

**Benefits of Chiropractic**

**Spinal Manipulation on Fibromyalgia Patients**

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# **Abstract**

## **Objectives**

The objectives of this study were to examine the research done on fibromyalgia patients with the use of spinal adjusting and the benefits that could be seen from it.

## **Methods**

The method used in the collection of data was searching on electronic database of articles on pubmed, googlescholar, chiroaccess, index to chiropractic research, and rehabilitation research center.

## **Results**

With the information collected, there were articles that both showed benefit and some that did not show benefit with use of adjusting the spine with fibromyalgia patients. Results varied with showing positive benefits in certain symptoms of fibromyalgia and also others with no positive effects on the symptoms of fibromyalgia patients.

## **Conclusion**

There was not enough research done in the topic of manipulation of the spine of fibromyalgia patients. There are few articles dealing in the topic and none of the articles deal with manipulation on its own, most are in conjunction with other techniques. More research must be done before a reliable conclusion can be decided.

## **Keywords:**

*Fibromyalgia, symptoms, manipulation, results*

## Introduction

Fibromyalgia is the most common cause of widespread pain, and is one of the most common disorders the general population is facing today. Hains stated “The prevalence of fibromyalgia in the general population is between 3% and 5%. It has been estimated that 2% to 6% of these patients seen in a primary practice have this chronic condition, and the number could be as high as 20% in rheumatology practices. Women appear to be 10 to 20 times more likely to acquire the disorder more than men. The mean age is 20 and 40 years of age but fibromyalgia can affect many more age groups.” (5) The Mayo clinic describes fibromyalgia as an “A disorder characterized by widespread musculoskeletal pain accompanied by fatigue, sleep, memory and mood issues. Researchers believe that fibromyalgia amplifies painful sensations by affecting the way your brain processes pain signals.”

Symptoms sometimes begin after a physical trauma, surgery, infection or significant psychological stress. In other cases, symptoms gradually accumulate over time with no single triggering event. In 1990, the college of rheumatology established a classification criterion for FMS that included a history of chronic widespread pain along with moderate pain or tenderness in at least 11 of 18 tender points. Wolfe & Hausser state “Widespread pain” is defined as pain in the axial skeleton of the body (cervical spine, anterior chest, thoracic spine and low back), pain in the left side of the body, pain in the right side of the body, pain above the waist and pain below the waist (14).

In 2010 the American college of rheumatology revised the criteria. Instead of assessing tender points, the new criteria relied on a detailed interview and examination to evaluate total

body pain using a widespread-pain index scale (0-19) that takes in to account 19 locations on the body. Locations include areas of the jaws, abdomen, chest, arms, legs, hips, shoulders, neck and back (14).

The purpose of this paper is to investigate chiropractic claims to its being able to help the signs and symptoms of fibromyalgia.

### **Discussion**

In clinical studies of fibromyalgia the following symptoms accompanying pain are usually reported: headache, fatigue, sleep disorders, irritable bowel syndrome, and restless leg syndrome, but patients with fibromyalgia may also report other symptoms such as paresthesia in the upper limbs, hemorrhoids or epistaxis. Most patients with fibromyalgia remain symptomatic for several years and no cure has been identified. Since most if not all the symptoms listed are usually treated by chiropractors, it should be seen that fibromyalgia patients can be helped greatly with being treated by a chiropractor.

One study that was done by Blunt, "Effectiveness of Chiropractic management of fibromyalgia patients: a pilot study." (1) The studies main goal was to demonstrate the effectiveness of chiropractic management for fibromyalgia patients using reported pain levels, cervical and lumbar ranges of motion, strength, flexibility, tender points, myalgic score and perceived functional ability as outcome measures. This study was a preliminary randomized control crossover trial.

The research consisted of Twenty-one rheumatology patients (25-70 yr). The treatment consisted of 4 week of spinal manipulation, soft tissue therapy and passive stretching at the chiropractors' discretion. The control intervention was Chiropractic management withheld for 4 weeks with continuation of prescribed medication. The outcome measures used in this research was changes in scores on the Oswestry Pain Disability Index (Appendix 1), Neck Disability Index (Appendix 2), Visual Analogue Scale (Appendix 3), straight leg raise, and lumbar, and cervical ranges of motion were observed.

