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"HANDGRIP ABOUT UPPER EXTREMITY OUTCOME IN RECOVERING STROKE PATIENTS, ELBOW FLEXOR TONE, ELBOW FLEXOR STRENGTH"

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ABSTRACT

BACKGROUND: Adults who suffer from strokes are most often disabled and it is the third biggest mortality cause. Affected individuals with upper extremity damage make up about one-third of all stroke victims. The result is a compromise of fundamental daily activities. Numerous variables affect one's capacity to carry out functional duties. Elbow Flexor Tone, Elbow Flexor Strength, and Handgrip Strength are three variables that determine the association between upper extremity functional outcome in stroke patients who are recuperating. Weakness and Strength are two further critical elements.

OBJECTIVE: To compare the functional outcome of the upper extremities in recovering stroke patients by measuring the tone, strength, and grip of the elbow flexors.

METHOD: About 60 stroke patients who met the eligibility requirements were recruited for the study. At the time of discharge, the Modified Ashworth Scale was used to assess elbow flexor tone, a hand-held dynamometer was used to assess elbow flexor strength, and a jamar dynamometer was used to assess handgrip strength in the affected upper extremity. Action Research Arm Tex (ARAT) was used to evaluate the functional outcome of the affected upper extremity in stroke patients who were recovering from their illness. Regular physiotherapy was administered to patients in the meantime.

RESULTS: The impairment variables that were most strongly related to Upper Extremist were Elbow Flexor Tone (resistance to passive movement), Elbow Flexor Strength (force-generating capacity), and Handgrip Strength (r=.75, P.001). Functional Outcome, Elbow Flexor Tone, and ARAT had a significant, but weak relationship. ARAT and Handgrip Strength had a substantial and positive association. 88% of the variance in the ARAT scores was accounted for by elbow flexor strength.

CONCLUSION: In recovered stroke patients, there was a significant association between elbow flexor tone, elbow flexor strength, and handgrip strength and the functional outcome of the upper extremities.

KEYWORDS: Dynamometer of Handgrip Strength Stroke, ARAT, and Upper Extremity Functional Outcome.

Chapter 1

INTRODUCTION

A stroke is an acute onset of neurological dysfunction due to an abnormality in cerebral circulation with resultant signs and symptoms that correspond to the involvement of focal areas of the brain. The term cardiovascular accidents (CVA) is used interchangeably with stroke to refer to the cardiovascular conditions that accompany either ischemic or hemorrhagic lesions. To be classified as stroke, focal neurological deficit persisting for at least 24 hours. 1

Stroke is the 3rd leading cause of death and the most common cause of disability among adults. Although 58% of patients regain independence in activities of daily living (ADL) and 82% learn to walk, 30% to 60% of patients have no arm function.

Roughly one-third of all people who experience a stroke will have some residual impairment of the upper extremity. Due to which basic ADL skills such as bathing, dressing, and toileting are also compromised. The ability to perform functional tasks is in by several factors.

Both the biomechanical factors like stiffness and contractures together with neurological factors like spasticity, strength, and co-activation, contribute to functional impairments in stroke subjects.

Weakness or a subject's inability to generate normal levels of muscle tension is now being recognized by an increasing number of rehabilitation professionals as a vital impairment leading to disability in stroke patients.

Several mechanisms including abnormal muscle recruitment, weakness, and spasticity have been suggested as contributing factors. Spasticity is a

motor disorder associated with motor lesions at different levels of the nervous system.

It can be aspects of upper extremity function including the ability to transport, grasp and release objects. Heller et al. found grip strength to be a sensitive measure after stroke.

Likewise, purposeful movements requiring precise control of distal segments (e.g. Grasping) are slow, inaccurate, and not well coordinated. An accurate reach depends primarily on precise control of the shoulder and elbow joints while an accurate grasp depends primarily on precise control of the wrist and finger27.

Few studies have explored the relationship between specific upper-limb impairments, such as altered tone and muscle weakness, and upper-limb function, such as ADL. One of the studies correlates the Motor variable with hand-to-mouth action and the result suggests that both active movement deficits and muscle strength may be important for upper extremity function.

