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Efekt terapeutyczny działania krioterapii miejscowej na staw kolanowy, uzależniony od rozpoznania choroby zwyrodnieniowej

Profil chorych kierowanych do leczenia w zakresie rehabilitacji ogólnoustrojowej

fizjoterapia polska
nr 1/2015 (15)

Wpływ mobilizacji stawu promieniowo-łokciowego bliższego na funkcję ręki po złamaniu przedramienia

Mobilisation of proximal radioulnar joint and functioning of the arm after forearm fracture

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Streszczenie:

Cel badania. Celem badania była ocena wpływu mobilizacji stawu promieniowo-łokciowego bliższego na funkcję ręki u leczonych zachowawczo po złamaniu w obrębie przedramienia.

Materiał i metodyka. Badaniem objęto 60 chorych w wieku powyżej 50 lat leczonych z powodu ograniczenia funkcji ręki na skutek złamania kości przedramienia. Pacjentów podzielono losowo na dwie równe grupy: badaną i kontrolną. U wszystkich chorych wykonano serię dziesięciu zabiegów fizjoterapeutycznych, na które składały się: aplikacja pola elektromagnetycznego niskiej częstotliwości oraz naświetlania lampą Sollux z niebieskim filtrem i kinezyterapię w postaci ćwiczeń czynnych wolnych w obrębie stawów: łokciowego, nadgarstkowego i palców. W grupie badanej wykonano dodatkowo mobilizację stawu promieniowo-łokciowego bliższego metodą Kaltenborna-Evjentha.

Wyniki. Analiza przeprowadzonych badań wykazała, że mobilizacja stawu promieniowo-łokciowego przyniosła poprawę stanu klinicznego i funkcjonalnego pacjentów po złamaniu przedramienia.

Wnioski. Osoby u których w programie rehabilitacji zastosowano mobilizację stawu promieniowo-łokciowego bliższego oceniały swoje dolegliwości bólowe jako łagodniejsze, odznaczały się lepszym zakresem ruchu zgięcia grzbietowego, zgięcia dłoniowego, odchylenia dołokciowego i dopromieniowego w stawie nadgarstkowym oraz ruchu supinacji i pronacji w stawie promieniowo-łokciowym. Ponadto terapia z zastosowaniem mobilizacji skutkowała poprawą siły chwytu cylindrycznego.

Słowa kluczowe:

uraz, złamanie przedramienia, mobilizacja, skala VAS, skala Laitinena

Abstract

Research objective. *The research aims to evaluate the effect of mobilisation of proximal radioulnar articulation on the hand function after a forearm fracture.*

Material and methods. *The research involved 60 patients over the age of 50 who were subject to treatment for limitation of hand function resulting from a forearm fracture. The respondents were randomly divided into equal research and control groups and subjected to a series of ten physiotherapy treatments, including low-frequency electromagnetic field therapy, blue filter Sollux lamp and physiotherapy in the form of free active exercises of the elbow, wrist and fingers. The research group also underwent the mobilisation of proximal radioulnar articulation using the Kaltenborn-Evjenth method.*

Results. *The analysis of the data obtained showed that mobilisation of proximal radioulnar articulation improved the clinical and functional condition of patients after a forearm fracture.*

Conclusions. *The respondents who went through a rehabilitation program which included mobilisation of proximal radioulnar articulation, assessed their pain level as being lower. They also achieved a wider range of dorsiflexion, palmar flexion, ulnar and radial deviation as well as supination and pronation motion in the radioulnar joint. Additionally, therapy that included the mobilisation resulted in improved strength of cylindrical grip.*

Key words:

injury, forearm fracture, mobilisation, VAS scale, Laitinen scale

Introduction

Forearm fractures are some of the most common upper limb injuries, especially on elderly patients suffering from osteoporosis. In younger people forearm fractures result from sport injuries and accidents [1].

Both the injury and following immobilisation in the cast have a negative impact on hand function. Reduction in the motion range as well as a decrease in muscle strength reduce the gripping and manipulating ability of the hand, causing difficulties in everyday life.

In the musculoskeletal system there is interdependence within the muscle, bone and joint triad. This connection means that any injury or weakness in one of the three components entails the insufficiency of the others [2]. The forearm fracture and following immobilisation treatment limit the range of motion in the wrist and reduce muscle strength and hand efficiency.

One of the procedures that can be incorporated into the rehabilitation of patients after a forearm fracture is mobilisation. The use of passive and translatoric mobilisation of the joints supports restoration of joint slide and thus rolling with a glide, which is essential for the performance of active movement. [3]

Research objective

The research presented below aims to evaluate the effect of mobilisation of proximal radioulnar articulation on the hand function after a forearm fracture treated conservatively.

