

To See the Effectiveness of Smart Phone Applications Aided with Therapeutic Hand Activities Treatment in Wrist Fracture on Hand Functions

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INTRODUCTION

Hand therapy is the art and science of rehabilitation of the upper limb from shoulder to hand. It mainly involves non-surgical management and comes under specialty with in Occupational therapy. It deals with evaluating and treatment of injuries and disorders of Hand. Hand therapist also treats other upper limb disorders that affect hand function. Hand therapy combines together techniques of occupational therapy which consist of scar management, retraining, splinting advice on activities of daily living, return to work process etc.

With the advancement of technology, mobile phones have turned in to smart phones which plays major role in many things besides talking. According to a leading research and analysis firm emarketer ⁽¹⁹⁾ there will be 204 million smart phone users in India by 2016. Nowadays, Smart phones are playing major role in day to day life of people in developed and developing countries. Lori Algar did a study about possible use of smart phone in hand therapy practice ⁽¹⁾. She further laid stress on involvement of therapeutic quantity of gaming using smart phone application as a component of treatment program. So if we incorporate hand therapeutic activities in to smart phone games, then this could be another new era of hand rehabilitation from virtual gaming technology to gravity sensor android gaming. Patients would find it more easy and exciting to use it during treatment because it may provide active wrist movements during gaming. Furthermore; it would be more easy and exciting to add it in home therapy plan in current technologically driven environment of modern world. So smart phone games can add a lot of exercises to the patient suffering from wrist fracture

Wrist fractures are the most common upper extremity fractures of in adults. The annual incidence is 8-10 per 1000 person a year. ⁽⁵⁾

Wrist fractures can be of compound, simple, comminuted, greenstick. The common wrist fractures that occur are colliers' fractures of distal radius, Smith fractures which involves distal radius, scaphoid fractures, Barton's fractures caused due to fracture dislocation of radio carpal joints,

chauffer's fractures in which fracture of radial styloid occurs, greenstick fractures and fractures of ulnar styloid. In fracture of distal radius, many symptoms decrease within two months but majority of patients has some amount of pain and disability by six months ⁽⁴⁾. So to find effective Treatment with newer modalities is need of time in this modern age which will enable the patient to engage themselves with their own interest in therapy plan and make the rehabilitation environment more enjoyable. Main symptoms associated with wrist fractures are pain. Especially when flexing the wrist. Then tenderness, swelling, bruising, deformity of the wrist causing it to look crook and bend. These symptoms can cause interference in activities of daily living and hampers the functional independence of person in long run. It has been seen that Occurrence of wrist fracture could result in to clinically important functional decline by 48%. ⁽⁵⁾

More over patients with wrist fracture give more time in home than the treatment in hand therapy clinic. So integrating smart phone application treatment in home therapy plan would be a boon for patients having wrist fractures. If a patient plays smart phone games then it will help them to enhance their movements of wrists. A study done by marketing cloud for mobile behavior report²⁰ revealed some interesting facts that people generally spent 3.3 hours on smart phones each day. So people can easily devote some time to play some android games for their hand therapy.

AIMS AND OBJECTIVES

1. To formulate the treatment based on smart phone application along with therapeutic activity.
2. To compare and see the effectiveness of above treatment on ROM, Pain, Grip strength, Pain and Disability in ADL.

HYPOTHESIS

Experimental/ alternate hypothesis

The Smartphone application along with therapeutic hand activity is found to be more effective in improving in hand function as compared to treatment based on activities alone.

NULL HYPOTHESIS

Smart phone application along with therapeutic hand activity will not be so effective in improving hand function as compared to treatment based on activities alone.

METHODOLOGY

Study setting – The study was conducted at Rehabilitation Department, HAHC hospital, Jamia Hamdard (New Delhi)

Study Population – Patients with wrist fracture

Duration - Treatment was given for 15 sessions with per session was of 50 minutes per day.

Study Design - Experimental- control design (Comparative study)

Sampling- Random Sampling (for both the groups)

No of patients -17; 8 in each group

Age group- 18 to 50 yrs.

