelines for chiropractic Quality Assurance and Practice Parameters. Aspen 1993, Gaithersburg.

4) Von Korff M, Ormel J, Keefe F, Dworkin SF. Grading the severity of chronic pain. Pain 1992;50:133-149.

5) Waddell G, Feder G. McIntosh A, Lewis M, Hutchinson A (1996) Low back pain evidence review. London: Royal College of General Practitioners.

6) Cherkin DC, Deyo RA, Street JH, Barlow W. Predicting poor outcomes for back pain seen in primary care using patients' own criteria. Spine 1996;21:2900-2907.

7) Frank JW, Kerr MS, Brooker AS, DeMaio SE, Maetzel A, et al. Disability resulting from occupational low back pain. Part 2: What do we know about secondary prevention? Spine 1996;21:2918-2929.

8) Mayer TG, Polatin P, Smith B, Smith C, Gatchel R, Herring SA, Hall H et al. Contemporary concepts in spine care; spine rehabilitation - secondary and tertiary nonoperative care. Spine 8;2060-2066, 1995.

9) Bigos S, Bowyer 0, Braen 0, et al. Acute low back problems in adults. Clinical Practice Guideline. Rockville, MC: US Department of Health and Human Services, Public Health Service, Agency for Health Care Policy and

Research, 1994.

10) Liebenson, C. Rehabilitation of the Spine: A Practitioner's Manual, Liebenson C. (ed.)) Williams and Wilkins, Baltimore, 1995

III Predictors of Chronic Pain behavior

A. Guidelines.
   1. CSAG – British Guidelines (1)
      a. Work loss in last year - history
      b. Radiating leg pain - history, pain diagram
      c. + SLR - ortho/neuro exam
      d. Signs of nerve root involvement - ortho/neuro
      e. Reduced trunk strength endurance (2, 3)
      f. Poor physical fitness - aerobic capacity tests
      g. Self-rated health poor - SF-36

   2. Mercy Center Conference Guides (4)
      a. Past history of >4 episodes - history
      b. Longer than 1 week of symptoms before Dr. visit - history
      c. Severe pain intensity - >50% on VAS
      d. Pre-existing structural pathology related to symptoms - history, imaging

B. Disability prone patient (Profile)
   1. Symptom magnification
   2. Pain avoidance behavior
   3. Psychologic distress
   4. Job dissatisfaction
   5. Anxiety
   6. Treatment dependency
   7. Catastrophizing as a coping strategy
   8. Pending litigation

C. Methods of identifying the disability prone patient
   1. Poor lumbar extensor strength/endurance (2, 3, 5)
   2. Modified Work APGAR (6)
   3. Vermont Disability Prediction Questionnaire (7)
   4. Correlation between / integration of other outcome assessment tools
      a. Pain drawing and VAS (8-10)
      b. Condition-specific Questionnaires (8-12)
         1. Example: Oswestry & Pain scale
      c. Depression and Mental Health Scales of the SF-36 (13, 14)
      d. SCL-90-R (15)
   1. Other OA Tool Options
      a. Bournemouth Questionnaire (19)
      b. Severity Index (20)

1. Waddell G, Feder G, McIntosh A, Lewis M, Hutchinson A. Low back pain evidence review. 1996; London: Royal College of General Practitioners.
2. Alarana H, et al. Non-dynamometric trunk performance tests: reliability & normative data. Scan J Rehab Med 1994;26:211-215.
3. Biering-Sorensen F: Physical measurements as risk indicators for low-back trouble over a one-year period. Spine 1984;9:106-119.
4. Haldeman S, Chapman-Smith D, Petersen DM. Guidelines for chiropractic quality assurance and practice parameters. Aspen 1993, Gaithersburg.
5. Luoto S, Heliovaara M, Hurri H, Alaranta H. Static back endurance and the risk of low-back pain. Clin. Biomech. 1995; 10(6):323-324.
6. Bigos S., Battie, Spenglere DM, et al. A prospective study of work perceptions and psychosocial factors affecting the report of back injury. Spine 1991;16:1-6.
7. Hazard RG, Haugh LD, Reid S, Preble JB, MacDonald L. Early prediction of chronic disability after occupational low back injury. Spine 1996; 21:945-951.
8. Ransford HV, Cairns D, Mooney V. The pain drawing as an aid to psychological evaluation of patients with low back pain. Spine 1976; 1:127.
9. Kirkaldy-Willis WH. Managing low back pain. Churchill Livingstone. New York 1983.
10. Von Korff m, Deyo RA, Cherkin D, Barlow SF. Back pain in primary care: Outcomes at 1 year. Spine 1993; 18:855-862.
11. Oswestry LBPDQ : Fairbank J, Davies J, et al. The Oswestry Low Back Pain Disability Questionnaire. Physiother 1980; 66(18): 271-273.
12. Hudson-Cook N, Tomes-Nicholson K. The revised Oswestry low back pain disability questionnaire. Thesis; Anglo-European College of Chiropractic, 1988.
13. Roland-Morris: Roland M, Morris R. A Study of the Natural History of Low Back Pain, Part II. Spine 1983; 8(2): 141-144.
14. NDI: Vernon H, Mior S. The Neck Disability Index: A Study of Reliability and Validity. J Manip Phys Ther 1991;14(7):409.
15. HDI: Jacobson Gary P., Ramadan NM, et al., The Henry Ford Hospital headache disability inventory (HDI). Neurology 1994;44:837-42.
16. Brazier J, Harper R, Jones SN. Validating the SF-36 Health survey questionnaire: new outcome measure for primary care. Br Med J. 1992;305:160-164.
17. Goertz CMH. Measuring functional health status in the chiropractic office using self-report questionnaires. Top Clin Chiro 1994; 1(1): 51-59.
18. SCL-90-R: Bernstein IH, Jaremko ME, Hinkley BS. On the utility of the SCL-90-R with low-back pain patients. Spine 1994;19:42-48.
19. Bolton JE, Breen AC. The Bournemouth Questionnaire: a short-form, comprehensive outcome measure. I Psychometric properties in back pain patients. J Manipulative Physiol Ther 1999; 22:503-510.
20. Chapter 21. Clinical Application of Outcomes Assessment. Ed. SG Yeomans. Appleton & Lange, 2000, 437-448.

THE DIAGNOSTIC CHARACTERISTICS OF CHRONIC PAIN: THE EIGHT D's

1. **DURATION**: > 6 months used to be the rule; current opinion is that chronic pain can be diagnosed as early as 2 to 4 weeks. Prompt evaluation and treatment are essential.

2. **DRAMATIZATION**: Unusual verbal and nonverbal behavior using emotionally charged words which is affective and exaggerated. Maladaptive, theatrical behavior including moaning, groaning, gasping, grimacing, posturing, or pantomiming.

3. **DIAGNOSTIC DILEMMA**: Extensive histories of evaluations by multiple physicians, often with repeated diagnostic tests and clinical impressions tend to be vague, inconsistent, and inaccurate.

