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Effects of Chiropractic Treatment on Blood Pressure and Anxiety: A Randomized, Controlled Trial

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ABSTRACT

This study examined the effects of chiropractic adjustments of the thoracic spine (T1-T5) on blood pressure and state anxiety in 21 patients with elevated blood pressure. Subjects were randomly assigned to one of three treatment conditions: active treatment, placebo treatment, or no treatment control. The adjustments were performed by a mechanical chiropractic adjusting device. Dependent measures obtained pre- and post-treatment included systolic and diastolic blood pressure, and state anxiety. Results indicated that systolic and diastolic blood pressure decreased significantly in the active treatment condition, whereas no significant changes occurred in the placebo and control conditions. State anxiety significantly decreased in the active and control conditions. Results provide support for the hypothesis that blood pressure is reduced following chiropractic treatment. Further study is needed to examine the long-term effects of chiropractic treatment on blood pressure. (J Manipulative Physiol Ther 1988; 11:484–488)

Key Indexing Terms: Chiropractic, Manipulative Therapy, Blood Pressure, Anxiety.

INTRODUCTION

The field of chiropractic has received much attention in both the popular press and the scientific literature regarding the efficacy of chiropractic health care. In a review of current trials of chiropractic, Brunarski (1) cites several studies that report favorable outcomes of chiropractic treatment with respect to low back pain, headaches, generalized pain and visceral disorders (2–7). Of particular interest are studies that have shown a reduction or normalization in blood pressure after spinal manipulative therapy (8–12).

In a recent review of the role of manipulative therapy in hypertensive disease, Crawford et al. (13) conclude that most patients with hypertensive disease may benefit from regular chiropractic care. Furthermore, they concur with Baldwin (14) that manipulation of the musculoskeletal system may be more effective than hypotensive drugs in correcting or modifying blood pressure. The potential contribution, therefore, of spinal manipulative therapy in the management of hypertension is significant.

The validity of these conclusions may, however, be limited by a serious methodological problem in previous studies. In controlled studies that have compared the effect of active vs. placebo spinal manipulation, placebo effects are typically assessed using a "sham" or fake manipulation or by using soft tissue massage. However, this method may be inappropriate as a placebo control due to the fact that patients can detect a difference between the placebo treatment and the active treatment.

We therefore employed a more valid placebo control treatment to investigate the effects of thoracic manipulation on blood pressure. Both active and placebo treatments in this study were administered by means of a chiropractic adjusting device. When in the "off" position, the device mimics all aspects of the treatment that is administered when in the "on" position but lacks the manipulative component. Therefore, a more valid placebo treatment can be obtained.

In addition to examining the effects of spinal manipulative therapy on blood pressure, we were interested in whether purported physical changes might also be

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associated with concommitant improvements in the psychological state. Because hypertension appears to be related to stress (13), which is mediated by the autonomic nervous system, it may be that spinal manipulative therapy may also be effective in reducing anxiety. We were unable, however, to find any studies which have evaluated the effects of chiropractic adjustments on anxiety.

The purpose of this study, therefore, was to investigate the short-term effects of chiropractic thoracic adjustments, or manipulation, on blood pressure and state anxiety in patients with elevated blood pressure. The study was conducted in a randomized, single-blinded, controlled fashion. Patients diagnosed as having thoracic (T1-T5) vertebral subluxation, determined by static and dynamic motion palpation, and with elevated blood pressure, were randomly assigned to one of three treatment conditions: active treatment, inactive placebo treatment, or no treatment control. We hypothesized that patients in the active treatment condition would have significantly lower systolic an diastolic blood pressure and state anxiety than the patients in the placebo and no treatment control condition.

MATERIALS AND METHODS

Subjects

Patients were selected from the files of a chiropractic office in the Hamilton, Ontario area according to the following inclusion criteria: age 35–60; blood pressure >130 mm Hg systolic and >90 mm Hg diastolic as documented in chiropractic health files; nonobese (obese defined as the inability to obtain a valid occlusive cuff blood pressure reading); normal structural examination except for palpable spinal lesion (subluxations) found in the thoracic region between T1-T5; and provision of informed consent. Twenty-one patients who met the above criteria comprised the final study sample. They were randomly assigned to the active treatment condition, to the placebo treatment condition, and to the no treatment control condition. Because the placebo effect is indistinguishable from the actual adjustment, it was unnecessary to limit participation to only those patients with no previous experience with chiropractic treatment.

Treatment Conditions

Patients were randomly assigned to one of three treatment conditions. The active and placebo treatment were administered by a Doctor of Chiropractic (D.C.) with the aid of a commonly used mechanical adjustment instrument manufactured by Activator Methods, Inc. The device delivers a 28-pound thrust within 1/300 of a second. The chiropractor was, by necessity, aware of the specific treatment condition to which the patient was assigned, but was blind to the patient's blood pressure reading and state anxiety scores and to the hypotheses related to the study. Patients in the *active treatment* condition received an actual chiropractic thoracic adjustment.

