Long-term Effectiveness of Bone-setting, Light Exercise Therapy, and Physiotherapy for Prolonged Back Pain: A Randomized Controlled Trial

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Abstract

Background: Chiropractic manipulation and strenuous exercise therapy have been shown effective in the treatment of nonspecific back pain. Bone-setting, the predecessor of modern manual therapies, still survives in some parts of Finland and was compared with a light exercise therapy and nonmanipulative, pragmatic physiotherapy in a year-long randomized controlled trial on patients with long-term back pain.

Methods: One hundred fourteen ambulatory patients of working age with back pain for 7 weeks or more were randomly assigned to the therapies, which were offered in up to 10 sessions during a 6-week treatment period. The outcome was measured by the Oswestry Disability Questionnaire. Sick-leaves and visits to health centers were recorded for 1 year before and after the therapy.

Results: The Oswestry disability scores improved most in the bone-setting group ($P = .02$, Kruskall-Wallis test). Visits to health centers for back pain were reduced only in the physiotherapy group ($P = .01$, Wilcoxon test). Sick-leaves were not significantly different between groups. A secondary analysis based on the use of additional therapies after the intervention showed a possible subgroup with an enhanced effect from bone-setting.

Conclusions: Traditional bone-setting seemed more effective than exercise or physiotherapy on back pain and disability, even 1 year after therapy. (J Manipulative Physiol Ther 2002;25:99-104)

Key Indexing Terms: *Low back pain; Chiropractic manipulation; Physiotherapy; Exercise therapy; Bone-setting*

Introduction

Long-term, nonspecific back pain is an epidemic, which unlike infectious diseases or atherosclerosis, still awaits a cure. Strenuous exercise and psychosocial interventions are regarded as the best options for patients with disabling back pain,[1-3] yet only a few studies have demonstrated a reduction in sick-leaves, in spite of the considerable effort these programs require.[4]

The concept of repetitive light back motion, a form of less demanding therapy for the patient, should be compared with the observation of motion-induced nutritional changes in connective tissues in animal models.[5] Repetitive-motion therapy is inexpensive because the patient can be instructed during an office visit or even by a booklet, but the results of controlled trials on this kind of an approach have, to date, been inconclusive.[6] More recent studies actually question its effectiveness, at least for acute back pain.[7,8] The exercise therapy seems effective under close supervision only.[9]

Manipulative therapies are quicker acting and more convenient than exercise. The numerous controlled studies claiming their effectiveness for acute back pain[10-13] have brought them acceptance by authorities in several countries.[2,14] Many studies have shown manipulation effective in chronic conditions even after extended follow-up,[10,11] but others have not.[15,16] Thus, the long-term effectiveness of manipulation and its effect on chronic conditions still needs to be studied.[2,13]

Bone-setting is a form of manipulative therapy still practiced by uneducated Finnish folk healers, especially in the rural county of Ostrobothnia. It is regarded as the basis from which the academic manipulative therapies such as chiropractic, naprapathy, and osteopathy evolved in the late

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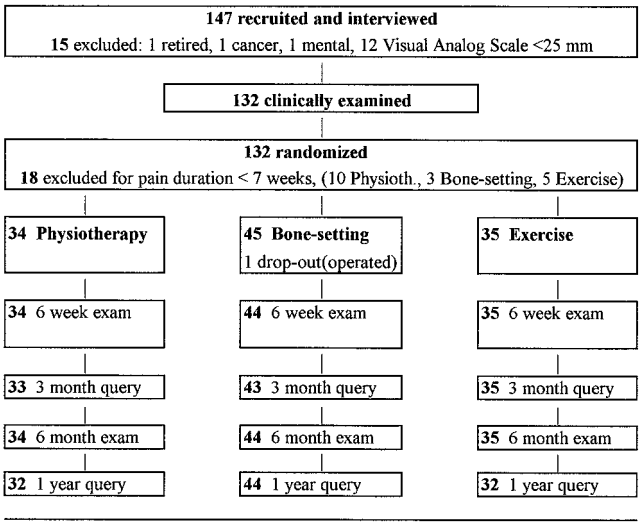