One of the studies determines the upper impairment, and upper limb performance in activities of daily living in people with chronic stroke in which the result shows that upper limb strength, grip strength, and tone were strongly related to activity and also best explained upper limb performance in activities of daily living.

Strength after stroke correlates with independence in functional activities such as transfers, gait, and stair climbing. Strength measurements are taken from patients with stroke also have predictive capabilities. Strength post-stroke has been shown to predict the future status of motor function, functional statuses at discharge from inpatient rehabilitation, length of stay in inpatient rehabilitation, destination after inpatient rehabilitation, and mortality. Bohannon and Smith measured the short-term recovery of strength after stroke by using a handheld dynamometer.

The measurement of grip strength has been used as a predictor of motor performance and functional independence in acute stroke subjects. In hemiparesis patients, weakness is considered an important factor limiting motor function. Many studies have looked at the relationships between the handgrip and upper limb function measurement with different clinical tests. Hence assessment of grip strength has been considered an important predictor of motor performance and functional independence in stroke subjects. There are many methods used to assess grip strength. But the easiest one and most commonly used is through hand dynamometer.

Movement deficits are most evident in the limb contralateral to the side of the stroke and are characterized by weakness of specific muscle, abnormal muscle tone, abnormal postural adjustments, abnormal movement synergies, and lack of mobility between structures at the shoulder girdle and the pelvic girdle. Hence it is necessary to evaluate function outcomes from time to time to know which factor affects the most for the disability.

Several measures assess the ability of a hemiparetic arm to carry out specific tasks such has its own set of limitations. In this study, we have used Action Research Arm Test (ARAT) as a measure for functional outcome. The ARAT was constructed for assessing the recovery of upper extremity function (focal disability) following cortical injury.

Several studies examined the influence of a single specific impairment on activity performance. However, rehabilitation practitioners are largely faced with clients who experience multiple impairments from a stroke. It is a dynamic instruction between several specific neurological impairments in carrying degree of severity & performance of specific activities that pose the challenge for practitioners deciding the course of rehabilitation intervention.

Studies linking tone, strength deficits of different muscle groups in hemiparetic patients, and their performance on functional tasks have been presented and discussed extensively in the literature. However, most of these studies have focused on the relationship between lower limb muscle strength and gait performance. Tone, strength deficits of upper limb muscles, and their relationship to upper limb performance have not been studied in depth.

So, the purpose of the study is to evaluate the relationship between elbow flexor tone, elbow flexor strength, and grip strength with upper limb functional activity in stroke patients.

Chapter 2

AIMS AND OBJECTIVES

AIMS:

To correlate Elbow Flexor Tone, Elbow Flexor Strength, Handgrip Strength in relation toss Upper Extremity Functional Outcome in recovering Stroke patients"

OBJECTIVES:

The study's purpose was to achieve the following objectives:

1. To find the relationship between Elbow Flexor Tone concerning Upper Extremity Functional Outcome in recovering Stroke patients.
2. To find the relationship between Elbow Flexor Strength concerning Upper Extremity Functional Outcome in recovering Stroke patients.
3. To find the relationship between Handgrip Strength concerning Upper Extremity Functional Outcome in recovering Stroke patients.

HYPOTHESIS

Alternate hypothesis (h1):

There will be a significant relationship among variables of Elbow Flexor Tone, Elbow Flexor Strength, and Handgrip Strength about their Upper Extremity Function.

Null hypothesis (H0):

There will not be a significant relationship among variables of Elbow Flexor Tone, Elbow Flexor Strength, and Handgrip Strength about their Upper Extremity Function.

Chapter 3

REVIEW OF LITERATURE

Despite advances in medical care and rehabilitation, the recovery of arm function following stroke is often limited.

A study has shown that static strength deficits of shoulder medial rotation and elbow flexion muscles in a group of 50 stroke patients with hemiparesis were significantly correlated with agonist muscle group spasticity but not antagonist muscle group spasticity.

