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## Assessment of the Cervical Spine Range of Motion After the Use of the Saunders Traction Device in Different Positioning of the Upper Extremities

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### Abstract

**Background.** Among the procedures used in the therapy of spinal pain syndromes one of the most frequently recommended is the cervical traction. The methods of performing the traction are varied.

**Objectives.** It was decided to examine in the research whether the abduction and external rotation of the brachium, causing relaxation of the pectoral girdle muscles as well as the cervical spine, affects the quality and efficiency of traction in the patient's subjective assessment and the changes in the cervical spine range of motion.

**Material and Methods.** Fifty subjects aged 20 to 42 were involved in the study, including 26 women and 24 men. The criterion of inclusion into the research project was the age between 20 and 40 years and the result of questionnaire containing the NDI scale for evaluation of the degree of dysfunction of the cervical spine, ranging in value between 5 and 14 points. The admitted group of 50 subjects was randomly divided into two experimental groups. The traction of the cervical spine was performed twice in both groups by means of the Saunders device. In the first group used the traditional positing, with the upper extremities placed along the torso, was adapted as first whereas in the second group the modified position was applied, in which the upper extremities were in the external rotation in abduction and with flexion in the cubital articulation, in other words the patients placed their hands next to head. In both cases the patient was in the supine position on a therapeutic table with a support roll under the knees.

**Results.** The evaluation of the cervical spine range of motion pointed, that in both position all the obtained differences proved statistical significance. The subjects taking part in the research claimed that the procedure performed by means of the traditional method was more pleasant.

**Conclusions.** No significant difference was discovered in the effectiveness of the suggested positioning of the arms during performing the traction procedure of the cervical spine. The modified position caused greater sensation of discomfort than position with traditional arrangement of the arms (*Adv Clin Exp Med* 2014, 23, 5, 769–774).

**Key words:** traction, neck, pain, range of motion.

Alongside the progress of civilization, cervical spine pain complaints have become an increasingly large therapeutic and epidemiological problem. It is connected with a radical change in the level of physical activity and in lifestyle [1–5]. During the initial phase of these ailments, the feeling of overload of the structures located directly in the nape area prevails. It is represented by increased tension of the muscles or even their “stiffness”, then pain

of different intensity occurs which, in the course of time, gradually radiates to the brachial girdle and upper extremities. The main factor of such conditions is believed to be the gradual change in the positioning of the head towards protraction, pushing forward the shoulders, and an increase in spine inclination in the cervicothoracic transition [2, 6–8]. Such a situation may lead to a progressive change in the length of the muscles operating within this

movement area and especially the upper part of the spiral and lateral line and the superficial back and arms lines [9]. Neglected pain of the cervical spine may lead to a developing cervical spondylitis which gradually affects the decrease in the range of motion in one segment, simultaneously overloading the neighboring ones [10].

Among the procedures used in the therapy of spinal pain syndromes, one of the most frequently recommended is cervical traction [11]. Thanks to a deloading of the spine, and as a consequence, the relaxing of the tensed paravertebral structures, the decompression of the irritated nerve roots as well as improvement in the circulation within the vertebral artery, and as a consequence, increased statokinetic efficiency, occur [12, 13]. The methods of performing the traction are varied (Peake 2005, Myśliwiec 2010). There is no conclusive answer whether the best results are obtained by means of traction with the use of a static traction force [14], intermittent traction [15, 16], manual traction [17] or a vibratory traction device [10]. Diversity may be also noticed in reference to the suggested force of the traction [6, 15, 18] as well as the patient's position. Some researchers indicate the possibility to perform the traction in a sitting position [12, 18, 19], whereas others claim that cervical traction should be always performed in the supine position [6, 11, 14, 15].