The results of this research by Hains are as follows: “Chiropractic management improved patients' cervical and lumbar ranges of motion, straight leg raise and reported pain levels. These changes were judged to be clinically important within the confines of our sample only.” (5).

More of this research is paramount to see the benefits patients can receive from chiropractic treatment that are dealing with fibromyalgia. The research shows how patient can improve in range of motion and also on different pain index's just by simply being adjusted and also treated with active and passive stretching. Even though it is a small sample size, fibromyalgia is still a relatively new disorder that is just now coming into light. With research still being done, we will see a larger population of patients with fibromyalgia, being treated with chiropractic spinal adjustments and see how helpful they can be.

The study done by Hains with chiropractic treatment and fibromyalgia patients showed just how helpful chiropractic can be. “Combined ischemic compression and spine manipulation in the treatment of fibromyalgia: a preliminary estimate of dose and efficiency” (5). The object

of the study was to provide preliminary information on whether a regimen of 30 chiropractic treatments that combines ischemic compression and spinal manipulation effectively reduce the intensity of pain, sleep disturbances, and fatigue associated with fibromyalgia. Subjects were assessed with self-administered questionnaires taken at baseline after 15 and 30 treatments, and 1 month after the end of the treatment trial. This took place in a private practice.

Participating subjects were adult members of a regional fibromyalgia association. Participating subjects had fibromyalgia for more than 3 months. They received 30 treatments including ischemic compression and spinal manipulation. The 3 outcomes being evaluated were pain intensity, fatigue level, and sleep quality. A minimum 50% improvement in pain intensity from baseline to the end of the treatment trial was needed to include the patient in the respondent category. (This was due to that 50% improvement was thought to be equal to the placebo effect).

The results were astounding with fifteen women total completing the trial. A total of 9 patients (60%) were classified as respondents. A statistically significant lessening of pain intensity and corresponding pain improvement in quality of sleep and fatigue level were observed after 15 and 30 treatments. After 30 treatments, the respondents showed an average lessening of 77.2% in pain intensity and an improvement of 63.5% in sleep quality and 74.8% in fatigue level. The improvement in the 3 outcome measures were maintained after 1 month without treatment. Subjects with less than 35% improvement after 15 treatments did not show a satisfactory response after 30 treatments. A trend determined as not statistically significant, suggests that older subjects with serve more chronic pain and a greater number of tender

points respond more poorly to treatments. The results of this trial show that chiropractic can be a great help in helping fibromyalgia patients dealing with their symptoms.

Although the study had a small sample study of only 15 patients, the study did show a true benefit in the symptoms that the sample size was dealing with. Since the study is a combination treatment of both spinal manipulation and ischemic compression we are not able to see strictly how spinal manipulation can help fibromyalgia symptoms. But that being said there was an improved benefit in the symptoms of fibromyalgia patients that were treated with spinal manipulation and ischemic compression in this research which is useful knowledge.

Another research article was done by Panton over the “Effects of Resistance training and Chiropractic treatment in women with fibromyalgia” (10). The objective of this study was to evaluate resistance training (RES) and RES combined with chiropractic treatment (RES-C) on fibromyalgia (FM) impact and functionality in women with FM.

This study was a randomized control study and took place at a chiropractic university and chiropractic clinics. The participants were randomly assigned to RES (n=10) and RES-C (n=11). Both groups completed 16 weeks of RES consisting of 10 exercises performed two times per week. RES-C received RES plus chiropractic treatment two times per week. (The exercises that were performed were as follows: chest press, leg extension, leg curl, leg press, arm curl, seated dip, overhead press, seated row, abdominal crunch, and one body weight exercises for the lower back extension.) Participants began training at approximately 50% of their initial 1-RM measurement and were slowly progressed to approximately 100% of their initial 1-RM by the end of the 16 weeks. Once 12 repetitions were completed on two consecutive workouts,

weights were increased by 5-10 lbs for upper and lower body respectively. Strength was assessed using one repetition maximum for the chest press and leg extension. FM impact was measured using the FM impact questionnaire (Appendix 4) , myalgic score, and the number of active tender points.

