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The use of Kinesio Taping in the treatment of pain and shoulder dysfunction in patients after stroke

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SUMMARY

Introduction. Stroke is an important medical problem. One of the most common complications associated with paresis or paralysis of upper limb after stroke is pain and shoulder dysfunction. Kinesio Taping action is physiotherapy.

Objective of the work. The aim of the study was to determine whether Kinesio Taping has the effect of reducing the shoulder complex pain in patients after stroke and to evaluate whether its use improves upper limb function in these patients.

Material and methods. The study included 100 patients after stroke. Application techniques tapes were made according to the method used in Kinesio Taping. The total time of treatment lasted for seven days continuously. Evaluation of the degree of disability of patients was performed according to the mRankin scale. The severity of pain was assessed using a visual – analog scale VAS and modified pain questionnaire Laitinen, and upper extremity function was examined using scales ASES and Brunnström.

Results. The level of pain by visual - analog scale VAS and a pain questionnaire modified Laitinen decreased after 7 days of treatment, and after 2 weeks after treatment was increased, but to a level lower than the initial one. Evaluation of upper limb function using Brunnström scale and factor SSI (Shoulder Score Index) indicated to improve the functionality of the shoulder and upper limb as a result of the applied therapy.

Conclusion. The use of Kinesio Taping may be helpful in reducing pain and improving shoulder complex upper limb function in patients after stroke.

Keywords: Kinesio Taping, stroke, pain and shoulder dysfunction, treatment

INTRODUCTION

Strokes are among the basic problems of modern medicine and physiotherapy. They occupy third place among causes of death in the adult population and the first leading cause of disability in people over 45 years of age [1-3].

The consequences of stroke, which include, among others: hemiparesis or hemiplegia, abnormal vision, balance disorders, speech disorders, cognitive disorders, many patients are causing inability to live independently. Consequences and complications of stroke are the main determining factor of the quality of life of the patient. Complications also have a significant impact on the return of the lost function. The incidence of complications of stroke is high and affects 45-95% of all

hospitalized patients. One of the most common complications related to the musculoskeletal system in patients after stroke is pain and dysfunction of the shoulder joint. The reasons for this are many, they may be caused by the subluxation of the shoulder joint, changes the rotator cuff syndrome, reflex sympathetic dystrophy, inflammation of the articular tissues, joint capsule contracture, and osteoarthritis. An important cause of pain shoulder complex may also be improper patient care and rehabilitation errors. The literature shows that shoulder pain occurs in 16% to 80% of stroke patients [1-6].

The most important guidelines for the treatment and rehabilitation process of stroke can be found in the Helsingborg Declaration, works of European Stroke Organization and the Polish Neurological Society. Medicine is looking for new therapeutic methods, which allow the most advantageous way to solve health and social problems of people after stroke. Important are quick and comprehensive therapeutic effects including treatment, early rehabilitation and proper care. The basic component of the whole process of rehabilitation is physiotherapy. One of the new physiotherapeutic methods for use in improving a patient after a stroke is Kinesio Taping. It is a method which can use regardless of the duration of the disease and the clinical condition of the patient. The literature shows that this therapy perpetuates the positive effect of improving and ensures the continuity of therapeutic action is therefore a practical element of comprehensive rehabilitation process and can be used in patients after stroke of the brain [1,7-10].

OBJECTIVE OF THE STUDY

The aim of the study was to determine whether Kinesio Taping can be used in the treatment of pain and dysfunction of the shoulder complex in patients after stroke. It was formulated the following research problems:

1. Is Kinesio Taping has an impact on the reduction of pain shoulder complex in patients after stroke.
2. As long as a reduction of pain shoulder complex maintains analgesic effect.
3. Does the use of Kinesio Taping has an impact on the improvement of upper limb function in patients after stroke.