Fig 1. *Patient flow chart.*

Table 1. *Subjective improvement ratings*

	Physiotherapy	Bone-setting	Exercise	χ^2 test*
At 6 weeks	n = 34	n = 44	n = 35	
Improved	77	82	60	0.08
Unchanged	15	18	37	
Worse	9	0	3	
At 6 months	n = 34	n = 43	n = 34	
Improved	65	70	65	0.9
Unchanged	23	23	26	
Worse	12	7	9	
At 1 year	n = 33	n = 43	n = 32	
Improved	61	70	56	0.5
Unchanged	39	14	34	
Worse	0	16	10	

Numbers are percentages unless otherwise noted.
*Number of improved patients tested against those not improved.

nineteenth century. Bone-setting itself has never before, to our knowledge, been subjected to a serious scientific study.

In this study, bone-setting and light exercise therapy were tested against ordinary physiotherapy on patients with prolonged back pain. The short-term results published earlier showed bone-setting to have effects on physical outcome measures exceeding those of physiotherapy or light exercise therapy.[17]

Methods

Subjects

The patients and the protocol have been described in detail in a previous article.[17] Nonretired people with back pain and no contraindications to manual therapies were included. Patients with back pain for less than 7 weeks were excluded from the analysis because of small numbers and uneven distribution not suitable for a preplanned subgroup analysis (Fig 1). No therapies were allowed for 1 month before the study. There were no statistically significant differences between the baseline characteristics of the therapy groups,[17] although patients in the bone-setting group tended to have somewhat higher pain and disability (Table 2).

Study Design

The study was conducted at the Folk Medicine Centre, an institution for the provision and research of Finnish traditional folk healing. A study nurse first registered and interviewed the patients, obtained a written consent, and finally randomized the patients by drawing sealed lots after a general practitioner had completed the baseline clinical examinations and measurements. The nurse also delivered the questionnaires and booked the therapy sessions, keeping the general practitioner strictly blind to the randomized therapies until the 6-month clinical examinations were completed. The questionnaires of back pain and disability were presented during the visits to the Centre before the randomization, after the 6-week therapy period, and 6 months later. Postal inquiries were mailed 3 and 12 months after baseline (Fig 1). The written consent included a permission to obtain information from the records of the local health centers, and the Finnish Social Insurance Institution. The ethics committee of the medical faculty of Oulu University approved the study plan.

Therapy Options

A maximum of 10 one-hour treatment sessions of each therapy option were offered during the 6-week therapy period.

The physiotherapy consisted of manual, thermal, and electrotherapies according to the Finnish routine. Massage, specific mobilizations, and manual traction (but no manipulations with impulse) were allowed. Individual autostretching exercises[18] were added when appropriate.

The bone-setting was administered by 4 folk healers. The bone-setters were free to choose their own methods, which generally resembled chiropractic or osteopathy. Ostrobothnian bone-setting is, however, generally more gentle than its academic counterparts. Their most popular method roughly resembles the sacral-push method for evaluating sacroiliac joint mobility described on page 494 of the textbook by Bergmann et al.[19] It is, however, used to mobilize sacroiliac joints as well as spinal vertebrae from the lumbar to cervical region. The particular healers in this study, however, did not use the chiropractic adjustments described in standard textbooks, which are well known to many other Finnish folk healers.

Patients in the exercise group were taught to rhythmically bend their backs in 3 planes whenever otherwise idle, thereby avoiding static postures as much as possible. Autostretching exercises were available for this group as well. Each patient received a booklet along with individual guidance to ensure correct performance.

