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ORIGINAL ARTICLE

Immediate Changes in the Peripheral Blood Flow after Applying aT3-T4 Manipulation to Smoking Women

Campos-Castro D (PT, DO)¹, Burrel-Botaya A (PT, DO)²

1.- Clinic of Osteopathy Delfin Campos. Ourense (Spain).

2.- Burrel Osteopathy. Ferrol (Spain).

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ABSTRACT

Keywords:

Smoking habit;
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Introduction: Our research is focused on smoking women, in order to evaluate thrust's effects in female gender and verify if nicotine could represent a factor of varying the blood flow of this population.

Objectives: Verify if using Manipulation with Dog Technique (MDT) in extension of the vertebral segment T3-T4, there is a change produced in the heart rate, blood pressure and/or the blood flow of the radial, carotid or the dorsalis pedis artery.

Material and methods: 25 smoking women were analysed, aged between 18 and 50, with no previous cardiovascular disease. They were divided into two groups, the Experimental Group (n=13; average age 36.15 ± 8.34 years) and the Control Group (n=12; average age 34.67 ± 6.95 years). A thoracic manipulative technique (Dog technique) was applied in bilateral extension of the spinal segment T3-T4, and heart rate, blood pressure and blood flow of the radial, carotid and dorsalis pedis artery were measured.

Results: There are significant intergroup differences between the CG and the EG with regard to the systolic velocity ($p=0.034$) and the mean velocity ($p=0.038$) of the right radial artery. As for the heart rate and the systolic and diastolic pressure, we obtained an immediate decrease of their values after applying the experimental technique, but there were no significant differences between groups ($p>0.05$).

Conclusions: Applying the MDT technique in extension of the vertebral segment T3-T4, on smoking women, obtains a significant increase of the flow in the right radial artery and a significant tendency in the left carotid artery. There are no significant changes, neither in the flow of dorsalis pedis artery, nor in the values of the heart rate and systolic and diastolic pressure.

INTRODUCTION

One of the most important principles of Osteopathy is Still's "rule of artery". This rule is essential for the concept of self-healing, because the artery is the one in charge of nourishing the tissues. A proper nutrition of the tissues is very important for their healing and regeneration¹.

There are few scientific articles that value the effects of the vertebral manipulation with thrust, concerning the blood flow. For this reason, we strongly believe Still's "rule of artery" could be considered as a hypothesis to confirm. Karason², Howard³ and Lombardini⁴ are the few studies we found in that regard.

Our research is focused on smoking women, in order to evaluate thrust's effects in the female gender, and verify if nicotine could be a varying factor in this population's blood flow, related to gender, since there are researches carried out for genders, smoking and non-smoking, with no significant results obtained⁵.

The fact of smoking and especially nicotine seems to be an important factor which influences blood flow, since it injures the vascular endothelium and facilitates vessels to become narrow and clogged⁶, since smoking facilitates cholesterol deposits on the vessels⁷, and alters this way, the blood flow by stimulating the sympathetic nervous system. Smokers' blood tends to clot more easily^{8,9} than the non-smokers' blood.

The effects of the nicotine last between⁵ and 10 minutes, provoking phases of stimulating action and depressant action of the central nervous system.

Firstly, nicotine stimulates some sensitive receptors and produces a discharge of adrenaline that accelerates the heart rate and increases the blood pressure; next, it depresses all the autonomous ganglions of the peripheral nervous system¹⁰.

Smokers were chosen according to the trials of Karason², whom investigated about applying a manipulation with thrust at L5, applied to 20 smokers of both genders, finding a significant improvement in the blood flow.

Our research is focused on the vertebral level T3-T4, in order to analyse if there are effects over the blood supply of the upper limbs, since there exist previous studies done over the lower limbs², but their effects are unknown over the upper limbs, and our intention is to distinguish if there are effects over the arterial or cardiac orthosympathetic system.

To measure the blood flow, we use as measurement device the Doppler, based on previous trials¹¹⁻¹⁴, taking into account the flow of the radial, carotid and dorsalis pedis artery. Also, we will control the values of heart rate and blood pressure, to observe the possible cardiac and arterial effects.