Research material and methods

The research involved 60 patients of the Department of Rehabilitation of the Medical Centre in Pabianice. All patients had suffered forearm fracture and were treated conservatively. The examinations and the treatments were performed as part of the standard operations of the Department of Rehabilitation. Permission to carry out the research was issued by the Bioethics Commission of the the Medical University of Łódź. Prior to the examinations the respondents had been informed of the purpose and nature of the tests and gave their consent. The respondents were randomly divided into equal research and control groups The research group comprised 30 people, including 27 female (90%) and 3 male (10%) respondents. The control also comprised 30 people, including 18 female (60%) and 12 male (40%) respondents. The average age of the respondents in the research group was 65.5 years (SD = 7.4); the youngest participant in the study was 57 and the oldest was 83. The average age of the patients in the control group was 64.8 years (SD = 9.9); the youngest participant in the study was 45 and the oldest was 82. In the research group in 18 cases (60%) the therapy was conducted on the right hand and in 12 cases (40%) on the left hand. In the control group in 21 patients (70%) the therapy was con-

ducted on the right hand and in 9 cases (30%) on the left hand.
In both groups a rehabilitation program with some elements of physical therapy was implemented, including low-frequency electromagnetic pulsed field therapy, blue filter Sollux lamp and physiotherapy in the form of free and active supported exercises of the elbow, wrist and fingers. The research group also underwent the mobilisation of in compliance with the methodology of Kaltenborn-Evjenth manual therapy. The mobilisation included both dorsal and ventral traction and translation of the radioulnar joint (Fig. 1, 2, 3).
The examination of the respondents was carried out before and after physiotherapy treatment. The measurements obtained were then entered in the test sheet drawn up especially for the purpose of this research. Each respondent had their own indivi-

Fig. 1. Manual test of radioulnar joint movement (by F.M.Kaltenborn)

Fig. 2. Mobilisation in case of supination (by F.M.Kaltenborn)

Rig. 3. Mobilisation in case of pronation (by F.M.Kaltenborn)

dual sheet completed. The treatments were carried out for 10 days.
Both measurements were carried out under the same conditions and with the use of the same research tools.

Examination sheet included:
• Interview with the patient
• Evaluation of the efficiency of analgesic therapy. The respondents were asked to rate the pain they perceived using the Visual Analogue Scale (VAS) [4] and the modified Laitinen scale. The VAS scale begins with "0", being a lack of any pain. The scale ends with "10", signifying an unbearable level of pain. The respondents were asked to identify a specific value that, in their opinion, corresponded to intensity of pain perceived at the time of examination. The modified Laitinen scale is based on the assessment of four parameters: intensity and frequency of pain, analgesic intake and limitation of physical activity. These factors are rated on the 04 five-point scale, where 0 signifies the minimum and 4 signifies the maximum value of evaluated characteristics.
• The measurement of the motion range in the radioulnar joint and the wrist. The evaluation of mobility was conducted with the use of goniometer with an accuracy of 5 degrees. During the examination the proximal section of the forearm was stabilised in order to avoid compensation. The axis of rotation of goniometer overlapped the axis of rotation of the examined joint in respective planes. The fixed arm was located along the long axis of the proximal bone element of the joint, the moving element along the long axis of the distal bone element of the joint (Fig. 4). The results were entered in the table using the SFTR method [5].

