Cardiovascular Changes After Naprapathic Treatment of the Cervical Spine and Mobilization of the Cranial Bones: A Pre-Post Clinical Trial

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Objective: The aim of this pre-post clinical trial was to investigate the response of the cardiovascular system after treatment with naprapathic mobilization and spinal manipulation of the cervical spine and manual osteopathic mobilization of the cranial bones.

Methods: One hundred and twenty two patients aged 9-85 years old were evaluated pre and post-treatment for changes in blood pressure and pulse rate. Inclusion criteria consisted in being chiropractic patients at the author's office and giving consent to participation in this study. No exclusion criteria were applied. Patients' blood pressure and pulse rates were evaluated pre and post-treatment. For all of the participants, treatment consisted of palpation, naprapathic and chiropractic manual therapy of the cervical spine followed by mobilization of the zygomatic, sphenoid and frontal bones. Data was analyzed by comparing results between participant two age groups and gender of the participants.

Results: There were no clinically significant changes across age or gender in either the systolic or diastolic blood pressure post-treatment. There were clinically significant decreases in the pulse rates across both age and gender groups. The most significant changes were found in the group of participants under 55 years old and the group of male participants.

Conclusion: Naprapathic mobilization and manipulation of the cervical spine coupled with mobilization of the cranial bones may result in decreased pulse rate and improved cardiovascular function.

Key words: Blood pressure, cardiovascular, cranial, hypertension, heart rate, mobilization, naprapath*, pulse rate, SMT, spinal manipulative therapy

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Introduction:

A review of the free full text literature on Pubmed regarding the effects of naprapathic manual therapy on humans provided only nine results. This pre-post clinical trial was designed to add to the body of literature regarding the effects of naturopathic treatments on the cardiovascular system testing a hypothesis that treatments would lower both blood pressure and pulse rate.

Blood Pressure Measurement:

Blood pressure is an indication of how the cardiovascular system is functioning. It's normally recorded in millimeters of mercury (mmHg) by indicating the systolic pressure over the diastolic pressure. The first number is the systolic pressure and it measures the arterial pressure when the heart beats and pumps blood into the arteries. The second number is the diastolic pressure. This measures the pressure when the heart rests between beats. Blood pressure measurements range from normal to hypertensive crisis (Ralph, 2017).

The American Heart Association has established 5 categories of blood pressure ranging from normal to hypertensive crisis.

Blood Pressure Categories:

1. Normal blood pressure: Systolic mmHg less than 120 and Diastolic mmHg less than 80,
2. Elevated blood pressure: Systolic mmHg 120-129 and Diastolic mmHg less than 80,
3. Hypertension, Stage 1: Systolic mmHg 130-139 or Diastolic mmHg 80-89,
4. Hypertension, Stage 2: Systolic mmHg 140 or higher or Diastolic mmHg 90 or higher and
5. Hypertensive crisis: Systolic mmHg higher than 180 and/or Diastolic mmHg higher than 120. (Johns Hopkins University, 2021)

Hypertension is a multifactorial condition that is among the leading causes of mortality worldwide. (Sullivan et al., 2020) Present day treatment for diagnosed hypertension around the world is largely pharmacological. (Zhou et al., 2019) However, 20-30% of individuals are resistant to traditional pharmacological treatment and this indicates the need for alternative intervention options. (Sullivan et al., 2020) Non-pharmacological treatments that help the autonomic nervous system regulate blood pressure should be researched for efficacy and used when possible. (Sullivan et al., 2020)

Pulse Rate Measurement:

The pulse rate indicates how many times per minute the arteries expand and contract in response to the pumping of the heart. It corresponds directly to the heartbeat in that the contractions of the heart increase the blood pressure in the arteries that lead to a detectable pulse. Although some sources say that heart rate and pulse rate are not interchangeable terms (Wong et al., 2012), for purposes of this study, pulse rate has been considered "both equal to and a direct measure of the heart rate". (MacGill, 2021) Pulse rate is largely regulated by the autonomic nervous system, which includes the sympathetic and parasympathetic nervous systems. When the sympathetic nervous system is activated, the heart rate increases. And when the parasympathetic nervous system is activated, the heart rate is suppressed. (Wehrwein et al., 2016)

A normal resting pulse rate for healthy adults ranges from 50 to 100 beats per minute. Pulse rate changes throughout the day based on exercise and activity levels, age, illness, medications, smoking, caffeine intake, injury and emotions. (Johns Hopkins Medicine, n.d.)