A study comparing the relative strength of different muscle groups of the paretic upper limb and their relationship with the motor performance concluded that strength is related to the function of the paretic upper limb.

Maximal grip from in chronic stroke subjects and its relationship to global upper extremity function was done & the result suggests that paretic maximal grip strength normalized with maximal grip strength on the non-affected side, which was a valuable outcome measure of upper extremity function in the chronic stroke subjects.

In a retrospective study, the initial and discharge strength deficits of 8 paretic upper extremity muscle groups of a stroke patient with hemiparesis were compared and concluded that the patient improve muscle strength concurrent with a reliable program.

A study relationship between spasticity, weakness, and contracture of elbow flexors and upper limb activity after stroke was performed and concluded that spasticity can cause contracture after stroke, and weakness is the main contributor to activity limitation.

A study was done to compare grip lift parameters in the affected and unaffected upper limbs in heterogeneous stroke patients and to correlate them but because throughout recovery, spared components of the descending motor systems may be able to compensate for the accuracy deficits in reaching (proximal control) but not he efficiency deficits in grasping (distal muscular control).[62]

A study was conducted on 48 patients with arm paresis. The assessment included 4 potential predictors of arm recovery (active finger extension, shoulder abduction, shoulder shrug, and hand movement scales) and 3 outcome measures for evaluation of arm function. The results showed that the active finger extension scale was the most powerful prognostic factor.

A study conducted to investigate the coordination of reach to grasp components in hemiparetic and healthy subjects concluded that the hemiparetic patients, who had a moderate amount of functional recovery, were similar to healthy subjects in their ability to control reach to grasp components. However, their performance was not as skilled.

A study conducted to see the effect of the dominant hand being affected versus the nondominant in individuals with chronic stroke concluded that the individuals with the dominant hand affected demonstrated less impairment than those with the nondominant hand affected. However, there was no effect of dominance on paretic arm use or performance in activities of daily living.

A study was done to assess the relative contributions of several neurological and biomechanical impairments mechanism to overall finger and hand impairment after stroke seem to derive mainly from weakness (which may be attributable to the loss of descending cortical spinal pathway activation of Motoneurons).

Chapter 4

METHODOLOGY

SOURCE OF DATA:

1. Physiotherapy department of Hope hospital (Meerut)
2. Physiotherapy department of Subharti hospital (Meerut)

METHOD OF COLLECTION OF DATA

Population: Patients diagnosed with a stroke, Study design: Co-relational observational study. Sampling technique: Purposive sampling technique. Study sample 60 Gender malefemale (heterogeneous sampling) Minimum 60 patients diagnosed with having a stroke and fulfilling the including criteria were selected.

The purpose, method, and procedure of the study were explained to the patient in a language understood by them, and prior written consent from the patient was obtained. All subjects were assessed using a specific Performa.

Time and duration of the study:- All 60 subjects of the hemiparesis were divided into different age groups but treated as one group. The subjects are exercise program use alternative treatment which includes passive movement, hold-relax technique, stretching exercise and active exercise, strengthening exercise and PNF Technique along with.

Data was taken on days zero 28 and 45.

Protocol:- all the 60 subjects will be assigned in one group and were selected by a convenient sampling method based on inclusion criteria.

All subjects were treated with normal alternative treatment with a normal control exercise program which consists of passive movement, stretching exercise, strengthening exercise, hold-relax technique, and PNF technique.

Procedure:- All the 60 subjects were divided into different age groups but they are treated in one group and treated by alternative treatment protocols which include passive movement, stretching exercise active exercise and strengthening exercise and hold-relax technique, and the PNF technique.

INCLUSION CRITERIA

1. Patients in the age group of 40 to 70 years were included in the study,
2. Stroke with confirmatory diagnosed by a physician.
3. Persistent hemiparesis, generally as indicated by a score of > 4 or 5 according to Brainstorm's scale.
4. Some upper extremity voluntary activity as indicated by the ability to move proximal and/or distal joints against gravity i.e. grade 3 or muscle power.
5. Single-sided stroke or first stroke
6. Evidence of preserved cognitive function.