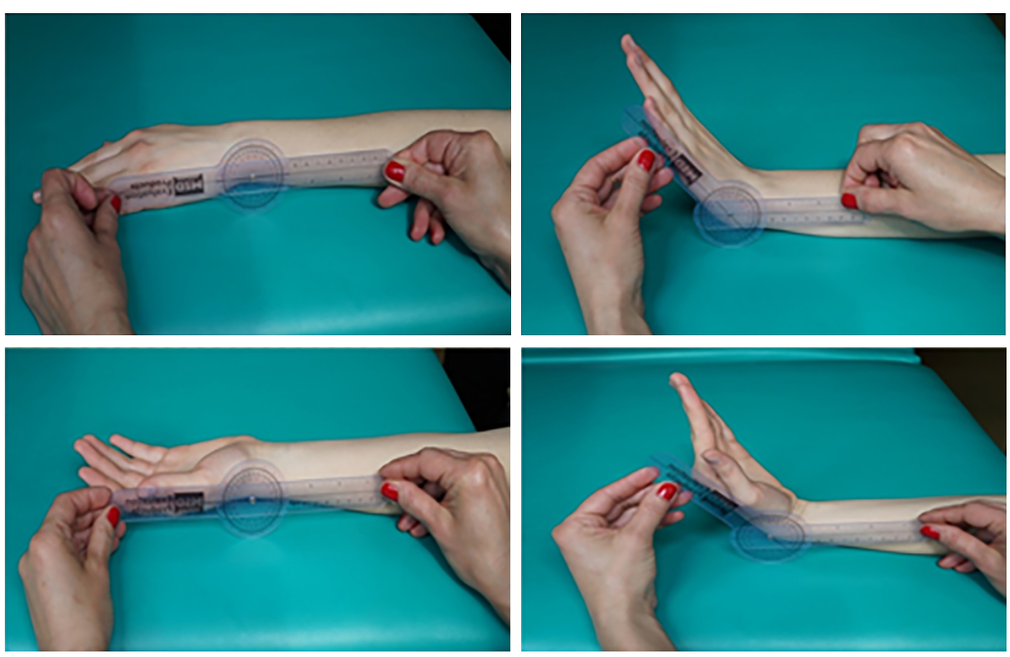

Fig. 4. Measurement of the motion range

• The measurement of the static strength. The measurement of the grip strength was conducted with a dynamometer (Fig. 5). The results were recorded in Newtons [N].

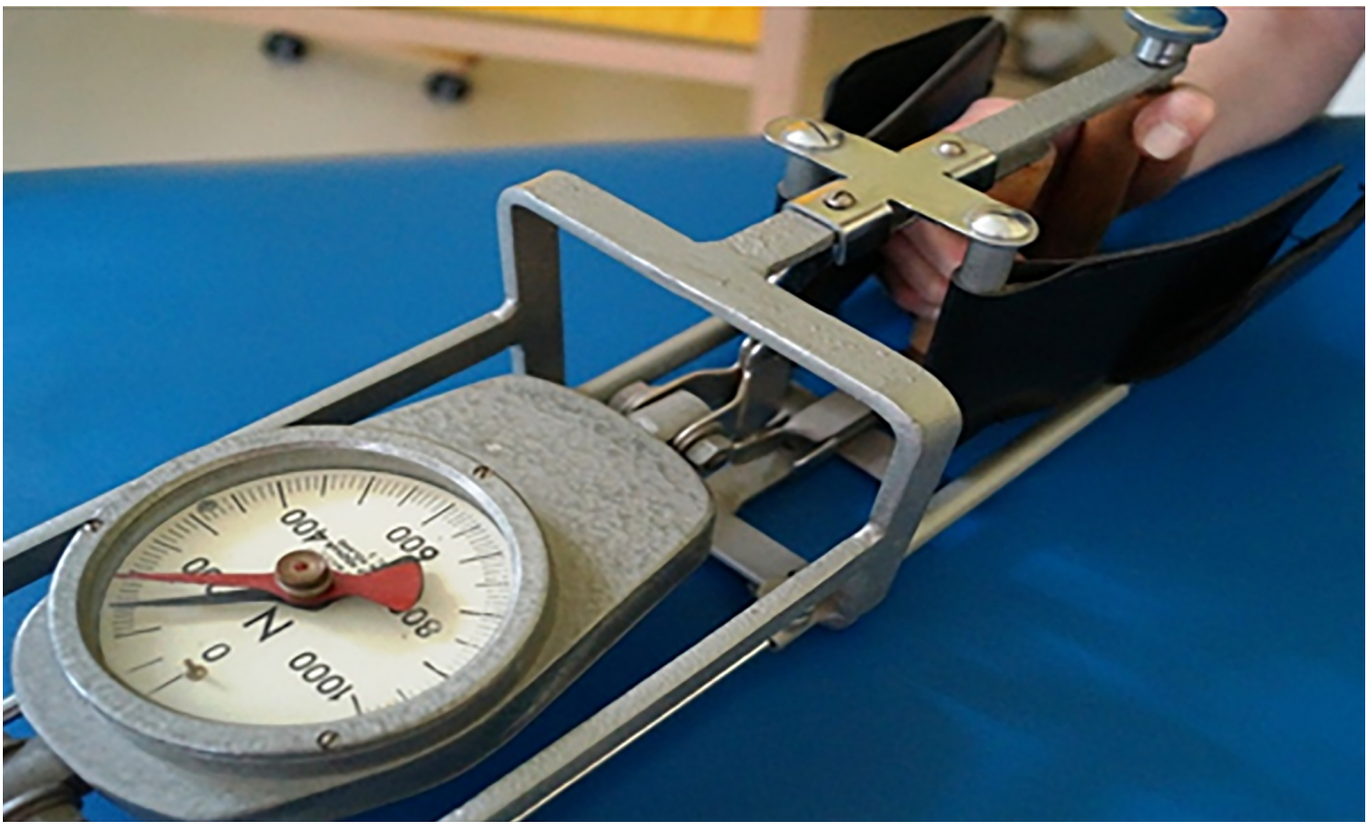

Fig. 5. Measurement of the muscle strength

The results obtained during the examination were analysed statistically using the arithmetic mean, median, variance and standard deviation (SD), which is a square root of the variance. Then t-Student for dependent samples was used which involves a comparison of the results obtained in the same research group (double observation) and determining the statistical significance between them. The examinations were considered dependent because they were conducted on the same respondent, so the second result dependent on the outcome of the first. The purpose of the t-Student test was to determine the volume of change in the specific value within the research group. The test was conducted on both the research and the control groups.