Higher heart rate has been shown to lead to both higher cardiovascular death rates as well as higher overall death rates. Data from the 1948 Framingham Heart Study showed that as resting heart rate increased, death rates also increased significantly. (Kannel, 1987)

Methodology:

This pre-post trial was conducted on a varied patient base in a chiropractic office in Barcelona, Spain between February 24, 2020 and March 10, 2020. Of the 120 participants, 66% of them were women. Of the 115 participants who disclosed their age, 57% were younger than 55 years old and 43% were 55 years or older.

Testing Protocol:

The equipment used to assess blood pressure was a Welch Allyn Home Blood Pressure Monitor 1500 series Standard BP, a device intended for use in measuring blood pressure and pulse rate in adults. Blood pressure measurement was performed on each participant's right arm while seated, immediately before and after receiving treatment. Instructions were given to each participant to refrain from bending their head during measurement.

Treatments were performed over a 15 minute period. Each participant received 60 seconds of naprapathic cervical spine mobilization and a manual or activator correction from C1 to C6 based on static and motion palpation findings. Cranial mobilization of the sphenoid bone was performed for 60 seconds by contacting the frontal and zygomatic bones and moving them in opposing directions to one another, medially and laterally along the transverse plane.

Parameters for hypertension were established at greater than or equal to 130mmHg for systolic pressure and greater than or equal to 90mmHg for diastolic pressure. Pulse rate parameters for tachycardia were established at greater than 100mmHg and less than 60mmHg for bradycardia. Two sets of statistical calculations were performed using the open-source statistics program JASP to analyze the data. One set of calculations separated the participants by age group, and the other by gender. Normality of values was determined by calculating skewness and kurtosis. No departure from normal values was found, so parametric tests were deemed adequate. Comparison between pre-adjustment (PRE) and post-adjustment (POST) values was performed using the paired t-test. Significant differences were determined at p belong less than .05.

Hypertension Parameters:

Systolic (Value)	**Systolic (Clinical change)**	**Diastolic (Value)**	**Diastolic (Clinical change)**
≥ 130mmHg	± 5	≥ 90mmHg	± 2.5

Distribution of Population Groups:

Age ranges:	**Number of Participants**	**Valid Percentages (Excluding undisclosed values)**
< 55 years old	66	57.391%
≥ 55 years	49	42.609%
Age Undisclosed	5	
Gender		
Female	80	66.116%
Male	40	33.884%
Eliminated for missing post treatment data	2	

Data Analysis:

Although no clinically significant changes were found in the systolic or diastolic pressure post-treatment, both age groups showed a decrease in pulse rate post-treatment. Based on p values, the most clinically significant results are found among the pulse rate changes in the two subgroups of males and those under 55 years old. Both subgroups reflected an average decrease of five pulses per minute. For the subgroups of women and participants 55 years and older, the mean pulse rate decreased by three pulses per minute.

Results by Age Group:

1. The mean systolic pressure of participants younger than 55 years old pretreatment was 124mmHg and 123mmHg post-treatment ($p = .617$).

2. The mean systolic pressure of participants 55 and older pretreatment was 143mmHg and 147mmHg post-treatment ($p = .33$).

3. The mean diastolic pressure of participants younger than 55 old pretreatment was 80mmHg and 82mmHg post-treatment ($p = .185$).

4. The mean diastolic pressure of participants 55 and older pretreatment was 85mmHg and 83mmHg post-treatment ($p = .375$).

5. The mean pulse rate of participants younger than 55 years old pretreatment was 75 pulses per minute and 70 pulses per minute post-treatment ($p = < .001$).

6. The mean pulse rate of participants 55 and older pretreatment was 73 pulses per minute and 70 pulses per minute post-treatment ($p = < .001$).

