

Wpływ aplikacji plastrowania dynamicznego na efekty fizjoterapii chorych po złamaniu nasady dalszej kości promieniowej typu Collesa

Impact of elastic therapeutic tape on final effects of physiotherapy in patients with Colles' fracture

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Streszczenie:

Wstęp. Złamania nasady dalszej kości promieniowej, stanowią nadal duży problem kliniczny. Wydaje się, że w procesie fizjoterapii chorych po złamaniu przedramienia skuteczne może być plastrowanie dynamiczne (PD). Celem pracy jest ocena wpływu wybranych aplikacji PD na efekty fizjoterapii u chorych po złamaniu nasady dalszej kości promieniowej typu Collesa leczonych zachowawczo. **Materiał i metody.** Badaniem objęto 38 chorych leczonych w Zakładzie Rehabilitacji Leczniczej SP ZOZ w Nysie w okresie od stycznia 2012 r. do listopada 2013 r. Nabór do obu grup odbywał się losowo. Chorych podzielono na 2 grupy. Grupę badanych (BA) stanowiło 20 chorych (16 kobiet i 4 mężczyzn), u których stosowana była fizjoterapia z wykorzystaniem urządzenia Hand Tutor oraz aplikacje PD. Grupa kontrolna (KO) obejmowała 18 chorych (15 kobiet i 3 mężczyzn), u których była stosowana tylko fizjoterapia z wykorzystaniem urządzenia Hand Tutor. Po przeprowadzeniu badania wstępnego, u chorych z grupy BA stosowano aplikacje mięśniową – tonizującą mięśnie zginacze nadgarstka oraz więzadłową lub korekcyjną – na okolicę nadgarstka.

Aplikacje PD były wymieniane co 4 dni. Fizjoterapia trwała 10 dni. W trakcie oraz po zakończonej fizjoterapii przeprowadzono badania zgodnie z ustalonym protokołem. **Wyniki.** Aplikacje PD stosowane w procesie fizjoterapii u chorych z grupy BA zwiększyły zakres ruchomości aktywnej i pasywnej oraz poprawiły jakość ruchów, w porównaniu z badanymi chorymi grupy kontrolnej. Zaobserwowano także, że deficyty ruchów (różnice między ruchami pasywnymi i aktywnymi) zmniejszyły się bardziej w grupie BA. **Wnioski.** 1. W badaniu końcowym nie stwierdzono istotnych różnic wskaźników pomiędzy chorymi z obu grup. Badania wykazały poprawę funkcji nadgarstka w zakresie częstotliwości ruchów aktywnych oraz zakresu ruchomości u obu grup. 2. W grupie BA stwierdzono istotnie wyższe wyniki badania końcowego częstotliwości ruchów oraz ruchomości nadgarstka, w stosunku do badania początkowego.

Słowa kluczowe:

złamanie Collesa, fizjoterapia, plastrowanie dynamiczne (PD), Biofeedback, Hand Tutor

Abstract

Background. Fractures of the distal radius constitute a serious clinical problem. It seems that appliance of elastic therapeutic tape may be an effective method of physiotherapy among patients suffering from the forearm's fracture. Aim of the study. The aim of the study is to assess the impact of selected elastic therapeutic tape applications on physiotherapy's effects among patients treated conservatively after Colles' fracture. **Material and methods.** The study included 38 patients treated in the Rehabilitation Department of Health Care Centre in Nysa in the period from January 2012 until November 2013. Participants were randomly divided into 2 groups. A study group (SG) consisted of 20 patients (16 women and 4 men), while a control group (CG) was composed of 18 patients (15 women and 3 men). Therapy for all of the participants was based on usage of the Hand Tutor device. Additionally, after a preliminary examination, patients from the study group received selected applications of elastic therapeutic tape as follows: muscular – toning for the wrist's flexors and ligamentous or corrective for the wrist area. Applications were replaced every 4 days. Physiotherapy lasted 10 days. According to the established protocol, during and after completion of physiotherapy regular checkups were conducted. **Results.** Elastic therapeutic tape's applications used in the process of physiotherapy in SG's patients increased range of motion for both active and passive movements and improved quality of them compared to the patients from CG. It was also observed that deficit of movements (difference between range of passive and active motions) decreased more in the SG's patients.