A difference in opinions may also be noted with regard to the suggested additional treatments, performed before or after the traction session. The types of procedures which prevail among these treatments are dynamic and/or isometric exercises, massage, thermotherapy and briefing, which focuses on maintaining the correct posture [13, 17, 20–22]. Other methods connected with traction are nonsteroidal anti-inflammatory medicines [18] or physiotherapy treatment procedures [21, 23]. There are also authors who suggest performing exclusively the manual traction treatment [24].

It was decided to examine in the research whether the abduction and external rotation of the brachium, causing relaxation of the pectoral girdle muscles as well as the cervical spine, affects the quality and efficiency of traction in the patient's subjective assessment and changes in cervical spine range of motion.

## Material and Methods

The research was carried out in accordance with the principles of the Helsinki Convention and based on the approval of Bioethics Committee No. 12/2006 functioning by the Jerzy Kukuczka Academy of Physical Education in Katowice. The

research procedures were carried out in the physiotherapy room in Rybnik and the Academy of Physical Education in Katowice. Fifty subjects aged 20 to 42 were involved in the study, including 26 women and 24 men, who were inhabitants of Silesia. The subjects were selected intentionally on the basis of voluntary applications. The criterion for inclusion into the research project was the age between 20 and 42 years and the results of a questionnaire containing the NDI scale for evaluation of the degree of dysfunction of the cervical spine, ranging in value between 5 and 14 points [25]. People with no or minimal pain complaints as well as those who indicated a value above 14 points were not admitted to the research. An additional criterion of exclusion was the occurrence of radiation of the symptoms along the upper extremities. All the people qualified to take part in the research obtained a physician's permission which, in a specific way, eliminated other than overload-induced causes of developing the condition such as neoplastic disease or hypermobility of the segment. The occurrence of vertebral artery occlusion was also eliminated. The biometric data as well as the values of the intensification of pain are presented in Table 1.

The group of 50 subjects admitted was randomly divided into 2 experimental groups. The nature of the groups was typically organizational and, after assigning the subjects a given group, a drawing was held in which it was indicated from which initial position the group would start the experiment. In both groups, the traction force was dosed in such a way that the patients perceived noticeable but painless traction [6, 11, 23]. The length of the traction was 15 min. After carrying out the first treatment session, a one week break took place, after which the method of performing the traction was changed in both experimental groups.

In order to assess the range of motion of the cervical spine, the CROM (cervical range of motion) instrument was used. It made it possible to perform the measurement to an accuracy of 2 degrees in all 3 planes [26]. The measurements were carried out by a person who did not know the method of the implemented traction, in a chair sitting

**Table 1.** Biometric data and intensification of pain complaints expressed in the NDI (neck of disability index) points of patients qualified to take part in the experiment

Parameters	$\bar{x}$ – SD	Min–Max
Age – years	28.5 ± 5.34	20–42
Weight – kg	71.76 ± 15.61	45–105
Height – cm	174.94 ± 10.77	158–208
Neck Disability Index	7.3 ± 3.34	5–14

position with the upper extremities placed along the torso and back firmly supported at a right angle. Special attention was paid to prevent the patient from deepening the movement by bending or torso rotation and to perform the movement in accordance with maintaining the plane. Each of the measurements was performed three times and so the result of the best test was used in further analysis. The movement of flexion and extension, side bends to the left and right as well as rotation movements in both sides were subjected to evaluation. Another area of study was the evaluation of the difference in pain complaints occurring before and after carrying out the traction procedure. In order to assess the pain, the analogue pain scale VAS (visual analogue scale) was used [27, 28]. The patients marked on a 10 cm line their current sensation of the pain occurring, assuming that on the left side of the line no pain occurs (0) whereas on the right side appears the pain sensation identified as unbearable (10). After marking on the line, the person conducting the research performed the measurement by means of a centimeter scale ruler. The results were noted down to an accuracy of 1 mm. The evaluation of feelings of comfort while performing the traction procedure, which was carried out immediately after completing the session, was implemented by means of a similar, modified instrument. The patient was to mark on the above-mentioned line, the point which corresponded to his/her sensation of discomfort and feeling of safety during the session. The 0 value represented the feeling of complete safety and comfort whereas the feeling of anxiety and discomfort, connected with the process of the procedure, increased toward the right side of the scale. The sensation perceived at the level of 10 was such that it resulted in an absolute necessity to interrupt the treatment procedure. The result was noted down to an accuracy of 1 mm also in this test.

