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The Effect Of Nerve Gliding Exercise To Improve Range Of Motion And Grip Strength In Hand Exercise Program

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Abstract

Background: Hand is one of the most important body part in human daily living activities. Thus, here comes to importance of hand rehabilitation to reestablish the normal range of motion, grip and pinch strength and capacity. There are four trials revealed a significant improvement in carpal tunnel syndrome related symptom seriousness and functional status in all groups. However, the efficacy of the tendon and nerve gliding exercises alone could not be distinguished because they involved different combinations of tendon and nerve gliding exercises with standard conservative treatments. Therefore, an experimental research is planned to be conducted on effect of nerve gliding exercise to improve range of motion and grip strength in hand exercise program.

Objective: To evaluate the effectiveness of nerve gliding exercise to improve range of motion and grip strength in hand exercise program.

Method: 32 participants are require and they will receive nerve gliding exercises. A series of physical examination will conduct on every participant before treatment. Nerve gliding exercise apply to the participants and assess range of motion, hand grip strength and pinch strength after exercise.

Result: In the current study, 23 females and 9 males participated. At the last follow up, range of motion on wrist flexion, extension, ulnar deviation and radial deviation, pain score, grip strength and pinch strength are statistically significant. (P = 0.000).

Conclusion: Nerve gliding exercises showed effectiveness in hand exercise program to improve range of motion and grip strength.

Keywords: Nerve gliding exercise, grip strength, range of motion, hand exercise

Introduction:

Hand is one of the most important body part in human daily living activities. Thus, here comes to importance of hand rehabilitation to reestablish the normal range of motion, grip and pinch strength and capacity. Hand rehabilitation is a vital management for injured individual recover from this condition in order to fasten the healing process and help patient restore their hand function as soon as possible. Therapists specializing in hand therapy provide therapeutic ways to restore function, slow down the evolution of a pathology or prevent upper limb dysfunction so that patients can return to their daily chores at home and at work, and also their recreational interests. (1) (2) Joint mobilisation, nerve mobilisation, edema mobilization, myofascial release, scar

management and therapeutic massage are included in hand rehabilitation program. Hot and cold modalities such as cryotherapy, ultrasound, paraffin wax, TENS and whirlpool are also used in hand rehabilitation. (3) In general, the lifetime prevalence of wrist and hand injuries is estimated to be between 15% and 46% with an annual frequency of 5% to 30%. (4) In Malaysia, the researchers in this study resulted that prevalence of disease and stress causing wrist pain ranges from 16.7% to 93.2% among primary and secondary school teachers. (5) A collaboration among physical therapist, occupational therapist and surgeon result an effective hand rehabilitation program. Complex injuries and contractures usually necessitate a combination of rehabilitative treatments chosen by the therapist with care. The short term and long term goals should rule out in the beginning of therapy for maximized the rehabilitative benefit and prevention of long term disability. (6) Nerve gliding exercise aims to reduce pressure by restoring normal kinematics of the nerve and surrounding structures. This exercise should be done slowly and softly to avoid aggravating nerve irritation and pain. Nerve gliding exercises have been shown to reduce fibroblastic activity, scar reduction, adhesion prevention and decrease fluid pressure surrounding the nerve. The glide is the process of putting stress on the nerve at one area while releasing it in another. (7) Interventions aimed at changing the neural structures or surrounding tissue (interface) directly or indirectly through manual techniques or exercise are referred to as neural mobilizations. Neural mobilisation is thought to change axoplasmic flow, mobility of the nerve and its connective tissue, and nerve circulation by changing the pressure in the nervous system and dispersing intraneural oedema. (8).

Problem statement: There are four trials revealed a significant improvement in carpal tunnel syndrome related symptom seriousness and functional status in all groups. However, the efficacy of the tendon and nerve gliding exercises alone could not be distinguished because they involved different combinations of tendon and nerve gliding exercises with standard conservative treatments. Therefore, an experimental research is planned to be conducted on effect of nerve gliding exercise to improve range of motion and grip strength in hand exercise program.

Objective: To evaluate the effectiveness of nerve gliding exercise to improve range of motion and grip strength in hand exercise program.

Methodology:

Parameters:

Pain will assess by 10cm Visual Analog Scales (VAS). The examination will include pinch and grip strength and range of motion on wrist or fingers. Besides, hand dynamometer will use for grip strength whereas mechanical pinch gauges or hydraulic pinch gauges for pinch strength. Hand goniometer will be used for range of motion.