The t values obtained were then compared with the Student t-distribution table for the adopted Level of Confidence. This constituted the basis for the conclusion as to whether or not the compared samples (values) were statistically significantly different.

The threshold level of significance for the compared values to be considered statistically significantly different was $p = 0.005$. The Level of Confidence was set at $p = 99$, i.e. the maximum permissible error in deciding on the statistical significance of differences between certain values was assumed at 1%.

The calculations were carried out in MS Excel using the Analysis Tool Pack and in R package using R, high-level programming language for statistical calculations.

Results

Table 1 presents a comparison of typical descriptive statistics for the research group (with mobilisation) and for the control group. In both groups, perceived pain after treatment was statistically significantly reduced. The level of significance calculated using the t-Student test for dependent samples was considerably lower than the 0.005 adopted. In both the research group and the control group almost all of the descriptive statistics were reduced after treatment. The mean value for pain assessed on the VAS scale decreased from 4.9 to 2.8 in the test group and from 4.3 to 3 in the control group. It is noteworthy that a greater difference in mean values was observed in the research group, which underwent the mobilisation treatment.

Table 1. Pain intensity on VAS scale

	Research group		Control group	
	Before treatment	After treatment	Before treatment	After treatment
Mean value	4.9	2.8	4.3	3
Standard deviation	2.04	1.98	1.21	1.5
Mean values difference	2.1		1.3	
Mean values difference %	32.2		13.1	
t-Student test t values	7.7		0.09	
t-Student test p values	7.7006		0.001	
Minimal value	1	0	2	1
Maximum value	7	6	6	5
Median	5.5	3	3	1

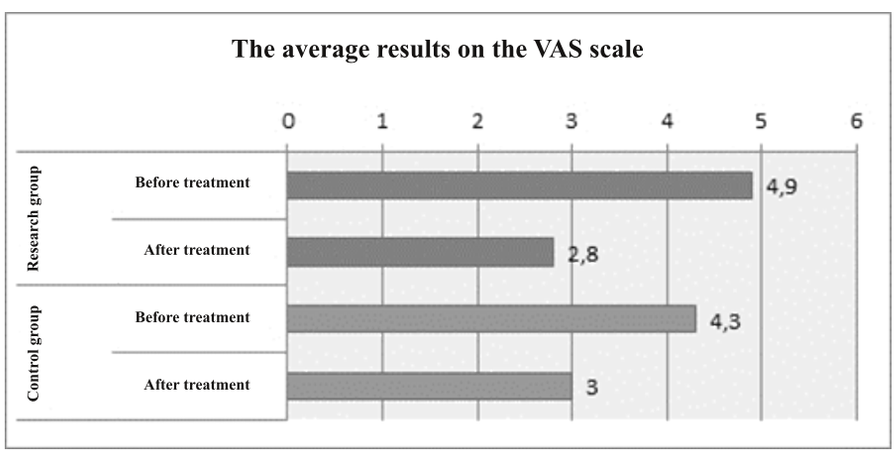

Fig. 6. Pain intensity on VAS scale

Table 2 presents the comparison of typical descriptive statistics for the research group (with mobilisation) and for the control group. In both groups, perceived pain measured with the modified Latinen scale after the treatments was statistically significantly reduced. The level of significance, calculated using the t-Student test for dependent samples, was considerably lower than the 0.005 adopted. In both the research group and the control group almost all of the descriptive statistics were reduced after treatment. The mean value for pain, assessed on the VAS scale, decreased from 6.9 to 3.8 in the test group and from 45.7 to 3.1 in the control group. It is noteworthy that a greater difference in mean values was observed in the research group, which underwent the mobilisation treatment.

Table 2. Pain intensity on the modified Latinen scale

	Research group		Control group	
	Before treatment	After treatment	Before treatment	After treatment
Mean value	6.9	3.8	5.7	3.1
Standard deviation	2.89	1.91	2.08	1.61
Mean values difference	3.1		2.6	
Mean values difference %	38.8		29.6	
t-Student test t values	5.85		17.50	
t-Student test p values	0.001		0.001	
Minimal value	2	1	3	1
Maximum value	10	7	9	6
Median	7.5	3.5	6	3