Inclusion criteria of the patient

This study is going to include wrist injury patients (both gender) which will be mainly consist of

1. Post traumatic fracture of one wrist being in rehabilitation stage .(after 6 weeks of injury)
2. Age group 18 to 50 years

Exclusion criteria of the patients

1. Wrist fracture with open wounds
2. Tendon injuries patients
3. Nerve injuries patients.

OUTCOME MEASURES

For pain

1. VAS (Annexure III)- visual analog scale-It's a measurement instrument that tries to measure a characteristic and attitude that is believed to range across a continuum.⁽¹⁶⁾

For ROM (range of motion)

1. Goniometer - A Goniometer is a device used in occupational therapy to measure range of motion around a joint in the body.
2. Measuring Tape- By using figure of 8 patterns. ^(17, 18)

Grip strength

1. Grip dynamometer (jammer)- measures the isometric strength of hand and forearm muscles.
2. Tablet (Google's Nexus 2014 version) – A minicomputer smart phone like device based on android operating system.

Edema

1. Measuring Tape- By using figure of 8 patterns. ^(17, 18)

Grip strength

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Pain and disability in ADL

1. **PRWE** (Annexure II)–(Patient Rated Wrist Evaluation) It is an 15 item questionnaire designed to measure wrist pain and disability in ADL.⁽⁹⁾ PRWE allows patient to rate their level of wrist pain and disability 0 to 10 and consist of 2 subscales.[Freely available for research purpose].

Pain subscale

0 = no pain
10 = worst pain

Function scale

0= no difficulty
10 = unable to do

PROCEDURE

The proposal was passed from dissertation committee, Research Project advisory committee and ethical committee.

The subjects were explained about the study. Also, a signed written informed consent were obtained from participants. Then after, 17 subjects were selected randomly for both the Groups; 8 subject in each. However, 1 subject withdrew from study.

Pre assessment was done for both the groups on outcome measures and variables like Pain, ROM, Edema, Grip strength.

Treatment was given for 15 sessions with per session was of 50 minutes per day based on smart phone application and hand therapeutic activities to experimental group. However, Only hand therapeutic activities was given to control group for 50 minutes for 15 sessions.

Revaluation was done and data was collected using the same outcome measures used during base line.

Finally Master chart formulated and compared. And, it was given for statistical analysis.

TREATMENT PROTOCOL

Experimental Group:

Protocol consists of therapeutic hand activity along with 10 gravity sensor android smart phone tablet games which will be given for 50minutes, for 15 sessions per individual (5 sessions per week) .⁽²⁾

Control Group:

15 sessions given to each subject consisting of only therapeutic activities.⁽⁶⁾

Therapeutic Activities		Time/Rep	Effect
A.	Peg Board	5 Minutes	Pincer grasp, Fine motor coordination, Visual motor coordination and Eye hand coordination.
B.	Hand Gripper	5 Minutes	Increasing grip strength
C.	Pronation supination Board	5 Minutes	Supination and Pronation exercises.
D.	Nirmal hand exercise table	5 Minutes	supination pronation and wrist circumduction
E.	Hand gym kit	5 Minutes	For strength and ROM of small joints.
F.	Hand roller exercise board	5 Minutes	Wrist flexion and extension along with wrist supination and pronation
G.	Fluido therapy ⁽⁷⁾	5 Minutes	Relief of local pain, edema and management of joint range of motion.
H.	Sanding and ADL board	5 Minutes	Flexion, extension, radial and ulnar deviation.

GAMES (5MIN / GAME) [20 min]

Games were given to improve ROM, Wrist flexion and extension, Ulnar and Radial deviation.^[1]

*Games were graded according to level of difficulty. 4 different games were given on each session for Experimental Group.

	Name of Game	Level of Difficulty	Movements due to game at each Joint.
A.	A tilt 3D Labyrinth	Grade -1	Wrist flexion and extension
B.	Tilt Maze	Grade -1	wrist flexion and extension , wrist ulnar and radial deviation, Supination and pronation
C.	Temple Run	Grade -3	Wrist flexion and extension
D.	Asphalt	Grade-3	Wrist flexion and extension, Supination and Pronation
E.	Burn The Rope	Grade-1	wrist flexion and extension , wrist ulnar and radial deviation, supination and pronation
F.	Abduction	Grade-2	wrist flexion and extension , wrist ulnar and radial deviation, Supination and pronation
G.	Penguin Jump	Grade-3	Wrist flexion and extension, Supination and pronation
H.	Ironman	Grade-2	wrist flexion and extension , wrist ulnar and radial deviation
I.	Falling Fred	Grade-1	wrist flexion and extension , wrist ulnar and radial deviation
J.	Penguin Skiing 3d	Grade-2	wrist flexion and extension , wrist ulnar and radial deviation

DATA ANALYSIS

16 subjects were divided in two equal groups' .i.e. experimental and control.