Study setting:

The study was conducted among patients who had hand pain related to wrist and fingers in Malaysia.

Study sampling:

32 participants will be collected in Malaysia and a convenience sampling method will be used.

Target population:

The study was conducted among patients who had hand pain related to wrist and fingers in Malaysia. Patients were of various races, gender and age groups from 18 years old and above. **Study duration:**

The study was studied throughout the year from May 2021 to May 2022.

Treatment duration:

Each patient received the treatment for four weeks. Three sets of exercises perform 10 times per day for 4 weeks. Data collected on second and fourth week.

Inclusion criteria:

Participants from 18 years old who willing to participate with wrist or hand pain related to wrist and fingers such as carpal tunnel syndrome, wrist or fingers fracture and trigger finger. Criteria should include participants who are oriented and aware.

Exclusion criteria:

Participants who are less than 18 years old and experienced hand pain related to cancer or tumor. Participants who experienced hand pain related to any neurological condition such as stroke and not oriented and not aware should be excluded.

Procedure:

Therapist will approach the subject if they meet the inclusion criteria and he or she will select as one of the participant in this study. Participants will receive a consent form and the expected duration of participation for each subject is 4 weeks. Therapist will explain the details and aims about the study with the participant before assessment conduct. Participants have sufficient time to consider participation in the study and have the opportunity to ask questions and will be answered satisfactorily.

After signed the consent form, subjective assessment and objective assessment will conduct on every participant before treatment. Pain will assess by 10cm Visual Analog Scales (VAS). The examination will include pinch and grip strength and range of motion on wrist or fingers. Besides, hand dynamometer will use for grip strength whereas mechanical pinch gauges or hydraulic pinch gauges for pinch strength. Hand goniometer will be used for range of motion. Pre-test measurement will be documented.

An exercise chart will give to the participants based on below nerve gliding exercises:

1) Finger and thumb flexion with the wrist in a neutral position

2) Finger and thumb stretches with the wrist in a neutral position

3) Wrist and finger stretches with the thumb in a neutral position

4) Wrist, finger and thumb stretches

5) Forearm supination while performing wrist, finger and thumb stretches

6) Thumb stretches with forearm supination

The shoulder girdle should in a neutral position and forearm placed on the table with the elbow flexed at a 90 degree angle. Each position maintain for 15 seconds. Three sets of exercises perform 10 times per day for 4 weeks. The parameters of pinch force, grip force and range of motion will evaluate at baseline and after the treatment.

Statistical tools:

The data analysis will be performed by using SPSS version 26.0 with significance set at P <0.05. Descriptive statistic will be used for data analysis which will focus through table and chart. Tabulation and computation of frequencies and percentages will be calculated on selected variables

.

Result:

Table 1: Demographic characteristics of study samples

	Mean (SD)	Frequency	Percentage (%)

Gender			
Male		23	71.9
Female		9	28.1
Ethnicity			
Malay		14	43.8
Chinese		17	53.1
Indian		1	3.1
Age	41.8(16.4)		

Note: SD: Standard deviation

In the current study, 23 (71.9%) females and 9 (28.1%) males participated. The mean age of the participant for this study is 41.8 (16.4). The frequency for Malay population in participation is 14 (43.8%), Chinese population is 17 (53.1%) and Indian population is 1 (3.1%).

Table 2: Results of pain score, grip strength, lateral pinch, three point pinch and pulp pinch after nerve gliding exercises

	Mean	**SD**	**95% CI**		**F (df)**	**p[a]**
			Lower	**Upper**		
Pain score						
T1	5.19	1.06	4.81	5.57	94.385 (2,62)	0.000**
T2	3.78	1.18	3.35	4.21		
T3	2.59	0.91	2.27	2.92		
Grip strength						
T1	43.44	10.67	39.59	47.28	84.628 (2,62)	0.000**
T2	48.59	9.93	45.02	52.17		
T3	54.98	10.27	51.28	58.69		
Lateral pinch						
T1	8.84	3.34	7.64	10.05	62.838 (1.357,42 .079)	0.000**
T2	10.09	3.42	8.86	11.33		
T3	11.34	3.62	10.04	12.65		
3 point pinch						
T1	9.14	2.85	8.11	10.17	48.160 (1,541,47 .764)	0.000**
T2	10.00	2.53	9.09	10.91		
T3	11.06	2.40	10.20	11.93		
Pulp pinch						
T1	8.00	2.94	6.94	9.06	51.226 (1.657,51 .379)	0.000**
T2	8.94	2.45	8.05	9.82		
T3	9.91	2.56	8.98	10.83		

