Original Research Paper

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EFFICACY OF PASSIVE MOBILIZATION IN DISTAL RADIUS FRACTURES.

Medical Science

KEYWORDS: Distal radius fractures, Post immobilization period, Paraffin wax bath, Home exercises, Passive mobilization.

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ABSTRACT

Objective: To find out the efficacy of passive mobilization in post immobilization period of distal radius fracture.**Methods:** Thirty subjects in post immobilization period of distal radius fractures were randomly allocated to experimental and control groups. They were evaluated for pain, grip strength, ROM and functional capabilities on 0 day (before the treatment started), at the end of 2nd and 4th week. Both groups received Paraffin Wax Bath and home exercises in common. However passive mobilization was an additional intervention received by the experimental group. **Results:** Statistical analysis showed significant gain in pain reduction, grip strength, ROM and functional capabilities in 0 day- 2nd week in experimental group but there was no difference in 2nd – 4th week. **Conclusion:** Passive mobilization is effective in 0 day – 2nd week but not in 2nd – 4th week in post immobilization period of distal radius fractures.

INTRODUCTION:

One of the most common injuries encountered in orthopedic practice is distal radius fractures accounting up to 16% of all fractures, 74.5% of all fractures of the forearm bones (1), and 8–15% in adults (2). Different age groups which are common for these injuries are typically between 5- 14 years and older than 60 years. Elderly females are more prone than males with a male – to – female ratio of 1 to 4. (3) Initially these fractures were considered as Colle's fractures but in recent period with better understanding of modes of injuries and various fracture types, different classifications and methods of treatment are developed. After removal of immobilization, patient generally experiences pain, unable to move freely resulting in muscle atrophy which together leads in limited ROM at the wrist. Exercises in the form of active and passive movements are performed by patients themselves while passive joint mobilization is done by therapist. Exercises of the wrist and hand are mandatory and studies have shown favorable outcomes. (4,5,6,7,8) Passive mobilization techniques may be utilized to restore functional range of pain free motion and has become popular where movements are performed between the joint surfaces for normal, osteokinematic movement of the bones. (9) There are contrasting reports about the effects of passive mobilization in these injuries. (10, 11, 12, 13, 14) Hence a need arises to find out the effectiveness of passive joint mobilization in the treatment of post immobilization period of distal radius fractures.

METHODOLOGY

Prior to the study ethical clearance was obtained from the Ethical Committee of S.D.M. College of Medical Sciences and Hospital, Dharwad. In this prospective interventional study subjects of either gender in immediate post immobilization period following distal radius fractures were included from Physiotherapy OPD of the hospital. Subject with either history of infective or inflammatory wrist joint condition or reflex sympathetic dystrophy or previous fracture around the wrist on the affected side or any neurological problems affecting the same upper limb or any simultaneous associated injuries in the same limb were excluded from the study.

Subjects fulfilling the criteria were explained about the study and written consent was taken. Each subject was evaluated for pain during free wrist movements, range of motion of wrist and radio-ulnar joints, grip strength and functional capabilities on 0 day (before the treatment started), at the end of 2nd and 4th week. The assessment tools used were Visual Analog Scale (VAS) for pain, Universal Goniometer for range of motion of flexion, extension, radial deviation, ulnar deviation, supination and pronation in degrees, Hydraulic Hand Dynamometer for grip strength in Kilograms, and functional assessment on a Functional Assessment Tool. (14)

Thirty subjects participated in the study. They were randomly allocated by lottery system into group 'A': Experimental group: N=15, M: F= 7:8, with mean age 46.1(SD 17.5) and group 'B': Control group: N=15, M: F= 5:10, with mean age 50.5 (SD 16.3) years. Subjects were advised to protect the fracture site and to control swelling. Subjects in both groups A & B took paraffin wax bath once and performed a set of exercises as home program in the morning as well as in evening, daily. On a compliance sheet they put a tick mark (√) every time they did exercises. Subjects in group A received an additional intervention in the form of passive mobilization on alternate days (i.e. thrice a week) in the OPD. Then at the end of 2nd and 4th week they were reassessed for the readings of the same four parameters.