MATERIAL AND METHODS

The study was conducted with the approval of the Bioethics Committee of the Medical University of Lublin (No. approval: KE-0254/47/2012). Prior to the study, each patient was informed about the manner and purpose of the study and gave informed consent. Test group (100

people) were randomly selected patients who met the following criteria and living in Lublin province.

The selection criteria for the study group:

- age 18-75 years,
- stroke confirmed by diagnostic test (magnetic resonance imaging of the brain, brain computed tomography),
- the occurrence of pain in the shoulder area,
- express an informed and written consent of the patient to participate in the study,
- no other forms of rehabilitation (physiotherapy, orthopedic upper limb) during the research.

Criteria for exclusion from the test:

- lack of informed and written consent to participate in the study,
- sensorimotor aphasia makes it difficult to establish verbal contact logic,
- a history of more than one stroke, and/ or previous other damage to the central nervous system,
- muscle tone of the upper extremity of modified Ashworth scale levels of 3 or more,
- a history of trauma shoulder complex.

Subjective and objective evaluation was performed using the following questionnaires:

- author's questionnaire concerning the patient's medical history,
- author's disease questionnaire concerning the Kinesio Taping method,
- visual - analog scale pain VAS,
- pain questionnaire modified Laitinen,
- scale ASES (American Shoulder and Elbow Society),
- scale Brunnström,
- mRankin scale.

Before the beginning of treatment, patients were evaluated physiotherapy presented above. At day 7 of treatment with Kinesio Taping method has been re-examined in order to determine the effectiveness of early treatment methods. Two weeks after treatment the last survey was made on the basis of which the durability of the applied therapy. Therapeutic and physiotherapy assessment has been focused on the paretic side of the shoulder joint.

Disability rating scale mRankin was done once (before applying the tapes). The severity of pain using a visual - analog scale VAS and modified questionnaire Laitinen has been evaluated three times (before applying the tapes, the last day of wearing belts and two weeks after removal of strips

of leather). Evaluation of upper limb function using scales ASES and Brunnström was done twice (before applying tapes and carrying tapes on the last day). The total time of treatment lasted for seven days continuously.

Application techniques tapes were made according to the method used in Kinesio Taping. The purpose of the application tape were:

- •minimization of pain,
- •support the work of the deltoid muscle,
- •support the work of external rotator muscles of the shoulder joint,
- •support the work front toothed muscle,
- •normalization of the pectoralis major muscle tension,
- •subluxation correction of the humeral head.

The study uses the following therapeutic strip:

- •Kinesio TexR Gold TM 5 cm
- •K-ActiveR Tape Classic 5 cm.

The study does not take into account differences between the various types of patches since all have the same therapeutic values.

Statistical analysis was performed using the statistical package R 3.1.2. Quantitative variables were described using the average value (X), standard deviation (SD), median (Me), minimum (Min), maximum (Max) and quartiles (Q1, Q3). Comparison measurements prior to treatment, and in its day 7 in the field of quantitative variables was performed Wilcoxon paired. Comparison of pretreatment measurements, in the 7 day and 2 weeks after the end of the field of the quantitative variables was performed Wilcoxon paired with Bonferroni correction. Differences between groups were analyzed by Student's t test or analysis of variance and by the Mann-Whitney test or Kruskal-Wallis test. In case the analysis for more than 2 groups showed significant differences, performed post-hoc tests. For a normal distribution test Tukey HSD was used, in the absence of normality tests Mann-Whitney test with Bonferroni correction. To evaluate the correlation between two variables quantitative applied Pearson correlation coefficient or Spearman. As the level of statistical significance was $p < 0.05$.

RESULTS

The study group of people after a stroke had 64 men (64%) and 36 women (36%). More than half (51%) was in the age group 70-75 years old. Ischemic stroke occurred in 70 patients

(70%), intracerebral haemorrhage in 23 (23%), a different kind of stroke was observed in 7 of the respondents (7%). Over half of the patients (65%) was in the period from 2 to 5 years after the onset of stroke. Almost all respondents (99%) of the first pain within the shoulder of paretic limbs felt within 6 months of the onset of stroke. More than half of the respondents had a low disability or lack of significant disability. Condition 31 out of 100 patients (31%) was rated 2, on a scale mRankin, the state of 28 patients (28%) to 1 point, the state of 21 patients (21%) at 3 points, the state of 13 patients (13%) at 4 points, and state of 7 patients (7%) at 5 points.