Conclusions: 1. In the final study no significant differences has been showed in the studied parameters between the groups. Research has presented wrist's functions improvement in the frequency of active movements and range of motion in both groups. 2. Significantly higher results in the final examination of the frequency and wrist's mobility in general were shown in comparison to the initial results.

Key words:

Colles' fracture, physiotherapy, elastic therapeutic tape, biofeedback, Hand Tutor

Background

The right choice of therapeutic method regarding fractures of the distal radius has a significant impact on the final results of treatment. After immobilization, aims set for physiotherapist are not only to rebuild patients' muscle strength, but also to select such methods that ensure minimization of possible complications and return to the greatest available efficiency [1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11].

It seems that in the physiotherapy of patients suffering from forearm fracture appliance of elastic therapeutic tape may give measurable effects; the method is used in general to reduce edema and obtain eventually optimum of the awaited hand's function.

For the study, it was assumed that application of elastic therapeutic tape can improve the effects of physiotherapy. However among available literature there are no reports on the detailed application of the method designed specifically for patients with Colles' fracture.

Aim of the study

The aim of the study is to assess the impact of selected elastic therapeutic tape applications on physiotherapy's effects among patients treated conservatively after Colles' fracture.

It was assumed that the applied technique may increase the effectiveness of physiotherapy process in patients, resulting in improved passive and active mobility and general quality of movement.

Material

The study included 38 patients treated in the Department of Rehabilitation of Health Care Centre in

Nysa in the period from January 2012 until November 2013. Specially designed computer program randomly assigned patients to a study group (SG) and control group (CG). All patients enrolled in the research gave informed consent to participate in the project. The study group (SG) consisted of 20 patients (16 women and 4 men); therapy included both use of an active exercise glove with biofeedback (Hand Tutor System™) and selected elastic therapeutic tape applications. The control group consisted of 18 patients (15 women, 3 men); treatment method in this group was limited to the use of Hand Tutor System™. All patients underwent medical check-up before the start of rehabilitation and in the first, fifth and tenth day of the study.

Comparative analysis showed no significant differences in the indicators analyzed in patients between the two groups prior the physiotherapy.

In both groups daily physiotherapy was carried out with the use of the hand rehabilitation system with biofeedback – Hand Tutor™. Patients from the study group received additionally selected applications of elastic therapeutic tape as follows:

1. muscular - toning for the wrist's flexors;
2. ligamentous or corrective for the wrist area. [Fig.1, 2]

Patients have been receiving regularly two applications, changed every 4 days.

Table 1. Characteristics of the study group (SG) and the control group (CG)

Group	Number of participants	Women	Men	\bar{x}	Age of patients			Examined upper limb	
					Min. age (years)	Max. age (years)	SD	left	right
BA	20	16	4	46,5	52	61	2,5	12	8
KO	18	15	3	55,5	51	62	3,5	11	7
	38	31	7	56,0	51	62	3,0	23	15
% of total	100,00%	81,58%	18,42%					60,53%	39,47%

For both study and treatment reasons, all patients were introduced to the hand rehabilitation system with biofeedback-Hand Tutor™, which is a modern system designed for the rehabilitation of sensory, motor and cognitive disorders of the hand. The system consists of an ergonomic, worn by the patient, glove and Medi Tutor™ software, which allows both the assessment of hand function and treatment of present functional disorders. The device allows the estimation of active and passive range of motion, speed, quality and fluidity of movement, ability to perform precise movements and the occurrence of tremors [Fig.3].



Figure 1. Muscular application



Figure 2. Corrective application

Three training programs were introduced to the patients taking part in the study:

1. Tracking a target (time of therapy: 680 s; the task was to maintain a point on a designated, moving path; it was possible to modify the indicators of hand movement during the therapy);
2. Catching a basketball (time of therapy: 180 s; the task was to correctly position a movable basket with hand movements in order to catch a passing ball; it was possible to modify applied degree of difficulty);