4. **DRUGS**: Substance dependence and abuse involving drugs and/or alcohol is frequent. Multiple drug therapy can lead to adverse interactions and an excessive amount of prescribed drugs may be consumed.
5. **DEPENDENCE**: Dependency on physicians, spouses, families, with excess medical care, passive physical therapies with only short term affects, and often, they relinquish all domestic and social responsibilities.

6. **DEPRESSION**: Emotional upheaval is a hallmark with psychological test results that suggest depression, hypochondriasis, and hysteria. Cognitive aberrations give way to unhappiness, depression, despair, apprehension, irritability, and hostility. Coping mechanisms are severely impaired. Low self-esteem results in impaired self-reliance and increased dependence on others.

7. **DISUSE**: Secondary pain from prolonged, excessive immobilization occurs. Health care provider misguided directives to be "cautious" can result in self-imposed splinting and as a result, progressive muscular dysfunction and generalized deconditioning. This further adds to the perpetuating pain cycle and illness behavior.

8. **DYSFUNCTION**: Progressive loss of coping strategies and skills results in a gradual withdraw from the social milieu including work, recreational endeavors, friendships, family, and with increased isolation, restricted activities to the bare essentials of life occurs. "Bereft of social contacts, rebuffed by the medical system, and deprived of adequate financial means, the patient becomes an invalid in the broadest sense: physical, emotional, social, and economic."

NOTE: The presence of ***two or more*** of the above characteristics should be considered to establish a presumptive diagnosis of chronic pain syndrome.

Reference: Guides to the evaluation of permanent impairment, 4th edition, American Medical Association. 1993; 308-309.

QUOTE: In the discussion of chronic pain syndrome, the Secretary of the US Department of Health and Human Services in 1985 formed a commission on the evaluation of pain, which concluded that chronic pain is not a psychiatric disorder. (p. 303)

Regarding pain and its interrelated determinants, it is wise to consider Dr William Osler's maxim: "It is not nearly as important what illness a patient has, as what patient has the illness."

Reference: Guides to the evaluation of permanent impairment, 4th edition, American Medical Association. 1993; p. 307.

Reprints & Abstracts

ABSTRACTS OF CHRONIC PAIN / CASE STUDY ARTICLES:

CERVICAL SPINE

Radiofrequency Medial Branch Neurotomy in Litigant and Nonlitigant Patients With Cervical Whiplash

A Prospective Study

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SPINE 2001;26:e268-e273

Study Design. The efficacy of radiofrequency medial branch neurotomy to treat cervical zygapophysial joint pain from whiplash was compared prospectively in litigants and nonlitigants.

Objectives. 1) To assess the effect of monetary gain on treatment of zygapophysial joint pain in cervical whiplash. 2) To determine whether radiofrequency medial branch neurotomy is effective treatment for whiplash.

Summary of Background Data. The influence of litigation on treatment outcome is a subject of controversy in both the medical and legal professions. This is the first study to examine this issue in a prospective manner using a previously proven diagnostic and therapeutic method.

Methods. Sixty patients with cervical whiplash who remained symptomatic after 20 weeks of conservative management were referred for radiofrequency cervical medial neurotomy. The patients were classified as litigant or nonlitigant based on whether the potential for monetary gain *via* litigation existed. Each group underwent identical evaluation and treatment. Patients were observed for 1 year. Visual analogue scores and self-reported improvement were obtained before, immediately after, and 1 year after radiofrequency cervical medial neurotomy.

Results. Forty-six patients completed the study. The overall reduction in cervical whiplash symptoms and visual analogue pain scores were significant immediately after treatment (nonlitigants *vs.* litigants: 2.0 *vs.* 2.5, $P = 0.36$) and at 1 year (nonlitigants *vs.* litigants: 2.9 *vs.* 4.0, $P = 0.05$). One-year follow-up scores were higher than immediate post-treatment scores (nonlitigants *vs.* litigants: 2.5 *vs.* 3.6). The difference between litigants and nonlitigants in the degree of symptomatology or response to treatment did not reach significance.

Conclusions. These results demonstrate that the potential for secondary gain in patients who have cervical facet arthropathy as a result of a whiplash injury does not influence response to treatment. These data contradict the common notion that litigation promotes malingering. This study also confirms the efficacy of radiofrequency medial branch neurotomy in the treatment of traumatic cervical facet arthropathy.

Key words: whiplash; litigation; cervical zygapophyseal joints; cervicogenic headache; radiofrequency] **Spine 2001;26:E268-E273**

Jordan A, Mehlsen J, Ostergaard K. A Comparison of Physical Characteristics Between Patients Seeking Treatment for Neck Pain and Age-Matched Healthy People. J Manipulative Physiol Ther 20(7):468-75, 1997.

Objective: To compare physical characteristics of the cervical musculature, including maximal isometric strength of the flexors and extensors, relative isometric endurance of the extensors and the active range of motion (ROM) in extension in a group of patients seeking treatment for chronic neck pain and a group of age-matched healthy people.
Setting: Department of Medical Orthopedics, National University Hospital, Denmark.
Methods: One hundred and nineteen chronic neck-pain patients underwent physical testing for active ROM in extension, maximal isometric torque in extension and flexion and relative isometric endurance in extension before entering a clinical controlled trial studying the treatment of chronic neck pain. Their results were then compared with those of 80 age-matched healthy people.

Results: The reliability study demonstrated good within-day and day-to-day reproducibility for active ROM. Active ROM was significantly reduced in female patients, but not in all male age groups. Patients exhibited clinically and statistically significant reductions in maximal isometric torque in both the flexors and extensors of the cervical spine, with the greatest reduction seen in the extensor muscle group. Most patient groups demonstrated a significant reduction in relative isometric endurance of the extensors.
Conclusions: In agreement with most low-back comparisons between patients and age-matched healthy people, the greatest relative muscular deficiencies seem to be in the extensor muscle group. Additionally, most patients exhibit a significant decrease in active ROM during extension. The clinical utility of physical measurements has not been firmly established.

Long Term Effect of Rear-End Collisions

Numerous studies have shown that a certain percentage of rear-end collision patients suffer long-term pain and disability from their accident. On the other hand, some like to point at reports such as the Quebec Task Force report[1] and state that whiplash is a self-limiting, short-term problem.

This current study[2] sought to determine the long-term effects of automobile collisions in a large Swedish city. The researchers studied the records of 255 people who had visited the emergency room after a car crash. They measured the length of sick leave that the patients used and the number of people who received a disability pension.

Rear-end collisions were responsible for only 39% of the injuries. However, 64% of the sick leave used within 2.5 years of the collision was by people in rear-end collisions, and at the four-year follow-up, 89% of those on disability had been in rear-end collisions.

Significantly, 8% of the occupants in rear-end collisions were receiving disability payments 4 to 6 years after their accidents.