The last parameter which was evaluated was the traction force. The result was obtained from the reading of the measuring instrument of the traction device at the moment when the patient reported a sensation of a noticeable and painless traction, which was a sign to stop increasing the intensity of the procedure. The value was read off to an accuracy of 1 kG of force.

The results obtained were subjected to statistical analysis performed by means of the Statistica 9.0 program. The arithmetical mean values ( $\bar{x}$ ) and standard deviation (SD) were calculated and the minimum and maximum values were indicated. In the evaluation of difference significance ( $p$ ) in the measurement of the range of motion in the pre-post sample, the Student's  $t$ -test for dependent samples was used. The measurement of differences

between the groups was implemented on the basis of a Student's  $t$ -test for independent samples. In view of the abnormal distribution, non-parametric tests were used to indicate the statistical significance of differences in results concerning the subjective evaluation as well as the traction force. The  $U$  Mann-Whitney test was used to evaluate the intergroup differences whereas the Wilcoxon signed-rank test was used to assess the differences in the pre-post sample. The critical level of significance was  $p < 0.05$ .

## Results

The evaluation of the cervical spine range of motion, implemented by means of a CROM instrument, made it possible to state that in the treatment procedure performed with the traditional positioning of the upper extremities as well as with the modified positioning, all the differences obtained proved statistically significant. No significant differences were discovered between the studied groups in the test preceding the traction. It is worth emphasizing that the range of motion after performing the traction in the modified positioning obtained greater statistical significance. The obtained results are illustrated in Tables 2 and 3.

The analysis of the difference in pain complaint intensification level before and after the traction made it possible to state that the group that had the procedure performed with the traditional positioning of the upper extremities demonstrated a greater reduction of the symptoms, which is presented in Table 4.

The subjects taking part in the research claimed that the procedure performed by means of the traditional method was more pleasant than with the hands placed by the head. It was also observed that the force of traction carried out in the traditional positioning of the upper extremities made it possible to obtain higher values than in the modified positioning. The results achieved in these observations are presented in Table 5.

## Discussion

Overload disease causes limitations in motion in the cervical spine area, additionally leading to body balance disorders during its rotation [29]. There are a lot of methods and manners for preventing its occurrence. Adopting the thesis that one of the main causes is the deterioration in posture quality, which leads to disorders in the proportion of muscle strength, especially between the anterior and posterior part of the muscles, it may

**Table 2.** Mean value, standard deviation, minimum and maximum value of cervical spine motion after the procedure with the traditional positioning of the upper extremities and the significance level in the Student's *t*-test

Traditional position (n = 50)	$\bar{x}$	Min	Max	SD	p
Extension before	73.64	60	82	5.07	0.02
Extension after	75.18	68	90	4.81	
Bend before	59.98	40	70	5.07	0.002
Bend after	61.76	40	70	5.01	
Side bend to the left before	41.74	32	50	3.73	0.001
Side bend to the left after	43.08	34	52	3.57	
Side bend to the right before	41.98	20	48	4.33	0.003
Side bend to the right after	43.08	30	52	4.02	
Rotation to the left before	66.52	40	80	5.72	0.07
Rotation to the left after	67.8	50	80	5.22	
Rotation to the right before	66.92	32	80	6.49	0.04
Rotation to the right after	68.3	54	80	4.69	

**Table 3.** Mean value, standard deviation, minimum and maximum value of cervical spine motion after the procedure with the modified positioning of the upper extremities and the significance level in the Student's *t*-test