The severity of the VAS pain scale and a modified Laitinen questionnaire after 7 days of treatment compared to pre-therapy showed a significant reduction ($p < 0.05$). Two weeks after the end of treatment compared to pre-therapy pain intensity also showed a significant reduction ($p < 0.05$). After 2 weeks after completion of therapy compared to the 7 day of treatment there was a significant increase in pain ($p < 0.05$). Pain intensity was reduced after 7 days of treatment, 2 weeks after the completion increased but to a level lower than the initial (Table 1-2).

Table 1. Assessment of pain intensity using VAS

Measurement	VAS							The significance of changes	
	X	SD	Me	Min	Max	Q1	Q3	Vs previous measurement	Vs status prior to treatment
before therapy	5.66	1.59	5.50	3	9	5	7	--------	-------
7 days of treatment	4.01	1.95	4	1	9	2	5	P <0.001	P <0.001
2 weeks after treatment	4.88	1.86	5	1	9	4	6	P <0.001	P <0.01

Table 2. **Assessment of pain intensity using a modified questionnaire Laitinen.**

Measurement	The modified questionnaire Laitinen							The significance of changes	
	X	SD	Me	Min	Max	Q1	Q3	Vs previous measurement	Vs status prior to treatment
before therapy	7.26	2.83	7	3	14	5	9	--------	-------
7 days of treatment	5.78	2.59	6	2	17	4	7	P <0.001	P <0.001
2 weeks after treatment	6.07	2.47	6	2	11	4	7.25	P = 0.012	P <0.001

The level of pain according to VAS measured before treatment, at day 7 of treatment, and 2 weeks after the end of therapy in each age group tested was not dependent on the age of patients (p> 0.05). While analyzing the dependence of the level of pain according to VAS on the type of stroke was found that the results of all the measurements depend on the type of prior stroke. Prior to therapy, and in its day 7, patients with intracerebral hemorrhage had significantly higher pain intensity than patients with ischemic stroke (p <0.05). After 2 weeks after completion of therapy, patients with intracerebral hemorrhage had significantly higher degree of pain than patients with ischemic stroke and another type (p <0.05).

MRankin scale level significantly correlated with the results of VAS questionnaire and modified Laitinen all time points (p <0.05). These relationships were positive, therefore, the more points on a scale mRankin, the greater the severity of pain at each measurement (Figure 1-3).

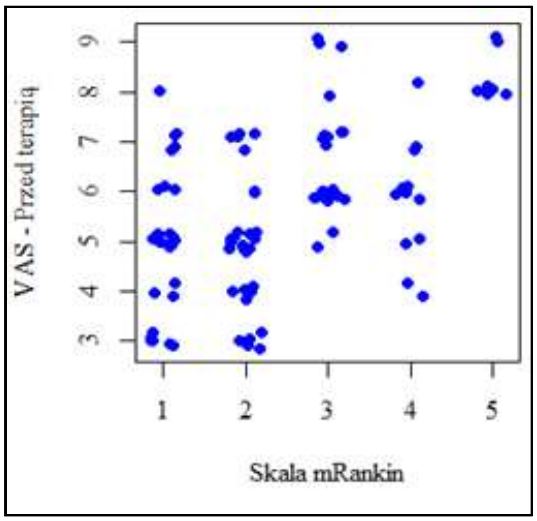

Figure 1. VAS scale before treatment and mRankin.