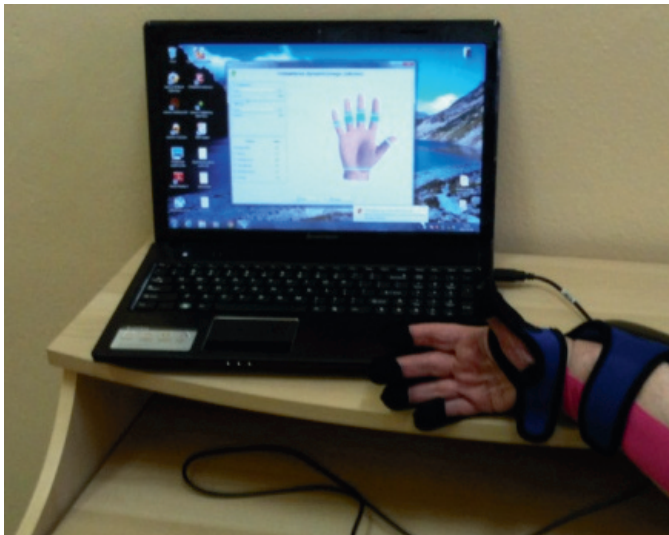


Figure 3. System for a hand rehabilitation with biofeedback – Hand Tutor™

3. Racing a car (time of therapy: 180 s; the task was to maintain a car on a racetrack with hand movements; program chose defined degree of difficulty depending on the individual level of the wrist and fingers' mobility).

Methods

Results are presented as arithmetic means, standard deviations and extreme values (min., max.). Low absolute values (<4) of skewness and kurtosis allow to use analysis of double classification variance for repeated measures. The analysis required the condition of sphericity, which was revised by Mauchley's test. Only in one case (for the variable "Pas") sphericity requirement was not met. Univariate analysis of variance (ANOVA) have been replaced by multivariate analysis of variance (MANOVA). Bonferroni correction was used in post-hoc analysis. The level of statistical significance was set at $p < 0.05$.

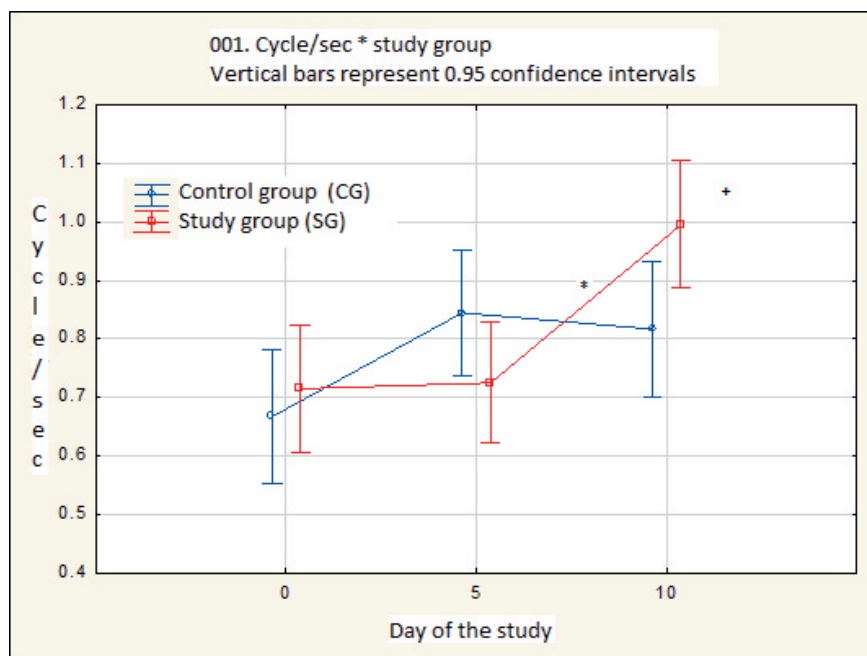
Results

1. Frequency of active movements in the study group (SG) and the control group (CG)

Analysis of the results showed that SG's patients demonstrate significantly higher frequency of the active movements in the final results in comparison to the initial ones. This group showed a significant improvement in the incidence of active movements observed between 5 and 10 day of the study (Fig.4).