EXCLUSION

1. Had clinically significant fluctuation in the mental status.
2. Sensory abnormality.
3. Had more than one episode of stroke.
4. Musculoskeletal conditions (e.g. Arthritis, previous fracture of an arm that caused deformity, muscle atrophy)
5. Neurological conditions (e.g. Parkinson's disease, Multiple Sclerosis, and Huntington's disease) other than Stroke.
6. Upper extremity injury or conditions that limited use before the Stroke.

Evaluation of Elbow Flexor Tone, Elbow Flexor Strength, Handgrip Strength, and Upper Extremity functional Outcome:

Outcome measure:

- Elbow Flexor Tone was measured by using the Modified Ashworth Scale.
- Elbow Flexor Strength was measured by using Hand Held Dynamometer.
- Handgrip strength was measured by using a Hand Dynamometer (Jamar).
- Upper Extremity Functional Outcome was measured by Action Research Arm Test.

Measurement Procedures:

Method of Measuring Elbow Flexor Tone:-

Elbow flexor tone was measured using a Modified Ashworth Scale (MAS). All the subjects were in a supine lying position with arms relaxed by the side of the body. The patient's elbow was extended from a position of maximal possible flexion to maximal possible extension over about one second as described by Bohannon and Smith 69. Patients were asked to relax during the procedure, therapist supported and passively move the limb. During the movement, the therapist should maintain firm and constant manual contact. The movement was repeated 3 times because one may not be sufficient for the attribute a score. After performing the three test movements, the tester graded the resistance felt with a single score recorded.

Method of Measuring Elbow Flexor Strength:

Elbow Flexor Strength was measured using the isometric strength of elbow flexors with the help of a handheld Dynamometer, All the patients were positioned supine on a bed with their arm beside their trunk, the posterior aspect of the arm contacting the bed, and their arm was stabilized using a belt. Elbow at 90 degrees of flexion and

MATERIALS USED:

1. Jamar Dynamometer,

2. Modified Ashworth Scale for Tone

3. Stopwatch.

4. Block, wood, 10cm cube,

5. Block, wood, 2.5cm, 5cm, 7.5cm cube,

7. Glass of water, two,

8. Tube 2.25cm, and 1cm diameter,

9. Cricket ball,

10. Washer and bolt,

11. Ball bearing, 6mm,

12. Marble, 1.5cm,

13. Table,

14. Couch

15. Strap

16. Sheets of paper

The forearm was fully suppurated. Hand-Held Dynamometer is placed 1cm proximal to the wrist joint. The patient was instructed to exert a maximal isometric contraction while the examiner holds the dynamometer in an affixed position, the patient performed two maximal elbow flexion efforts and there was 30 sec, of rest under each effort. Patients were given total verbal encouragement during the maximal voluntary muscle group control of the stationary dynamometer. The averages of the two were recorded.

Method of measuring Hand Grip Strength:

Handgrip strength was measured using a Jamar Dynamometer, All the subjects were seated in straight-backed chairs with the feet flat on the floor and positioned in a standardized position as described by Mathiowetz and advocated by the ASHT (The American Soe. Of Hand Therapists) with the shoulder adducted and in neutral rotation, elbow flexed at 90 degrees, forearm in a neutral rotation and the wrist between o degree extension and between 0 and 15degree ulna deviation. The dynamometer was then presented vertically and in line with the forearm to maintain the standard forearm and wrist position. Then the patient was asked to press the handle of the dynamometer with maximum strength.

Three consecutive readings were taken with a rest period of 2 minutes between each trial and the average value of 3 attempts was recorded,

Method of Measuring Upper Extremity Functional Outcome:

The Upper Extremity Functional Outcome was measured using ARAT, which is a test consisting of 19 items focusing on grasping objects of different shapes and sizes, and gross movements in the vertical and horizontal planes. The ARAT contains four subscales-'Grasp', 'grip', 'pinch' and 'gross movement'.