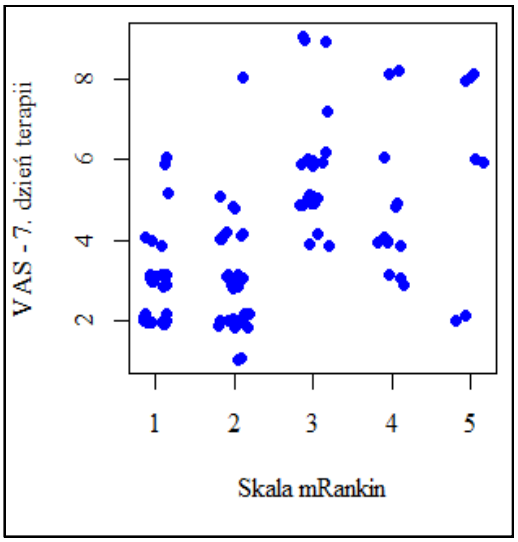

Figure 2. VAS at day 7 of therapy and the scale mRankin.

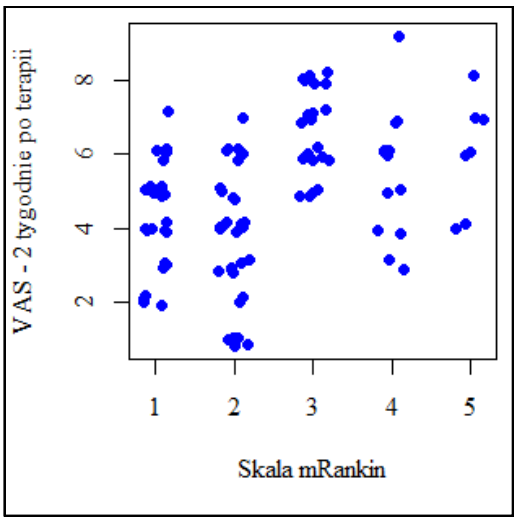

Figure 3. VAS two weeks after completion of therapy and the scale mRankin.

Ranges active and passive raising the front and side, the range of active and passive internal rotation of the shoulder along the body, internal rotation of active and passive as well as active and passive ranges horizontal adduction were significantly higher after 7 days of treatment than prior to treatment ($p < 0.05$). Active and passive ranges external rotation with the arm taken to 90˚ have not changed significantly after treatment ($p > 0.05$).

Perform activities of daily living was assessed using a scale of 0-3, where 0 - meant to act impossible for the patient, 1 - activity very difficult to implement, 2 - function quite difficult to do, and 3 - action is not causing any difficulty. Independence in the range of back wash / wear the bra on the back, lifting of a load above the level of the shoulder and throwing the ball (upper method) was significantly higher after 7 days of treatment than prior to treatment ($p < 0.05$).

Analyzing the value SSI (*Shoulder Score Index*) found that after 7 days of treatment SSI coefficient was significantly higher than prior to treatment ($p < 0.05$). A higher value of SSI indicates the improvement in the functionality of the upper limb due to the therapy (Table 3).

Table 3. The rating factor SSI (Shoulder Score Index).

Measurement	Factor SSI							P
	X	SD	Me	Min	Max	Q1	Q3	
before therapy	44.48	19.72	45	5	83	29.5	60	P <0.001
7 days of treatment	53.74	21.37	53	5	88	36.5	73	

MRankin scale correlates significantly with SSI at both time points ($P < 0.05$). These relations are very strong and negative, which means that the more points on a scale mRankin, the lower SSI in both measurements. This underlines the smaller upper limb function in persons with a greater degree of disability scale mRankin.

SSI correlates significantly with the VAS at both time points ($P < 0.05$). These relations are very strong and negative, so the higher the SSI, the lower the intensity of pain in both measurements (Figures 4-5). There is therefore a close relationship between the functionality of the upper limb and the level of pain experienced by the subjects.

