Physiotherapy and Health Activity
www.ptha.eu pth@awf.katowice.pl
2014;22:15-20 ISSN: 2392-2664

Assessment of the influence of cervical spine traction on the change of heart hemodynamic parameters

Received: 26-10-2014
Accepted: 29-10-2014
Published: 9-11-2014

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Abstract

Background: The vast majority of pain dysfunctions of the cervical spine is underlain by prolonged overload and one effective therapy is traction. The aim of this study is to assess the influence of cervical spine traction on changes in heart rate and arterial blood pressure in people with arterial hypertension and normotension.

Material/Methods: The study involved a total of 168 patients, in whom chronic cervical spine pain syndrome of low intensity, with no radiation of symptoms and with no significant functional limitations occurred. The subjects were intentionally allocated into a group with arterial hypertension and a group with normotension.

Results: The analysis of the obtained results showed that cervical spine traction does not strain the cardiovascular system. In the group of subjects with arterial hypertension, a linear value reduction of all the heart hemodynamic parameters measured in the successive trials was observed. The most significant difference between the initial and final test was observed in patients, in whom the traction procedure was only simulated.

Conclusions: Cervical spine traction performed according to D. Saunders' method does not constitute any threat to patients with arterial hypertension.

Keywords: cervical spine traction, arterial hypertension, heart rate, pain-overload syndromes

Word count: 2151
Tables: 5
Figures: 0
References: 23

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INTRODUCTION

The vast majority of pain dysfunctions of the cervical spine is underlain by a prolonged overload. It develops as a result of adopting, for many years, non-ergonomic body positions at work and during rest time, decreasing physical activity and gradual posture deterioration. These phenomena affect the impairment of motor control and central stabilization, leading to the deterioration of static-dynamic properties of the human body. About 80% of the population experience problems with pain or functional disorders of the spine, out of which 50% concern the cervical spine. Those ailments tend to intensify with age, when human beings experience bradykinesia, there is a fear of taking up physical activity which in consequence causes obesity, diabetes, cardiovascular system diseases and other bodily diseases (Hodges 2001; Cote et al., 2003; Falla, 2004; Falla et al., 2006; Richardson et al., 2004; Knapik et al., 2009).

Methods of preventing the occurrence of pain dysfunctions of the cervical spine are diverse. Among these actions, the prevailing ones are analgesic procedures, exercises aimed at creating properly developed deep muscles and a habit of maintaining correct posture as well as exercises improving motor control (Saunders and Saunders, 1995; Gross et al., 2002; Kjellmann, 2002; Graham et al., 2006). It needs to be remembered, however, that the effectiveness of the exercises carried out is strongly conditioned by the preparation of tissues. One of a series of treatment procedures, facilitating the reconstruction of optimum tissue parameters, is the traction procedure. Its basic task is to create appropriate conditions for hydration of the intervertebral disc and stretching the paraspinal tissues. According to many authors it constitutes a significant complementation, and at times, the main direction of a therapy (Gieremek et al., 2003a; Gieremek et al. 2003b; Graham et al., 2006).

Undoubtedly, a crucial problem connected with traction of the cervical spine is the method of its performing and accompanying treatment procedures. There is no conclusive answer to the question whether the best results are achieved by means of traction with a constant force, intermittent traction, manual traction or vibration traction. A significant diversity may also be noticed in the suggested application of force. The position of the patient is a problem as well; some researchers point at the possibility of performing traction in a sitting position, while others claim that cervical traction should always be carried out in the supine position (Zylbergold and Piper, 1985; Saunders and Saunders, 1995; Constantoyannis et al., 2002; Myśliwiec et al., 2010).

During the treatment procedure, irrespective of the method of performing cervical spine traction, the vertebrae move away from each other, ligaments and muscles stretch and cervical lordosis decreases. There arises a question, how the other tissues located in the neck area react. It was observed that during traction performed while lying down the patients become sleepy and frequently fall asleep (Myśliwiec et al., 2010). It is interesting whether the cause of such a situation may be solely connected with the patients' body position or whether there is also another explanation. It may be assumed that spinal pain, as well as other bodily diseases, occurs with age and here emerges a doubt whether performing the traction procedure is a dangerous strain or, on the contrary, acts in a toning up manner on the functioning of other systems.