Results by Gender:

1. The mean systolic pressure of female participants pretreatment was 129 mmHg and 133mmHg post-treatment ($p = .012$).

2. The mean systolic pressure of male participants pretreatment was 138 mmHg and 137mmHg post-treatment ($p = .197$).

3. The mean diastolic pressure of female participants pretreatment was 81mmHg and 81mmHg post-treatment ($p = .804$).

4. The mean diastolic pressure of male participants pretreatment was 86mmHg and 88mmHg post-treatment ($p = .132$).

5. The mean pulse rate of female participants pretreatment was 74 pulses per minute and 71 pulses per minute post-treatment ($p = < .001$).

6. The mean pulse rate of male participants pretreatment was 73 pulses per minute and 68 pulses per minute post-treatment ($p = < .001$).

Results by Age Group:

Systolic and diastolic blood pressure and pulse rate are shown in figures 1.A, 1.B and 1.C, respectively.

Figure 1.A

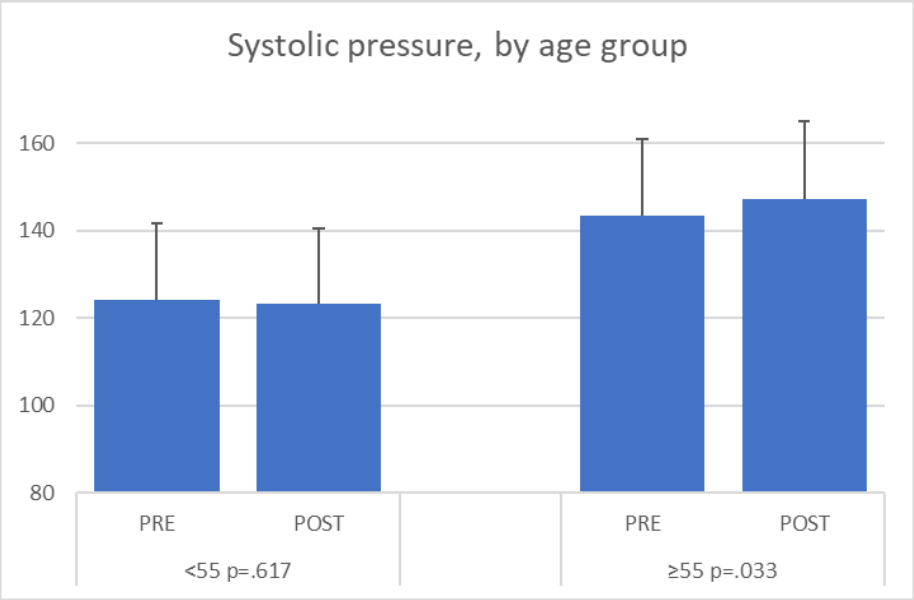


Figure 1.B

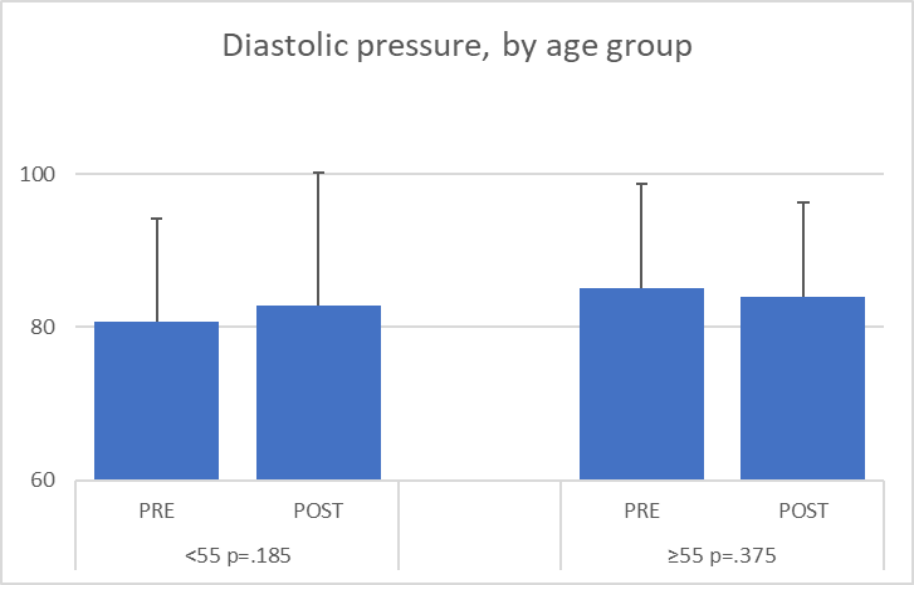
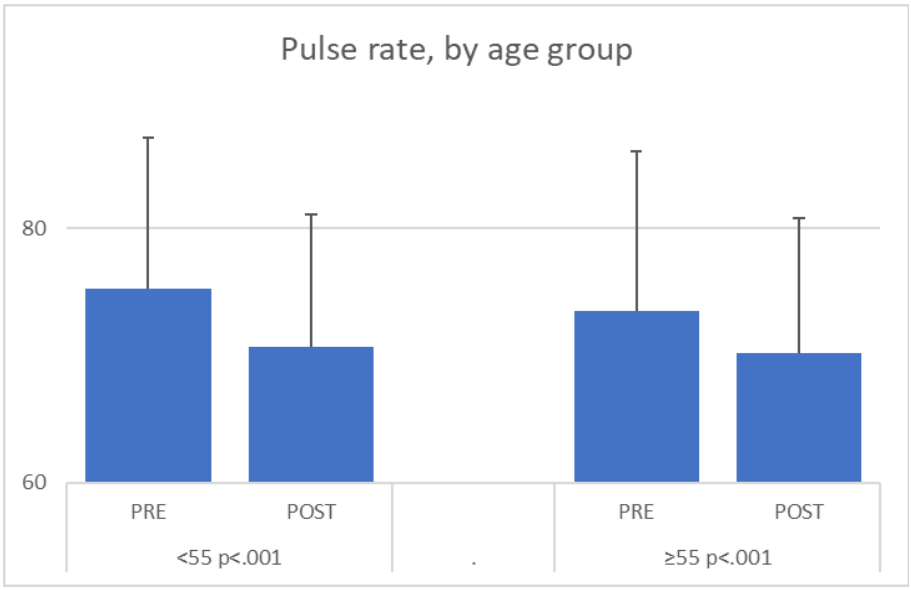


Figure 1.C



Results by Gender:

Systolic and diastolic blood pressure and pulse rate are shown in figures 2.A, 2.B and 2.C, respectively.

