Abstract

Study Design. Eighteen-month, randomized controlled trial with partial crossover.

Objectives. To test the hypothesis that the control of lumbar flexion in the early morning will significantly reduce chronic, nonspecific low back pain.

Summary of Background Data. Previous studies have indicated an increased risk of low back pain with bending forward in the early morning, primarily because of increased fluid content in the intervertebral discs at that time.

Methods. After 6 months of recording baseline data, 85 subjects with persistent or recurring low back pain were randomly assigned to treatment and control groups. The treatment group received instruction in the control of early morning lumbar flexion. The control group received a sham treatment of six exercises shown to be ineffective in reducing low back pain. Six months later, the control group received the experimental treatment. Diaries were used to record daily levels of pain intensity, disability, impairment, and medication usage.

Results. Significant reductions in pain intensity ($P < 0.01$) were recorded for the treatment group, but not for the control group (point estimate, 33%; 95% confidence interval, 11-55%). After receiving the experimental treatment, the control group responded with similar reductions ($P < 0.05$). Significant reductions also were observed in total days in pain, disability, impairment, and medication usage.

Conclusions. Controlling lumbar flexion in the early morning is a form of self-care with potential for reducing pain and costs associated with chronic, nonspecific low back pain.

Up to 85% of low back pain has no definite etiology and thus is classified as idiopathic or nonspecific. Although nonspecific low back pain has no known cause, theories abound. This study is based on the theory that a source of chronic, nonspecific low back pain is in the intervertebral disc, and that the specific lesion is internal disc disruption.

The characteristic features of internal disc disruption are radial fissures extending from the nucleus pulposus to the innervated, outer third of the anulus fibrosus. It is thought that the fissures expose the nerve endings of the outer anulus to the noxious or inflammatory material of the nucleus. Bogduk reviewed the numerous studies that confirm the existence of various nerve ending types in the outer anulus. Other studies provide evidence for the inflammatory nature of nuclear material.

It is known that discs imbibe fluid from surrounding tissues during the recumbency of sleep when loading on the discs is reduced. After 8 hours of recumbency, enough fluid is imbied to increase body height by approximately 1%. At rising, the spine is subjected to the compressive forces of gravity, and fluid is expelled from the discs. A similar situation occurs in the weightless environment of space, where the height of astronauts increases up to 5 cm and then rapidly decreases on their return to earth.

A series of in vivo and in vitro studies performed in the United Kingdom led Adams et al to
conclude that there is an increased risk of injury (sudden prolapse) to the lumbar discs when a person bends forward in the early morning, primarily because of the increased fluid content in the disc at that time. It was estimated that the bending stresses are three times greater in the early morning than they are later in the day. The investigators asked the question: Is this likely to be of any clinical significance? The purpose of this experiment was to answer that question, not for disc prolapse, but for pain in the disc. The estimates of Adams et al. were coupled with the theory of internal disc disruption to form the specific hypothesis that the control of lumbar flexion (forward bending) in the early morning will significantly reduce chronic, nonspecific low back pain.

Methods

Approval for this project was received from the Institutional Review Committee of the Liberty Mutual Research Center for Safety and Health.

Protocol. Advertisements were placed in local newspapers to recruit men and women with persistent or recurring low back pain who 1) were between 30 and 60 years of age, 2) were not under current care by a practitioner, 3) had not experienced low back surgery, 4) had not filed a workers’ compensation claim, and 5) were not pregnant. Subject selection criteria were intended to minimize cointerventions by practitioners and financial incentives from compensation claims.

A total of 124 applicants responded to the advertisements, and each was given a medical examination. Eight applicants were rejected for medical reasons (lung cancer, diabetes, ankylosing spondylitis, severe scoliosis, etc.). The remaining 116 applicants were accepted as subjects and asked to sign informed consent forms.

Independent Variable (Intervention). The independent variable in this experiment was instruction in the control of early morning lumbar flexion. After a brief description of internal disc disruption, subjects were told that the first 2 hours after rising were the most important time of the day to protect and maintain a straight back. Getting out of bed without bending the back was demonstrated. After rising to a standing position, subjects were told not to bend, squat, or sit for the first 2 hours. Standing and walking were permissible.

Each subject was given a back scratcher to assist in raising the toilet cover or seat. A urinal was given to female subjects for urinating in the standing position. A reacher was provided for picking up objects from the floor. Subjects were told that after 2 hours, sitting, squatting, or kneeling with a straight back was permissible, but that actual bending should be avoided. After 4 hours, moderate activity with slight bending was allowed. After 6 hours, subjects were told, usual activities were allowed, but extreme bending should be avoided.

The difficulties in complying with this schedule were discussed with each subject. Advice was given for shaving, showering, eating, cleaning teeth, getting dressed, and having bowel movements. Changing the daily routine was suggested so that bending activities or heavier physical activities could be performed later in the day or in the evening when the back is less vulnerable. Subjects were told to plan ahead, to arrange their clothes and toilet articles in the evening so early morning bending would not be necessary. The possibility of getting up earlier was suggested. It was emphasized that partial compliance with the schedule was better than no compliance. Subjects were asked to record the time they were able to stand every morning without bending, squatting, or sitting. A stopwatch was provided to assist in obtaining accurate times of compliance. Subjects also were told not to expect an immediate reduction in pain, and
Compliance

The average time that subjects were able to stand in the morning without bending, squatting, or sitting was 58 minutes (range, 0-111 minutes).