The authors of methodology books concerning physiotherapy, mention atlantoaxial instability, vertebral artery insufficiency, spine developmental defects, neoplasms, osteoporosis as well as cardiovascular system diseases as contraindications towards performing cervical spine traction (Saunders and Saunders, 1995; Constantoyannis et al., 2002). In this study, the question was posed: how does cervical traction affect changes in heart rate and arterial blood pressure in people with arterial hypertension and whether, from this perspective, should carrying it out be contraindicated for patients with pressure disorders?

MATERIAL AND METHODS

A total of 168 patients were involved in the study. They were Silesian Voivodeship residents who agreed to have a single cervical spine traction procedure. The studies were carried out from January to December 2010 in the Silesian Rehabilitation Center in Mysłowice and the Clinical Provincial Hospital in Rybnik. All the subjects had developed a chronic cervical spine pain syndrome, diagnosed by a physician, of low intensity with no radiation and no significant functional limitations. Any possible contraindications for performing the treatment procedure occurring in the patients were excluded. According to the guidelines of the Declaration of Helsinki, the people taking part in the study were informed about the methodological basis of executing the research, and they agreed to take part in the experiment; they were not, however, informed about its direct purpose. The subjects involved were intentionally divided into two groups. The first group comprised patients in whom arterial hypertension had occurred, which was stated in an interview and confirmed by a physician. Those persons had systematically taken antihypertensive drugs. The second group included patients with normotension. In the subsequent stage of the study, the patients of both groups were randomly divided into an experimental group, in which the traction treatment procedure was carried out and a control group in which the traction procedure was simulated.

71 persons, including 38 men (52%) and 33 women (48%) were classified into the first group, while the second group consisted of 97 persons, including 66 men (68%) and 32 women (32%). Both

groups were homogeneous in respect of the sex distribution (p=0.11).

The values of the biometrical data of both groups are presented in table 1.

Table 1. Comparison of the biometrical data in the group with arterial hypertension and group with correct blood pressure.

parameter	arterial hiper-tension	correct blood pressure	P
age	49.65±12.58 21-69	40.05±15.64 17-75	p<0.001
body weight	89.32±19.72 51-138	74.79±16.1 44-129	p<0.001
height	170.58±9.99 156-198	170.35±10.29 150-191	p<0.88
BMI	30.43±4.86 20-39	25.6±4.6 18-39.7	p<0.001

In order to explain the fact of a lack of homogeneity between the group of people with hypertension and group of persons with correct blood pressure, the correlation of arterial blood pressure with age (r=0.39; p<0.05), body weight (r=0.41; p<0.05) and BMI (r=0,46; p<0,05) was statistically analyzed by means of Spearman's rank test. It was proven unequivocally that arterial hypertension in the examined group is characteristic of elderly people and people with heavier body weight.

In the group of people with arterial hypertension, the traction procedure was performed in 36 persons (19 men and 17 women), while with 35 subjects (19 men and 16 women) the traction procedure was simulated. In the case of the group distinguished by correct blood pressure the traction procedure was carried out in 33 men and 16 women (49 people in total), whereas the simulation was performed with 33 men and 15 women (48 people in total). The detailed biometrical data of the specific subgroups are presented in table 2 and 3.

The traction treatment procedure was performed by means of the Saunders traction device (Saunders and Saunders, 1995). The patients were laid on the therapy table with their head placed on the stabilizing elements of the device. The traction force was administered according to the patient's subjective perception, which means, until they felt a noticeable but painless traction (Gieremek, 2003b; Myśliwiec, 2010; Myśliwiec, 2011). The duration of the treatment procedure was 15 minutes. In the control group the patient was placed in the same position, with his/her head in the device, the traction procedure was not, however, performed. In both, while preparing the control group subjects as well as during simulation of the traction procedure, they were in no way informed that the treatment procedure was not being carried out. During the interview it was verified whether any of the patients of this group had had the Saunders traction performed before. Any possible patients' questions, why they did not feel any 'stretching', were answered that a very subtle phase of the procedure was being performed.

