

The purpose of the present study was to assess the effect of ice stimulation on improving the function of the subluxated wrist joint in children with rheumatoid arthritis.

SUBJECTS, MATERIALS AND METHODS

Subjects

Preparatory to this study, it was determined that the subjects chosen to participate should meet the following criteria:

- Have inflammatory rheumatoid arthritis with a persistent subluxated wrist.
- Absence of deformities or nerve trapping.
- Have unilateral subluxated wrist joints (mild).
- Have pain.
- All patients were under anti-inflammatory drugs

Twenty children with subluxated wrist were involved in the present study, which was

sample included twenty girls. Their age ranged between seven and ten years old. Date of onset in all patients ranged between five and six year of life. Patients were randomly divided into two equal groups, each comprised ten patients, control and study groups.

Materials

A) For evaluation

- Grip dynamometer: Digital display grip dynamometer, D-type, with four spaces by special grip range adjustment screw.
- LCD goniometer.

B) For treatment

- Dry cup of ice.
- Rubber hand gripper.
- V-shaped spring hand gripper.

Methods

A) For evaluation

The measurements of hand grip strength (hand grip dynamometer) were conducted before and after ten weeks of treatment. Measurement was carried out while the patient was in sitting position on standard height chair, with back and arm support. The shoulder was adducted and neutrally rotated, the elbow flexed at 90° and the forearm was in, more or less, a neutral position. The elbow was fixed in flexed position by strap and the forearm supported on soft pillow. All subjects were instructed to hold the dynamometer properly in the hand. After the first trial score, representing the hand grip strength, was recorded other two trials were allowed. The highest score of the three trials was recorded for each patient individually.

The measurement for the ROM of the wrist joint was achieved while the patient was in sitting position, with elbow flexed and forearm and wrist were in the neutral position, stabilizing hand at the distal end of the patients forearm. The stationary arm of the goniometer was aligned with the radius, while the movable arm was aligned with the second metacarpal. The axis of motion of the goniometer was approximately at the level of the radial styloid. The wrist joint was moved into flexion, extension, ulnar and radial deviation. Then, the degree of every movement was recorded.

B) For treatment

Patients belonging to the control group received a physical therapy program, which comprised isometric exercises, free active exercises for the wrist joint and fingers, rubber hand strength gripper, spring hand strength gripper, V-shaped spring hand strength gripper and night splint, aiming for relieving pain and

improving muscle strength and endurance. Duration of each treatment session lasted about 45 minutes. On the other hand, the study group patients were exposed to the same line of treatment in addition to ice stimulation on the dorsum surface of the wrist joint in a slow circular motion for 5-10 minutes. All patients were treated for five days per week, for ten successive weeks.

Comparison of each patient's data at the end of the treatment period to her pre-treatment measurements, resulted in calculated change for each variable.

RESULTS

The collected data were statistically treated to show the mean, standard deviation and standard error of the mean for both groups. The student t-test was then utilized to examine the significance of treatment. It revealed no significant difference between both groups before the application of treatment ($P > 0.05$).

As shown from table (1) and fig. (1), the mean values of handgrip strength in the study group before treatment was 14.4 ± 5.7 kgm, which increased after 10 weeks of the combined treatment to 17.6 ± 5.9 kgm. The mean difference was 3.2 kgm. A highly significant improvement has been noticed ($t = 13.0324$, $P < 0.001$). Concerning the control group, the mean value of handgrip strength was 14.1 ± 6.5 kgm before treatment, which increased to 14.7 ± 6.7 kgm after treatment, with a mean difference of 0.6 kgm ($t = 1.3491$, $P > 0.05$).

Table (1): Shows the mean values of handgrip strength in both groups (in Kgm) before and after 10 weeks of treatment.

Comp.	Study Group		Control Group	
	Pre	Post	Pre	Post
Mean	14.4	17.6	14.1	14.7
SD	± 5.7	± 5.9	± 6.5	± 6.7
SE	1.259	1.339	1.405	1.504
MD	3.2		0.6	
t	13.0324		1.3491	
P	< 0.001 Sig.		> 0.05 N.Sig.	