PROCEDURE

For passive mobilization subject sat erect with full thigh support on a chair with back and arm rests while therapist sat on an adjustable height stool opposite to the subject facing each other. A pillow was placed over the subject's lap to support the hand. The joint on work was placed in its loose packed position or near to it. Keeping pain factor in mind initially, 1) distraction of radiocarpal and midcarpal joints 2) 8- 10 repetitions of Maitland's grade I or II mobilization for inferior radioulnar, radiocarpal, intercarpal, first, fourth, fifth carpometacarpal and intermetacarpal joints, 3) followed by three repetitions of slow passive physiological movements starting from neutral position and till it touched the pain (flexion, extension, radial deviation, ulnar deviation, pronation and supination)were given. Similarly 2nd and 3rd sets were given. Rest time of one minute was added in between the sets.

As pain subsided 1) grades of mobilization was progressed to III & IV (8- 10 repetitions and to the same joints), 2) followed by three repetitions of slow passive physiological movements same as before and 3) Here sustained stretching was added. For sustained stretching the part was taken passively up to the end range with hold time of 30seconds and then gradually brought back to neutral. This was done for each group i.e., for flexors, extensors, radial deviators, ulnar deviators, pronators & supinators. Same way 2nd & 3rd sets were given. Rest time of one minute was added in between the sets.

RESULTS

Table: 1 Comparison of groups A & B with respect to different variables.

0 day – 2nd week									
GROUP	**VARIABLES**	**0 - DAY (MEAN)**	**SD**	**2nd WEEK (MEAN)**	**SD**	**MEAN DIFF.**	**PAIRED t-VALUE**	**p - VALUE**	**SIGNI.**
A(Experimental)	Pain (VAS) {¥}	6.47	0.990	2.60	0.828	3.87	42.6	0.000	S

	Grip strength (KG) {€}	0.933	0.594	6.47	0.640	-5.53	-41.5	0.000	S
	Combined ROM (DEGREES) {‡}	37.8	17.5	211	31.0	-173.2	-25.6	0.000	S
	Functional capabilities {Θ}	1.87	0.990	6.93	2.05	-5.06	-10.1	0.000	S
B(Control)	Pain (VAS) {$}	6.80	0.862	3.87	0.640	2.93	24.8	0.000	S
	Grip strength (KG) {#}	0.800	0.775	5.73	0.799	-4.93	-41.7	0.000	S
	Combined ROM (DEGREES) {@}	31.3	22.1	118	33.4	-86.7	-17.3	0.000	S
	Functional capabilities {¶}	2.20	1.37	6.07	1.58	-3.87	-16.4	0.000	S
2nd week - 4th week									
A(Experimental)	**VARIABLES**	**2nd WEEK (MEAN)**	**SD**	**4th WEEK (MEAN)**	**SD**	**MEAN DIFF.**	**PAIRED t-VALUE**	**p-VALUE**	**SIGNI.**
	Pain (VAS) {£}	2.60	0.828	0.933	0.704	1.67	13.2	0.000	S
	Grip strength (KG) {¢}	6.47	0.640	9.67	1.29	-3.20	-14.4	0.000	S
	Combined ROM (DEGREES) {§}	211	31.0	279	33.3	-68	-6.46	0.000	S
	Functional capabilities {¤}	6.93	2.05	11.8	1.78	-4.87	-7.80	0.000	S
B(Control)	Pain (VAS) {©}	3.87	0.640	1.27	0.961	2.60	19.9	0.000	S
	Grip strength (KG) {µ}	5.73	0.799	8.53	1.13	-2.80	-16.0	0.000	S
	Combined ROM (DEGREES) {Ø}	118	33.4	188	48.4	-70	-4.40	0.001	S
	Functional capabilities {ℓ}	6.07	1.58	10.9	1.75	-4.83	-11.8	0.000	S

Table: 2 Comparison of groups A & B with respect to gain scores of different variables.

0 day – 2nd week							
VARIABLES	**Group A**		**Group B**		**t-value**	**p-value**	**Signi. Mean**
	Mean	**S D**	**Mean**	**S D**			
PAIN {¥}	3.87	1.13	2.93	0.704	2.72	0.011	S
GRIP STRENGTH {€}	5.53	0.516	4.93	0.458	3.37	0.0022	S
COMBINED ROM {‡}	173.2	26.2	86.7	19.4	10.3	.0001	S
FUNCTIONAL CAPABILITIES {Θ}	5.06	1.94	3.87	0.915	2.16	0.039	S
2nd week – 4th week							
PAIN {$}	1.67	1.11	2.60	1.06	-2.36	0.026	S
GRIP STRENGTH {#}	3.20	0.862	2.80	0.676	1.41	0.17	NS
COMBINED ROM {@}	68	26.2	70	20.3	-0.226	0.82	NS
FUNCTIONAL CAPABILITIES {¶}	4.87	2.28	4.83	1.60	0.278	0.78	NS

DISCUSSION

The results were analyzed using parametric tests and analysis showed that combination of home exercises and passive mobilization was more effective than home exercises alone in 0 day -2 week but not in 2 - 4 week.