Table 2. Comparison of the biometrical data of the group of people with arterial hypertension in subgroups, in which the traction procedure was and was not performed

Parameter	Traction procedure	No traction procedure	Signifi-cance level
Age	47.43±13.23 21-69	52.5±11.43 25-69	p=0.21
Body weight	88.22±21.27 51-138	90.72±18.05 51-138	p=0.52
Height	170.61±11.14 156-198	170.55±8.62 159-188	p=0.82
BMI	30±5.16 20-39	31±4.52 20-39	p=0.52

Table 3. Comparison of the biometrical data of the group of people with correct arterial pressure in subgroups, in which the traction procedure was and was not performed

Parameter	Traction procedure	No traction procedure	Signifi-cance level
Age	40.46±15.76 17-75	39.17±15.54 17-75	p=0.62
Body weight	74.48±15.16 44-110	75.44±18.09 45-129	p=0.97
Height	170.44±10.38 150-191	170.17±10.25 150-191	p=0.89
BMI	25.45±4.29 18-37	25.91±5.24 18.1-39.7	p=0.55

The examination of systolic (sBP) and diastolic blood pressure (dBP) as well as heart rate (HR) was performed by means of the electronic sphygmomanometer Riester 'ri-champion' put on the patient's left arm. Blood pressure was examined to an accuracy of 1 mmHg, whereas heart rate to one beat per minute. Four measurements of the heart hemodynamic parameters were performed. The initial test (1) was performed before beginning the treatment procedure after a 10-minute rest in the supine position. The next test (2) was carried out in the middle of the traction procedure, which means after 7 minutes. The 3rd examination was performed during the last minute of the procedure, whereas the final measurement (4) was taken 2 minutes after finishing the traction procedure, also in the supine position. The

measurements in the control group were taken likewise.

Statistical analysis was implemented by means of the Statistica 9.0 program. In order to analyze the differences in biometrical data within the specific group the Whitney-Mann U-test was exploited, whereas to assess the changes occurring during subsequent examinations the non-parametric ANOVA Friedman test was applied. The critical level of the statistical significance of the differences was the value $p<0.05$.

RESULTS

The analysis of the change in parameters obtained as a result of the conducted study unequivocally indicated that cervical spine traction performed in the supine position as well as the supine position itself has a tonic effect on the cardiovascular system. A linear value reduction of all the examined parameters in subsequent measurements was observed in the group of subjects with arterial hypertension. The most significant difference between the initial and final examination was noticed in patients in whom the traction procedure was only simulated. The values of systolic and diastolic blood pressure decreased by over 6%. In the group of persons with correct blood pressure, a high significance level of the differences was discovered only with regard to the value of systolic blood pressure. The measurement decreased between the first and fourth test by 1.5% in the group in which the traction procedure was introduced, whereas in persons to whom traction was not performed, by 2.28%. In the process of taking the measurements, this group presented a minimal increase in the value of diastolic pressure; this change, however, appeared not to be statistically significant.

Table 4. Arithmetical mean, minimum and maximum values, standard deviation and the level of statistical significance for the experimental group in which the traction procedure was performed (trac.) and control group in which the traction procedure was simulated (no/trac.) in persons with arterial hypertension.

Paremeter	Test 1	Test 2	Test 3	Test 4	Significance level
HR Trac.	78.17±15.1 60-109	76.48±13.58 56-104	74.91±13.11 56-104	74.82±13.65 56-112	p=0.001*
HR No/trac.	74.05±10.1 60-95	73.17±10.15 56-89	72.5±10.73 59-90	72.11±10.65 56-89	p=0.04*
sBP Trac.	143.6±12.6 120-175	141.35±14.92 120-185	140.69±13.2 125-181	138.17±13.82 110-174	p=0.004*
sBP No/trac.	142.89±7.2 130-155	138.33±7.61 120-150	135.66±7.92 120-148	133.05±9.69 110-145	p=0.001*
dBP Trac.	87.95±7.78 72-101	85.74±9.37 68-101	85.74±8.08 69-101	85.04±8.02 70-99	p=0.003*
dBP No/trac.	90.28±5.63 75-95	86.55±6.81 75-101	85.28±5.6 75-94	84.38±5.45 75-95	p=0.001*

*statistically significant differences

Table 5. Arithmetical mean, minimum and maximum values, standard deviation and the level of statistical significance for the experimental group in which the traction procedure was performed (trac.) and control group in which the traction procedure was simulated (no/trac.) in persons with correct blood pressure.