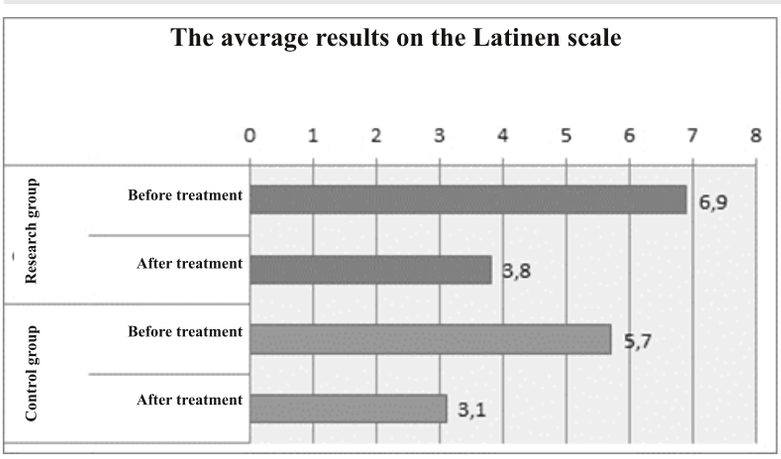

Fig. 7. Pain intensity on the modified Latinen scale

A similar research procedure to that which was used for the analysis of pain on the VAS scale and the modified Laitinen scale was used to analyse the assessment of range of movement in the radioulnar joint and wrist.

Table 3 presents the statistical values of results obtained for dorsiflexion range in the wrist (in degrees). In the research group the mean value increased from 38° to 48° (5.5%). The improvement was also observed in the control group, from 30° to 35° (2.3%). It is noteworthy that a greater improvement was observed in the research group, which underwent the mobilisation treatment. The t-Student test for dependent samples confirmed the statistical significance of the change observed in both groups after treatment.

Table 3. Dorsiflexion range in the wrist

	Research group		Control group	
	Before treatment	After treatment	Before treatment	After treatment
Mean value	38	48	30	35
Standard deviation	13.49	12.90	12.66	12.86
Mean values difference	10		5	
Mean values difference %	5.5		2.3	
t-Student test t values	2.628		2.628	
t-Student test p values	0.014		0.014	
Minimal value	20	30	15	15
Maximum value	60	65	45	50
Median	40	50	30	35

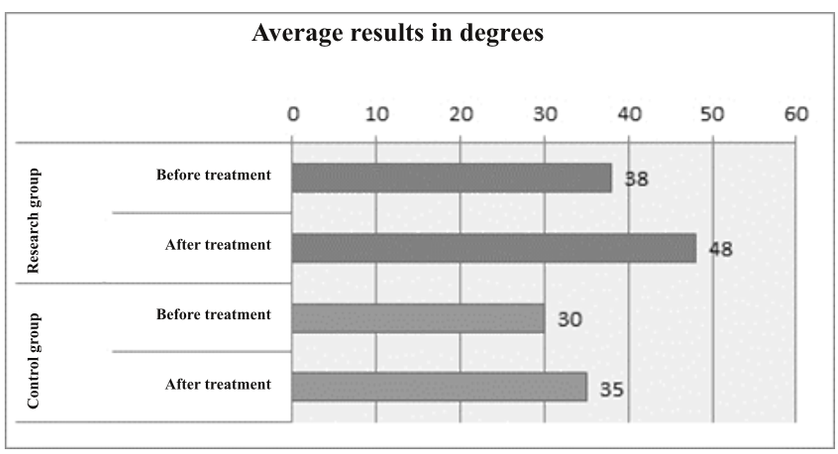

Fig. 8. Dorsiflexion in the wrist

Table 4 presents the statistical values of results obtained for palmar flection range in the wrist (in degrees). In the research group the mean value increased from 38° to 53° (11.2%). An improvement was also observed in the control group, from 36° to 46° (6%). It is noteworthy that a greater improvement was observed in the research group, which underwent the mobilisation treatment. The t-Student test for dependent samples confirmed the statistical significance of the change observed in both groups.

Table 4. Palmar flexion range in the wrist

	Research group		Control group	
	Before treatment	After treatment	Before treatment	After treatment
Mean value	38	53	36	46
Standard deviation	12.28	11.18	9.59	8.44
Mean values difference	15		10	
Mean values difference %	11.2		6	
t-Student test t values	4.287		17.029	
t-Student test p values	0.001		0.001	
Minimal value	20	25	20	35
Maximum value	55	65	45	60
Median	40	57.5	35	45