Table 1{¥, $, £, and ©} shows there is significant decrease on VAS scores for pain in both the groups A & B in both 0 day – 2nd week & 2nd – 4th week, which can be due to the application of heat [paraffin wax bath]. Superficial heating increases blood flow and washes local metabolites [15], reduce muscle spasm (by decreasing the sensitivity of the muscle's secondary afferents which decreases muscle tone and alleviates pressure on the nerve [16], leads to a state of sedation and analgesia (by acting on free nerve endings) and blocks the

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transmission of pain (with a counterirritant effect) [17].

Table 1{€, ≠, ¢, and µ}shows there is significant increase in the grip strength scores in both the groups A & B in both 0 day – 2nd week & 2nd – 4th week. Application of heat results in increase of conduction velocity and decrease of fluid viscosity which in turn increase muscle function and strength. [18] Subjects of both groups A & B apart from receiving heat, also performed set of exercises as home program, which included both isometrics and dynamic resistive exercises. Active exercises increase recruitment of motor units in the muscle and results in hypertrophy of muscle fibers. [19]. so, we can say the effects of heat and exercises together are responsible for significant improvement of grip strength in both groups A & B.

Table 1{‡, @, §, and Ø} shows there is significant increase in ROM in groups A & B in both 0 day – 2nd week & 2nd – 4th week, which can be due to relief of pain & muscle spasm, strengthening of the weakened muscles and stretching of the tightened soft tissues.

Table 1{ϴ, ¶, ¤, and ℓ} shows that there is significant increase in functional capabilities scores in both groups A and B in both 0 day – 2nd week & 2nd – 4th week, which can be attributed to significant decrease in pain, significant increase in grip strength and ROM.

Table 2{¥} shows that there is significant gain in pain reduction in-group A as compared to group B in 0 day – 2nd week. This signifies that adding grades I & II mobilization was responsible for additional significant pain relief in-group A. These non-stretch motion where no tissue resistance was encountered would have inhibited perception of pain by stimulating mechanoreceptors at the spinal cord or brainstem levels by interfering pain pathways[20] and also caused synovial fluid motion, which is the vehicle for bringing nutrients to the avascular portions of the articular cartilage (and intra-articular fibrocartilage when present).[19]

Table 2{€, ‡, and } shows that there is significant gain in grip strength, ROM and functional capabilities respectively in-group A as compared to group B in 0 day – 2nd week. Passive mobilization which resulted in significant decrease in pain and muscle guarding (spasm) would have allowed subjects to perform the exercises more freely and efficiently.

Table 2{$} shows that there is significant gain in pain reduction in-group B as compared to group A in 2nd week – 4th week. In-group A during the period of 0 day-2nd week there was pain relief from 6.47 to 2.60 and in-group B there was comparatively less pain relief from 6.80 to 3.87, which continued to decrease in the period of 2nd – 4th week. In group A due to the higher grades of mobilization and sustained stretching (where tissue resistance was encountered to increase range), pain relief would have been relatively less. The residual pain in both groups at end of 4th week could be due to the residual bony deformity which is supported by a study where shortening of >4mm secondary to distal radial fractures was associated with wrist pain at a mean follow-up of 23 months. [21]

Table 2{≠, @, and ¶} also shows that there is no significant difference in grip strength, ROM and functional capabilities respectively in groups A & B at 2nd week – 4th week.

These could again be due to the residual bony deformity where malunion affecting the coronal and sagittal inclination of the articular surface of the radius result in decrease in wrist flexion and grip strength [22] also dorsal tilt>20 degree and >2mm of radial shift was found to be clearly associated with significant functional limitation. [23]

CONCLUSION

Passive mobilization with exercises was more effective than exercises alone in 0 day - 2nd week but there was no difference in 2nd – 4th week in post immobilization period of distal radius fractures. Further studies can be performed on a larger sample size with importance for uniform age group and nature of fracture pattern.

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