2. Mobility of the wrist (mm) in the study group (SG) and the control group (CG)

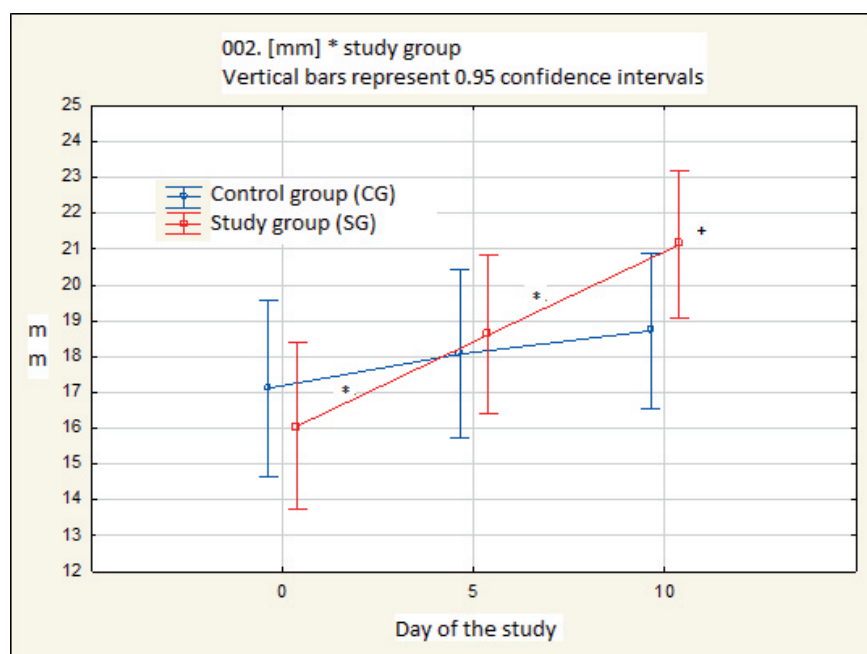
In the final study SG's patients showed significantly higher values of the wrist's mobility in relation to the initial results. In this group of patients significant improvement of examined indicator occurred between 1 and 10 day of the study (Fig.5).



* - Statistically significant difference ($p \leq 0.05$) between successive tests
- Statistically significant difference ($p \leq 0.05$) between groups in a particular study
+ - Statistically significant difference ($p \leq 0.05$) relative to the initial test

Wstęp

Figure 4. The results of the study on the active movements' frequency for both SG and CG's patients



* - Statistically significant difference ($p \leq 0.05$) between successive tests
- Statistically significant difference ($p \leq 0.05$) between groups in a particular study
+ - Statistically significant difference ($p \leq 0.05$) relative to the initial test

Figure 5. The results of the study on the mobility of the wrist (mm) for both SG and CG's patients

3. Active mobility of the wrist both in the study group (SG) and the control group (CG)

Analysis of the results showed in both groups significantly higher active mobility of the wrist in the final examination compared to the initial one. In the SG's patients a significant increase in mobility occurred between 1 and 5 day; in the