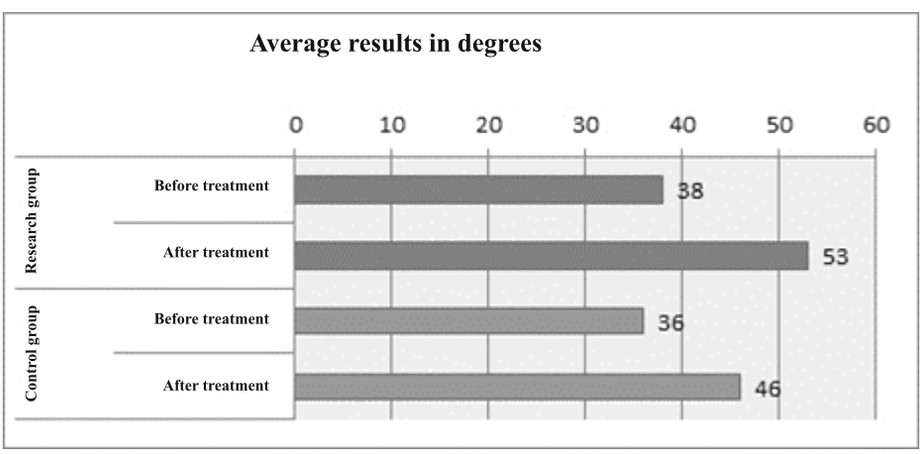

Fig. 9. Palmar flexion in the wrist

Table 5 presents the statistical values of results obtained for radial deviation range in the wrist (in degrees). In the research group the mean value increased from 14° to 20° (12.8%). The improvement was also observed in the control group, from 15° to 17° (1.6%). It is noteworthy that a greater improvement was observed in the research group, which underwent the mobilisation treatment. The t-Student test for dependent samples confirmed the statistical significance of the change observed in both groups.

Table 5. Radial deviation range in the wrist

	Research group		Control group	
	Before treatment	After treatment	Before treatment	After treatment
Mean value	14	20	15	17
Standard deviation	2.03	2.27	2.27	2.49
Mean values difference	6		2	
Mean values difference %	12.8		1.6	
t-Student test t values	5,109		4.397	
t-Student test p values	0.001		0.001	
Minimal value	10	15	10	15
Maximum value	15	25	20	20
Median	15	20	15	15

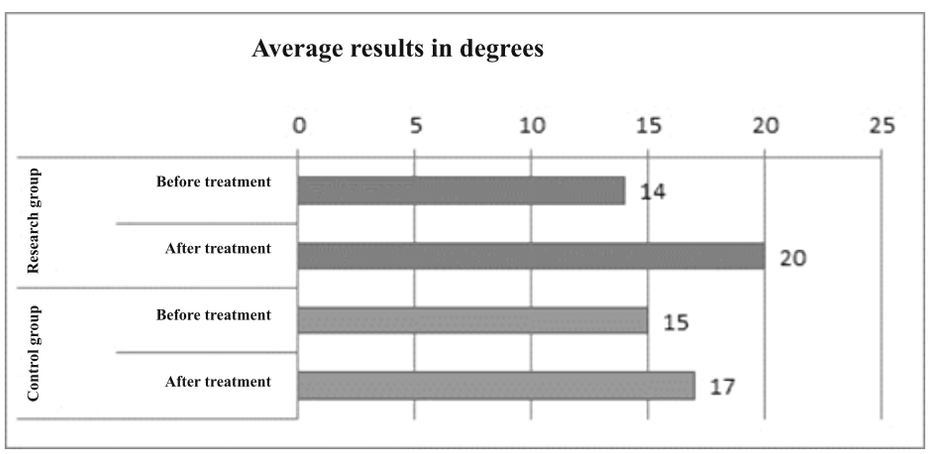

Fig. 10. Radial deviation in the wrist

Table 6 presents the results of the statistical values of results obtained for ulnar deviation range in the wrist (in degrees). In the research group the mean value increased from 21° to 28° (8.3%). An improvement was also observed in the control group, from 22° to 25° (2.7%). It is noteworthy that a greater improvement was observed in the research group, which underwent the mobilisation treatment. The t-Student test for dependent samples confirmed the statistical significance of the change observed in both groups.

Table 6. Ulnar deviation range in the wrist

	Research group		Control group	
	Przed leczeniem Before treatment	Po leczeniu After treatment	Przed leczeniem Before treatment	Po leczeniu After treatment
Mean value	21	28	22	25
Standard deviation	7.11	7.94	6.51	5.08
Mean values difference	7		5	
Mean values difference %	8.3		2.7	
t-Student test t values	4.506		6.506	
t-Student test p values	0.001		0.001	
Minimal value	10	10	10	15
Maximum value	35	40	30	30
Median	20	27.5	20	25