Note: SD; Standard deviation; CI: Confidence interval; T1: First visit (baseline); T2: Second visit; T3: Third visit; a: Repeated measures ANOVA; *p<005; **p<0.01

Table 3: Results of ROM wrist flexion, wrist extension, ulnar deviation and radial deviation after nerve gliding exercises

	Mean	**SD**	**95th CI**		**F**	**p[a]**
			Lower	**Upper**		

ROM write flexion						
T1	50.56	13.56	45.67	55.45	125.919 (1.424,4 4.155)	0.000**
T2	58.78	11.07	54.79	62.77		
T3	64.59	9.95	61.01	68.18		
ROM wrist extension						
T1	41.53	19.36	34.55	48.51	69.044 (1.245,3 8.601)	0.000**
T2	49.56	15.68	43.91	55.21		
T3	54.78	14.35	49.61	59.96		
ROM ulnar deviation						
T1	18.31	6.91	15.82	20.80	82.917 (2,62)	0.000**
T2	23.28	7.66	20.52	26.04		
T3	25.50	7.44	23.82	29.18		
ROM radial deviation						
T1	15.47	6.61	13.09	17.85	45.029 (2,62)	0.000**
T2	18.41	8.20	15.45	21.36		
T3	20.75	6.74	18.32	23.18		

Note: SD; Standard deviation; CI: Confidence interval; T1: First visit (baseline); T2: Second visit; T3: Third visit; ROM: Range of motion; a: Repeated measures ANOVA; *p<005; **p<0.01

The repeated measures ANOVA was used to determine the changes of pain score, grip strength, pinch strength and range of motion on wrist flexion, wrist extension, ulnar deviation and radial deviation after 3 visits of nerve gliding exercises. P value <0.05 was deemed statistically significant in all analyses. Therefore, pain score, grip strength, pinch strength, range of motion on wrist flexion, wrist extension, ulnar deviation and radial deviation are statistically significant.

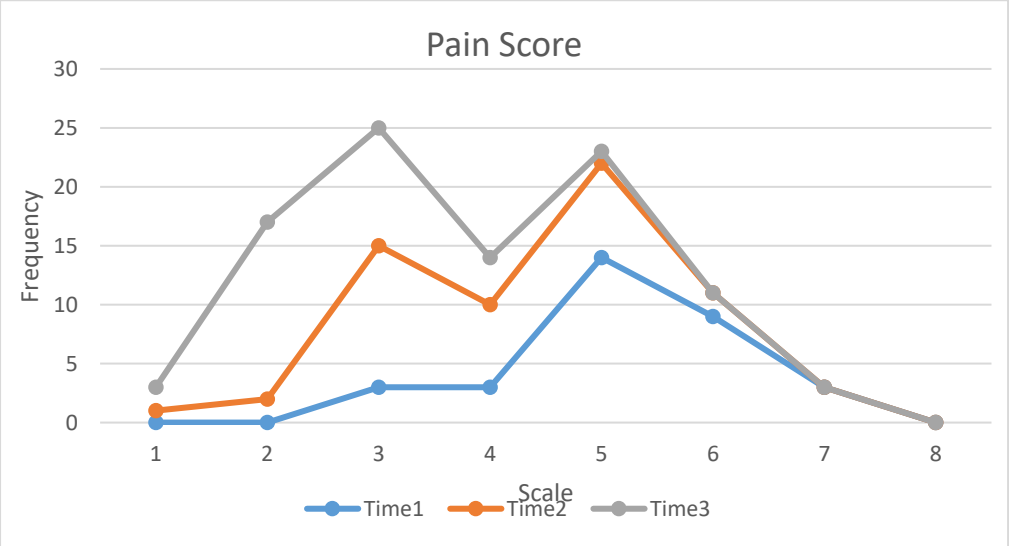


Figure 1: Frequency distribution showing changes in pain score from first to subsequent visit after intervention

Figure 1 shows a line graph of frequency distribution of changes in pain score from first to subsequent visit after intervention. The graph shows that the blue line is for the time at beginning, orange line is the second timeline and final timeline is gray line. The most of the frequency of pain score at time beginning is at pain score 5. However in second timeline it

shows that most of frequency distribution of pain score at 5 but mostly pain score reduce slowly at last visit compare to timeline beginning. For the final timeline, we can see the most frequency distribution of pain score is at 3. Besides, the pain score was reduced after intervention and it proved that intervention was effective.