Functionality was assessed using the 10 item continuous scale physical functional performance test. Analyses of variances with repeated measures compared groups before and after intervention. The results were six participants discontinued the study 5 from RES and 1 from RES-C. Adherence to the training was significantly higher in RES-C (92.0 +/- 7.5%) than in RES (82.8 +/- 7.5%). Both groups increased upper and lower body strength. There were similar improvements in FM impact in both groups. There were no group interactions for the functionality measures. Both groups improved on strength domains; however, only RES-C significantly improved in the pre- to post functional domains of flexibility, balance and coordination, and endurance.

The research concluded that women with FM, resistance training improves strength, FM impact, and strength domains of functionality. The addition of chiropractic treatment improved adherence to drop out rates to the resistance training and facilitated greater improvements in the domains of functionality. However chiropractic treatment did not provide a greater effect of the magnitude of change in pain perception or FM impact associated with the tender points, myalgia score, and FIQ, nor did it have a greater effect on the magnitude of strength and physical functional improvements.



This research again has a small sample size to collect data from (21). Even though the research was good showing how resistance training can be effective in helping treat the symptoms of fibromyalgia, it did not show that chiropractic alone could be effective. Since chiropractic was not given to the participants alone we have no way of knowing how effective it could be for the symptoms of fibromyalgia by it being the only form of treatment. The research did show that with chiropractic added to the treatment shows that dropout rates were improved greatly by only one person dropping out of the RES-C group, compared to the 5 that dropped out of the research from the RES group. The research also showed that resistance training in addition with chiropractic showed no improvement on FM impact compared to the group that only received RES.

### **Conclusion**

From analyzing the research out there in the subject of Fibromyalgia and the benefits seen with Chiropractic spinal manipulation one thing was shown; it is inconclusive. There is nowhere near enough research out there today on the topic. The research that is available has either too small of a population size, or the treatment of spinal manipulation was used in conjunction with other forms of treatment. Fibromyalgia is one of the biggest question marks out there in modern medicine today so it is of no surprise that doctors of any branch would use a combination of different treatments when treating fibromyalgia patients, but as Chiropractic research has shown more needs to be done. Chiropractors need to do research with a larger patient base and also a research study that consists of just spinal manipulation. As Chiropractors we are seen as people that adjust the spine and with this we need to do more

research that starts from this foundations and builds. Research should be started with just spinal manipulation and then other forms of treatment should be added, especially in the topic of fibromyalgia. Without this research we cannot say conclusively that adjusting the spine has any benefit for fibromyalgia patients.

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## Appendices

1)