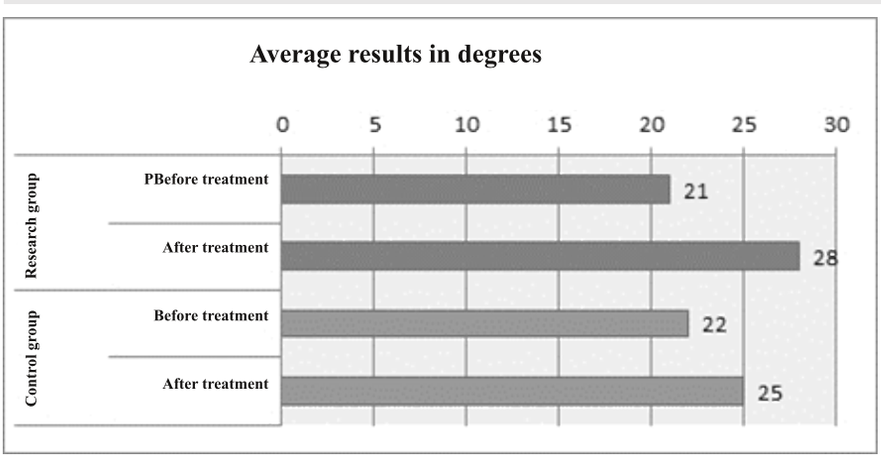

Fig. 11. Ulnar deviation in the wrist

Table 7 presents the results of the statistical values of results obtained for supination range in the radioulnar joint (in degrees). In the research group the mean value increased from 30° to 43° (13.1%). The improvement was also observed in the control group, from 24° to 34° (12.2%). It is noteworthy that a greater improvement was observed in the research group, which underwent the mobilisation treatment. The t-Student test for dependent samples confirmed the statistical significance of the change observed in both groups.

Table 7. Supination range in the radioulnar joint

	Research group		Control group	
	Before treatment	After treatment	Before treatment	After treatment
Mean value	30	43	24	34
Standard deviation	13.83	15.12	13.22	14.52
Mean values difference	13		10	
Mean values difference %	13.1		12.2	
t-Student test t values	5.147		13.904	
t-Student test p values	0.001		0.001	
Minimal value	10	15	10	15
Maximum value	60	70	50	60
Median	27,5	42.5	17.5	30

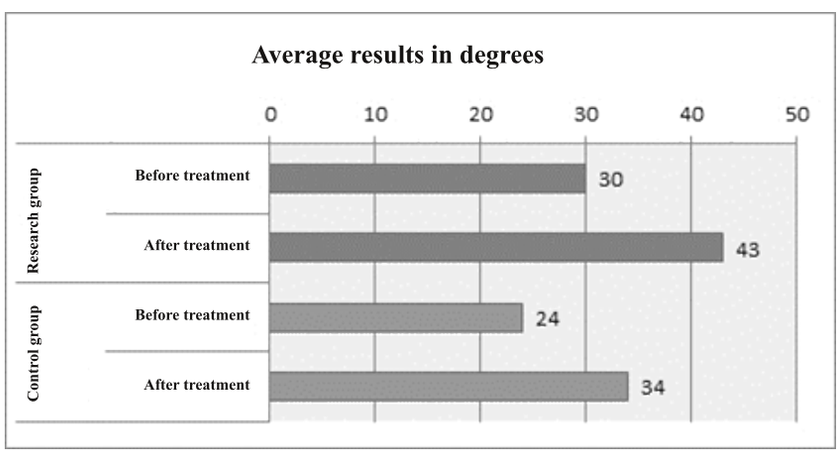

Fig. 12. Supination in the radioulnar joint

Table 8 presents the results of the statistical values of results obtained for pronation range in the radioulnar joint (in degrees). In the research group the mean value increased from 51° to 73° (13.1%). The improvement was also observed in the control group, from 60° to 72° (3.5%). It is noteworthy that a greater improvement was observed in the research group, which underwent the mobilisation treatment. The t-Student test for dependent samples confirmed the statistical significance of the change observed in both groups.

Table 8. Pronation range in the radioulnar joint

	Research group		Control group	
	Before treatment	After treatment	Before treatment	After treatment
Mean value	51	73	60	72
Standard deviation	22.83	13.49	13.64	12.07
Mean values difference	22		12	
Mean values difference %	13.1		3.5	
t-Student test t values	4.527		14.102	
t-Student test p values	0.001		0.001	
Minimal value	15	40	30	40
Maximum value	80	85	80	85
Median	57,5	80	60	72.5

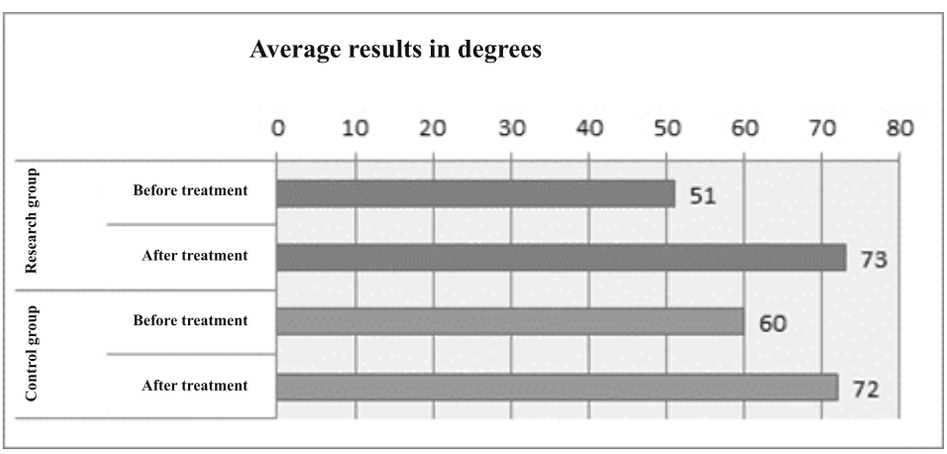

Fig. 13. Pronation range in the radioulnar joint

The values of cylindrical grip strength before and after treatment is presented in table 9. In the research group the mean value increased from 51 N to 73 N. The improvement was also observed in the control group, from 45 N to 85 N. It is noteworthy that a greater improvement was observed in the research group, which underwent the mobilisation treatment. The t-Student test for dependent samples confirmed the statistical significance of the change observed in both groups.