Figure 2.A

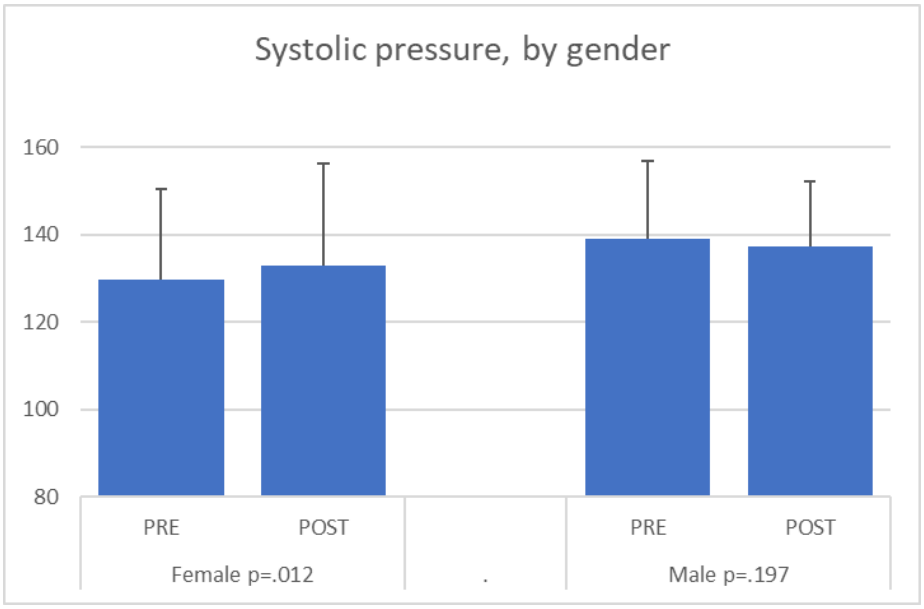


Figure 2.B

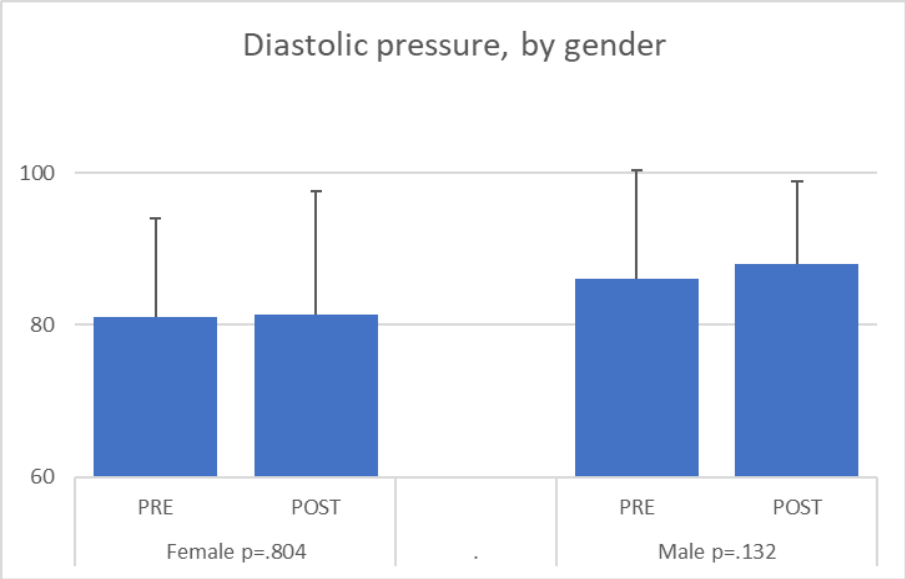
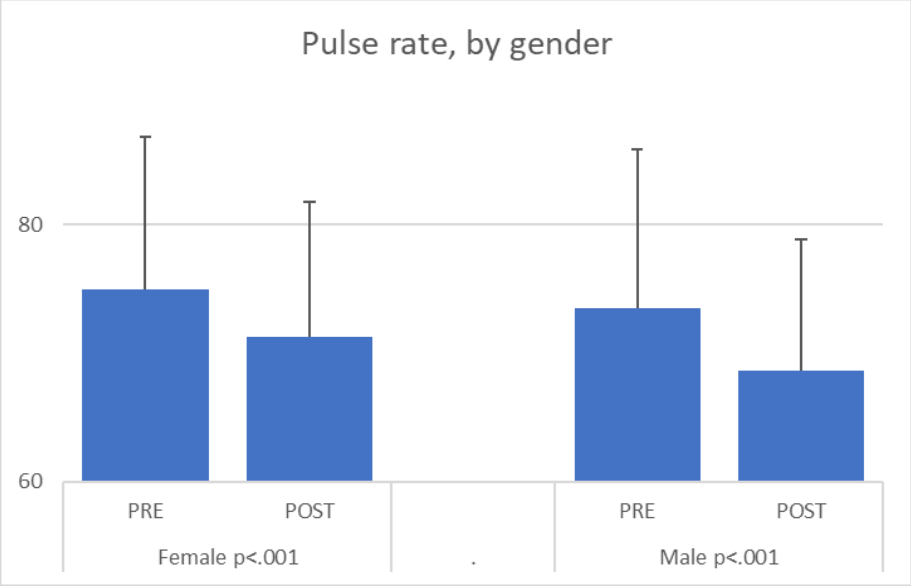


Figure 2.C



Analysis:

More than 25% of the global adult population currently suffers from hypertension. By 2025, that number is expected to increase to 29%. (Sullivan, et al. 2020) Although pharmacotherapy is currently the most widely used treatment for hypertension, there are two main challenges to this treatment: medication side effects and therapeutic resistance. In a 2020 review of 28 articles written between 1980-2019 relating to chiropractic care and hypertension, chiropractic care was found to be a promising non-pharmacological treatment alternative worthy of further research.