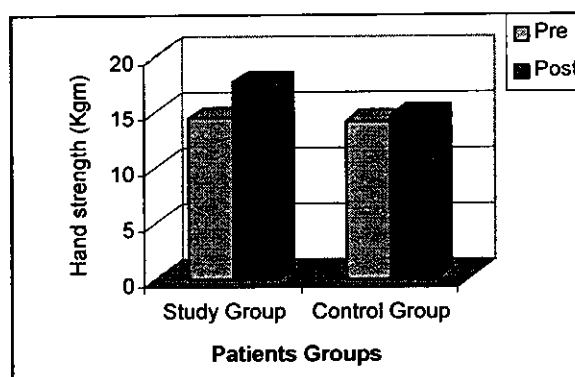


Fig. (1): Shows the mean values of handgrip strength in both groups before and after treatment

The results obtained from table (2) and fig. (2) showed that the mean value of the wrist dorsiflexion ROM in the study group was $40.1 \pm 9.735^\circ$, which increased after the suggested period of treatment to $61.0 \pm 9.944^\circ$. The mean difference was 21.0° , indicating a highly significant result ($t = 13.8411$, $P < 0.0001$). The mean value of wrist dorsiflexion ROM in the control group increased also from $33.6 \pm 9.131^\circ$ before treatment with the traditional physical therapy methods to $38.0 \pm 8.233^\circ$, with a mean difference of 4.6° . A significant difference was recorded ($t = 5.5542$, $P < 0.001$).

Table (2): Shows the mean values of wrist dorsiflexion ROM in both groups (in degrees) before and after 10 weeks of treatment.

Comp.	Study Group		Control Group	
	Pre	Post	Pre	Post
Mean	40.1	61.0	33.6	38.0
SD	± 9.735	± 9.944	± 9.131	± 8.233
SE	3.081	3.747	1.405	1.504
MD	21.0		4.6	
t	13.8411		5.5542	
P	< 0.0001 Sig.		< 0.001 Sig.	

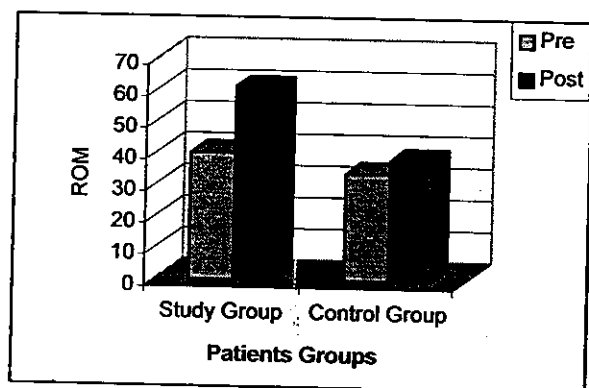


Fig. (2): Shows the mean values of wrist dorsiflexion in both groups before and after treatment

As shown from table (3) and fig. (3), the mean values of wrist flexion ROM before treatment in the study group were $33.2 \pm 7.225^\circ$, which increased after 10 weeks of treatment to $49.9 \pm 6.244^\circ$. The mean difference was 16.7° . Similarly, in the control group, the mean values of wrist flexion ROM increased from $31.1 \pm 7.062^\circ$ before treatment to $38.9 \pm 7.062^\circ$ after treatment, which indicated significant differences, with a mean difference of 7.8° ($t = - 8.6188$ and $- 11.1930$, significantly, $P < 0.001$).

Table (3): Shows the mean values of wrist flexion ROM in both groups (in degrees) before and after 10 weeks of treatment.

Comp.	Study Group		Control Group	
	Pre	Post	Pre	Post
Mean	33.2	49.9	31.1	38.9
SD	± 7.223	± 6.244	± 7.062	± 7.062
SE	2.286	1.976	2.235	2.235
MD	16.7		7.8	
t	- 8.6188		- 11.1930	
P	< 0.001 Sig.		< 0.001 Sig.	