> "The current results show that every ninth person of the 141 with cervical strain injuries received disability pension or was still on sick leave 4-6 years after the time of injury, which is consistent with the results in several other studies. In two English studies, [3,4] it was reported that 14% and 8% of those with who had cervical strain injuries had persistent sequelae 8 and 4 years after the injury event, respectively. The results reported by Hildingsson and Toolanen[5] also indicate significant long-term consequences for approximately every 10th person with this type of injury. In a follow-up study 8-12 years after the injury event, Gargan and Bannister[6] state that 12% of patients with cervical strain injuries had such severe, persistent medical problems that they were forced to stop working, were treated with analgesics or cervical collar, or became large-scale health care consumers. *Murray et al*[3] also demonstrated that this type of injury causes the highest proportion of persistent medical problems."

1. *Spitzer WO, Skovron ML, Salmi LR, Cassidy JD, et al. Scientific monograph of the Quebec Task Force on Whiplash-Associated Disorders: redefining "whiplash" and its management. Spine 1995;20(Suppl):S1-73.*
2. *Bylund P, Bjornstig U. Sick leave and disability pension among passenger car occupants injured in urban traffic. Spine 1998; 23(9):1023-1028.*
3. *Murray PA, Pitcher M, Galasko CSB. The cost of long-term disability from road traffic accidents: four year study: final report. Transport Research Laboratory. University of Manchester, 1993.*
4. *Parmar HV, Raymakers R. Neck injuries from rear impact road traffic accidents: prognosis in persons seeking compensation. Injury 1993;24:75-78.*
5. *Hildingsson C, Toolanen G. Outcome after soft-tissue injury of the cervical spine: a prospective study of 93 car accident victims. Acta Orthopedica Scandinavica 1990;61:357-359.*
6. *Gargan MF, Bannister GC. Long-term prognosis of soft-tissue injuries of the neck. Journal of Bone and*

Joint Surgery [Br] 1990;72:901-903.

Spitzer WO, Skovron ML, Salmi LR, Cassidy JD, et al.; Bylund P, Bjornstig U.; Murray PA, Pitcher

Whiplash Injury Determination With Conventional Spine Imaging and Cryomicrotomy

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SPINE 2001;26:2443-2448

Study Design. Soft tissue–related injuries to the cervical spine structures were produced by use of intact entire human cadavers undergoing rear-end impacts. Radiography, computed tomography, and cryomicrotomy techniques were used to evaluate the injury.

Objectives. To replicate soft tissue injuries resulting from single input of whiplash acceleration to whole human cadavers simulating vehicular rear impacts, and to assess the ability of different modes of imaging to visualize soft tissue cervical lesions.

Summary of Background Data. Whiplash-associated disorders such as headache and neck pain are implicated with soft tissue abnormalities to structures of the cervical spine. To the authors' best knowledge, no previous studies have been conducted to determine whether single cycle whiplash acceleration input to intact entire human cadavers can result in these soft tissue alterations. There is also a scarcity of data on the efficacy of radiography and computed tomography in assessing these injuries.

Methods. Four intact entire human cadavers underwent single whiplash acceleration (3.3*g* or 4.5*g*) loading by use of a whole-body sled. Pretest and posttest radiographs, computed tomography images, and sequential anatomic sections using a cryomicrotome were obtained to determine the extent of trauma to the cervical spine structures.

Results. Routine radiography identified the least number of lesions (one lesion in two specimens). Although computed tomography was more effective (three lesions in two specimens), trauma was not readily apparent to all soft tissues of the cervical spine. Cryomicrotome sections identified structural alterations in all four specimens to lower cervical spine components that included stretch and tear of the ligamentum flavum, anulus disruption, anterior longitudinal ligament rupture, and zygopophysial joint compromise with tear of the capsular ligaments.

Conclusions. These results clearly indicate that a single application of whiplash acceleration pulse can induce soft tissue–related and ligament-related alterations to cervical spine structures. The pathologic changes identified in this study support previous observations from human volunteers observations with regard to the location of whiplash injury and may assist in the explanation of pain arising from this injury. Although computed tomography is a better imaging modality than radiography, subtle but clinically relevant injuries may be left undiagnosed with this technique. The cryomicrotome technique offers a unique procedure to understand and compare soft tissue–related injuries to the cervical anatomy caused by whiplash loading. Recognition of these injuries may advance the general knowledge of the whiplash disorder.

Key words: whiplash acceleration; computed tomography; cryomicrotomy; soft tissue injury; zygopophysial joint] **Spine 2001;26:2443–2448**

Chronic Cervical Zygapophysial Joint Pain After Whiplash: A Placebo-Controlled Prevalence Study Lord SM, Barnsley L, Wallis BJ, Bogduk N Spine 21(15):1737-44; discussion 1744-5, 1996 Aug 1

Study Design: The authors developed a diagnostic double-blindfolded survey using placebo-controlled local anesthetic blocks.
Objective: To determine the prevalence of cervical zygapophysial joint pain among patients with chronic neck pain (more than 3 months' duration) after whiplash injury.
Summary of Background Data: The prevalence of cervical zygapophysial joint pain after whiplash has been studied by means of comparative local anesthetic blocks. The concern is that such blocks may be compromised by placebo responses and that prevalence estimates based on such blocks may exaggerate the importance of this condition.
Methods: Sixty-eight consecutive patients referred for chronic neck pain after whiplash were studied. Patients with dominant headache were first screened with the use of comparative blocks of the C2-C3 zygapophysial joint. Patients who had positive responses concluded investigations. Those who did not experience pain relief together with the patients with dominant neck pain proceeded to undergo placebo-controlled local anesthetic blocks. Two different local anesthetics and a placebo injection of normal saline were administered in random order and under double-blindfolded conditions. A positive diagnosis was made if the patient's pain was completely and reproducibly relieved by each local anesthetic but not by the placebo injection.
Results: Among patients with dominant headache, comparative blocks revealed that the prevalence of C2-C3 zygapophysial joint pain was 50%. Among those without C2-C3 zygapophysial joint pain, placebo-controlled blocks revealed the prevalence of lower cervical zygapophyseal joint pain to be 49%. Overall, the prevalence of cervical zygapophysial joint pain (C2-C3 or below) was 60% (95% confidence interval, 46%, 73%).
Conclusion: Cervical zygapophysial joint pain is common among patients with chronic neck pain after whiplash. This nosologic entity has survived challenge with placebo-controlled, diagnostic investigations and has proven to be of major clinical importance.

Central Hypersensitivity in Chronic Pain After Whiplash Injury

Curatolo M, Petersen-Felix S; Arendt-Nielsen L; Giani C; Zbinden, Alex M; Radanov, Bogdan P. Central Hypersensitivity in Chronic Pain After Whiplash Injury. Clin J Pain, Volume 17(4).December 2001.306-315

Objective: The mechanisms underlying chronic pain after whiplash injury are usually unclear. Injuries may cause sensitization of spinal cord neurons in animals (central hypersensitivity), which results in increased responsiveness to peripheral stimuli. In humans, the responsiveness of the central nervous system to peripheral stimulation may be explored by applying sensory tests to healthy tissues. The hypotheses of this study were: (1) chronic whiplash pain is associated with central hypersensitivity; (2) central hypersensitivity is maintained by nociception arising from the painful or tender muscles in the neck.

Design: Comparison of patients with healthy controls.

Setting: Pain clinic and laboratory for pain research, university hospital.