The performance of each motor task is rated on a 4-point scale, ranging from 0 (on movement possible) to 3 (movement performed normally), The scores on the individual items are addressed living an overall sum score the maximum obtainable sum, the score is 57 points. items within each subscale are ordered in such a way that if a patient accomplishes the most difficult item (the first item of each subscale), then this predicts success with all less difficult subscale items. Thus, the patient is credited with succeeding with all items of the subscale for that limb. On the other hand, failure with the easiest item (the second item of the first three subscales and the first item of the fourth subscale) predicts failure with all items of greater difficulty on that subscale. The whole procedure of the test was explained to the subject in the language he/she understands. For the starting position, the subjects were seated in a chair, with a firm back and no armrests. The subject's back was in contact with the back of the chair at all times during the test performance. The subject’s feet were in contact with the floor throughout testing. If the subject did not understand the instructions the evaluator demonstrated the task. The subject's hand started and finished the task with palms down on the table. But for gross movement tasks, the subject's hands were placed probated on their lap. Data of the variables were recorded in an Evaluation Chart (refer to Annexure). The data from all the subjects were tabulated in a master chart and taken up for Statistical Analysis.

CHAPTER 5

STATISTICAL ANALYSIS

Statistical was done by using person product-moment correlation (R-value) to predict the score on ARAT with Elbow Flexor tone, Elbow flexor strength, handgrip, and P-value <

0.05 was taken as the level of statistical significance.

Statistical Software SPSS was used for the data and Microsoft word and excel have been used to generate graphs and tables.

RESULTS

Descriptions of the table and graphs are as follows. (Refer to annexure) Table 1 & Graph 1: The age distribution of subjects who participated in the count in % as 3.3% are included between the age group of 46-50 years, 10% are included between the age group of 51-55 years, another 23.3% raise between the age group of 56-60 years and 61-65 respectively and remaining 40% are included between the are group of 66-70 years. The mean age of the subjects who had participated in the study is 62.50 and the Standard Deviation is 5.768.

Table 2 & Graph 2: The gender distribution of subjects who participated in the study has a count in % as 32% female and 68% male.

Table 2 & Graph 3: This shows the correlation between the Elbow Flexor Tone and Action Research Arm Test scores at the time of discharge in recovering Stroke patients. The means and standard deviation of Elbow Flexor Tone was 1.5 $\pm$ .45 and the mean and standard deviation of the Action Research Arm test was 29.20

$\pm$ 7.55. Pearson correlation deficient value 'r' shows a correlation between Elbow flexor Tone and ARAT open with($r = .49$)$p <$ .05), so this scores demonstrated weak relationship but had statistically significant correlations.

Table 4 & Graph 4: This shows the correlation between the Elbow Flexor Strength and Action Research Arm Test Scores at the time of discharge in recovering Stroke patients. The mean and standard deviation of Elbow Flexor Strength was 4.15 ± 1.35 and standard deviation of Action Research Arm Test was29.20 ± 7.55. Person correlation coefficient value 'r' shows correclation between Elbow ………………… Strength and ARAT with ($r = .92$, p .00), so this scores demonstrated statistically highly strong corrections.

Table 5 & Graph 5: This shows the correlation between the Handgrip Strength and Action Research Arm Test scores at the time of discharge in recovering Stroke patients. the means and standard deviation of Handgrip Strength was 7.03 ± 1.59 and means and standared deviation of Action Research Arm Test was 29.20 ± 7.55. Pean correlation coefficient value 'r' shows correlation between Handgrip Strength and ARAT with($r = .75, p < .000$), so this scores demonstrated strong statistically significant correlations.

Table 8: Regression analysis, taking EFT as the independent variable (Predictor) and ARAT (dependent) variable shows that one unit change in EFT causes .833 changes in ,ARAT and rate of change is in ratio of 1:.833. As taking FS as independent variable (Predictor) and ARAT (dependent) variable shows that one unit change in EFS causes 4.529 changes in the ARAT and rate of Change is in ratio of 1:4.529. Taking Handgrip Strength causes 0.984 change in ARAT and rate of change is in the ratio of 1:.984. in totality GRIP and EFS has a high significant effect on ARAT at P<0.01. But EFT has no significant effect on ARAT in comparison with EFS and Handgrip Strength as P=.373>0.05.