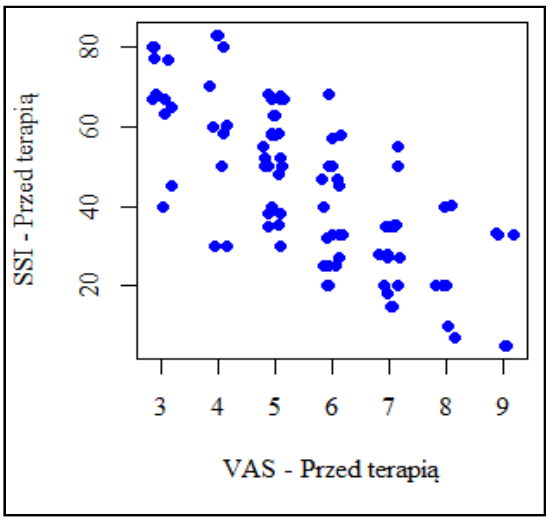

Figure 4. Factor SSI and VAS before therapy.

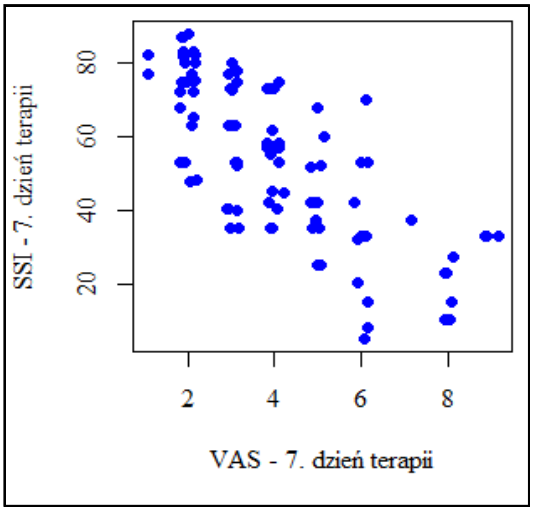

Figure 5. Factor SSI and VAS on day 7 of treatment.

DISCUSSION

Shoulder pain of paretic limbs after stroke is a phenomenon quite common. It is estimated that occurs in the majority of patients who had a stroke, and complications concern both the active agent (neuromuscular) and passive (osteoarticular). Data from the literature shows that pain occur in 12-80% of patients within a year of stroke onset. Pain is not only a source of discomfort for the patient, but may also adversely affect the possibility of improving the movement [11-13]. Kwakkel et al. [14] suggest that the best indicator of the degree of probability predicting limb reconstruction efficiency is the ability of upper limb motor one month after the onset of stroke. The authors estimate that about 60-70% of stroke patients in the future will experience a significant performance limitation of the upper limb, and the limb functional state within six months of the onset of stroke is

highly predictive. Pop [15] shows the correlation between the intensity of pain and functional efficiency; the stronger the pain, the lower the efficiency of the limbs. Similar results were obtained in our study, the proportion of SSI correlates significantly with the VAS; the higher the functionality of the upper limbs, the lower the intensity of pain. This relationship demonstrates that shoulder pain is a significant problem in this group of patients and has a huge impact on the functioning of patients.

Kinesio Taping in improving stroke patients, it is mainly used as a method of supporting a complex therapy. Significant differences upper limb function in patients with stroke, after application Kinesio Taping noted Sliwinski et al [16]. Improve the function obtained after the application of the concept of therapy according to PNF, while an additional significant improvement in the application of functional tape on the wrist rectifiers. Thelen et al. [17] compared the efficacy of Kinesio Taping and placebo in young patients with pain of shoulder. After the first day of treatment showed a significant reduction in pain intensity in the test group in relation to the control group. The results of these studies the authors speak for analgesic efficacy of Kinesio Taping. The aim of Djordjevic et al. [18] study was to compare the efficacy of mobilization in motion and Kinesio Taping with traditional kinesitherapy in patients with pain of shoulder. The vast improvement in the active range of motion without any pain in the joint of shoulder occurred in the treated group of mobilization in motion and Kinesio Taping.