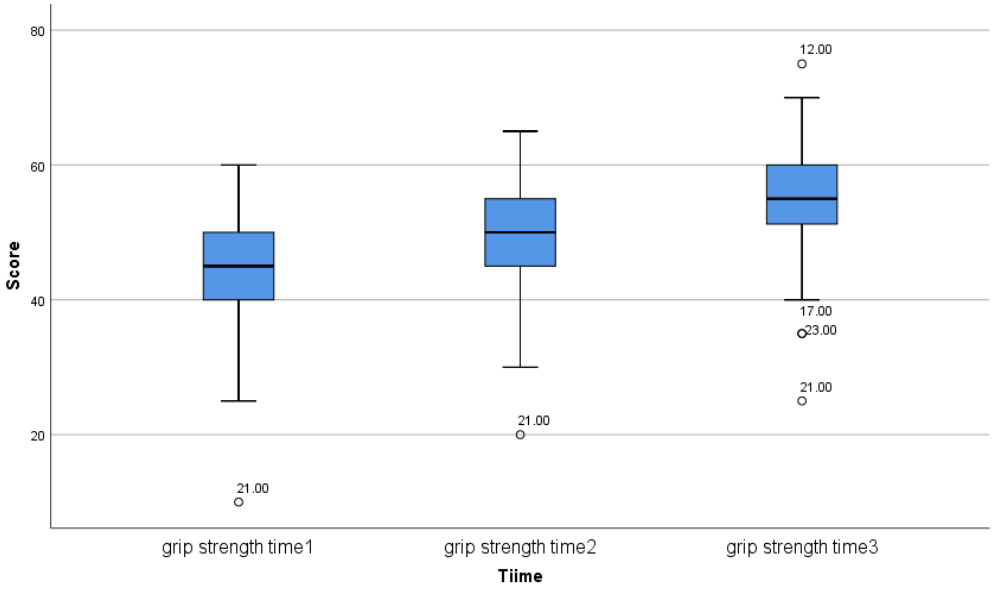


Figure 2: Distribution of changes in grip strength from first to subsequent visit after intervention

Above figure shows a box spot distribution of changes in grip strength from first to subsequent visit after intervention. For the grip strength in first visit, the score of strength at the range between 40 to 50 and the mean is at around 45. The score of strength at the range between 45 to 55 and the mean is around 50 for second visit. On final visit, score of strength at the range between 50 to 60 and the mean around 55. As the result shown, the score of strength is increase in every visit.