### Revised Oswestry Low Back Pain Disability Questionnaire

From N. Hudson, K. Toms-Nicholson, A. Breen; 1989 rev. 09/11/92

**Please mark the ONE choice from EACH group that best describes your problem right now.**

<p><b>PAIN INTENSITY</b></p> <p><input type="checkbox"/> A. The pain comes and goes and is very mild.</p> <p><input type="checkbox"/> B. The pain is mild and does not vary much.</p> <p><input type="checkbox"/> C. The pain comes and goes and is moderate.</p> <p><input type="checkbox"/> D. The pain is moderate and does not vary much.</p> <p><input type="checkbox"/> E. The pain comes and goes and is severe.</p> <p><input type="checkbox"/> F. The pain is severe and does not vary much.</p> <hr/> <p><b>PERSONAL CARE</b></p> <p><input type="checkbox"/> A. I would not have to change my way of washing or dressing in order to avoid pain.</p> <p><input type="checkbox"/> B. I do not normally change my way of washing or dressing even though it causes some pain.</p> <p><input type="checkbox"/> C. Washing and dressing increases the pain, but I manage not to change my way of doing it.</p> <p><input type="checkbox"/> D. Washing and dressing increases the pain and I find it necessary to change my way of doing it.</p> <p><input type="checkbox"/> E. Because of the pain, I am unable to do some washing and dressing without help.</p> <p><input type="checkbox"/> F. Because of the pain, I am unable to do any washing or dressing without help.</p> <hr/> <p><b>LIFTING</b></p> <p><input type="checkbox"/> A. I can lift heavy weights without extra pain.</p> <p><input type="checkbox"/> B. I can lift heavy weights, but it causes extra pain.</p> <p><input type="checkbox"/> C. Pain prevents me from lifting heavy weights off the floor.</p> <p><input type="checkbox"/> D. Pain prevents me from lifting heavy weights off the floor, but I can manage if they are conveniently positioned, e.g., on a table.</p> <p><input type="checkbox"/> E. Pain prevents me from lifting heavy weights, but I can manage light to medium weights if they are conveniently positioned.</p> <p><input type="checkbox"/> F. I can only lift very light weights, at the most.</p> <hr/> <p><b>WALKING</b></p> <p><input type="checkbox"/> A. Pain does not prevent me from walking any distance.</p> <p><input type="checkbox"/> B. Pain prevents me from walking more than one mile.</p> <p><input type="checkbox"/> C. Pain prevents me from walking more than ½ mile.</p> <p><input type="checkbox"/> D. Pain prevents me from walking more than ¼ mile.</p> <p><input type="checkbox"/> E. I can only walk while using a cane or on crutches.</p> <p><input type="checkbox"/> F. I am in bed most of the time and have to crawl to the toilet.</p> <hr/> <p><b>SITTING</b></p> <p><input type="checkbox"/> A. I can sit in any chair as long as I like without pain.</p> <p><input type="checkbox"/> B. I can only sit in my favorite chair as long as I like.</p> <p><input type="checkbox"/> C. Pain prevents me from sitting more than one hour.</p> <p><input type="checkbox"/> D. Pain prevents me from sitting more than ½ hour.</p> <p><input type="checkbox"/> E. Pain prevents me from sitting more than ten minutes.</p> <p><input type="checkbox"/> F. Pain prevents me from sitting at all.</p>	<p><b>STANDING</b></p> <p><input type="checkbox"/> A. I can stand as long as I want without pain.</p> <p><input type="checkbox"/> B. I have some pain while standing, but it does not increase with time.</p> <p><input type="checkbox"/> C. I cannot stand for longer than one hour without increasing pain.</p> <p><input type="checkbox"/> D. I cannot stand for longer than ½ hour without increasing pain.</p> <p><input type="checkbox"/> E. I cannot stand for longer than ten minutes without increasing pain.</p> <p><input type="checkbox"/> F. I avoid standing, because it increases the pain straight away.</p> <hr/> <p><b>SLEEPING</b></p> <p><input type="checkbox"/> A. I get no pain in bed.</p> <p><input type="checkbox"/> B. I get pain in bed, but it does not prevent me from sleeping well.</p> <p><input type="checkbox"/> C. Because of pain, my normal night's sleep is reduced by less than one-quarter.</p> <p><input type="checkbox"/> D. Because of pain, my normal night's sleep is reduced by less than one-half.</p> <p><input type="checkbox"/> E. Because of pain, my normal night's sleep is reduced by less than three-quarters.</p> <p><input type="checkbox"/> F. Pain prevents me from sleeping at all.</p> <hr/> <p><b>SOCIAL LIFE</b></p> <p><input type="checkbox"/> A. My social life is normal and gives me no pain.</p> <p><input type="checkbox"/> B. My social life is normal, but increases the degree of my pain.</p> <p><input type="checkbox"/> C. Pain has no significant effect on my social life apart from limiting my more energetic interests, e.g., dancing, etc.</p> <p><input type="checkbox"/> D. Pain has restricted my social life and I do not go out very often.</p> <p><input type="checkbox"/> E. Pain has restricted my social life to my home.</p> <p><input type="checkbox"/> F. I have hardly any social life because of the pain.</p> <hr/> <p><b>TRAVELING</b></p> <p><input type="checkbox"/> A. I get no pain while traveling.</p> <p><input type="checkbox"/> B. I get some pain while traveling, but none of my usual forms of travel make it any worse.</p> <p><input type="checkbox"/> C. I get extra pain while traveling, but it does not compel me to seek alternative forms of travel.</p> <p><input type="checkbox"/> D. I get extra pain while traveling which compels me to seek alternative forms of travel.</p> <p><input type="checkbox"/> E. Pain restricts all forms of travel.</p> <p><input type="checkbox"/> F. Pain prevents all forms of travel except that done lying down.</p> <hr/> <p><b>CHANGING DEGREE OF PAIN</b></p> <p><input type="checkbox"/> A. My pain is rapidly getting better.</p> <p><input type="checkbox"/> B. My pain fluctuates, but overall is definitely getting better.</p> <p><input type="checkbox"/> C. My pain seems to be getting better, but improvement is slow at present.</p> <p><input type="checkbox"/> D. My pain is neither getting better nor worse.</p> <p><input type="checkbox"/> E. My pain is gradually worsening.</p> <p><input type="checkbox"/> F. My pain is rapidly worsening.</p>
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**Patient Signature** \_\_\_\_\_ **Date** \_\_\_\_\_