Outcome Assessments

Subjective improvement was assessed at 6 weeks, and at 3, 6, and 12 months after the randomization on a 5-point

Table 2. *Improvement of Oswestry Disability Scores*

	n	Baseline	n	6 weeks	n	3 months	n	6 months	n	12 months
Physiotherapy	34	18.1 (7.7)	33	2.0 (−1.1-5.1)	33	4.0 (1.3-6.7)	33	4.7 (1.5-7.9)	32	4.4 (1.2-7.6)
Bone-setting	44	23.7 (11.6)	39	7.0 (3.4-10.2)	43	5.1 (1.8-8.4)	44	9.4 (6.7-12.1)	44	8.4 (5.2-11.6)
Exercise	35	19.4 (9.5)	29	3.2 (0.4-6.1)	35	2.9 (−0.2-5.9)	33	3.5 (0.2-6.8)	32	2.2 (−1.2-5.7)
Kruskall-Wallis test		0.06		0.09		0.6		0.01		0.04

Baseline values = mean (SD) of Oswestry Disability Scores.
Follow-up values = mean change scores from baseline (95% CI).

verbal scale from "distinctly better" to "distinctly worse." For the report, the data were reduced to 3 points. Back pain disability was assessed by the Oswestry Disability Questionnaire,[20] which was completed by the patients before the randomization and at 6 weeks and 3, 6, and 12 months after baseline. The numbers of sick-leaves were obtained from the records of the Social Insurance Institution. The prescriptions for sick-leaves, especially those lasting for less than 9 days (not compensated by the Social Insurance Institution), were checked from the records of the local health centers, which also allowed differentiation between sick-leaves for back pain and other reasons. The numbers of visits to general practitioners were also calculated from the patient records. The use of additional therapies was monitored on the questionnaires at 3, 6, and 12 months after baseline and checked from patient records.

Statistical Analyses

The statistical analyses were performed with a microcomputer by using the SPSS for Windows 6.1 software package (SPSS, Chicago, Ill). The differences in the onset values or change scores among the 3 groups were tested with the nonparametric Kruskall-Wallis 1-way analysis of variance. The Mann-Whitney test was applied between paired groups if the Kruskall-Wallis test was significant. The changes within groups were analyzed with the Wilcoxon signed rank sum test. For categorical data, the χ^2 test was applied. All were completed as intent-to-treat analyses. A subgroup analysis was made after exclusion of all additional therapies for back pain.

Results

The patient flow is summarized in the trial profile (Fig 1). Only 1 patient, who underwent surgery for a herniated disk, failed to attend the follow-up examinations. Completed study questionnaires were returned by 101 patients (89%) at 6 weeks, 111 patients (97%) at 3 months, 113 patients (99%) at 6 months, and 108 patients (95%) at 1 year after baseline.

After a 6-week therapy period, patients in the bone-setting group reported significantly more often than patients in the exercise group that their back pain was "distinctly" or "slightly better" ($P = .03$, χ^2 test) (Table 1). The differences between the physiotherapy and exercise ($P = .14$) groups and physiotherapy and bone-setting groups ($P = .56$) did not reach statistical significance ($P = .08$ between all groups). After 3, 6, and 12 months, the differences were no longer significant, although more patients in the bone-setting group remained in the "improved" category at each point than patients in the physiotherapy or exercise groups.

By 6 weeks the Oswestry Disability ratings had diminished significantly from baseline in all but the physiotherapy group (Table 2). At 3 and 12 months, the exercise group remained without a statistically significant effect. The change scores from baseline differed significantly among the 3 groups in favor of bone-setting after 6 and 12 months ($P = .01$ and .04, respectively, Kruskall-Wallis test). The largest differences appeared between bone-setting and exercise (5.9 and 6.2 percentage points, $P = .009$ and .02, respectively, Mann-Whitney test). The differences between bone-setting and physiotherapy were smaller (4.7 and 4.0 percentage points, $P = .03$ and 0.1, respectively). Physiotherapy and exercise were not significantly different at any point. At 1 year, 9/32 of the physiotherapy patients, 10/44 of the bone-setting patients, and 14/32 of the exercise patients had Oswestry scores as high or higher than at baseline ($P = .1$, χ^2 test). The difference between bone-setting and exercise was significant ($P = .05$).