Treatment protocol was of 15 sessions for each patient. Experimental group was given Smart phone application and therapeutic activities but control group was given only therapeutic activity.

Pre and post test was done for all the variables like, ROM, grip, strength, edema and ADL. Master chart (Annexure VI) was formulated.

Then after Statistical analysis was performed using SPSS v16.0 .

Then after Statistical analysis was performed using SPSS v16.0 . Student t test was applied within the group and between the group and t value was evaluated.

Objective - To compare and see the effectiveness of above treatment on ROM, pain, Grip strength, edema and pain and disability in ADL.

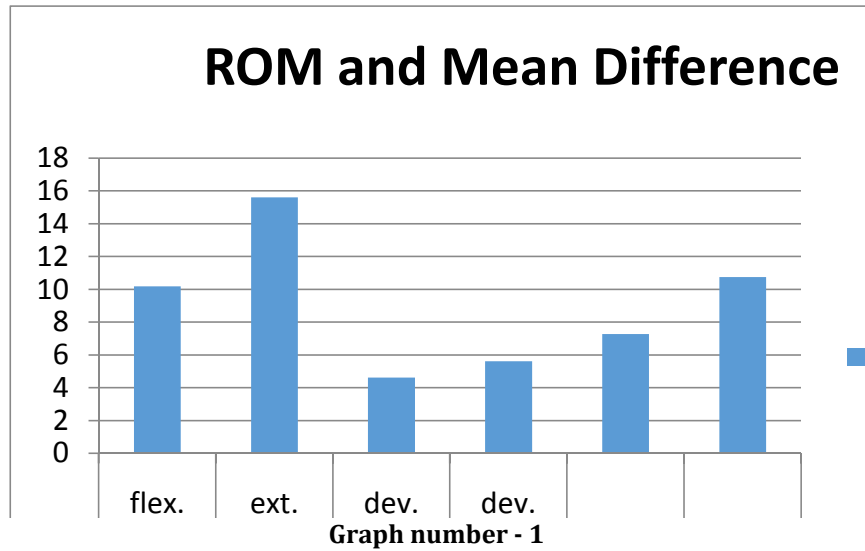
Comparison between the groups (Experimental Vs. Control).

1. ROM (Range of motion)

Comparison was done between the experimental and control groups which depicted the difference of 10.2 (21.5-11.3) mean value in wrist flexion. And in wrist extension marked difference of 15.62 (30-14.38) mean is obtained with t value of 2.4 and p value of .03 which was <0 .05 statistically significant.

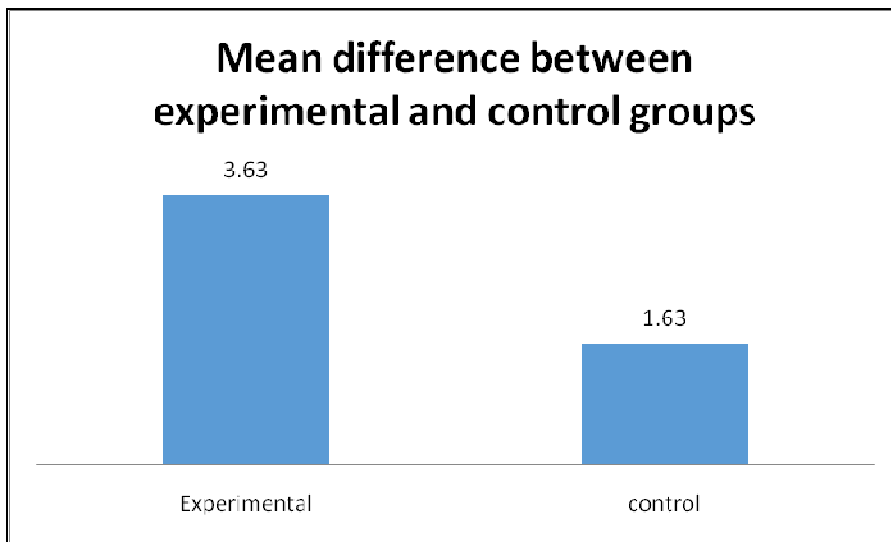
Difference of mean value 4.6 (7.38-12) was obtained in radial deviation and in ulnar deviation, Difference in mean value of 5.6(4.25-9.87) was marked.