Patients: Fourteen patients with chronic neck pain after whiplash injury (car accident) and 14 healthy volunteers.

Outcome Measures: Pain thresholds to: single electrical stimulus (intramuscular), repeated electrical stimulation (intramuscular and transcutaneous), and heat (transcutaneous). Each threshold was measured at neck and lower limb, before and after local anesthesia of the painful and tender muscles of the neck.

Results: The whiplash group had significantly lower pain thresholds for all tests, except heat, at both neck and lower limb. Local anesthesia of the painful and tender points affected neither intensity of neck pain nor pain thresholds.

Conclusions: The authors found a hypersensitivity to peripheral stimulation in whiplash patients. Hypersensitivity was observed after cutaneous and muscular stimulation, at both neck and lower limb. Because hypersensitivity was observed in healthy tissues, it resulted from alterations in the central processing of sensory stimuli (central hypersensitivity). Central hypersensitivity was not dependent on a nociceptive input arising from the painful and tender muscles.

LUMBAR SPINE

Repeated Injury to the Lumbar Nerve Roots Produces Enhanced Mechanical Allodynia and Persistent Spinal Neuroinflammation

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SPINE 2001;26:2073-2079

Study Design. A lumbar radiculopathy model investigated pain behavioral responses after nerve root reinjury.
Objectives. To gain a further understanding of **central sensitization** and neuroinflammation associated with chronic lumbar radiculopathy after repeated nerve root injury.
Summary of Background Data. The pathophysiologic mechanisms associated with chronic radicular pain remain obscure. It has been hypothesized that lumbar root injury produces neuroimmunologic and neurochemical changes, sensitizing the spinal cord and causing pain responses to manifest with greater intensity and longer duration after reinjury. However, this remains untested experimentally.
Methods. Male Holtzman rats were divided into two groups: a sham group having only nerve root exposure, and a chromic group in which the nerve root was ligated loosely with chromic gut suture. Animals underwent a second procedure at 42 days. The chromic group was further divided into a reinjury group and a chromic-sham group, in which the lumbar roots were only re-exposed. Bilateral mechanical allodynia was continuously assessed throughout the study. Qualitative assessment of spinal cord glial activation and IL-β expression was performed.
Results. Mechanical allodynia was significantly greater on both the ipsilateral and contralateral sides after reinjury ($P < 0.001$), and the response did not return to baseline after reinjury, as it did with the initial injury. There were also persistent spinal astrocytic and microglial activation and interleukin-1β expression.
Conclusions. The bilateral responses support central modulation of radicular pain after nerve root injury. An exaggerated and more prolonged response bilaterally after reinjury suggests central sensitization after initial injury. Neuroinflammatory activation in the spinal cord further supports the hypothesis that central neuroinflammation plays an important role in chronic radicular pain.
Key words: lumbar radiculopathy; central sensitization; neuropathic pain; persistent pain; spinal neuroinflammation; nociception] **Spine 2001:26:2073–2079.**

Depression and Chronic Low Back Pain

Establishing Priorities in Treatment

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SPINE 2000;25:2566-2571

It is a common clinical observation that patients with chronic pain also manifest concurrent psychiatric illness,[17] most commonly depression. The association between chronic pain and depression remains a complex one. "Depression" may refer to a temporary bad mood, a reaction to concurrent stresses or losses, a chronic state of "dysthymia," or "major depression." This last illness is characterized by 2 weeks or more of either sustained and pervasive sad mood, or loss of interest and pleasure in everyday life. Accompanying this are at least four of the following: change in weight, sleep disturbance, psychomotor agitation or retardation, fatigue, guilty ruminations, difficulty thinking or concentrating, and recurrent thoughts of death or suicide. This is a summary of present knowledge about depression that informs the care of patients with chronic pain and current knowledge about patients with chronic pain when they are also affected with depression. We will conclude with clinical implications of this current body of knowledge to the management of patients with chronic pain, particularly chronic low back pain. Differential diagnosis, anticipated outcomes, the decision for or against surgery as a treatment for chronic low back pain, as well as implications for overall patient management are discussed.

Point of View: Complex Regional Pain Syndrome Type 2 (Causalgia) After Automated Laser Discectomy

A Case Report

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SPINE 1997;22:461-462

There remains a great deal of controversy regarding the diagnosis and management of causalgia and reflex sympathetic dystrophy. In 1864, a civil war physician, Silas Weir Mitchell, documented a syndrome of intense burning pain and vasomotor dysfunction in union soldiers suffering partial nerve injury after gunshot wounds and later coined the term *causalgia.*[5] Mitchell's accounts included vivid descriptions of "...red-hot fire rasping the skin;...favoured site is the foot or hand;...exquisitely hyperesthetic, so that a touch or a tap of a finger increases the pain; ... deep red or mottled glossy skin." Over time, several conditions with common signs and symptoms were reported as distinct clinical disorders; a partial list includes: causalgia, minor causalgia, algodystrophy, post-traumatic vasomotor disorder, Sudeck's atrophy, post-traumatic painful osteoporosis, and shoulder-hand syndrome. In 1953, John Bonica published *The Management of Pain,* wherein he observed that these conditions had similar features and proposed that the term *reflex sympathetic dystrophy syndrome* (RSDS) be applied to all these entities.[1] However, the role of the sympathetic nervous system in these patients has not been determined. Recent evidence suggests that patients with RSDS have normal sympathetic efferent activity, thus making the role of the sympathetic nervous system anything but clear.[2,8] In 1993, pain experts at a consensus workshop recommended that this pain disorder be renamed using a descriptive, "umbrella" term that will support future discoveries regarding pathophysiology.[7] The term *complex regional pain syndrome* (CRPS) now has been adopted by the International Association for the Study of Pain (IASP).[4] CRPS is subclassified as Type I, referring to clinical symptoms of RSDS where no nerve trauma is identified. Type II CRPS applies to cases previously termed "causalgia" after a documented nerve injury.

Risk Factors Associated With the Transition From Acute to Chronic Occupational Back Pain

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SPINE 2002;27:92-98

Study Design. A prospective cohort study was conducted on workers claiming earnings-related compensation for low back pain. Information obtained at the time of the initial claim was linked to compensation status (still claiming or not claiming) 3 months later.

Objective. To identify individual, psychosocial, and workplace risk factors associated with the transition from acute to chronic occupational back pain.

Summary of Background Data. Despite the magnitude of the economic and social costs associated with chronic occupational back pain, few prospective studies have investigated risk factors identifiable in the acute stage.

Methods. At the time of the initial compensation claim, a self-administered questionnaire was used to gather information on a wide range of risk factors. Then 3 months later, chronicity was determined from claimants' computerized records.

Results. The findings showed that 3 months after the initial assessment, 204 of the recruited 854 claimants (23.9%) still were receiving compensation payments. A combined multiple regression model of individual, psychosocial, and workplace risk factors demonstrated that **severe leg pain** (odds ratio [OR], 1.9), **obesity** (OR, 1.7), all three **Oswestry Disability Index categories** above minimal disability (OR, 3.1–4), a **General Health Questionnaire** score of at least 6 (OR, 1.9), unavailability of light duties on return to work (OR, 1.7), and a job requirement of lifting for three fourths of the day or more all were significant, independent determinants of chronicity ($P < 0.05$).