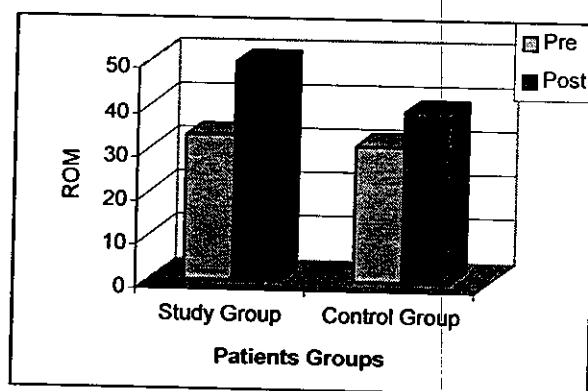


Fig. (3): Shows the mean values of wrist flexion in both groups before and after treatment

As shown from table (4) and fig. (4), the mean value of wrist ulnar deviation ROM in the study group was $11.8 \pm 2.781^\circ$, which increased after the suggested period of treatment to $18.9 \pm 2.961^\circ$, with a mean difference of 7.1° , indicating significant results ($t = - 8.2000$, $p < 0.001$). The mean value of the wrist ulnar deviation ROM in the control group increased also from $12.4 \pm 2.366^\circ$ before treatment with the traditional physical therapy treatment to $14.8 \pm 2.394^\circ$, forming a mean difference of 2.4° . The results were also significant ($t = - 7.8600$, $P < 0.001$).

Table (4): Shows the mean values of wrist ulnar deviation ROM in both groups (in degrees) before and after 10 weeks of treatment.

Comp.	Study Group		Control Group	
	Pre	Post	Pre	Post
Mean	11.8	18.9	12.4	14.8
SD	±2.781	±2.961	±2.366	±2.394
SE	0.879	0.936	0.748	0.757
MD	7.1		2.4	
t	-8.2000		-7.8600	
P	<0.001 Sig.		<0.001 Sig.	

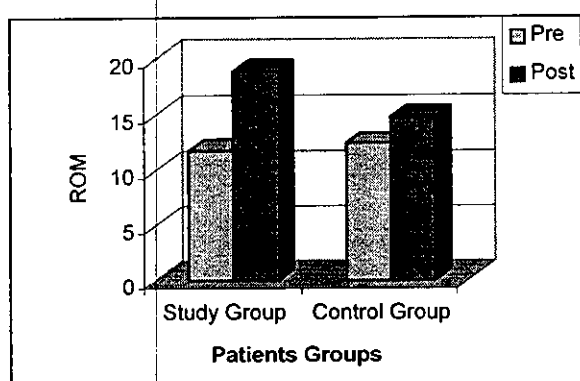


Fig. (4): Shows the mean values of wrist ulnar deviation in both groups before and after treatment

As shown from table (5) and fig. (5), the mean value of wrist radial deviation ROM in the study group was $8.8 \pm 1.317^\circ$, which increased after the suggested period of treatment to $12.3 \pm 2.111^\circ$, with a mean difference of 3.5° , indicating significant results ($t = -9.0000$, $p < 0.001$). The mean value of the wrist ulnar deviation ROM in the control group increased also from $9.2 \pm 1.317^\circ$ before treatment with the traditional physical therapy treatment to $11.9 \pm 1.663^\circ$, forming a mean difference of 2.7° . The results were also significant ($t = -5.8000$, $P < 0.001$).

Table (5): Shows the mean values of wrist radial deviation ROM in both groups (in degrees) before and after 10 weeks of treatment.

Comp.	Study Group		Control Group	
	Pre	Post	Pre	Post
Mean	8.8	12.3	9.2	11.9
SD	±1.317	±2.111	±1.317	±1.663
SE	0.416	0.667	0.416	0.526
MD	3.5		2.7	
t	-9.000		-5.800	
P	<0.001 Sig.		<0.001 Sig.	

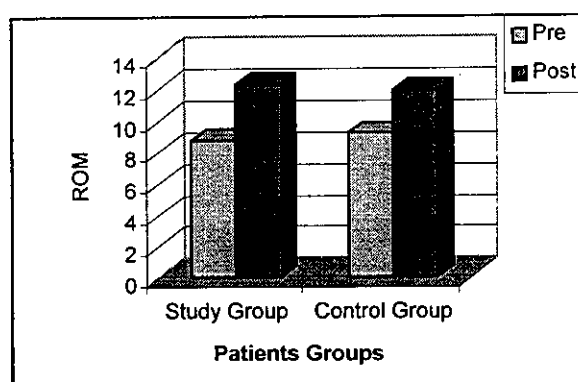


Fig. (5): Shows the mean values of wrist radial deviation in both groups before and after treatment