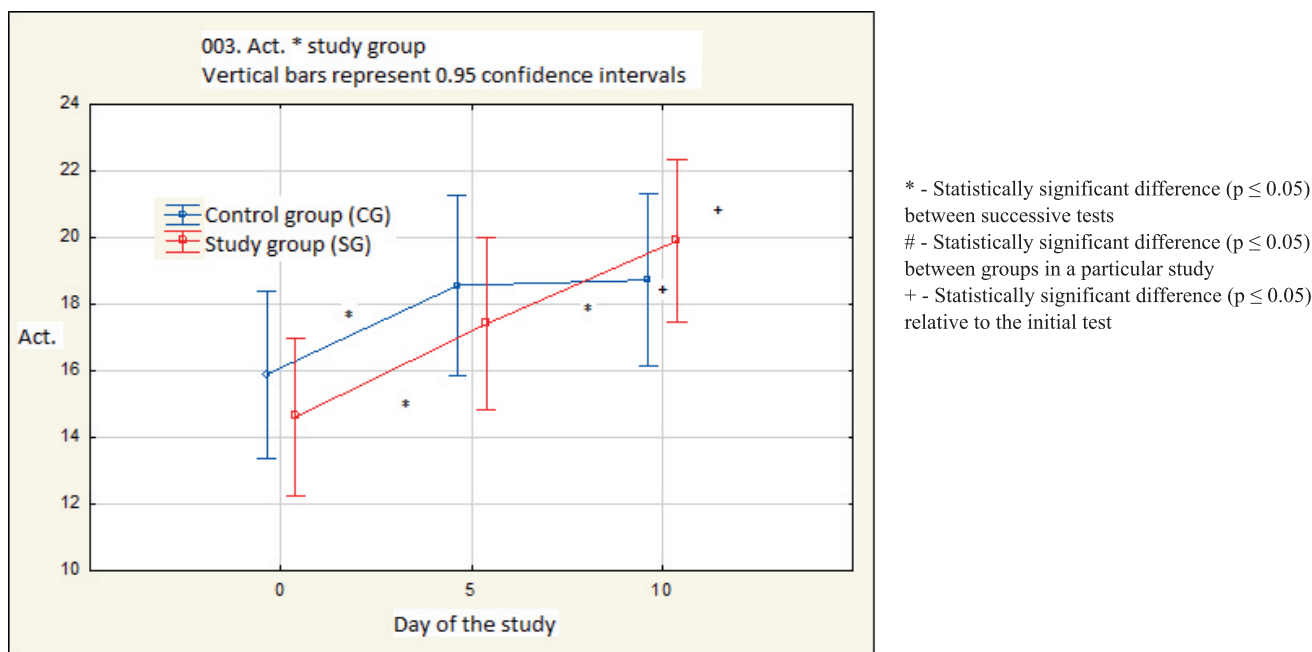


Figure 6. The results of the study on the active mobility of the wrist (mm) for both SG and CG's patients

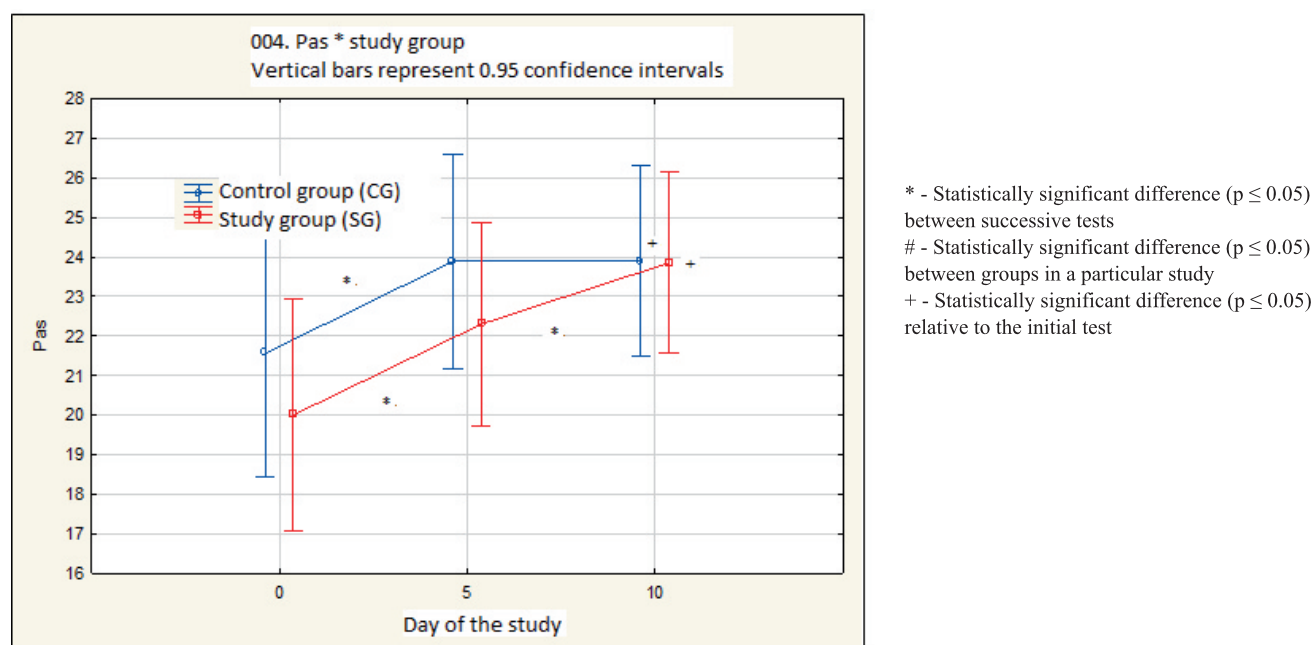


Fig. 7. The results of the study on the passive mobility of the wrist (mm) for both SG and CG's patients

CG's patients a significant improvement of mobility was observed between 1 and 10 day of the study (Fig.6).