Conclusions. Simple self-report measures of individual, psychosocial, and workplace factors administered when earnings-related compensation for back pain is claimed initially can identify individuals with increased odds for development of chronic occupational disability.

Key words: chronic back pain; occupational back injury; risk factors] **Spine 2002;27:92–98.**

2001 Volvo Award Winner in Clinical Studies: Effects of a Media Campaign on Back Pain Beliefs and Its Potential Influence on Management of Low Back Pain in General Practice

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SPINE 2001;26:2535-2542

Study Design. Quasi-experimental, nonrandomized, nonequivalent, parallel group-controlled study involving before and after telephone surveys of the general population and postal surveys of general practitioners was conducted, with an adjacent state used as a control group.

Objectives. To evaluate the effectiveness of a population-based intervention designed to alter beliefs about back pain, influence medical management, and reduce disability and workers´ compensation-related costs.

Summary of Background Data. A multimedia campaign begun during 1997 in Victoria, Australia, positively advised patients with back pain to stay active and exercise, not to rest for prolonged periods, and to remain at work.

Methods. The campaign´s impact on population beliefs about back pain and fear-avoidance beliefs was measured in telephone surveys, and the effect of the campaign on the potential management of low back pain by general practitioners was assessed by eliciting their likely approach to two hypothetical scenarios in mailed surveys. Demographically identical population groups in Victoria and the control state, New South Wales, were surveyed at three times: before, during, and after intervention in Victoria.

Results. The studies were completed by 4730 individuals in the general population and 2556 general practitioners. There were large statistically significant improvements in back pain beliefs over time in Victoria (mean scores on the Back Beliefs Questionnaire, 26.5, 28.4, and 29.7), but not in New South Wales (26.3, 26.2, and 26.3, respectively). Among those who reported back pain during the previous year, fear-avoidance beliefs about physical activity improved significantly in Victoria (mean scores on the Fear-Avoidance Beliefs Questionnaire for physical activity, 14, 12.5, and 11.6), but not in New South Wales (13.3, 13.6, and 12.7, respectively). General practitioners in Victoria reported significant improvements over time in beliefs about back pain management, as compared with their interstate colleagues. There were statistically significant interactions between state and time for 7 of 10 responses on management of acute low back pain, and for 6 of 10 responses on management of subacute low back pain.

Conclusion. A population-based strategy of providing positive messages about back pain improves the beliefs of the general population and general practitioners about back pain and appears to influence medical management.

Key words: back pain; beliefs; disability; population based; primary care; primary prevention] **Spine 2001;26:2535-2542**

Abstracts: *The Journal of Pain*, Volume 2, Number 5, October, 2001:

Gender Role Expectations of Pain: Relationship to Sex Differences in Pain

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About one in six U.S. adults is in pain at any given moment. Several published studies have suggested that women may be over represented among those reporting pain. Further, women are known to more often report

multiple pain sites, intense pain and frequent pain. Most researchers have emphasized sex differences in pain response, but only with regard to biological mechanisms.

This study investigates a new measure, the Gender Role Expectations of Pain (GREP) questionnaire, to assess sex-related stereotypic attributions of pain sensitivity, endurance and willingness to report pain. Using GREP, researchers studied 156 male and 235 female university students. Results supported the hypotheses about gender role. Both men and women rated men as less willing to report pain, considered women more sensitive to pain, and believe women have less endurance of pain. The findings suggest that GREP is an excellent tool for distinguishing the socially learned reactions to pain for men and women.

Perceived Spouse Responsiveness to Chronic Pain

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Until this study, no published research had explored patterns of perceived spouse responsiveness to pain. It has been assumed that the behaviors of a married patient with chronic pain may be influenced by spousal response and by a context of decreased social and occupational interaction. Is there a better adjustment to pain when a spouse is perceived to consistently respond to the patient's expression of pain? What quality and type of perceived response are associated with better function?

To answer these questions, researchers evaluated 744 patients (360 women and 414 men) from two pain clinics associated with the University of Florida. They identified three distinct subgroups of perceived spousal responsiveness: positively attentive, negatively attentive and inattentive. The positively attentive subgroup had high scores for solicitous and distracting responses, the negatively attentive subgroup was high on punishing responses, and the inattentive subgroup was low on all response scales.

Results of the analysis suggest that the profiles have conceptual and clinical validity. Patients whose spouses were in the inattentive or negatively attentive subgroups had poor adjustment to pain. Patients with positively attentive spouses showed the highest social activity score, which suggest that these patients, with the support of their spouses, were able to maintain some social activities.

Acupuncture for Chronic Low Back Pain: A Randomized Placebo-Controlled Study With Long-Term Follow-Up

Objective: To authors sought to determine whether a series of needle acupuncture treatments produced long-term relief of chronic low back pain.

Design: A blinded placebo-controlled study with an independent observer. The patients were randomized to receive manual acupuncture, electroacupuncture, or active placebo (mock transcutaneous electrical nerve stimulation). Subjects were examined and monitored by an investigator who was blinded to the treatment given.

Setting: A tertiary-level pain clinic at a Swedish university hospital.

Patients: Fifty consecutive patients (33 women, 17 men; mean age, 49.8 years) with chronic low back pain (mean pain duration, 9.5 years) and without rhizoplasty or history of acupuncture treatment were included in the study.

Interventions: Treatments were given once per week for 8 weeks. Two further treatments were given during the follow-up assessment period of 6 months or longer.

Outcome Measures: The independent observer made a global assessment of the patients, 1, 3, and 6 months after treatment. The patients kept pain diaries to score pain intensity twice daily analgesic intake, and quality of sleep daily, and activity level weekly.

Results: At the 1-month independent assessment, 16 of 34 patients in the acupuncture groups and 2 of 16 patients in the placebo group showed improvement ($p < 0.05$). At the 6-month follow-up assessment, 14 of 34 patients in the acupuncture groups and 2 of 16 patients in the placebo group showed improvement ($p < 0.05$). A significant decrease in pain intensities occurred at 1 and 3 months in the acupuncture groups compared with the placebo group. There was a significant improvement in return to work, quality of sleep, and analgesic intake in subjects treated with acupuncture.

Conclusions: The authors found a long-term pain-relieving effect of needle acupuncture compared with true placebo in some patients with chronic nociceptive low back pain.

Carlsson CPO, Sjölund BH. Acupuncture for Chronic Low Back Pain: A Randomized Placebo-Controlled Study With Long-Term Follow-Up. Clinical Journal of Pain. 2001;17:296-305.

Lumbar Sagittal Balance Influences the Clinical Outcome After Decompression and Posterolateral Spinal Fusion for Degenerative Lumbar Spondylolisthesis

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SPINE 2002;27:59-64

Study Design. This study was designed to assess both lumbar sagittal balance and clinical outcomes of decompression and posterolateral fusion for degenerative lumbar spondylolisthesis. As an index for the radiologic evaluation of sagittal alignment, the L1 axis S1 distance was used (*i.e.*, the horizontal distance from the plumbline of the center in the L1 to the back corner of the S1).