Table 9 Cylindrical grip strength

	Research group		Control group	
	Before treatment	After treatment	Before treatment	After treatment
Mean value	58	91	45	85
Standard deviation	43.58	60.07	27.80	34.02
Mean values difference	33		40	
Mean values difference %	20.6		41.8	
t-Student test t values	4.323		21.824	
t-Student test p values	0.001		0.001	
Minimal value	0	0	0	30
Maximum value	130	200	100	150
Median	50	85	50	90

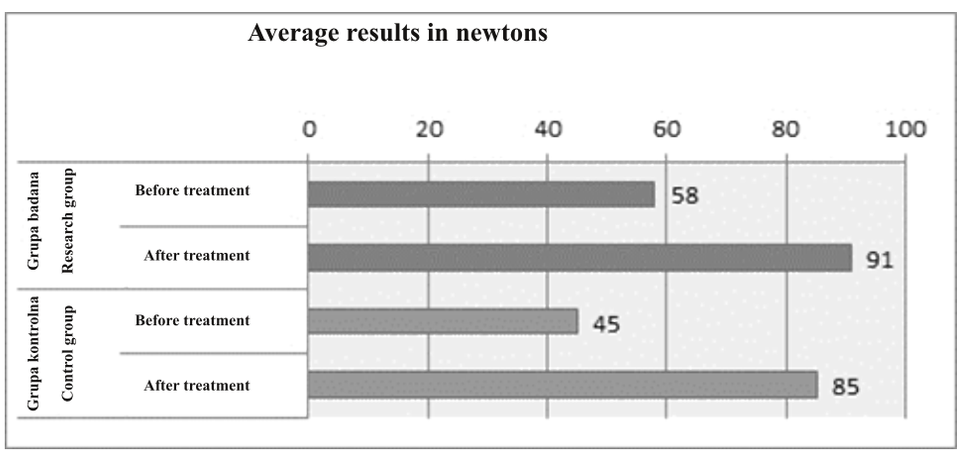

Fig. 14. Cylindrical grip strength

Discussion

A significant reduction in the efficiency of the hand occurs as a result of various damage and shorter or longer-lasting immobilisation. This manifests itself as pain, reduced range of motion and decreased level of muscle strength and limits the gripping strength and manipulating ability, resulting in difficulties in everyday life.

There are numerous methods of rehabilitation available to patients after a forearm fracture [1, 6]. One of the procedures that can be incorporated in the rehabilitation programme is joint mobilisation. The use of this technique has been described in professional medical literature. Knapik et al, in his publication discuses the efficiency of mobilisation techniques on the basis of his examinations of patients who had undergone rehabilitation using this technique. He found that the improvement in the motion range was significantly greater and the overall therapeutic effect was better [7].

Ciechomski, in an article discussing manual therapy techniques associated with the physiotherapy, stated that these procedures significantly eased perceived pain and facilitated fast recovery [8].

Similar conclusions were reached by Książek-Czekaj et al in an article describing the case of a patient for whom the mobilisation technique was used in the rehabilitation programme. The therapeutic effects of the treatment meant that hand function was significantly improved [9].

In his article discussing the Kaltenborn – Evjenth orthopedic manual therapy method, Dębski emphasises the fact that patients can function without pain thanks to the mobilisation technique [10].

On the other hand, when describing conservative rehabilitation after a forearm fracture, Brotzman et al state that the use of passive mobilisation in the process of recovering after the fracture of the distal part of the radius is not justified [1].

Conclusions

Analysis of the data showed an improved clinical and functional condition of patients after a forearm fracture. Patients subjected to mobilisation of the proximal radioulnar joint in their rehabilitation programme evaluated their pain at a much lower level than those for whom mobilisation was not used.

Using the mobilisation of the radioulnar joint resulted in a better range of dorsiflexion, palmar flexion and ulnar and radial deviation of the wrist, as well as supination and pronation movement in the radial-ulnar joint.

Furthermore, obilisation, as part of therapy, resulted in improved cylindrical grip strength.

The clinical material gathered is not sufficient to draw far-reaching conclusions and requires further research. The results obtained, however, are promising and may indicate that mobilisation of proximal radioulnar joint is a valuable complement to the conservative rehabilitation treatment of patients after forearm fractures.

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