HYPHOTESIS

Manipulation with Dog Technique (MDT) in extension of the vertebral segment T3-T4 causes immediate changes in blood pressure, heart rate and the blood flow of the radial, carotid and dorsalis pedis artery, bilaterally after the manipulation of the mentioned smokers.

OBJECTIVES

The goal is to verify whether applying a MDT in bilateral extension of the vertebral segment T3-T4 produces immediate changes in heart rate, blood pressure and/or the blood flow of the radial, carotid and dorsalis pedis artery.

MATERIAL AND METHODS

Study design

It is a randomised clinical trial, double-blind, with no relation between the evaluator and the controller¹⁵.

Study population

25 (n=25) women were included in this trial (13 in the Experimental Group, with an average age of 36.15 ± 8.34 years old, and 12 in the Control Group, with an average age of 34.67 ± 6.95).

Randomisation

The allocation of subjects to one study group or the other, meaning to the Control Group (CG) or the Experimental Group (EG), was made using a table of random numbers. Smoking women were allocated randomly to those groups, and did not receive any information neither about the trial's objectives, nor about the assignment to the groups CG and EG. The random sequence was hidden to participants and was protected by a collaborator external to the research.

Study variables

The variables which were taken into account in our trial are age (years), gender, presence of cardiovascular disease, systolic, mean and diastolic velocity (cm/s), heart rate (pul/min) and blood pressure (mmHg).

Variables like the systolic, mean and diastolic velocity were measured with Doppler (Bidop Es-100V3, Hadeco, Arima, Japan)¹⁶⁻²¹ (Figure1).

Heart rate and blood pressure were evaluated with a digital pressure gauge (R6, Omron Healthcare, Kyoto, Japan)²²⁻²⁴ (Figure1).



FIGURE 1. Tension gauge and Doppler.

Selection criteria

We selected smoking women according to WHO's criteria, which considers a "smoker" to be someone who has been smoking daily for the last month, no matter how many cigarettes, even one²⁵. The study population was chosen between the attendants at the Delfin Campos' clinic (Ourense, Spain).

Inclusion criteria: a) women aged between 18 and 50 years²⁶; b) no diagnosed cardiovascular disease; c) more than 10 daily cigarettes smoker for more than a year;

Exclusion criteria: women with high blood pressure; medical history of angina; medical history of acute myocardial infarction; coronary atheromatosis; stroke; temporal arteritis; mitral insufficiency; arterial thrombosis; arterial aneurysm; Barré-Lieou's syndrome; epilepsy; Ménière's disease; balance disorders; Arnold Chiari; disc prolapse; visceral and bone cancer; osteoporosis; infectious or inflammatory rheumatism; fracture; patient's rejection to manipulations.

Study protocol

We carry out the following sequence of actions: we verify criteria of inclusion/exclusion and signing of the consent; random allocation of women in the treatment groups; measurement of the heart rate at rest and in supine position, after waiting for 5 minutes to normalise the blood pressure; measurement of systolic and diastolic pressures at rest and in supine position; measurement of the systolic, mean and diastolic velocity with Doppler at rest and in supine position; applying thrust at the experimental group and placebo to the control group; measurement of the heart rate 5 minutes after applying the technique; measurement of systolic and diastolic pressure 5 minutes after the technique; measurement of the systolic, mean and diastolic velocity also 5 minutes after the technique.

Procedures applied

To the Experimental Group (EG): An MDT, in extension of T3-T4, was applied to smoking women in supine position, with the lower limbs extended and the upper ones in an embrace position with flexed elbows. Once we establish contact with our hand over the vertebral level T3-T4, we perform a thrust on the patient, towards his head, which produced in all cases articular cavitation^{27, 28} through an audible "pop" sound. MDT was applied by an experienced osteopath.

To the Control Group (CG): A placebo technique was applied through positioning in the same position, but without applying any thrust to the smoker, and with no articular cavitation with an audible "pop" sound obtained.