Objective. To determine whether lumbar sagittal balance affected the clinical outcome after posterolateral fusion.

Summary of Background Data. Little is known about whether the sagittal vertical axis influences clinical outcomes in cases of degenerative lumbar spondylolisthesis.

Methods. A retrospective review of 47 patients (15 men and 32 women), ranging in age from 41 to 79 years, was conducted. The mean follow-up period was 3.6 years. Relations among outcomes including the visual analog pain scale, recovery rate, L1 axis S1 distance, slippage, and lumbar lordosis were evaluated.

Results. Recovery rates were 44% and 62% in patients whose preoperative L1 axis S1 distance, respectively, was more than 35 mm (Group A, n = 16) and less than 35 mm (Group B, n = 31) ($P < 0.05$). Follow-up assessment found a positive correlation between only lordosis and recovery rate. Severe low back pain and lower recovery rate were observed in patients with *in situ* fusion in Group A (n = 9), as compared with patients with reduced slippage in Group A (n = 7) and patients in Group B.

Conclusions. Both preoperative L1 axis S1 distance and lordosis at follow-up assessment affected surgical outcome. Reduction of slippage may improve clinical outcomes of posterolateral fusion for degenerative lumbar spondylolisthesis with an L1 axis S1 distance more than 35 mm.

Key words: clinical outcome; degenerative lumbar spondylolisthesis; posterolateral spinal fusion; sagittal balance] **Spine 2002;27:59–64**

Young Investigator Award 2001 Winner: Risk Factors for Lumbar Disc Degeneration

A 5-Year Prospective MRI Study in Asymptomatic Individuals

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SPINE 2002;27:125-134

Study Design. A longitudinal magnetic resonance imaging investigation of lumbar disc degeneration in asymptomatic individuals was conducted.

Objective. To investigate risk factors for the development or deterioration of lumbar disc degeneration.

Summary of Background Data. Numerous studies have explored the significance of certain risk factors for the development or progression of disc degeneration, but no comprehensive longitudinal magnetic resonance imaging–based study has been reported that simultaneously considers clinical, morphologic, physical, psychosocial, and occupational risk factors.

Methods. In the 5-year follow-up evaluation of 41 asymptomatic individuals, the risk factors for the development of lumbar disc degeneration and its progression were investigated. All 41 individuals had a magnetic resonance imaging scan at baseline and at the minimum 5-year follow-up assessment using the same scanner and protocol. The magnetic resonance images were analyzed independently by two radiologists with regard to disc degeneration. Various predictor variables were assessed both at baseline and follow-up, with special emphasis on physical job characteristics, sports activities, and magnetic resonance image–based morphologic findings.

Results. Of the 41 individuals, 17 (41%) exhibited a deterioration of the disc status. In 10 individuals, the progression of disc degeneration was one grade or more. Only a weak correlation existed between progressive disc degeneration and low back pain development during a 5-year follow-up period. Multiple logistic regression

analysis demonstrated that the extent of **disc herniation** (odds ratio [OR], 12.63; confidence interval [CI], 1.24–128.49), **the lack of sports activities** (OR, 2.71; CI, 1.04–7.07), and **night shift work** (OR, 23.01; CI, 1.26–421.31) were significant predictors for disc degeneration during follow-up evaluation when control was used for the number of degenerated discs at baseline, gender, age, and body mass index.

Conclusions. The results indicate that the extent of disc herniation, the lack of sports activities, and night shift work are significant risk factors for the development of lumbar disc degeneration and its progression.

Key words: asymptomatic individuals; low back pain; MRI—disc degeneration; natural history; night work; prediction; work-related risk factors] **Spine 2002;27:125–134**

2001 Volvo Award Winner in Clinical Studies: Lumbar Fusion *Versus* Nonsurgical Treatment for Chronic Low Back Pain

A Multicenter Randomized Controlled Trial From the Swedish Lumbar Spine Study Group

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Members of the Swedish Lumbar Spine Study Group are listed in the Appendix at the end of this article.

SPINE 2001;26:2521-2532

Study Design. A randomized controlled multicenter study with a 2-year follow-up by an independent observer.

Objectives. To determine whether fusion of the lower lumbar spine could reduce pain and diminish disability more effectively when compared with nonsurgical treatment in patients with severe chronic low back pain (CLBP).

Summary of Background Data. The reported results after fusion surgery on patients with CLBP vary considerably, and the evidence of treatment efficacy is weak in the absence of randomized controlled studies.

Patients and Methods. A total of 294 patients referred to 19 spinal centers from 1992 through 1998 were randomized blindly into four treatment groups. Patients aged 25–65 years with CLBP for at least 2 years and with radiologic evidence of disc degeneration at L4–L5, L5-S1, or both were eligible to participate in the study. The surgical group (n=222) included three different fusion techniques, not analyzed separately in this study. Patients in the nonsurgical group (n=72) were treated with different kinds of physical therapy. The surgical group comprised 49.5% men, and the mean age was 43 years. The corresponding figures for the nonsurgical group were 48.6% and 44 years. The patients had suffered from low back pain for a mean of 7.8 and 8.5 years and been on sick leave due to back pain for a mean of 3.2 and 2.9 years, respectively. The Visual Analogue Scale (VAS) was used to measure pain. The Oswestry Low Back Pain Questionnaire, the Million Score and the General Function Score (GFS) were used to measure disability. The Zung Depression Scale was used to measure depressive symptoms. The overall result was assessed by the patient and by an independent observer. Records from the Swedish Social Insurance were used to evaluate work disability. Patients who changed groups were included in the analyses of significance according to the intention-to-treat principle.

Results. At the 2-year follow-up 289 of 294 (98%) patients, including 25 who had changed groups, were examined. Back pain was reduced in the surgical group by 33% (64 to 43), compared with 7% (63 to 58) in the

nonsurgical group (P=0.0002). Pain improved most during the first 6 months and then gradually deteriorated. Disability according to Oswestry was reduced by 25% (47 to 36) compared with 6% (48 to 46) among nonsurgical patients (P=0.015), according to Million by 28% (64 to 46) compared with 8% (66 to 60) (P=0.004), and accordingtoGFS by 31% (49 to 34) compared with 4% (48 to 46) (P=0.005). The depressive symptoms, according to Zung, were reduced by 20% (39 to 31) in the surgical group compared with 7% (39 to 36) in the nonsurgical group (P=0.123). In the surgical group 63% (122/195) rated themselves as "much better" or "better" compared with 29% (18/62) in the nonsurgical group (P<0.0001). The "net back to work rate" was significantly in favor of surgical treatment, or 36% vs. 13% (P=0.002). The early complication rate in the surgical group was 17%.

Conclusion. Lumbar fusion in a well-informed and selected group of patients with severe CLBP can diminish pain and decrease disability more efficiently than commonly used nonsurgical treatment.