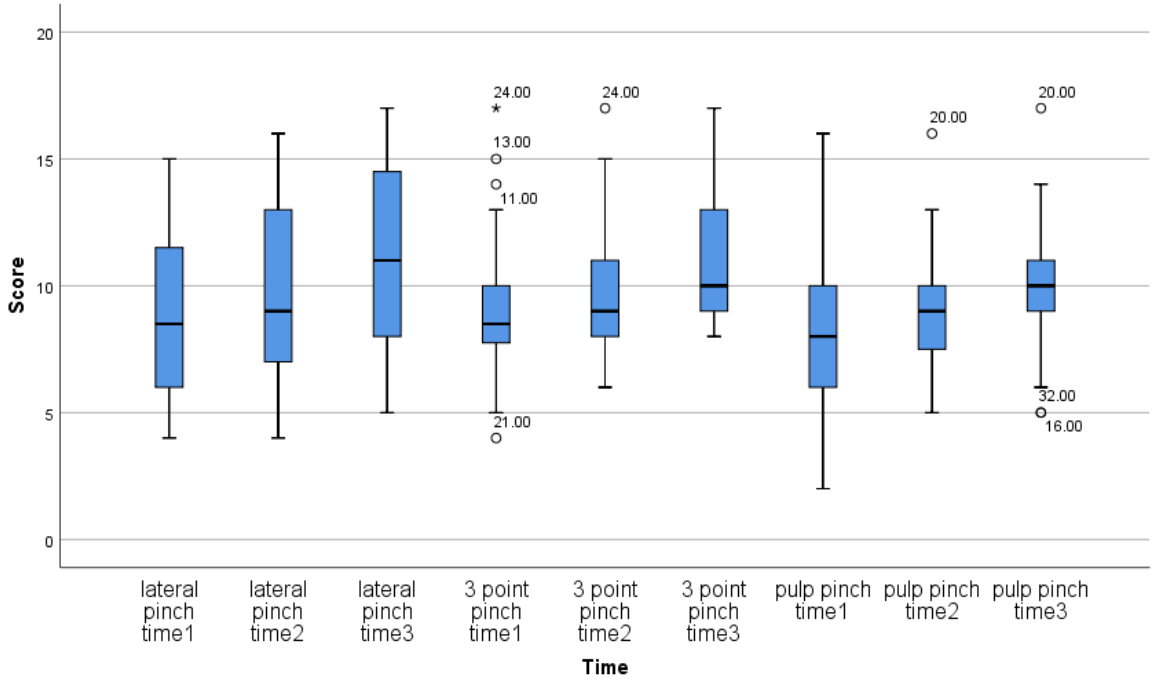


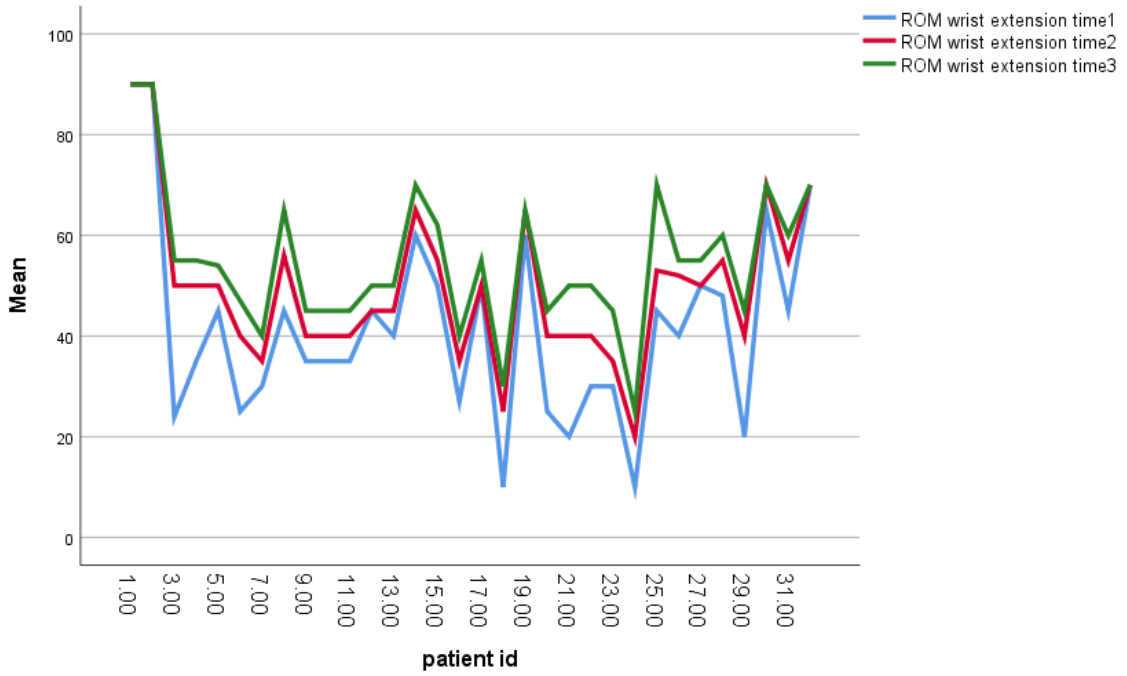
Figure 3: Distribution of changes in lateral pinch, 3 point pinch and pulp pinch from first to subsequent visit after intervention

Figure 3 show a box spot distribution of changes in lateral pinch, 3 point pinch and pulp pinch from first to subsequent visit after intervention. For lateral pinch in first visit, the score at the range of 6 to 12 and mean at 8. For lateral pinch in second visit, the score at the range of 7 to 13 and mean at 9. For lateral pinch in final visit, the score at the range of 8 to 14.5 and mean at 12. For 3 point pinch in first visit, the score at the range of 8 to 10 and mean at 8.5. For 3 point pinch in second visit, the score at the range of 8 to 11 and mean at 9. For 3 point pinch in final visit, the score at the range of 9 to 13 and mean at 10. For pulp pinch in first visit, the score at the range of 6 to 10 and mean at 8. For pulp pinch in second visit, the score at the range of 8 to 10 and mean at 9. For pulp pinch in final visit, the score at the range of 9 to 11 and mean at 10. All of these pinch strength result illustrates the changes in three visit and this indicates that the intervention was effective.