**Disability Index Score: %** \_\_\_\_\_

2)

## NECK PAIN AND DISABILITY INDEX (Vernon-Mior)

Patient Name: \_\_\_\_\_ File# \_\_\_\_\_ Date \_\_\_\_\_

**PLEASE READ INSTRUCTIONS:**

*This questionnaire has been designed to give the doctor information as to how your neck pain has affected your ability to manage in everyday life. Please answer every section and mark in each section only ONE box which applies to you. We realize you may consider that two of the statements in any one section relate to you, but just mark the box which most closely describes your problem.*

<p><b>SECTION 1 - PAIN INTENSITY</b></p> <p><input type="checkbox"/> I have no pain at the moment.  <input type="checkbox"/> The pain is very mild at the moment.  <input type="checkbox"/> The pain is moderate at the moment.  <input type="checkbox"/> The pain is fairly severe at the moment.  <input type="checkbox"/> The pain is very severe at the moment.  <input type="checkbox"/> The pain is the worst imaginable at the moment.</p> <p><b>SECTION 2 - PERSONAL CARE (Washing, Dressing, etc.)</b></p> <p><input type="checkbox"/> I can look after myself normally without causing extra pain.  <input type="checkbox"/> I can look after myself normally but it causes extra pain.  <input type="checkbox"/> It is painful to look after myself and I am slow and careful.  <input type="checkbox"/> I need some help but manage most of my personal care.  <input type="checkbox"/> I need help every day in most aspects of self care.  <input type="checkbox"/> I do not get dressed, I wash with difficulty and stay in bed.</p> <p><b>SECTION 3 - LIFTING</b></p> <p><input type="checkbox"/> I can lift heavy weights without extra pain.  <input type="checkbox"/> I can lift heavy weights but it gives extra pain.  <input type="checkbox"/> Pain prevents me from lifting heavy weights off the floor, but I can manage if they are conveniently positioned, for example on a table.  <input type="checkbox"/> Pain prevents me from lifting heavy weights, but I can manage light to medium weights if they are conveniently positioned.  <input type="checkbox"/> I can lift very light weights.  <input type="checkbox"/> I cannot lift or carry anything at all.</p> <p><b>SECTION 4 - READING</b></p> <p><input type="checkbox"/> I can read as much as I want to with no pain in my neck.  <input type="checkbox"/> I can read as much as I want to with slight pain in my neck.  <input type="checkbox"/> I can read as much as I want with moderate pain in my neck.  <input type="checkbox"/> I can't read as much as I want because of moderate pain in my neck.  <input type="checkbox"/> I can hardly read at all because of severe pain in my neck.  <input type="checkbox"/> I cannot read at all.</p> <p><b>SECTION 5 - HEADACHES</b></p> <p><input type="checkbox"/> I have no headaches at all.  <input type="checkbox"/> I have slight headaches which come infrequently.  <input type="checkbox"/> I have moderate headaches which come infrequently.  <input type="checkbox"/> I have moderate headaches which come frequently.  <input type="checkbox"/> I have severe headaches which come frequently.  <input type="checkbox"/> I have headaches almost all the time.</p>	<p><b>SECTION 6 - CONCENTRATION</b></p> <p><input type="checkbox"/> I can concentrate fully when I want to with no difficulty.  <input type="checkbox"/> I can concentrate fully when I want to with slight difficulty.  <input type="checkbox"/> I have a fair degree of difficulty in concentrating when I want to.  <input type="checkbox"/> I have a lot of difficulty in concentrating when I want to.  <input type="checkbox"/> I have a great deal of difficulty in concentrating when I want to.  <input type="checkbox"/> I cannot concentrate at all.</p> <p><b>SECTION 7 - WORK</b></p> <p><input type="checkbox"/> I can do as much work as I want to.  <input type="checkbox"/> I can only do my usual work, but no more.  <input type="checkbox"/> I can do most of my usual work, but no more.  <input type="checkbox"/> I cannot do my usual work.  <input type="checkbox"/> I can hardly do any work at all.  <input type="checkbox"/> I can't do any work at all.</p> <p><b>SECTION 8 - DRIVING</b></p> <p><input type="checkbox"/> I can drive my car without any neck pain.  <input type="checkbox"/> I can drive my car as long as I want with slight pain in my neck.  <input type="checkbox"/> I can drive my car as long as I want with moderate pain in my neck.  <input type="checkbox"/> I can't drive my car as long as I want with because of moderate pain in my neck.  <input type="checkbox"/> I can hardly drive at all because of severe pain in my neck.  <input type="checkbox"/> I can't drive my car at all.</p> <p><b>SECTION 9 - SLEEPING</b></p> <p><input type="checkbox"/> I have no trouble sleeping.  <input type="checkbox"/> My sleep is slightly disturbed (less than 1 hour sleepless).  <input type="checkbox"/> My sleep is mildly disturbed (1-2 hours sleepless).  <input type="checkbox"/> My sleep is moderately disturbed (2-3 hours sleepless).  <input type="checkbox"/> My sleep is greatly disturbed (3-5 hours sleepless).  <input type="checkbox"/> My sleep is completely disturbed (5-7 hours sleepless).</p> <p><b>SECTION 10 - RECREATION</b></p> <p><input type="checkbox"/> I am able to engage in all my recreation activities with no neck pain at all.  <input type="checkbox"/> I am able to engage in all my recreation activities, with some pain in my neck.  <input type="checkbox"/> I am able to engage in most, but not all of my usual recreation activities because of pain in my neck.  <input type="checkbox"/> I am able to engage in few of my usual recreation activities because of pain in my neck.  <input type="checkbox"/> I can hardly do any recreation activities because of pain in my neck.  <input type="checkbox"/> I can't do any recreation activities at all.</p>
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**Pain Scale:**

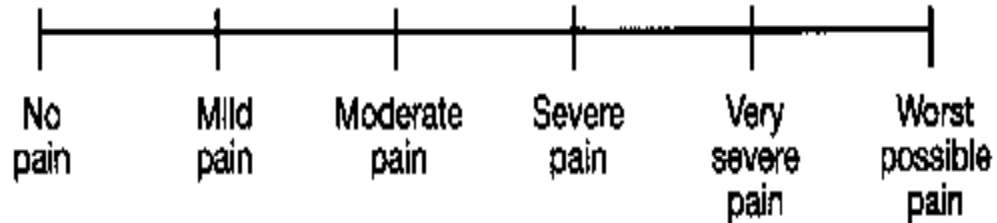
Rate the severity of your pain by checking one box on the following scale.