Key words: chronic low back pain; degenerative disc disease; lumbar spinal fusion; nonsurgical treatment; clinical outcome; multicenter randomized controlled trial] **Spine 2001;26:2521–2534.**

Prognostic Value of the Quebec Classification of Whiplash-Associated Disorders

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SPINE 2001;26:36-41

Study Design. Retrospective cohort.
Objectives. 1) Evaluate the utility of the Québec Classification of Whiplash-Associated Disorders as an initial assessment tool; 2) assess its ability to predict persistence of symptoms at 6, 12, 18, and 24 months postcollision; 3) examine one potential modification to the Classification.
Summary of Background Data. In 1995, a task force from Québec, Canada, developed the Québec Classification of Whiplash-Associated Disorders to assist health care workers in making therapeutic decisions. The Classification was applied to an inception cohort of patients presenting for emergency medical care following their involvement in a rear-end motor vehicle collision.
Methods. All patients (n = 446) presenting to the only two emergency departments serving Kingston, Ontario, between October 1, 1995 and March 31, 1998 were considered for inclusion in the study. Eligible patients (n = 380) were categorized according to the Classification based on signs and symptoms documented in their emergency medical chart. Attempts were made to interview all patients shortly following and again 6 months after their collision. Patients were contacted at 12, 18, and 24 months postinjury only if sufficient time had elapsed between recruitment into and cessation of the study. Data were gathered regarding symptoms, treatments received, effects on usual activities, crash circumstances, and personal factors. Associations between initial Classification grade and the frequency/intensity of follow-up symptoms were quantified *via* multivariable analyses.
Results. The Classification was prognostic in that risk for Whiplash-Associated Disorders at 6, 12, 18, and 24 months increased with increasing grade. Analyses supported modification of the Classification to distinguish between Grade II cases of Whiplash-Associated Disorders with normal or limited range of motion. The greatest risk for long-term symptoms was seen among the group of patients with both point tenderness and limited range of motion.
Conclusion. The analyses of this study support the use of the Québec Classification of Whiplash-Associated Disorders as a prognostic tool for emergency department settings, and the authors propose a modification of the Classification using a subdivision of the Grade II category.
Key words: whiplash injuries classification; prognosis; accidents; traffic; Quebec epidemiology

Whiplash Associated Disorders: Prognosis

1. Prognostic Value of the Quebec Classification of Whiplash-Associated Disorders
   a. As the grade increased, the prognosis worsened assessed at 6, 12, 18, & 24 months
   b. The second category was divided into 2
   c. Classification:

WAD Clinical Classification

GRADE	**Clinical Presentation**	**Notes**
0	No complaint about the neck & no physical signs.	
I	Neck complaint of pain, stiffness, or tenderness only; no physical signs.	*SUBDIVISION of Grade II*
II	Neck complaint and musculoskeletal sign(s): decreased ROM and point tenderness	IIa: Point tender w normal ROM IIb: Point tender w abnormal ROM
III	Neck complaint and neurological sign(s): decreased or absent DTRs, weakness, & sensory deficits	
IV	Neck complaint & fracture or dislocation	(Excluded in the prognostic analysis)
Note: Symptoms and disorders that can appear in all grades include deafness, dizziness, tinnitus, headache, memory loss, dysphagia, and temporomandibular joint pain		

Harling L, Brison RJ, Ardern C, Pickett W. Prognostic Value of the Quebec Classification of Whiplash-Associated Disorders. Spine 2001;26:36-41.

PROGNOSIS SCALE

Name_____ BD / Age_____/_____ Date_____

(Norris, S.H., Watt, I: The Prognosis of Neck Injuries Resulting from Rear-End Vehicle Collisions. J. Bone & Joint Surgery. 65B: 608-611, 1983.

MAJOR INJURY CATEGORY (MIC)	**DEFINITION**	**POINT VALUE**
MIC 1	**Symptoms without significant objective findings**	**10**
MIC 2	**Decreased range of motion (ROM) without neurological findings**	**50**
MIC 3	**Symptoms, ROM decreases and neurological loss (sensory or motor)**	**90**

MODIFIERS

Canal size of 10-12 mm	**20**
Canal size of 13-15 mm	**15**
Kyphotic curve	**15**
Fixated segment of flexion and extension films	**15**
Loss of consciousness	**15**
Straight cervical curve	**10**
Pre-existing degeneration	**10**

INTERPRETATION	**TOTAL POINTS**
Prognosis Group 1 (PG 1)	**10-30**
MIC 1 with one major or two minor modifiers. The prognosis is excellent (no objective finding and few modifiers). Residual symptoms may include intermittent, mild muscle pain and/or occipital headaches. (HA)	

Prognosis Group 2 (PG 2) **MIC 1 or 2 patients with modifiers. Prognosis is good as future neurological losses are unlikely. Residual symptoms include intermittent, moderate neck pain, decreased ROM and HA.**	**35-70**
Prognosis Group 3 (PG 3) **Comprised of MIC 2 with several modifiers or MIC 3 patients. Prognosis is poor, and neurological deficits are possible. If MIC 3 with few modifiers, neurological symptoms may resolve. Residual symptoms include PG1 and PG2 residuals plus area of numbness or more rarely, muscle weakness.**	**75-100**
Prognosis Group 4 (PG 4) **MIC 2 and 3 with many modifiers. The prognosis is guarded as persistent neurological deficits are likely. More motor losses are likely and a fair probability of future surgical need exists.**	**105-125**
Prognosis Group 5 (PG5) **"Unstable" clinical pattern. Neurological losses, modifiers and future surgical need are probable. Radiculopathy and/or myelopathy are primary complication(s).**	**130-165**

The Reliability of the Shuttle Walking Test, the Swiss Spinal Stenosis Questionnaire, the Oxford Spinal Stenosis Score, and the Oswestry Disability Index in the Assessment of Patients With Lumbar Spinal Stenosis

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Study Design. The Shuttle Walking Test (SWT), the Swiss Spinal Stenosis (SSS) Questionnaire, the Oxford Claudication Score (OCS), and the Oswestry Disability Index (ODI) were administered to patients with lumbar spinal stenosis and neurogenic claudication.

Objective. To determine reliability of the SWT, the SSS (Q1-12), the OCS, and the ODI in lumbar spinal stenosis assessment.

Summary of Background Data. Reliability data for exercise tests in lumbar spinal stenosis are lacking.

Methods. To determine reliability, 32 clinic patients with lumbar spinal stenosis were assessed twice, with 1 week between assessments. Retrospective data from 17 patients assessed before surgery and 18 months after surgery for lumbar spinal stenosis were used to investigate the use of reliability in a clinical setting.

Results. Test-retest reliability in terms of the intraclass correlation coefficient (ICC) was 0.92 for the SWT, 0.92 for the SSS, 0.83 for the OCS and 0.89 for the ODI. The mean percentage scores were 51 for the SSS, 45 for the OCS, and 40 for the ODI. To achieve 95% certainty of change between assessments for a single patient, the SSS would need to change by 15, the OCS by 20, and the ODI by 16. The mean SWT was 150 m, with a change of 76 m required for 95% confidence. Cronbach´s alpha was 0.91 for the SSS, 0.90 for the OCS, and 0.89 for the ODI. The change in ODI correlated most strongly with patient satisfaction after surgery ($\rho = 0.80$; $P < 0.001$).