DISCUSSION

The results of this study indicated that application of ice stimulation could help ROM in the subluxated wrist. This statement is made with the understanding that subjects, who probably can be helped most with this technique, are those who meet pre-determined criteria, such as those described previously. Ice massage was used for two purposes. Firstly, it can assist in the relief of pain by what is called counter irritant action. The second purpose is for muscle facilitation by brief stimulation of the skin dermatome, supplied by the same nerve roots as those of the muscle^{8,11}.

Wise (1973)²⁰ mentioned that the cooling applied to the skin immediately stimulates cold receptors. Both pain and

temperature neurons synapse in the posterior horn of the spinal cord, the subsequent neurons ascend in the spinothalamic tract of the opposite side. A point from a synapse in the thalamus with a neuron to the sensory cortex gives the awareness of cold. The hypothalamus acts as a thermostat to maintain core temperature. This application produces the short-latency response of vasoconstriction of the superficial skin vessels by the axon reflex through the spinal segmental reflexes, causing vasoconstriction of the adjacent areas such as muscles and joints in the region^{9,19}.

The possible explanation for improvement shown in the study group as compared with the control group is that the combination between exercise and ice massage has better effect than exercise alone because stimulation of the thermoreceptors may pass the affection point and lead at the end to muscle contraction^{15,17}. This improvement might also be attributed to the increased blood flow in the massaged muscles, which means stimulation through the autonomic nervous system^{8,20}. Ice massage changes skin sensitivity and this may add more help for muscle habilitation. The relative duration of the post application effect of ice may explain the changes in this group¹⁹.

In this work, ice massage was applied for 5-10 minutes. This time might be enough to reduce pain^(16,18) and improve ROM. The results of this study agreed with Pegg and Litter (1979)¹⁵, who stated that cold application resulted in improvement of motor function in rheumatic patients. The results also confirmed the findings of other earlier studies, which reported that inflammation of the joint can be reduced and the function becomes better when ice is applied^{2,6,20}.

The findings of the present study also coincide with the findings of McKeeken et al. (1984)¹¹ who emphasized the positive effects

of ice stimulation on facilitation of muscle contraction and pain reduction.

CONCLUSION

The results collected from the present study indicated the significant effect of ice stimulation on improving wrist function in subluxated wrist with arthritis. Ice stimulation may be valuable in preparing the patient for subsequent therapeutic modalities (e.g. joint ranging and mobilization), provided that physical therapy is performed immediately after ice stimulation.

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المخلص العربي

تأثير التنبيه بالتلج على خلع مفصل الرسغ عند التهاب مفاصل الأطفال

الهدف من البحث: تحديد أثر العلاج بالتنبيه بالتلج على تحسن وظيفة مفصل الرسغ لدى الأطفال ذوي التهاب المفاصل. مواد البحث وأساليبه: أجرى البحث على عشرين مريضاً من المصابين بالتهاب مفصل الرسغ تراوح أعمارهم من سبعة إلى عشرة سنوات وقد تم تقسيمهم عشوائياً إلى مجموعتين متساويتين إحداهما ضابطة والأخرى تجريبية. تم علاج المجموعة الضابطة باستخدام العلاج الطبيعي التقليدي الأساسي بينما عولجت المجموعة التجريبية باستخدام التنبيه بالتلج لمدة من خمسة إلى عشرة دقائق قبل كل جلسة علاج تقليدي وذلك بواقع خمسة جلسات أسبوعياً لمدة عشرة أسابيع. وقد تم قياس قوة قبضة اليد وكذلك حركة مفصل الرسغ في المجموعتين قبل وبعد العلاج.

النتائج: أظهرت النتائج حدوث تحسن ذو دلالة إحصائية في مرضى المجموعتين بعد انتهاء فترة العلاج مع وجود فروق واضحة لصالح المجموعة محل البحث. وبذلك يعد العلاج باستخدام التنبيه بالتلج علاجاً فعالاً في تحسن حركة مفصل الرسغ لدى الأطفال المصابين بالتهاب المفاصل.