Paremeter	Test 1	Test 2	Test 3	Test 4	Significance level
HR Trac.	72.51±10.3 52-117	71.58±10.04 53-11	71±9.95 51-99	71.13±9.95 51-104	p=0.02*
HR No/trac.	71.51±9.64 54-102	70.95±9.58 54-101	70.49±9.36 54-99	70.29±9.02 57-98	p=0.14
sBP Trac.	124.36±9.3 105-140	122.82±10.29 101-146	123.23±9.85 101-150	122.44±10.43 90-150	p=0.001*
sBP No/trac.	121.78±9.1 95-137	120.24±9.32 93-138	118±9.06 96-135	119±9.27 97-137	p=0.001*
dBP Trac.	75.75±7.28 57-88	75.86±7.99 60-94	76.35±8.12 59-95	75.86±8.27 50-95	p=0.23
dBP No/trac.	74.39±8.56 55-86	74.56±8.78 54-94	74.63±9.85 53-95	74.61±9.46 53-95	p=0.66

* statistically significant difference

DISCUSSION

Traction is a treatment procedure frequently recommended in cases of cervical as well as lumbar spine pain. Its clinical popularity is determined by the fact that on the one hand, it is an effective treatment procedure in the therapy of cervical pain syndromes and on the other hand, conducting it is safe for the patient (Shakoor et al., 2002; Gieremek, 2003a; Gieremek, 2003b; Peake and Harte, 2005). Undoubtedly, its advantage is also the fact that, mechanically carried out, by means of different systems and devices, it is a relatively cheap treatment, which can be as well conducted by the patient at home (Saunders and Saunders, 1995). The purpose of performing a traction procedure is to stretch the paraspinal structures, which relieves and causes hydration of the intervertebral disc. A situation of this kind should result in the improvement of segment mobility and decrease in pain complaints. A problem might be the fact that conducting a skeletal system oriented treatment procedure, in this case oriented on the cervical spine, affects also the tissues localized around it. There is no sufficient information on how performing treatment procedures at this level of the spine affects the neighboring structures. Numerous research studies present only the benefits for the main problem resulting from spinal dysfunction. A decrease in pain complaints, an increase in the range of motion of the cervical spine, centralization of the nucleus pulposus - noticeable both in the diagnostic imaging as well as in a decrease in the perception of pain radiation - are observed (Hill et al., 2004). It may not, however, be unambiguously investigated whether treatment procedures performed within such a complex body area, as the neck is, affect functioning of the organs localized there. In one of the studies concerning physiotherapy techniques it was proved that performing the rotation movement, preceding the manipulating treatment procedure, affects the decrease of pressure in the vertebral arteries (Arnold, 2004). There arises a question: why do patients subjected to the cervical spine traction procedure frequently fall asleep during the treatment (Myśliwiec, 2010)? Is it determined only by the lying position and a moment of rest or, for instance, increased tension on the vagus nerve responsible for slowing the heart rate and decreasing its output or tension of the cervical plexus which includes the phrenic nerve, or perhaps a change in the blood flow in the vertebral and carotid arteries (Narkiewicz and Moryś 2003)? An answer to this question gives the potential for safer conducting of the procedure, also in situations when the patient is not provided with specialist care. Undoubtedly, the frequency of occurrence of cervical spine pain grows with age, similar to cardiovascular system diseases (Peralta et al., 2005; Broomfield et al., 2008). It is connected with a decrease in physical activity and physical fitness (Knapik et al., 2009). A situation of this kind leads to a gradual decline of antigravity potential resulting in bent posture, head and shoulders protraction, loss of motor control and impairment of both central as well as local stabilization in the neck area (Hodges, 2001; Falla, 2004). Even though the traction procedure does not improve directly the above mentioned consequences of body ageing, it creates conditions for a more effective improvement of cervical spine function, which is desired to be achieved during performing the exercises. The results of this research may constitute significant information, useful in planning rehabilitation strategies for elderly patients in whom the occurrence of several ailments simultaneously is highly probable.

CONCLUSION

The cervical spine traction procedure performed in patients with cervical spine pain syndromes does not constitute a strain on the cardiovascular system to a greater extent than the recumbent position itself. The cervical spine traction procedure may be carried out with people with arterial hypertension.