No Pain	0	1	2	3	4	5	6	7	8	9	10	Excruciating Pain
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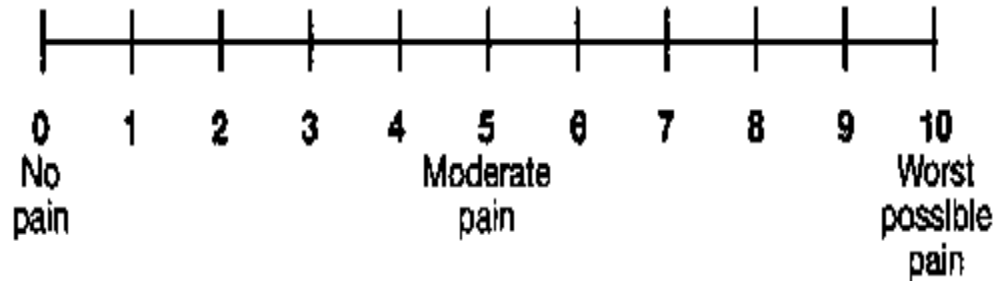
3)

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### Simple Descriptive Pain Intensity Scale<sup>1</sup>



### 0-10 Numeric Pain Intensity Scale<sup>1</sup>



### Visual Analog Scale (VAS)<sup>2</sup>



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<sup>1</sup>If used as a graphic rating scale, a 10 cm baseline is recommended.

<sup>2</sup>A 10-cm baseline is recommended for VAS scales.

4)

<b>Table 1. Change in Fibromyalgia Impact Questionnaire (FIQ) items (n = 99)</b>						
<b>Changes in</b>	<b>Baseline mean</b>	<b>Follow-up mean</b>	<b>Absolute change</b>	<b>Relative change</b>	<b>(5%, 95%) quartiles</b>	<b>Wilcoxon signed rank p value</b>
<b>Ability to:<sup>a</sup></b>						
do shopping in last week	1.3	1.1	-0.2	-14.0%	(-2, 2)	0.064
do laundry in last week	1.0	0.9	-0.1	-11.1%	(-1, 1)	0.169
prepare meals in last week	1.1	1.0	-0.1	-10.1%	(-1, 1)	0.208
wash dishes in last week	1.1	1.0	-0.2	-13.5%	(-2, 2)	0.120
vacuum in last week	1.7	1.6	0.0	-2.0%	(-1, 2)	0.710
make beds in last week	1.2	1.2	-0.1	-7.0%	(-1, 1)	0.401
walk several blocks in last week	1.7	1.7	0.0	0.6%	(-2, 1)	0.893
visit friends and relatives in last week	1.3	1.2	-0.1	-5.8%	(-2, 2)	0.411
do yard work in last week	2.2	2.0	-0.2	-9.8%	(-2, 1)	0.017 <sup>b</sup>
drive car in last week	0.9	0.9	0.0	-3.7%	(-1, 1)	0.539
<b>Number of:</b>						
days felt good in last week	2.1	2.7	0.6	26.6%	(-3, 4)	0.017 <sup>b</sup>
nights restful sleep in last week	2.0	2.8	0.9	43.3%	(-3, 6)	0.009 <sup>b</sup>
days of missed work due to fibromyalgia symptoms in last week	1.3	0.7	-0.7	-49.2%	(-3, 2)	0.003 <sup>b</sup>
<b>Amount:<sup>c</sup></b>						
fibromyalgia interfered with ability to do job	5.3	2.1	-3.2	-59.5%	(-10, 4)	<0.001 <sup>d</sup>
of pain	7.0	5.9	-1.1	-15.0%	(-7, 4)	0.003 <sup>b</sup>
of tiredness	7.8	7.3	-0.6	-7.4%	(-6, 4)	0.022 <sup>b</sup>
of how rested felt in morning	7.8	7.0	-0.9	-10.9%	(-5, 4)	0.001 <sup>d</sup>
of stiffness	7.7	6.6	-1.1	-13.7%	(-7, 4)	<0.001 <sup>d</sup>
of tenseness/nervousness/anxiety	7.1	5.8	-1.3	-18.1%	(-8, 4)	<0.001 <sup>d</sup>
of depression/feeling blue	5.6	4.6	-1.0	-17.6%	(-5, 4)	0.001 <sup>d</sup>

<sup>a</sup> for these 10 items, 0 = always, 3 = never

<sup>b</sup> significant at < 0.05

<sup>c</sup> for these 7 items, 0 = best, 10 = worst

<sup>d</sup> significant at < 0.001