The study patients were on sick-leave for back pain for less than 1 week on average, both the year before and the year after the therapies. The number of patients on sick-leave for back pain decreased from the year before to the year after therapy in all groups, but the changes during follow-up and the differences between the groups were slight and insignificant (Table 3).

The average number of visits to health centers for back pain tended to diminish in all groups, but the change was significant in the physiotherapy group only ($P = .01$, Wilcoxon signed rank sum test). The number of visits for all causes was not reduced (Table 3).

Almost two thirds of all patients took additional therapies during the subsequent year. Massage was used by 13 patients in the physiotherapy group, 19 patients in the bone-setting group, and 9 patients in the exercise group. Thirteen patients in the physiotherapy group, 24 patients in the bone-setting group, and 11 patients in the exercise group visited a bone-setter after the randomized treatments. Physiotherapy was taken by 3 patients from the physiotherapy group, by 7 patients from the bone-setting group, and by 10 from the exercise group. One patient underwent surgery for a herniated disk (exercise group), and 8 were referred to a rehabilitation centre (6 from bone-setting group and 2 from

Table 3. *Use of health care resources*

	Physiotherapy	Bone-setting	Exercise
Visits to health centers, mean nr (SD)			
For back pain			
Year before therapy	0.7 (1.1)	0.5 (0.9)	0.6 (1.1)
Year after therapy	0.2 (0.5)*	0.4 (0.7)	0.5 (1.1)
All visits			
Year before therapy	2.2 (2.0)	2.4 (2.2)	2.7 (2.7)
Year after therapy	2.2 (2.7)	2.3 (2.3)	3.1 (3.3)
Sick-leave days, mean nr (SD)			
For back pain			
Year before therapy	3.2 (11)	8.7 (28)	2.5 (5.9)
Year after therapy	1.0 (3.4)	7.9 (33)	3.5 (12)
All sick-leaves			
Year before therapy	6.5 (13)	15 (32)	15 (34)
Year after therapy	4.6 (9.9)	18 (50)	21 (43)
Sick-listed (%)			
For back pain			
Year before therapy	18	24	23
Year after therapy	9	16	17
All sick-leaves			
Year before therapy	79	69	63
Year after therapy	32	47	54

*$P < .01$, Wilcoxon signed rank sum test.

exercise group). All the rehabilitation courses had been applied before this study.

A secondary analysis was made on patients who did not take any additional therapy during the follow-up as opposed to those who did (Fig 2). The patients in each randomized therapy group who took extra therapies had slightly higher pain and disability scores at baseline but tended to benefit less than the others. A strikingly different outcome was seen in the 13 patients from the bone-setting group who took no extra therapy. They had the second highest disability scores at baseline and the lowest scores after the 1-year follow-up. The statistical significance of the improvement in their mean Oswestry score was greater than that of any other subgroup ($P = .006$, Kruskall-Wallis-test). At 1 year, none of the bone-setting group had Oswestry scores as high as or higher than baseline, in contrast to the noncontaminated physiotherapy (2/10) or exercise (5/13) groups. There were no statistically significant differences between the subgroups in such baseline characteristics as age, sex, body mass index, occupation, or duration of back pain. The Oswestry scores at onset differed ($P = .05$, Kruskall-Wallis test) mostly between the noncontaminated physiotherapy group and the 2 bone-setting subgroups ($P = .05$, Mann-Whitney test).

Discussion

Traditional bone-setting seemed to have more marked long-term effects on subjective measures of back pain and disability than light exercise therapy or physiotherapy. Only physiotherapy was able to reduce the use of health services. There were no differences in the numbers of work days lost.

The patients in this study had rather low levels of pain and disability, leaving limited space for measuring recovery and finding differences between therapies. In addition, the baseline values of disability were unequal, making regression toward the mean one possible explanation for the changes between therapies. Minimization instead of randomization might have produced more balanced onset values. A third confounder was the abundant use of extra therapies by the patients. One third had taken extra therapies during the first 6 months (17), and two thirds had done so by the end of this study. One explanation may be our rigorous attempt to gather all the data, especially the use of alternative therapies.