Similarly in supination, difference of 7.28 mean value (22.28-15) was seen and in pronation marked difference of 10.75 (22.25-11.5) was obtained. As depicted in Graph number 1



2. VAS (Visual analogue scale)

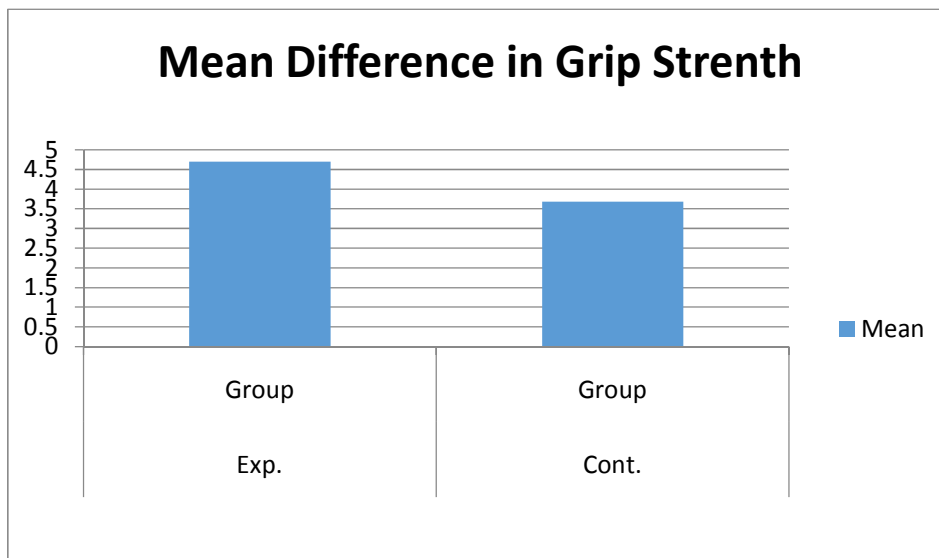
VAS score for pain was assessed for subjects and Comparison was done between the experimental and control groups which depicted the marked difference of mean i.e. 2 (3.63-1.63) with t value of 2.59 and p value of .02 which is < 0.05 statistically significant as depicted on Graph no .2



Graph number - 2

3. Grip strength

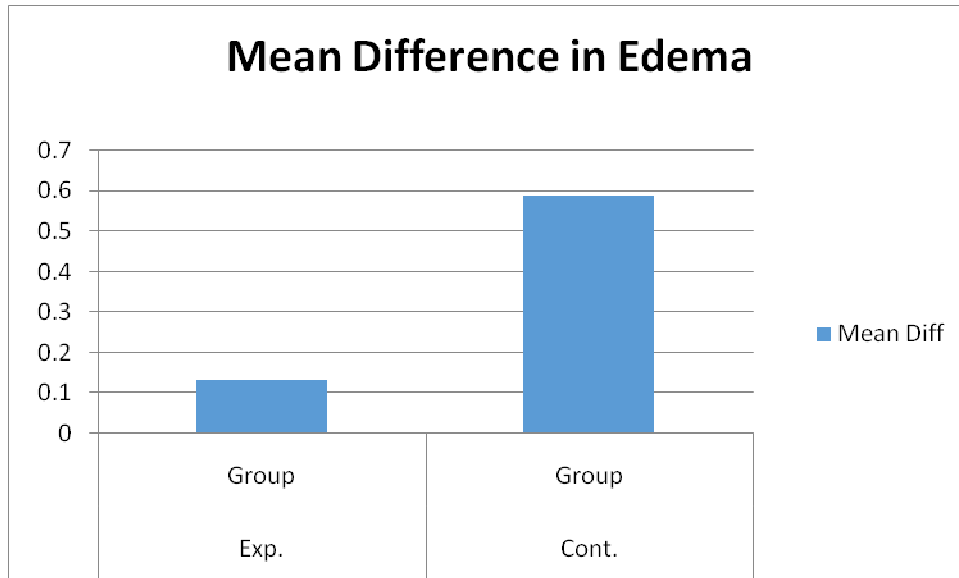
Comparison of grip strength between experimental and control group after intervention showed the difference Of mean value 1.02(4.7-3.68) as graph no. 3