Conclusions. Fluctuations in a patient´s symptoms result in wide individual confidence intervals. Performance on the SSS, OCS, and ODI questionnaires are broadly similar, the most precise being the condition-specific SSS. The SWT gives a snapshot of physical function, which is acceptable for group analysis. Use of the SWT for individual assessment after surgery is feasible.

Key words: functional status; lumbar spinal stenosis; measurement; neurogenic claudication; outcome; reliability] **Spine 2002;27:84-91**

Table 4. The Shuttle Walking Test (SWT)*

A 10-m course (one shuttle) is measured on flat ground without obstacles and is marked. A tape recorder plays the SWT prerecorded tape, which explains the test to the patient. The patient must reach the end of the walkway within a specified time dictated by a beep sounding from the tape. During the first minute of the test, beeps sound each 20 seconds, and three shuttles (30 m) are completed. During the second minute, four shuttles are completed; during the third minute five shuttles are completed; and so on up to 14 transits in 12 minutes, with a maximum total distance of 1020 m. The assessor counts the number of completed shuttles.

The test ends when the patient can no longer complete a shuttle before the next beep sounds. If the patient is within 50 cm of the end of the shuttle when the beep sounds, he or she is given the opportunity to make up the distance during the next shuttle.

The result of the test is given in meters (number of completed shuttles multiplied by 10).

* A tape of the shuttle test is available from Pulmonary Rehab Coordinator, Respiratory Medicine, Glenfield Hospital, Groby Road, Leicester LE3 9QP, UK (Phone +44 116 287 1471).

Spinal Stenosis Treatment Outcome Questionnaire

Symptom Severity Scale

In the LAST MONTH, how would you describe:	**1**	**2**	**3**	**4**	**5**
1. The pain you have had on average including pain in your back, buttocks and pain that goes down the legs?	NONE	MILD	MODERATE	SEVERE	VERY SEVERE
2. How often have you had back, buttock, or let pain?	More than once a week	At least once a week	Everyday, for at least a few minutes.	Everyday for most of the day.	Everyday, every minute of the day.
3. The pain in your back or buttocks?	NONE	MILD	MODERATE	SEVERE	VERY SEVERE
4. The pain in your legs or feet?	NONE	MILD	MODERATE	SEVERE	VERY SEVERE
5. Numbness or tingling in your legs or feet?	NONE	MILD	MODERATE	SEVERE	VERY SEVERE
6. Weakness in your legs or feet?	NONE	MILD	MODERATE	SEVERE	VERY SEVERE
7. Problems with your balance?	NONE		**SOMETIMES** balance is off, less sure footed		**OFTEN** balance is off and not sure footed

Physical Function Scale

In the LAST MONTH, on a typical day:	**1**	**2**	**3**	**4**
1. How far have you been able to walk?	> 2 miles	> 2 blocks but < 2 miles	> 50 feet but < 2 blocks	Less than 50 feet
2. Have you taken walks outdoors or in malls for pleasure?	Yes, comfortably	Yes, but sometimes with pain	Yes, but always with pain	No
3. Have you been shopping for groceries or other items?	Yes, comfortably	Yes, but sometimes with pain	Yes, but always with pain	No
4. Have you walked around the different rooms in your house or apartment?	Yes, comfortably	Yes, but sometimes with pain	Yes, but always with pain	No
5. Have you walked from your bedroom to the bathroom?	Yes, comfortably	Yes, but sometimes with pain	Yes, but always with pain	No

Satisfaction Scale	**1**	**2**	**3**	**4**

How satisfied are you with:	Very Satisfied	Somewhat Satisfied	Somewhat dissatisfied	Very dissatisfied
1. The overall result of back operation?				
2. Relief of pain following the operation?				
3. Your ability to walk following the operation?				
4. Your ability to do housework, yard work, or job following the operation?				
5. Your strength in the thighs, legs, and feet?				
6. Your balance, or steadiness on your feet?				

Name _____ Age _____Date_____Score_____

Stucki G, Daltroy L, Liang MH, Lipson SJ, Fossel AH, Katz JN. Measurement properties of a self-administered outcome measure in lumbar spinal stenosis. Spine 1996;21:796-803.

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Does the evidence for spinal manipulation translate into better outcomes in routine clinical care for patients with occupational low back pain? A case-control study

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Abstract

Background context

Previous research has identified clinical characteristics of patients who are likely to respond favorably to thrust manipulation. The application of this evidence and its effect on clinical outcomes among patients with occupational low back pain has not been examined.

Purpose

Examine patients treated in physical therapy with occupational low back pain who fit a subgroup likely to respond to thrust manipulation.

Study design/setting

Retrospective review of clinical database.

Patient sample

Patients with low back pain of less than 16 days duration with no symptoms distal to the knee or signs of nerve root compression receiving workers' compensation and referred to physical therapy were included.

Outcome measures

Self-report measures: numeric pain rating and Oswestry disability questionnaire.

Functional measures

Number of visits, duration, and costs of physical therapy.

Methods

Physical therapy notes for the first two sessions were examined. Patients were categorized as having received thrust manipulation, nonthrust manipulation, or no manipulation. Pain intensity and disability were recorded at initial and final sessions. The number of sessions, length of stay, and costs of physical therapy were recorded. Comparisons were made between patients receiving manipulation versus no manipulation, and between those receiving thrust versus nonthrust manipulation.

Results

Two hundred fifteen patients were included (mean age 35.9 [±10.1] years, 67.9% male). Thrust manipulation was received by 107 (49.8%) patients; 36 (16.7%) received nonthrust manipulation and 72 (33.5%) received no manipulation. Patients receiving manipulation (thrust or nonthrust) experienced greater reductions in pain and disability with treatment. Patients receiving thrust manipulation had fewer sessions, a shorter length of stay, and lower costs in physical therapy than patients receiving nonthrust manipulation.

Conclusions

The evidence supporting superior clinical outcomes with the use of manipulation for a subgroup of patients was corroborated by this retrospective review of patients with occupational low back pain. The use of thrust manipulation appeared to be more efficient than the use of nonthrust manipulation for these patients.

Keywords: Low back pain, Work-related, Physical therapy, Subgrouping, Manipulation

Physeal Widening in the Knee Due to Stress Injury in Child Athletes

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OBJECTIVE. The objective of our study was to describe the MRI appearance of and possible mechanism responsible for physeal widening in the knees of high-level child athletes.

CONCLUSION. Widened physes in the knees of skeletally immature child athletes have MR signal characteristics similar to the normal physis but likely are a sign of stress injury. These children should cease the offending sport and rest the knee to allow rapid healing.

Key Words: growth plates • knee • MRI • musculoskeletal imaging • pediatric imaging • physes • sports medicine • trauma

Case History

Clinical Pearl

Review of the Literature

Current Events

Attribution

Ed Payne, FCER,