Discussion

Pain intensity was reduced from 18% to 29% in the treatment group ($P < 0.01$), compared with a 6% to 9% reduction in the control group. (The exact figures depend on the amount of dropout data included in the analysis; see Tables 3 and 4.) Days in pain were reduced from 15% to 23% in the treatment group ($P < 0.05$) compared with a 2% to 4% reduction in the control group. Furthermore, after subjects in the control group received the same instructions for controlling early morning flexion, they experienced a significant reduction ($P < 0.05$) in pain intensity and days in pain similar to that of the treatment group subjects. On the basis of these results, the flexion control hypothesis appears to be valid. In a small sample of relatively unselected subjects with less than 50% compliance, chronic low back pain was significantly reduced without medication, manipulation, exercises, injections, or surgery. The reduction in pain was accomplished by a change in behavior.

As demonstrated in this experiment, it is not easy to change behavior. More than twice as many dropout subjects came from the treatment group, and 93% of the subjects reported some difficulty in complying with the flexion control instructions (compared with 39% of the control group who reported difficulty complying with the exercises). However, for those who decide that the treatment is preferable to the disorder, chronic low back pain can be reduced for a substantial number of people. Thirty-five percent of all subjects reduced their pain by more than 50% after 6 months of flexion control. Eighty percent of the subjects said they intended to continue with flexion control after trying it for 6 months.

In addition, the Phase 2 results from the treatment group indicated that subjects continued to improve after 6 additional months on the intervention, reducing the pain even further. The reduction in pain was similar for both men and women, and for younger and older subjects. Although the daily accumulation of fluid in the intervertebral disc gradually decreases with age, there was no significant difference in the reduction of pain between the younger (30-45 years) and older (46-60 years) subjects. Perhaps somewhat surprising, but also encouraging, is the finding that subjects with high psychological overlay benefited as much as those with low psychological overlay, and subjects with leg pain benefited as much as those without leg pain (see Table 5). The only subjects who did not benefit as well were those who performed heavy physical work.
The results of this experiment indicate that the reduction in pain was carried over, at least in part, to disability, impairment, and medication usage. Other investigators have observed that there is not a good correlation between pain and disability. Nevertheless, reductions ranging from 41% to 63% in disability days were recorded after the start of flexion control, although these results were not always statistically significant. Similar results were found with impairment days. Statistically significant reductions ranging from 27% to 39% in medication days were recorded after the start of flexion control.

Critique

Both strengths and weaknesses exist in this study. The strengths include the use of a daily diary to record the dependent variables, a control group that received a sham treatment, randomization and a partial cross-over in the experimental design, 6 months of baseline data, and 6 to 12 months of follow-up data after intervention. The major weakness was the high dropout rate and the resulting imbalance in the treatment and control groups. Fortunately, the imbalance was offset by the experimental design, which allowed both the treatment and control groups to receive the experimental intervention, but at different times. Furthermore, when partial data from the dropout subjects are included in the analysis, the results are essentially the same.

Implications

There are several important implications from this study regarding the treatment and cost of chronic, nonspecific low back pain, and the ergonomics of the workplace. The results are quite consistent with several studies on the ineffectiveness of bed rest and exercises on low back pain. For example, a Finnish study found that continuing ordinary activities within the limits permitted by low back pain leads to more rapid recovery than either bed rest or back-mobilizing exercises. The results of a British study favored mobilization over bed rest and suggested that isometric flexion exercises were doing more harm than good. A Norwegian study found superior results when low back pain was treated as a benign, self-limiting condition with light mobilization. The results from the current study suggest that bed rest may be counterproductive because of fluid accumulation in the discs, and that morning exercises may be harmful if they involve lumbar flexion.

The poorer results shown by subjects with heavy physical work emphasize the ergonomic implications of this study. Low back pain can occur at any time of the day. However, the results of this study suggest that the problem is more likely to be initiated in the early morning. This is consistent with the findings from a Canadian study that found the probability of sprain and strain injuries greater between 6 and 11 AM than at any other time of the day (odds ratio, 1.21).

Bending activities also have been related closely to a higher risk of low back pain in industry. For example, back disorders in an automobile assembly plant were associated with mild trunk flexion (odds ratio, 4.9) and severe trunk flexion (odds ratio, 5.7). The results from the current study suggest that heavy physical activities should be scheduled later in the day, and that jobs should be redesigned to reduce bending activities as much as possible.

Finally, there are cost implications from this study. Frymoyer pointed out that when policymakers look at the cost of low back care and compare it to the outcome, they can easily conclude that the cost is too high and the quality is too low. Practitioners who treat low back pain are often criticized for overtreatment, inappropriate treatment, excessive imaging and testing, and
unnecessary surgery: 3, 11, 16, 19, 22, 35

After finding that the outcomes of low back pain treatment are similar regardless of the type of practitioner, Carey et al. suggested that the best care for low back pain may be minimal care, and that improved techniques of self-care should be investigated. Controlling early morning lumbar flexion is a form of self-care that can help develop a sense of control or mastery over low back pain, and thereby build confidence and improve outcome. This is consistent with the concept of Fries et al. that health care costs can be lowered by reducing the need and demand for medical services. The control of lumbar flexion in the early morning may provide some welcome relief for patients, practitioners, and policymakers alike.

Acknowledgments

The authors are indebted to Mary-Beth Melanson, Susan E. Martin, BS, Todd C. Harris, MA, Joanne B. Gouin, and Linda Cantley, BSPT, MS, for their assistance in collecting and analyzing the large amounts of data associated with this experiment.

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