Michalak et al. [19] assessed gait pattern after application of Kinesio Taping in stroke patients. In the test group in relation to the control group significantly improved gait pattern, which becomes apparent in the extension of the support phase, equalization step length and the shortening of the transition time during the test Up&Go. Similar studies of patients with stroke have conducted Choi et al [20]. The authors applied a parallel study group therapy using PNF and Kinesio Taping in the knee and quadriceps, control group received only therapy PNF. After a month of therapy in the study group increased range of dorsiflexion and significantly better results were obtained during a 10 – meter Timed Walking Test. Szczegielniak et al. [21] studied the effects of Kinesio Taping result 100 - Meter Walking Test patients after stroke. After using the application for the correction of foot drop, it noted significant reduction in transit time designated distance.

Pelosin et al. [22] have noted a significant difference in the intensity of pain after application of Kinesio Taping in patients with focal dystonia. Kinesio Taping vs. placebo significantly affected the reduction of pain experienced. Studies Gonzalez-Iglesias et al. [23] also showed a significant reduction in pain, cervical spine after application Kinesio Taping vs. apparent taping (placebo) of patients with whiplash type injuries. Application of Kinesio Taping significantly impact the relief of pain immediately after the application of patches and 24-hour observation. However, the improvement in the mobility of the cervical was too small in order to be clinically significant. As

the Kinesio Taping is a mild and non-invasive form of therapy, its effect may be too weak, in order to reduce muscle tension on spastic and affect correction of pathological settings motor system [24]. Herbert [25] evaluating the efficacy of Kinesio Taping in patients with knee pain symptoms found that after 3 months of kinesitherapy and Kinesio Taping compared to the same kinesitherapy use tape influences the reduction of pain within the joint. However, the control test carried out 12 months after the end of treatment revealed no differences between the two groups of patients. Similar results were obtained Quilty et al. [26], who also observed a significant reduction in pain of the knee and improvement in WOMAC scores after 10 weeks of treatment with the combined kinesitherapy and Kinesio Taping compared to the same kinesitherapy. Differences between groups were not observed 12 months after the end of therapy. These studies suggest that Kinesio Taping is a good form supporting and accelerating the healing process in the initial stage of rehabilitation also has an analgesic effect but has no effect on the final result of the therapy.

In patients with stroke occurs very frequently muscle imbalances, due to the weakness and muscular control due to impairment of the central nervous system. Kinesio Taping is just one of these therapeutic methods which can be used locally or globally based on mechanics fascial chain systems and routes muscle [27,28]. This is demonstrated by testing Senderek et al. [29], who showed effect of Kinesio Taping on posture myofascial mechanisms.

Data from the literature and the results of our study indicate that the use of Kinesio Taping has analgesic and improving the functionality and independence of people after stroke. Kinesio Taping adjunct is a good improvement, especially in the initial stage physiotherapy unnoticed while its long-term therapeutic effects [28,30-32]. It is a promising method of physiotherapy, requires further research according to scientific standards of Evidence Based Medicine. However, medicine is obliged to use all available treatment options to help patients achieve optimum efficiency and independence.

CONCLUSIONS

1. Techniques used in the study according to the rules application tape of Kinesio Taping decreased shoulder pain in patients after stroke. The level of pain using VAS scale and modified Laitinen questionnaire after 7 days of Kinesio Taping showed a significant reduction when compared to pre-treatment.

2. The analgesic effect obtained by using the Kinesio Taping lasted for two weeks after completion of therapy. Two weeks after the end of treatment compared to pre-therapy pain severity of the VAS and the modified Laitinen questionnaire it showed a significant decrease, in comparison to the 7 day of treatment there was a significant increase in the severity of pain, but to a level lower than the initial one.

3. After applying Kinesio Taping improved upper limb function in patients after stroke was observed. The therapy had an impact on improving the range of motion of the shoulder joint and independence of patients in terms of everyday activities.

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