CHAPTER 6

DISCUSSION

Stroke is a focal neurological disorder lasting for more than 24 hours, giving rise to functional disabilities in tone. Upper limb strength and activities of daily living. As stroke has been found to impair tone, upper limb strength, and ADL, in our present study we have tried to find the relationship between Elbow Flexor Tone, Elbow Flexor Strength, and Handgrip Strength with Upper Extremity Functional outcome using the Action Research ARM Test in recovering Stroke patients.

In this study, samples had a wide range of impairment and activity scores they are typically for individuals with Stroke. Here this study determines which impairment variables best explained performance and use of the practice upper limb using measures exclusive to upper-limb function and not global function. The study detected several upper limb impairments that are related to activity in individuals with stroke. A study found that Elbow Flexor strength has the strongest relationship with Upper Limb Functional Outcome (ARAT): followed by Elbow Flexor Tone and Handgrip Strength.

In this study Elbow Flexor, Tone was measured using Modified Acworth Scale at the time of discharge in recovering Stroke patients, with grades ranging from 0 to 4, but subjects were scored between 1, 1+, and 2. The means of the Elbow Flexor Tone was 1.5. Table 3, shows the EFT & ARAT were weakly correlated with each other but statistically significant. Regression analysis, taking EFT as an independent variable (Predictor) and ARAT (dependent) variable shows that one unit change in EFT causes 0.833 change in ARAT, and the rate of change is in the ratio of a unit change in EFT causes 0.833 change in ARAT and rate of change is in the ratio of 1:.833 (table 6).

Similar research done by Jocelyn Harris et al reported that elbow flexor tone was a weak correlation with upper extremity function, which was found to be similar in comparison to the finding of the present study.

Although other findings suggest that spasticity increases lead to a decrease in the upper extremity function. This finding shows that tone has a statistically significant relationship with upper extremity function as proved by other previous studies; But had a minimal influence when compared with other impairment variables considered in this study.

It is well recognized that increased tone after stroke may interfere with motor and activity performance. Initially, the limb may be flaccid and tone is supposed to emerge followed by spasticity; this spasticity of muscles seems to interfere with motor performance and activity limitations. 60

Secondly, Elbow flexor Strength was measured using a Hand-Held Dynamometer at the time of discharge in recovering Stroke patients. Elbow Flexor Strength was strongly correlated to the Upper Extremity Function Outcome (ARAT) as shown in Table no. 4 and which was similar to the previous study which shows that the strength of the paralytic upper limb was strongly related to the measures of activity as a study done by J Harrish31.

The present study shows that there is a strong relation between Elbow Flexor Strength at the time of discharge in recovering Stroke patients. This finding illustrates the relationship between weakness and poor performance on measures of ADL; the weaker the strength of the elbow flexor worst the score on upper limb function. This also proves that weakness as an impairment is equally important to tone.

As shown in Table 6, regression analysis taking EFS as the independent variable (Predictor) and ARAT (dependent) variable shows that one unit change in EFS causes 4.529 change in ARAT and the rate of change is in the ratio of 1:4.529.

Weakness in upper limb muscles impairs the stabilization of the proximal arm segment. Limits

……………… ability, confine hand usage, and affect upper limb control and coordination. These factors would have a direct impact on the paretic upper limb in upper extremity function; it supports our finding of the importance of upper limb strength.

Handgrip strength was measured using a Jamar Dynamometer in recovering Stroke patients. In this study table, 5 shows that Handgrip Strength as the independent variable (Predictor) and ARAT (dependent variable shows that one unit change in Handgrip Strength causes 0.984 change in ARAT, and the rate of change is in the ratio of 1:.984.

It has been supported by the previous study that evaluates maximal grip force in chronic stroke subjects and its relation to global upper extremity functions and suggests that maximal grip force appears to be a valuable marker for hand-arm function. So the present study suggests that Handgrip Strength has a good significant relationship with ARAT function29. This shows that Handgrip Strength is important for various upper extremity functions and Handgrip Strengths as a valuable predictor. Upper Extremity Functional Outcome.