Studies have shown that spinal manipulative therapy in the cervical spine can help reduce blood pressure and improve cardiovascular health. For example, in one 2014 case study, sixteen sessions of NUCCA chiropractic care were shown to maintain blood pressure at desirable levels. (Chung, et al. 2014) In another pilot study, correcting the misalignment of the first cervical vertebrae was shown to reduce and help maintain lower blood pressure. (Bakris, et al. 2007)

Similar to spinal manipulative therapy, naprapathic therapy has been shown to be effective in the treatment of non-specific low back and neck pain. (Skillgate, et al. 2010) It is possible that similar to the benefits of spinal manipulative therapy, the benefits of naprapathic therapy go beyond relief of low back or neck pain. Based on the results of this pre-post trial, one benefit of naprapathic therapy appears to include lowered pulse rates by 3-5 pulses per minute. Naprapathy should be considered as a viable non-pharmacological or supplemental treatment option for hypertension.

In the 2019 article that addressed the role and the importance of personalizing treatment of hypertension, nonpharmacologic methods of control with lifestyle modifications and regular physical activity were shown to be efficacious for some people and especially useful in patients with subtypes of hypertension that did not respond as expected to pharmacological treatment. The authors concluded by saying that "[c]linicians seeing patients with unusual hypertension phenotypes should be familiar with emerging trends in personalized treatment of hypertension. In the final analysis, we expect a variety of approaches to co-exist, to be called upon when most useful." (Melville, et al. 2019) To respond to this emerging trend in health care needs, more research should be conducted into the role of naprapathic therapy as one of these approaches.

Naprapathy may be considered to be a viable option for reducing cardiovascular related morbidity and mortality.

Limitations of study:

Three areas have been identified in which this study could have been improved.

First, if three unique control groups had been established to provide either mobilization of the cervical spine, manipulation of the cervical spine or manual osteopathic mobilization of the cranial bones then it would have been possible to determine post facto which, if any of the interventions produced a better response rate than another. Additionally, if a fourth control group had been established to receive "sham" interventions, it would have been possible to determine whether the interventions alone were responsible for the changes recorded.

Second, it is impossible to determine whether the interventions were the only factor that were responsible for the changes observed. For example, the decreased pulse rates could have been caused by the fact that the participants were lying down and resting for fifteen minutes during treatment sessions.

Finally, participants who were taking pharmacological treatments to control their blood pressure could have been excluded from the study to ensure that the changes observed were based solely on the treatments received and not on pharmacotherapy.

Conclusion:

This pre-post clinical trial tests the hypothesis that naprapathic manual therapy and cranial mobilization may improve cardiovascular function by reducing blood pressure and heart rate. The most clinically significant improvements ($p = < .001$) to cardiovascular function were seen in participants under the age of 55 and in males. The mean decrease of 5 pulses per minute post treatment was seen in both sub groups. Similarly, a mean decrease of 3 pulses per minute was seen in the sub groups of those 55 and older and female participants. This initial data merits further further research to ascertain the future role of naprapathic manual therapy as a non pharmacotherapy for the treatment of hypertension.

While there is evidence that suggests that long term spinal manipulative therapy can improve cardiovascular function by decreasing blood pressure and heart rate, there is very little evidence based research about the effects of naprapathic mobilization techniques in general and there is no evidence that examines whether naprapathic techniques including cranial bone mobilization may contribute to improved cardiovascular function. Given the emerging need for personalization of care and non-pharmacological treatment options for hypertension, more research is the first step to meeting those needs and providing more options.

This study adds to the body of literature on a possible association between manual therapies of the cervical spine and cardiovascular assessments. As this is the first study to combine naprapathic and cranial osteopathic techniques, further research (such as a randomized clinical trial) seems warranted as a next step toward introducing a novel treatment for a safe, natural approach to cardiovascular health.

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