Graph no.3

4. Edema

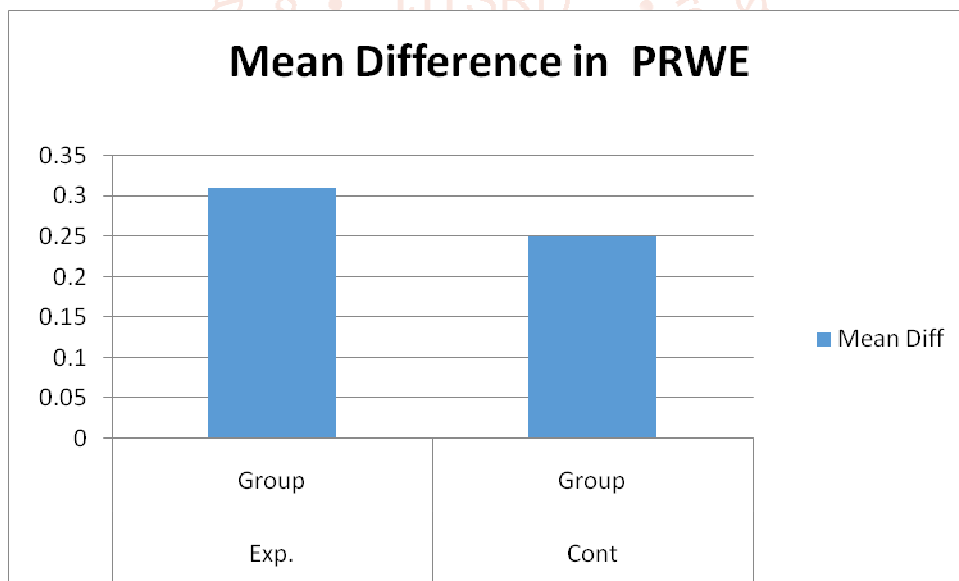
Comparison of grip strength between Experimental and control group after intervention showed the difference of mean value -.046(0.13-0.59) in edema. As shown in graph no. 4



Graph no. 4

5. PRWE (Patient Rated Wrist Evaluation)

PRWE was scored and Comparison was done between the experimental and control groups which depicted the marked difference of mean .06(.31-.25) with t value of 4.227 and p value of .001 which was <0.05 statistically significant as shown in graph no.5



Graph no - 5

Most of the parameter shows better result in experimental group and control group when compared with in the groups. However,

When parameters were compared between the groups, three parameters specifically wrist Extension, VAS and PRWE (Patient rated wrist evaluation) were statistically significant with large significant mean difference, whereas all other parameter reflected small mean difference which supports our experimental hypothesis.

Discussion of the result

During the intervention, it was observed that subjects were having more wrist extension in experimental group while playing gravity sensor games in tablet along with therapeutic activity.

So, there was a significant improvement of wrist extension in experimental group. Since Most of the activities require extension of the wrist and 15 degree of wrist extension is functional position. Therefore significant improvement in ADL (activities of daily living) was noted on experimental group. Similarly Reduction in pain was also attributed to significant improvement of wrist extension in experimental group.

CONCLUSION

Conclusion of the study is that use of smart phone application along with therapeutic activity is found effective in rehabilitation of patients with hand injury and can be used further as an occupational therapy intervention.

Nowadays, mobile and tablets can be found in pocket of every one. So playing a game for few minutes in smart phone and tablet can give a good hand exercise. This could add great benefit to people suffering from wrist fracture which will complement the whole hand therapy program. Moreover Occupational therapists can use Tablet and smart phone gaming in rehabilitation clinic to add more fun in therapy that can remove boredom of traditional therapy program.

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