To examine the validity of the active treatment, and for purposes of comparison, an inactive *placebo treatment* was also employed. The placebo treatment was also administered using the adjustment activator instrument; however, the instrument was kept in the off position.

A *no treatment control* condition was included in order to control for the passage of time. Patients in this group waited in the treatment room for the same amount of time that a standard treatment takes, but did not receive any treatment.

Dependent Measures

Systolic and diastolic blood pressure were measured by means of a Tycos cuff digital blood pressure monitor (Model 7052-08). Blood pressure was measured at three assessment points: immediately after the subject entered the room; immediately before treatment, following a 5- to 10-min relaxation period in the treatment room; and immediately after treatment.

The state version of the State-Trait Anxiety Inventory (STAI) (15) was used to measure state anxiety. The STAI is a 20-item scale designed to measure subjective feelings of anxiety at the time of testing. It is one of the most widely used scales in anxiety research. State anxiety was measured at two assessment points: immediately before treatment, following the second blood pressure reading; and immediately after treatment, following the third blood pressure reading.

Procedures

Ethical approval was obtained from the McMaster University Ethics Committee. Patients who met the inclusion criteria were contacted by telephone and invited to participate in the study. Those who agreed came to the clinic, where informed consent was obtained prior to beginning the study.

Upon arrival at the clinic, the patient entered the treatment room and baseline blood pressure was measured. After a 5-min relaxation period, pretreatment blood pressure and state anxiety measures were assessed. The chiropractor then entered the room, palpated the spine for any subluxated vertebrae, and

opened a sealed note that indicated which treatment condition was to be administered. At this point, the active or inactive treatment was administered. In the no treatment control condition, the patient was asked to wait for 5 min but did not receive treatment. Following the treatment, or in the case of no treatment control patients, the waiting period, posttreatment blood pressure and state anxiety measures were obtained. After the treatment, the experimenter fully debriefed patients and provided each with a written explanation of the study.

RESULTS

Overview of Data Analyses

Data analyses were performed on a CYBER 170 computer using the Statistical Package for the Social Sciences (SPSS, Version X).

Two types of analyses were conducted: a) baseline and pretreatment comparability analyses. Prior to analyzing treatment effects, comparability between treatment conditions at baseline was assessed using χ^2 tests for discrete variables and one-way analysis of variance (ANOVA) for continuous variables. The purpose of these analyses was to ensure comparability between the three treatment groups on baseline demographic and treatment-related variables. This was done in order to rule out any possible confounds that may have existed between the treatment conditions, and to determine that there were no selective biases among the three groups; and b) treatment effects. The effects of the three treatments (active, placebo, control) on blood pressure and state anxiety were examined using one-way analysis of variance (ANOVA) with post hoc Newman-Keuls multiple comparisons.

Baseline and Pretreatment Comparability Analyses

χ^2 tests and one-way analyses of variance were conducted to determine whether the three treatment groups were comparable at baseline with respect to demographic and treatment-related characteristics. The results of these analyses are presented in Table 1.

χ^2 tests on discrete variables indicated that subjects in the three treatment conditions did not differ significantly with respect to sex, marital status, or blood pressure medication use. A one-way analysis of variance indicated that there were no significant differences between the three groups with respect to age.

One-way ANOVAs were also performed on baseline and pretreatment systolic and diastolic blood pressure and state anxiety scores to ensure that the three treatment groups were comparable prior to treatment. The results of these analyses are presented in Table 2. There were no significant differences between the three treatment groups with respect to baseline and pretreatment scores on the dependent variables.

Treatment Effects

Baseline comparability analyses indicated that there were no treatment group differences on baseline and pretreatment dependent measures. Furthermore, correlational analyses indicated that the correlations between pre- and posttreatment scores for blood pressure and state anxiety were highly and significantly correlated. Therefore, treatment effects were analyzed by means of one-way analyses of variance (ANOVA) on pre/posttreatment change score means (posttreatment score minus pretreatment score). The results of these analyses are presented in Table 3.

A significant effect of treatment was found on change scores for both systolic blood pressure (F (2, 18) = 16.87, $p < 0.0001$) and diastolic blood pressure (F (2, 18) = 16.28, $p < 0.0001$). Post hoc Newman-Keuls multiple comparisons indicated that systolic blood pres-

TABLE 1. Baseline comparability of treatment conditions on demographic and treatment-related variables

Variable	Treatment condition: Active	Placebo	Control	Difference
Age (yrs)				
Mean	45.14	51.71	51.43	F (2, 18) = 1.476, $p < 0.255$
Sex				
Male	2	0	3	
Female	5	7	4	χ^2 (2) = 3.675, $p < 0.159$
Marital status				
Married	5	6	6	
Unmarried	2	1	1	χ^2 (2) = 0.618, $p < 0.743$
Currently on BP medications				
Yes	3	5	5	
No	4	2	2	χ^2 (2) = 1.615, $p < 0.446$