Handgrip Strength is one of the important factors for the function and ability of the hand. Weakness of the upper limb is the major constraint affecting all aspects of the upper extremity function including the ability to transport, grasp and release objects. Heller et al found the grip strength to be a sensitive measure after stroke. In the chronic stage of recovery, individuals may have developed ways to cope with grip strength and thus are able to complete function.

However, the present study showed that Elbow Flexor Tone, Elbow Flexor Strength, and Handgrip Strength affect ARAT significantly but Elbow Flexor Tone, Elbow Flexor Strength, and Handgrip Strength do not only the factors affect ARAT in recovering Stroke patients, but other factors also affect the Upper Extremity Function. So for the clarity of the study factor should be ruled out.

Elbow Flexor Tone, Elbow Flexor Strength, and Handgrip Strength show a good correlation with ARAT in recovering stroke patients. Additionally, Elbow Flexor Strength was found to be a strong indicator of upper limb performance using ARAT. However, the only weak relationship was found between Elbow Flexor Tone with ARAT.

Thus, assessing Elbow Flexor Tone, Elbow Flexor Strength and Handgrip Strength in recovering stroke patients may be a useful tool in predicting ARAT to rehabilitate awareness of possible deficit of Elbow Flexor Tone, elbow Flexor strength and Handgrip Strength may be assistance to health care workers' treatment planning and in turn with a patient recovering Stroke patients.

The present study clearly showed that there was a strong significant relationship between

Elbow Flexor Strength and Handgrip Strength with Upper Extremity Function (ARAT) and Elbow Flexor Tone has a weak correlation with Upper Extremity Function (ARAT) in recovering Stroke patients. Hence, the alternate hypothesis can be retained.

Further Recommendations:

1. In further studies, correlation of the similar variables (Elbow Flexor Strength, Handgrip Strength with Upper Extremity Function Outcome) can be done in Stroke patients without ongoing conventional physiotherapy.
2. Factors such as sensation, and coordination can be assessed in future studies.

3. In future studies, correlation of similar variables (e.g. Elbow Flexor Tone, Elbow Flexor Strength, Handgrip Strength with Upper Extremity Function Outcome) can be done using some other scales.

Limitations:

1. Sample size would have been larger to make the more generation of the results obtained.
2. Out of the upper extremity only EFT and EFS were taken for the study while Shoulder muscles (flexors, extensors, abductors, and adductors) and Wrist muscles were not assessed.
3. In the present study only over 40 years of subjects with Stroke were assessed to find a relationship, younger Stroke patients below 40 years were not at all assessed since strength could be more in younger subjects with Stroke, so the results of the study might have varied.
4. Variables list was not exhaustive, and other variables also may be important (e.g. Coordination, Finger Dexterity, Force, Sensation).

CONCLUSION

Our hypothesis that there would be a significant relationship between Elbow Flexor Tone, Elbow Flexor Strength with Upper Extremity Functional Outcome was confirmed.

We found a high strong positive correlation found was between Elbow Flexor Strength and Handgrip Strength regarding their Upper Extremity Functional Outcome after discharge and a weak relationship between Elbow Flexor Tone with Upper Extremity Functional Outcome after discharge in recovering Stroke patients.

Though Elbow Flexor Tone, Elbow Flexor Strength, and Handgrip Strength correlated with Upper Extremity Functional Outcome, Elbow Flexor Strength and Handgrip Strength are found to be important factor in predicting the functional status of the Upper Extremity in Stroke subjects.

SUMMARY

The purpose of this study was to correlate Elbow Flexor Tone, Elbow Flexor Strength

Handgrip Strength with Upper Extremity Functional Outcomes in recovering Stroke patients. A total of 60 Stroke patients were included in this study. Elbow Flexor Tone was measured with Modified Ashworth Seale (MAS), Elbow Flexor Strength was measured with Hand Held Dynamometer and, Handgrip Strength was measured using a Hand Dynamometer (Jamar) at the time of discharge. Late Upper Extremity Functional Outcome was measured using ARAT. In between all the patients received conventional physiotherapy treatment, and were visited once a week on an outpatient basis. The data collected, were statistically analyzed using

Pearson's correlation coefficient. The mean and standard deviation of Elbow Flexor Tone, Elbow Flexor Strength, and Handgrip Strength correlated with the ARAT score using Pearson's coefficient.