Note: ROM: Range of motion

Figure 4: Distribution of changes in ROM wrist flexion from first to subsequent visit after intervention

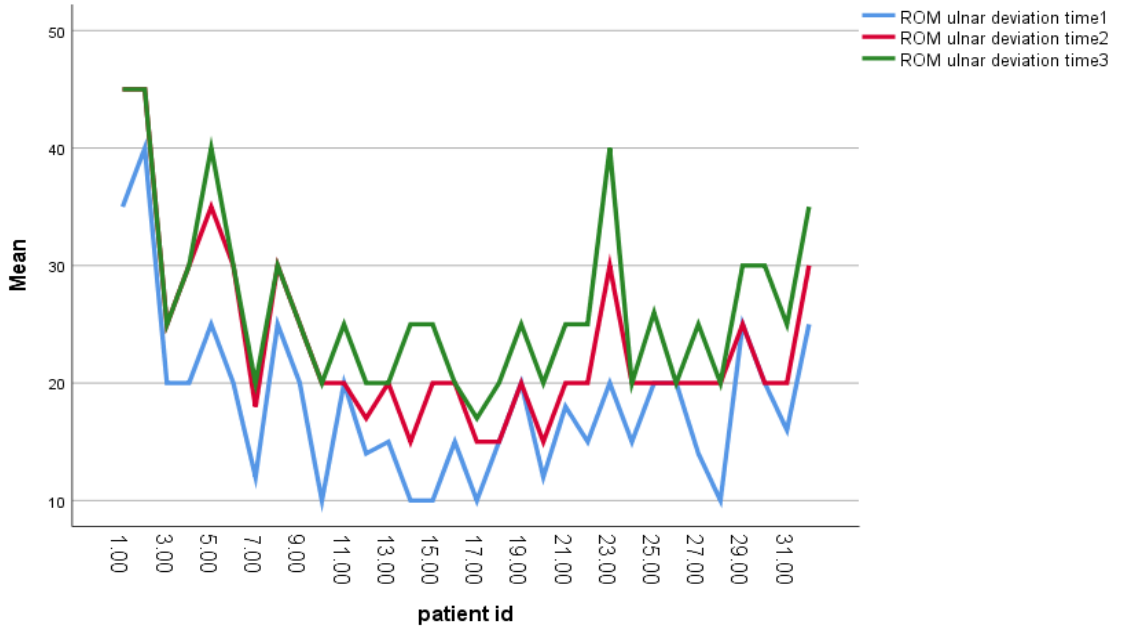
The above line chart of mean distribution of changes in range of motion of wrist flexion from first to subsequent visit after intervention shows irregular pattern. From the data obtained, it shows that range of motion for wrist flexion on last visit higher than first and second visit. Participant number 3 to 7 and number 21 to 25 increased dramatically from first to last visit after intervention.



Note: ROM: Range of motion

Figure 5: Distribution of changes in ROM wrist extension from first to subsequent visit after intervention