Meade et al[10] studied patients with low back pain treated in hospitals or chiropractic clinics. At 1 year, their patients demonstrated an improvement in Oswestry scores of 10 to 15 percentage points. Their onset values, however, were considerably higher (about 30 percentage points) than those in our study, probably because 40% of their patients had episodes shorter than 1 month, making them more prone to spontaneous cure as well. The difference between the outcomes of the 2 therapies was 2.09 percentage points after 1 year, which is slightly smaller than the differences between the bone-setting and physiotherapy groups or the bone-setting and exercise groups in our study. The number of patients with Oswestry scores as high or higher than at baseline (24% of chiropractic group vs 34% of the hospital treatment group) corresponded to the figures in our study. The difference between the therapies increased by the 2-year follow-up in the study by Meade et al, but less than one third of the patients were followed up, and 40% of them had taken further therapies.

The study by Triano et al[16] of patients in a chiropractic clinic was comparable to ours in sample size, inclusion and exclusion criteria, age of subjects, and the duration and severity of symptoms (Oswestry 17.5–20.2 percentage points). They used a placebo control but published only short-term results. The improvement of Oswestry scores by 6.9 to 8.8 percentage points after 4 weeks in their study corresponds well to that of bone-setting after 6 weeks in our study.

Cherkin et al[21] studied the effect on subacute low back pain of chiropractic manipulation, McKenzie physiotherapy exercise, and provision of an educational booklet. The disability and "bothersomeness" scores were lowered by two thirds after 4 weeks of both active treatments, whereas the scores of the booklet group were approximately cut in half. The Oswestry score of our bone-setting group was lowered by one third only, but a part of this difference may have been that more acute cases were enrolled by Cherkin et al,[21] with 59% of their patients having back pain for less than 3 weeks and a mean Roland Disability Score of over 50% of the maximum. They found both active treatments better than provision of a booklet, but the differences were found statistically significant only for the "bothersomeness" scores at 4 weeks. The largest difference in the improvement of disability was 1.6 points between the booklet and the chiropractic groups at 12 weeks (6.9% of the scale maximum), whereas the chiropractic and the physical therapy groups