Assessments performed

All participants received their measurements of the different values in two different moments, pre-intervention and post-intervention, carried out by qualified health professionals (vascular surgeon) with wide experience in the mentioned measurements. Procedure of intervention, monitoring and data collection:

Smoking women were surveyed about their smoking habit and recent pathologies. They were generally informed about the trial they were about to be involved in, without details about its objective, and they received the informed consent form, in order to sign it previously.

To verify the exclusion criteria, all smoking women filled out an explicit statement, indicating they do not suffer from any diagnosed cardiovascular disease.

Once inside the examination room, participants were asked to lie down in supine position on a treatment table, in anatomical position (Before measuring, it is necessary to wait for 5 minutes, so that blood pressure can normalise after the change of position), where we also had a Doppler portable equipment (Bidop Es-100V3, Hadeco, Arima, Japan) and a digital tension gauge, as well as administrative material for data collection. The room was maintained to a stable temperature, between 18 and 24°C, and with no noise pollution.

All women smoked a last cigarette before entering the treatment room. Pre-manipulative measurements with Doppler were carried out (radial, carotid, dorsal is pedis artery), and also with the digital tension gauge. The intervention was performed for the EG or CG, and after waiting for 5 minutes, a new data collection was taken.

All the time, the evaluator was completely unaware of what group the participants belonged to, and also what the objectives of the trial were.

Statistical analysis

Data were analysed using software SPSS V.18 (version 18.0)²⁹⁻³². Averages, and also the standard deviation of each variable, were calculated.

The Kolmogorov-Smirnov test was applied to establish the degree of normality for the studied variables. The initial comparisons between groups were performed through the statistica IU of Mann-Whitney, for which there were compared the pre-post improvements between groups. The statistical analysis was performed with a confidence level of 95%. A p-value that was lower than 0.05 in all analyses was considered statistically significant.

ETHICAL STANDARDS

Our research fulfils the ethical standards of the Helsinki Declaration and its subsequent revisions^{34, 35} (figure 2).

RESULTS

25 women were involved in this trial (13 in the experimental group with an average age of 36.15 ± 8.34 years and 12 in the control group, with an average age of 34.67 ± 6.95 years). All study variables presented an abnormal distribution ($p > 0.05$). There were no differences between groups at the beginning of the trial, except for the heart rate ($p = 0.005$) (table1).

An increase of blood flow was observed in basically all the measurements of flow of the carotid and radial arteries, in the case of the experimental group after 5 minutes, except for the systolic velocity of the of the left radial artery and left dorsalis pedis. The same thing happened with the diastolic velocity of the left radial artery and right dorsalis pedis (table1). There are significant inter group differences between the EG and the CG as for the systolic velocity ($p = 0.034$) and the mean velocity ($p = 0.038$) of the right radial artery (table1). As for the heart rate, and the systolic and diastolic pressure, we obtained an immediate decrease of their values after applying the experimental technique, but there were no significant differences between groups ($p > 0.05$) (table1).

DISCUSSION

The obtained results are the same as those from other trials, where an increase of blood flow was observed at the segmentary level after applying a manipulation with thrust²⁻⁴.