Modified position (n = 50)	$\bar{x}$	Min	Max	SD	p
Extension before	72.88	58	86	4.9	0.001
Extension after	75.06	62	86	4.36	
Bend before	60.04	44	68	4.34	0.001
Bend after	63.4	42	80	5.41	
Side bend to the left before	42.2	32	50	3.4	0.001
Side bend to the left after	44.06	32	50	3.4	
Side bend to the right before	42.1	30	50	3.48	0.001
Side bend to the right after	44.12	34	58	4.13	
Rotation to the left before	67.16	60	80	4.06	0.001
Rotation to the left after	69.5	58	80	4.01	
Rotation to the right before	67.44	60	80	3.98	0.001
Rotation to the right after	69.44	58	80	3.94	

**Table 4.** Mean value, standard deviation, minimum and maximum value of the pain intensity formulated by the VAS (visual analogy scale) scale and the level of significance in the Wilcoxon signed-rank test

	Traditional	Modified
	$\bar{x} \pm SD$ min-max	$\bar{x} \pm SD$ min-max
Point on VAS scale before	1.09 ± 0.95 0–3.2	1.06 ± 0.83 0–3.2
Point on VAS scale after	0.71 ± 0.81 0–3	0.88 ± 0.83 0–3
p	0.001	0.034

be assumed that the traction of the cervical spine has an initial function, preparing for deep stabilization exercises and postural re-education [2, 20].

**Table 5.** Mean value, standard deviation, minimum and maximum value of the evaluation of discomfort and traction force as well as the significance level in the *U* Mann-Whitney test

	Traditional	Modified	p
	$\bar{x} \pm SD$ min-max	$\bar{x} \pm SD$ min-max	
Discomfort (points on analogic scale)	2.12 ± 1.59 0–6	3.42 ± 2.11 0–8	0.003
Traction force (kG)	9.65 ± 3.21 5–18	7.72 ± 2.68 4–16	0.002

This type of algorithm should encourage the formulation of such methods which would allow the most effective influence of traction. The traction

preceded by physiotherapy procedures including electrotherapy and thermotherapy appears to be more effective in consideration of their analgetic and relaxing effect [13]. While observing the process of the traction procedure while carrying out the therapy with patients with cervical spine pain syndrome, it is difficult to resist the impression concerning the necessity of creating the most comfortable position for the patient. The patients who are subjected to the therapy are frequently asked to relax, which often leads to their falling asleep [11, 23]. It is difficult here to agree with the methodology recommending performing the traction in a sitting position, in which the very act of maintaining the body's upright position requires appropriate muscle tone [12, 18, 19].

The position suggested in the research performed was inspired, among others, by the fact that while resting, a lot of people adopt the position in which the hands are placed under the head. Such positioning causes rising of the brachial girdle, which in consequence decreases the tone of muscles localized in the nape area by relaxing the back line and arms lines [9]. Adopting such a position is possible basically only in a situation when the radiation of symptoms does not occur. In this case, the suggested positioning might have caused intensification of the complaints and made

it impossible to continue the procedure [30, 31]. In the case of pain complaints, in which no irritation of the brachial plexus as well as the peripheral nerves of the upper extremity occurred, adopting such a position did not cause any difficulties for the patients, consequently giving a full opportunity to carry out the observation. However, maintaining the position for a longer time resulted in greater discomfort than was in the case of the traditional position. Also in this position, the feeling of sufficient force of traction was reported faster by the patients. This type of situation may prove that such a position decreases muscle protection, provoking faster tension in the area of the passive locomotor system, represented by ligaments. To a certain extent, this observation may explain the achieving of higher statistical significance in reference to cervical spine mobility, especially in flexion and side bending. This advantage; however, is not convincing in relation to the minor reduction of pain complaints.

The authors concluded that no significant difference was discovered in the effectiveness of the suggested positioning of the arms while performing the traction procedure of the cervical spine. The modified position caused greater sensations of discomfort than the position with traditional arrangement of the arms.

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