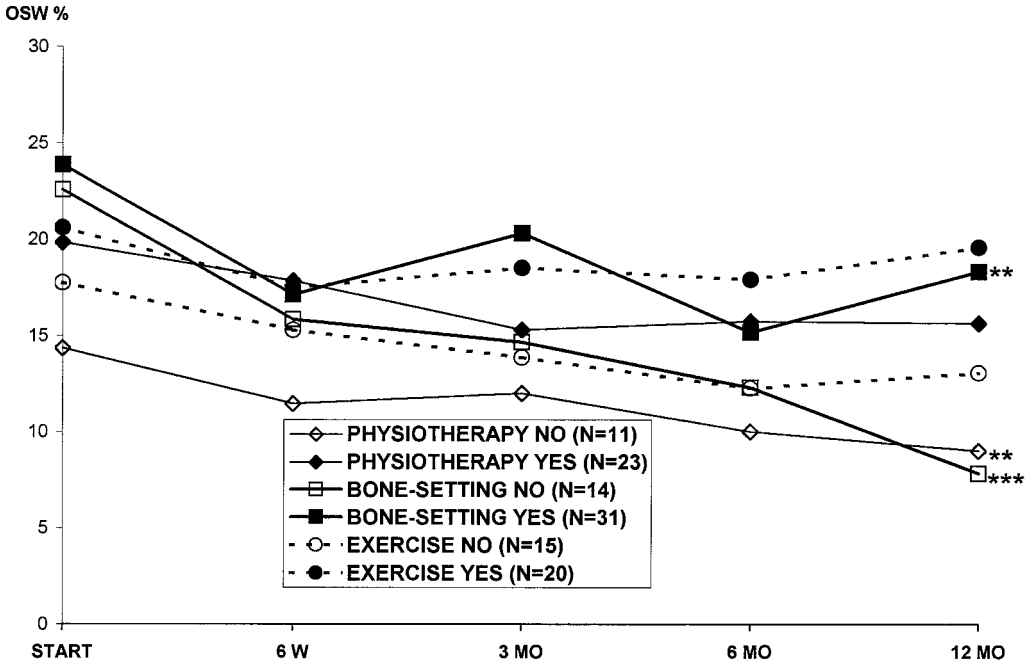

Fig 2. *Secondary analysis based on additional therapies.* OSW%, *Oswestry Disability Questionnaire percentage score;* NO, *no additional therapy after study therapy;* YES, *additional therapy after study therapy,* 2 asterisks, $P < .01$; 3 asterisks, $P < .001$. *Wilcoxon signed rank sum test between start and 12 months.*

differed by 0.9 points (3.9%). These differences were less than the predefined criteria for clinical significance: 2.5 points on the Roland Disability Scale or 1.5 points on the "bothersomeness" scale. The study confirmed earlier findings on the effectiveness of chiropractic therapy on back pain, but the extra costs to reach these marginal benefits were questioned.

The current light exercise therapy seemed to have no effect on back pain. Exercise therapies have not been found effective for acute back pain.[7,8,22] Some types of exercise therapy, however, are presumed to help patients with long-term back pain return to normal daily activities and work.[22]

Frost et al[9] treated patients with long-term low back pain with fitness training in 8 group sessions or carried out individually at home. The change of Oswestry scores after the supervised fitness program was 6.8 percentage points, whereas the reference group improved by 3 percentage points. The benefit was maintained for 6 months. Patients in our exercise group were probably most comparable to the control patients in the study by Frost et al.

Physiotherapy, in spite of its frequent use for back pain, has seldom been evaluated against placebo or untreated control patients. Koes et al[11] found physiotherapy significantly better than detuned ultrasound or treatment by general practitioners. Hansen et al[23] found physiotherapy effective in some subgroups with long-term low back pain. It was not, however, significantly better than their intensive exercise therapy.

The Finnish type of physiotherapy is a combination of thermal, electric, and manual therapies, often consisting of mere massage but sometimes combined with specific exercises, specific mobilizations or, seldom, manipulations. This study with nonmanipulative, pragmatic physiotherapy showed only a vague benefit (4.4 percentage points) after 1 year, which was not statistically different from that of our light exercise therapy.

The number of visits to health centers was only reduced in the physiotherapy group. One tentative explanation could be that patients with back pain consult primary health care providers most often to obtain prescriptions for physiotherapy in addition to those for pain medication and sick-leave. The physiotherapy patients evidently had one reason less for consultation.

The secondary analysis based on additional therapies after the intervention, although not planned beforehand, showed interesting results. The progressive improvement during the follow-up year of the noncontaminated bone-setting subgroup resembled the gradually increasing difference between the Oswestry scores of chiropractic and hospital patients observed by Meade et al.[10] Although our study used methods void of the dynamic thrust techniques typical of chiropractic adjustments, it may find confirmation from the report of Meade et al.

The findings in the secondary analysis may be the result of chance. It was, indeed, based on only one third of the original patients. Faster spontaneous healing of more acute or less severe back pain may be also be suspected. The patients in each subgroup may have had different reasons to refrain from further therapies: they may have either been healed or resigned to not being cured. And finally, the different psychosocial dimensions of the therapies may have had profoundly different influences on the subjective well-being of the primarily uneducated patients.

Conclusion

These findings on the effectiveness of bone-setting on prolonged back pain are the first of their kind and should be interpreted with extreme caution. The results should be confirmed, preferably in a different population. The psychosocial dimensions are the primary targets of future research into the effectiveness of this therapy. The mere survival of this tradition merits an attempt to explain its possible mechanisms of action.

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