4. Passive mobility of the wrist both in the study group (SG) and the control group (CG)

Analysis of the results showed in both groups significantly higher final results of the wrist's passive mobility examination compared to the initial ones. In the CG's patients a significant increase in mobility was observed between 1 and 5 day of the study; in the group of SG's patients a significant increase in mobility occurred between 1 and 10 day (Fig.7).

Discussion

Fractures of the distal radius are today a major clinical problem, representing about 1/6 of all fractures treated in the ER.

Type of a fracture is one of the main determining factor when selecting a therapy. Colles' fracture is one of the most common conditions in which there is a peripheral fraction's displacement (cranially and dorsally) in the radial direction and its supination, leading directly to a functional disturbances of an injured hand.

It appears that the elastic therapeutic tape's applications may be beneficial to the final effects of the hand's physiotherapy.

Appliance of the elastic therapeutic tape is based on kinesiology and existing self-healing process in the body. So far, there is a small number of materials evaluating the effectiveness of technique, especially those meeting the criteria of work based on scientific approach. In the available literature we can find few works valuing possible use and explaining the principles of elastic therapeutic tape application, but the results are not conclusive. Some hypotheses and theories are incompatible with each other, many of them are not supported by any research, and presented results appear to be questionable.

So far applicability of elastic therapeutic tape has been demonstrated in sports medicine as well as in many other medical specialties [2, 3, 9, 12, 13, 14, 19, 20, 23, 25, 27, 28, 29, 30, 31, 33].

Impact of elastic therapeutic tape in normalization of muscle tone was demonstrated in some previously conducted clinical studies. It has been found that an important feature of the tape is a direction, area and value of the tension between the tape and the patients' skin. In cases of overloaded, dysfunctional and painful structures' treatment, applications were administered in accordance with the course of the muscle fibers [3, 19, 23, 24, 26, 27, 28, 29, 31, 32].

It appears that elastic therapeutic tape may affect the tension of the muscle fiber. Published studies show a significant improvement in muscle tone occurring immediately after application and sustaining for 72 h after. Favorable impact of the application has also been showed in hypotonia [31].

In the existing literature there are no reports on the detailed application of elastic therapeutic tape and the effects of hand therapy equipment on physiotherapy in Colles' fractures.

The aim of the study was to evaluate the impact of specific elastic therapeutic tape's application on physiotherapy of the patients after of the distal radius fracture (Colles' fracture) treated conservatively. Both in therapy and evaluation of results a system with biofeedback - Hand Tutor™ - was used. It is a hand rehabilitation equipment designed for sensory, motor and cognitive disorders of hand.

According to the frequency of the wrist's active movements shown in the group that used the elastic therapeutic tape's applications, the final results are significantly higher in as compared to the initial ones. Worth mentioning is the fact that in this group a significant improvement in the frequency of active wrist's movements showed up between 5 and 10 day. Significantly higher final results are observed in the study group.

The final results of the active and passive mobility examination were significantly higher compared to the initial results for the patients in both groups. The CG's patients demonstrated a significant increase in mobility that occurred between 1 and 5 day of the study, while the SG's patients showed significant improvement between 1 and 10 day of the therapy.

The results are consistent with those obtained previously in our own pilot studies [17].

Our study showed that elastic therapeutic tape can effectively facilitate the process of hand's physiotherapy after distal forearm fractures by improving congruence of the articular components and wrist flexor muscle tension. It effectively increases the range of active and passive motion, possibly influence the shortening of physiotherapy. It was also shown that the use of the tape and hand rehabilitation system with bio-feedback (Hand Tutor™) is one of the effective ways of physiotherapy in Colles' fractures.

Conclusions.

1. In the final study no significant differences has been showed in the studied parameters between the groups. Research has presented wrist's functions improvement in the frequency of active movements and range of motion in both groups.
2. Significantly higher results in the final examination of the frequency and wrist's mobility in general were shown in comparison to the initial results.

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Piśmiennictwo

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