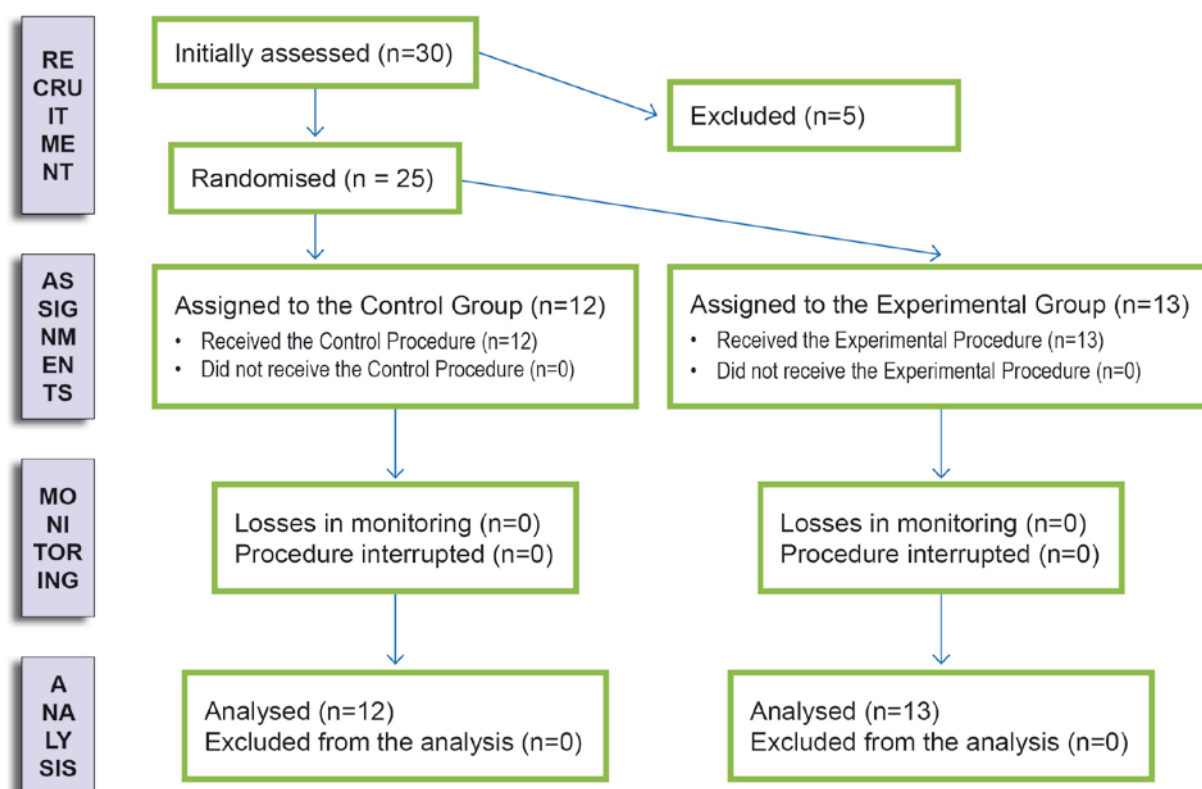


FIGURE 2. Flow chart according to the CONSORT³³ statement for the Report of Randomised Trials.

The involved action mechanisms could vary, including the influence of the segmentary orthosympathetic system at the arterial level, which could influence to a large extent than the orthosympathetic system at the central level, since we obtained immediate increases of flow of the radial artery, although for the carotid and dorsalis pedis artery was not the same significant situation. We believe that if the action mechanism had been involved in the heart's segmentary orthosympathetic system, heart rate would have changed significantly, and that was not the case, agreeing with Boscá³⁶ whom had not seen changes either. Budguell³⁷ did observed changes in the heart rate after applying a thoracic manipulation technique. Likewise, we believe that if the effect had an impact on the central orthosympathetic system at the level of the regulatory centres, there would be some changes of heart rate, blood pressure and blood flow. Budguell³⁷ described these findings, although other authors like Yates³⁸ or Boscá³⁶ did not agree with these statements.

Harris and Wagnon³⁹ observed that the skin's temperature changes after applying a thrust technique, but not in the entire body, just in the area of the skin that shares the orthosympathetic nerve supply with the vertebral segment that receives the manipulation.

There are no significant changes neither in the flow of the dorsalis pedis artery, nor in the values of heart rate or the systolic and diastolic pressure between groups, which means that MDT is a safe technique at the cardiovascular level.

Other researches would be necessary with a greater sample size, to provide evidences of the changes in blood flow that the MDT can produce among smoking women. The foresight of this trial could head towards the MDT's effects on other vascular pathologies that affect women's upper limbs, such as the carpal tunnel syndrome.