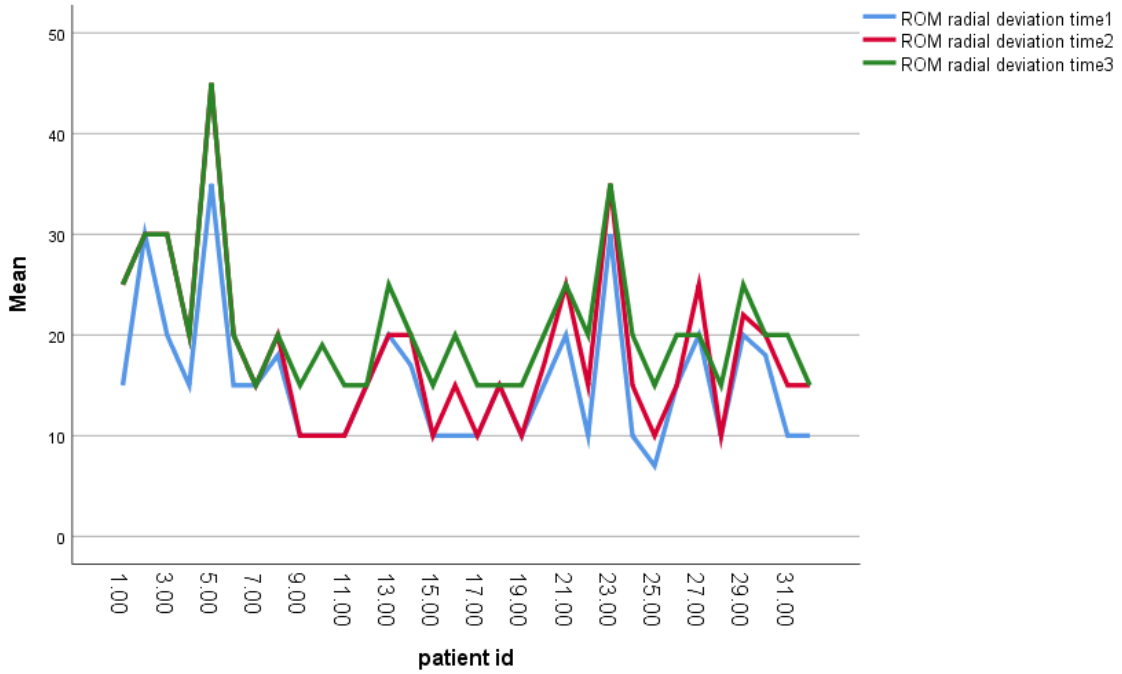
The above line chart of mean distribution of changes in range of motion of wrist extension from first to subsequent visit after intervention shows irregular pattern. From the data obtained, it shows that range of motion for wrist extension on last visit higher from first to subsequent visit. For participant number 15 to 19 and 29 to 31 the mean is grew slightly whereas mean for participant number 20 to 23 increased markedly after intervention.



Note: ROM: Range of motion

Figure 6: Distribution of changes in ROM ulnar deviation from first visit to subsequent visit after intervention

The above line chart of mean distribution of changes in range of motion of ulnar deviation from first to subsequent visit after intervention shows irregular pattern. The line chart illustrates range of motion for ulnar deviation rose gradually from first visit to last visit. The mean for participant number 22 to number 24 is went up rapidly after intervention. For participant number 31 and 32 the mean value is increased steadily as shown at figure above.



Note: ROM: Range of motion

Figure 7: Distribution of changes in ROM radial deviation from first visit to subsequent visit after intervention

The above line chart of mean distribution of changes in range of motion of radial deviation from first to subsequent visit after intervention shows irregular pattern. Above line chart describes range of motion for radial deviation increased slowly from first visit to third visit after intervention. The mean value for participant number 19 to number and 22 to number 24 is grew proportionally from first visit to last visit.

Discussion:

This study evaluated the effectiveness of nerve gliding exercise to improve range of motion and grip strength in hand exercise program. It showed effectiveness in range of motion and grip strength in hand exercise program as range of motion on wrist flexion, wrist extension, radial deviation and ulnar deviation (P value=0.000), grip strength (P value=0.000), pinch strength (P value=0.000) and pain score (P value=0.000) were found to be significant variables in this study.

Grip and pinch strength were dramatically raised following intervention, according to the findings of this study. These findings are in line with those of other investigations. In their inter-group analysis, the researchers found that neural mobilisation is more successful in terms of symptom severity reduction, functional improvement, grip strength, and pinch strength. (9)

Our study also stated that range of motion on wrist and ulnar and radial deviation improved after 4 weeks of nerve gliding exercise. These authors showed significant improvement seen in all 3 groups in measurement of grip and

pinch strength at 8 weeks follow-up and 3 weeks treatment protocol ($p < 0.05$). (10) They illustrated that significant in results of range of motion measurements of wrist flexion or extension for group I and group II by using related t test. (Tal-Akabi, A., & Rushton, A., 2000)

Conclusion:

In conclusion, nerve gliding exercises showed effectiveness in hand exercise program to improve range of motion and grip strength. This study resulted the range of motion of the wrist, grip strength and pinch strength were significantly improved in four weeks of treatment.

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