REFERENCES

1. Arnold C, Bourassa R, Langer T, Stoneham G. Doppler studies evaluating the effect of physical therapy screening protocol on vertebral artery blood flow. *Man Ther*, 2004; 9(1):13-21
2. Broomfield J, Scheida N, Sullivan SM, Chambers L, Kaczorowski J, Karwalajtys T. Recording blood pressure Reading in elderly patients' charts. *Can. Fam. Physician*, 2008; 54(2):230-231
3. Constantoyannis C, Konstantinou D, Kourtopoulos H, Papadakis N. Intermittent cervical traction for cervical radioculopathy causes by large–volume herniated disks. *J Manipulative Physiol Ther*, 2002; 25:188-192
4. Cote P, Cassidy JD, Carroll L. The epidemiology of neck pain : what we have learned from our population–based studies. *J Can Chiropr Assoc*, 2003; 47(4):284-290
5. Falla D, Jull G, Hodges P, Vicenzimo B. An endurance –strength training regime is effective in reducing myoelectric manifestation of cervical flexor muscle fatigue in females with chronic neck pain. *Neurophysiol Clin*, 2006; 117:828-837
6. Falla D. Unravelling the complexity of muscle impairment in chronic neck pain. *Man Ther*, 2004; 9:125-133

7. Gieremek K, Saulicz E, Piłat A, Molicka D. La eficacia del aparato vibratorio de extension cervical en el tratamiento de los pacientes con espondylosis cervical. *Cuestiones Fisioterapia*, 2003; 21-28
8. Gieremek K, Saulicz E, Śliwiński Z, Grygorowicz M, Socha A, Kubacki J. A new type of cervical traction generating mechanical pulsation (vibration) In the comprehensive treatment of patients with cervical spondylosis. *Pol. J. of Physioter*, 2003; 2:99-105
9. Graham N, Gross AR, Goldsmith C. Mechanical traction for mechanical neck disorders: a systematic review. *J Rehabil Med,* 2006; 38(3):145-152
10. Gross AR, Kay T, Hondras M. Manual therapy for mechanical neck disorders: a systematic revive. *Man Ther,* 2002; 7(3):131-149
11. Hill J, Levis M, Papageorgiou A, Dziedzic K, Croft P. Predicting persistent neck pain. *Spine*, 2004; 29(15):1648-1654
12. Hodges PW. Changes in motor planning of feed forwards postural responses of the trunk muscles in lower back pain. *Exp. Brain Res*, 2001; 141 (2):261-266
13. Kjellmann G, Skargren E, Oberg B. Prognostic factors for perceived pain and function at one-year follow-up in primary care patients with neck pain. *Disabil Rehabil*, 2002; 24 (7):364-370
14. Knapik A, Saulicz E, Kuszewski M, Plinta R. An analysis of the relation between a self-assessment of health and active lifestyle. *Med. Sportiva*, 2009; 13(1):17-21
15. Myśliwiec A, Saulicz E, Kuszewski M, Kokosz M, Gnat R, Wolny T. Changes In the subjective sensation of pain in patients with cervical spine dysfunction treated by means of Saunders traction and TENS. *Pol. J. of Physioter,* 2010; 3(4),10:211-221
16. Myśliwiec A, Saulicz E, Kuszewski M, Kokosz M, Wolny T. Assessment of the influence of Saunders traction and transcutaneos electrical nerve stimulation on hand grip force in patients with neck pain. *Ort. Traum. Rehab*, 2011; 1(6)13:37-44
17. Narkiewicz O, Moryś J. Neuroanatomia czynnościowa i kliniczna. *PZWL*, Warszawa 2003
18. Peake N, Harte A. The effectiveness of cervical traction. *Physical Therapy Reviews,* 2005; 10:217-229
19. Peralta CA, Hicks LS, Chertow GM, Ayanian JZ, Vittinghoff E, Lin F, Shlipak MG. Control of hypertension in adults with chronic kidney disease in the United States. *Hypertension*, 2005; 45:1119-1124
20. Richardson C, Hodges P, Hides J. A motor control approach to the treatment and prevention of lower back pain. *Churchill Livingstone*, London, 2004
21. Saunders HD, Saunders R. Evaluation, Treatment and Prevention of Musculoskeletal Disorders. *The Saunders Group*, Minnesota, 1995
22. Shakoor M, Ahmed MS, Kibria G, Khan AA, Mian MAH, HasanSA. Effects of cervical traction and exercise therapy in cervical spondylosis. *Bangladesh MRC Bull*, 2002; 28:61-69.
23. Zylbergold RS, Piper MC. Cervical spine disorders. A comparison of three types of traction. *Spine*, 1985; 10: 864-871