	EG				CG				P Value
	PRE		POST		PRE		POST		
	Average	SD	Average	SD	Average	SD	Average	SD	
VSCAROTD (cm/sg)	6.73	2.60	8.52	2.88	6.44	2.82	6.96	3.68	0.253
VSCAROTI (cm/sg)	4.83	2.49	7.20	3.58	5.48	1.88	5.20	1.56	0.053
VMCAROTD (cm/sg)	1.96	1.35	2.38	2.18	1.49	1.12	2.32	2.33	0.399
VMCAROTI (cm/sg)	1.31	1.07	1.92	1.34	0.85	0.65	1.20	0.84	0.849
VDCAROTD (cm/sg)	0.38	0.58	1.46	1.26	0.85	0.86	1.33	2.21	0.880
VDCAROTI (cm/sg)	0.65	1.42	0.85	1.08	0.51	0.50	0.49	0.65	0.200
VSRADIALD (cm/sg)	3.95	2.13	5.89	5.50	6.26	4.47	4.42	2.49	0.034*
VSRADIALI (cm/sg)	4.98	2.20	4.30	2.02	5.72	3.16	5.74	1.75	0.480
VMRADIALD (cm/sg)	0.71	0.84	1.12	.81	1.64	1.77	0.63	0.43	0.038*
VMRADIALI (cm/sg)	1.07	1.01	1.45	2.10	1.22	1.03	1.26	1.22	0.623
VDRADIALD (cm/sg)	0.15	0.29	0.85	0.93	0.92	1.81	0.30	0.40	0.071
VDRADIALI (cm/sg)	0.72	1.32	0.52	1.16	0.28	0.36	0.26	0.46	0.452
VSPEDIAD (cm/sg)	4.25	2.55	5.22	5.73	4.99	2.87	5.09	3.72	0.978
VSPEDIAI (cm/sg)	4.61	4.19	4.37	2.87	5.41	2.12	4.50	1.93	0.683
VMPEDIAD (cm/sg)	1.05	1.19	0.53	0.40	1.27	1.65	1.06	1.51	0.978
VMPEDIAI (cm/sg)	1.05	2.02	0.98	0.96	1.03	1.15	0.93	1.53	0.114
VDPEADIAD (cm/sg)	0.38	0.67	0.27	0.51	0.14	0.29	0.22	0.47	0.445
VDPEADI (cm/sg)	0.27	0.39	0.65	1.42	0.53	0.87	0.53	0.67	0.640
FC (pul/min)	72.77	9.37	69.08	7.11	81.42	8.16	76.75	9.55	0.495
PAS (mmHg)	106.38	11.19	103.85	10.75	104.67	10.64	98.83	8.17	0.172
PAD (mmHg)	65.38	18.50	60.46	8.62	64.08	7.54	64.50	7.20	0.354

TABLE 1. Results of the Experimental and Control Group.

VSCAROTD: right carotid artery systolic velocity; VSCAROTI: left carotid artery systolic velocity; VMCAROTD: right carotid artery mean velocity; VMCAROTI: left carotid artery mean velocity; VDCAROTD: right carotid artery diastolic velocity; VDCAROTI: left carotid artery diastolic velocity; VSRADIALD: right radial artery systolic velocity; VSRADIALI: left radial artery systolic velocity; VMRADIALD: right radial artery mean velocity; VMRADIALI: left radial artery mean velocity; VDRADIALD: right radial artery diastolic velocity; VDRADIALI: left radial artery diastolic velocity; VSPEDIAD: right dorsalis pedis artery systolic velocity; VSPEDIAI: left dorsalis pedis artery systolic velocity; VMPEDIAD: right dorsalis pedis artery mean velocity; VMPEDIAI: left dorsalis pedis artery mean velocity; VDPEADIAD: right dorsalis pedis artery diastolic velocity; VDPEADI: left dorsalis pedis artery diastolic velocity; FC: heart rate; PAS: systolic blood pressure; PAD: diastolic blood pressure. SD: Standard Deviation. P-values are from the U of Mann-Whitney test. *It expresses statistical significance.

Study limitations

Apart from the sample size, there are other limitations that can be taken into account for future researches, such as the application of MDT in patients with cardiovascular and lung diseases. It would be interesting to include men in future trials, since we are not familiar with the effects on them.

CONCLUSIONS

Applying MDT in extension of the vertebral segment T3-T4 in the case of smoking women means a

significant increase of flow for the right radial artery, and a tendency in the left carotid artery. There are no significant changes, neither in flow for the dorsalis pedis artery, nor for the values of heart rate or systolic and diastolic pressure.

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CONFLICT OF INTERESTS

The authors declare that there are no conflicts of interests concerning this research.

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