TABLE 2. Means and standard deviations for baseline and pretreatment measures by treatment condition[a]

Variable	Treatment condition: Active	Placebo	Control	Difference
Systolic BP (BL)	141.29 (12.45)	143.14 (14.20)	143.00 (8.91)	F (2, 18) = 0.051, $p < 0.950$
Systolic BP (Pre)	142.71 (11.71)	143.29 (8.83)	144.43 (9.85)	F (2, 18) = 0.051, $p < 0.950$
Diastolic BP (BL)	108.00 (18.57)	112.71 (15.36)	105.28 (11.51)	F (2, 18) = 0.416, $p < 0.666$
Diastolic BP (Pre)	108.15 (18.91)	114.00 (13.90)	105.29 (11.93)	F (2, 18) = 0.598, $p < 0.561$
State anxiety (Pre)	34.43 (8.70)	28.00 (8.70)	29.14 (5.34)	F (2, 18) = 1.374, $p < 0.278$

[a] BL, baseline; Pre, pretreatment; and BP, blood pressure.

TABLE 3. Means and standard deviations on dependent measures by treatment condition

	Treatment condition			
Variable[a]	Active	Placebo	Control	Difference
Systolic BP[b]	−14.71	1.43	1.43	$F(2, 18) = 16.87$,
	(3.45)	(6.24)	(7.57)	$p < 0.0001$
Diastolic BP	−13.00	−1.43	0.71	$F(2, 18) = 16.28$,
	(3.27)	(2.53)	(1.44)	$p < 0.0001$
State anxiety	−5.29	2.29	−1.43	$F(2, 18) = 7.27$,
	(2.14)	(5.47)	(2.64)	$p < 0.005$

[a] Denotes change score (posttreatment score minus pretreatment score).
[b] BP, blood pressure.

sure decreased significantly (14.71 mm Hg) in the active treatment group ($p < 0.05$) as compared to the other two groups, which did not differ significantly (13.00 mm Hg) from each other.

A one-way ANOVA on change scores for state anxiety indicated a significant effect of treatment ($F(2, 18) = 7.27$, $p < 0.005$). Contrary to predictions, however, Newman-Keuls multiple comparisons revealed that state anxiety decreased significantly in both the active and control groups ($p < 0.05$), which were not significantly different from each other, compared to the placebo group in which state anxiety significantly increased.

DISCUSSION

Results of this study lend support to the hypothesis that chiropractic manipulation of the thoracic spine significantly reduces blood pressure in patients with elevated blood pressure. Subjects in the active treatment condition showed a statistically significant decrease in both systolic and diastolic blood pressure as compared to the placebo and control conditions. Although this study does not address the issue of the mechanism of such an effect, the results lend indirect support to the hypothesis that chiropractic adjustment relieves increased sympathetic neural discharge due to a subluxation of the vertebral unit (16–17).

The effects of chiropractic manipulation of the thoracic spine on state anxiety are, however, more difficult to interpret. Although state anxiety in the active treatment group decreased significantly, state anxiety also decreased significantly in the control treatment group. On the basis of these results, one cannot rule out that the observed decrease in the active group is due to factors other than the passage of time. Furthermore, the placebo treatment may have had a slightly negative effect, insofar as anxiety increased in patients who received the placebo treatment. One interpretation of this finding is that patients who had anticipated an actual manipulation, when in fact it was not administered, may have become anxious when their expectations were not confirmed.

Findings from this study indicate that elevated blood pressure can be decreased on a short-term basis by chiropractic manipulation of the thoracic spine. These results are consistent with findings from previous studies (8–12) which demonstrate the effectiveness of chiropractic adjustments in reducing blood pressure. The added methodological rigor of a controlled design with a more valid placebo treatment enhances these findings. Spinal manipulative treatment does not, however, reduce anxiety to any greater extent than a general decrease in anxiety due to the passage of time. Thus, it appears that the short-term beneficial effects of spinal manipulative therapy are physiological in nature.

One of the limitations of this study is that the diagnosis of hypertension was not made on a standard clinical basis. Rather, classification of elevated blood pressure was determined on the basis of medical records. This was corroborated by the baseline blood pressure reading obtained during the study. More stringent diagnostic criteria should be employed in further studies in order to demonstrate efficacy for clinically diagnosed hypertensive patients.

One question raised by this study concerns the long-term efficacy of the observed treatment effect. While spinal manipulative therapy appears to be effective in producing a temporary reduction in blood pressure immediately after treatment, the effect of such treatment in reducing blood pressure over a period of days or weeks is unknown and warrants further investigation.

CONCLUSION

The feasibility of developing more effective blinding procedures for studies of this nature should be explored. Although the present methodology permitted a single-blind treatment condition, in that patients were unaware of the active/inactive placebo treatment distinction, it was not possible to achieve a double-blind treatment condition. One possible approach for use in such studies might be to have a technician give the activator to the clinician with the designated on or off position shielded from view. This would preclude knowledge about which of the active or inactive treatments is to be administered.

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