After analyzing the data following inferences were drawn:

- Both Elbow Flexor Tone, Elbow Flexor Strength, and Handgrip Strength correlated well with the Upper Extremity Functional Outcome after discharge.
- Though Elbow Flexor Tone is weakly correlated with the functional outcome of Elbow Flexor Strength, Handgrip Strength is correlating more with the functional outcome.
- Thus Elbow Flexor Tone, Elbow Flexor Strength, and Handgrip Strength can help in predicting the Upper Extremity Functional Outcome in Stroke.

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ANNEXURE I

CONSENT FORM

1. Voluntarily declares to participate in the research study "**ELBOW FLEXOR TONE, ELBOW FLEXOR STRENGTH, HANDICRIP ABOUT UPPER EXTREMITY OUTCOME IN RECOVERING STROKE PATIENTS.**" The researcher has explained to me about the study, risks, and benefits of participation and has answered all my questions and queries regarding the study to my satisfaction.

Signature of participant: ______________________________.

Signature of the witness: ______________________________.

Signature of the researcher:______________________________.

Subject is fit/ unfit for the study:________________________.

Guide:________________________ Co–guide:__________________

Date:__________________________

ANNEXURE-II

Assessment Form

(1) DEMOGRAPHIC DATA

- Age
- Sex
- Occupation
- Dominance
- Duration
- Address

(2) CHIEF COMPLAINTS

(3) HISTORY

- Present history
- Family history
- Medical history. DM/Cardiac problems/ Previous surgeries/ Bowel problems/ Bladder problems.
- Persona history: Smoking Alcohol/ Drugs/ food/ Types A personality.
- Psychological status: Depressed? Confident Socio–economical status:

(4)GENERAL D **Vital signs**

Temp Pulse

BP BR

(5)ON OBSERVATION

- Built: Poor/Moderate/Well
- Postural attitude Obvious muscle wasting:
- Scars:
- Swelling:
- Deformities:
- External appliances:

(6)On Palpation

- Tenderness:
- Warmth:
- Spasm:
- Scar:
- Crepitate and Bony spur

(7)CNS EXAMINATION

Higher mental Functions;

- Level of consciousness
- Orientation
- Memory
- Speech

Cranial Nerve Examination:

- **Olfactory**
- **Optic**
- **D, trochlear, Abducent**
- **Trigeminal**
- **Facial**
- **Vestibule cochlear**
- **Glossopharyngeal**
- **Vagus**
- **Spinal accessory**
- **Hypoglossal**

Perceptual Examination

- D/body image disorders
- Spatial relations disorder
- Agnosia
- Apraxia

Sensory Examination

- Superficial/ Thalamic sensations

  Pain

  Fine touch Temp.

- Joint position sense

  Crude touch

  Vibration

- Cortical sensation

  Stereognosis

ANNEXURE III EVALUATION OF THE PATIENT

Name :

Age:

Sex:

Date of assessment:

Occupation:

Address:

Time since stroke:

Side of paresis:

Elbow flexor Tone (EFT) (Score)	Elbow flexor Strength (EFS) in (kg)	Hand Grip (kg)	ARAT (Score)

ANNEXURE IV

ACTION RESEARCH ARM ASSESSMENT FORMAT

Name:

History:

Age:

Address:

Date of CVA:

Phone:

Diagnosis:

Aphesis:

Sex:

Handedness:

Significant medical history:

Test number:

Tester:

INSTRUCTIONS:

There are four subtests grasp, grip, Pinch, and gross Movement. Items in each are ordered so that:

- If the subject passes the first, no more need to be administered and the scores top marks for that subtest;
- If the subject fails the first and fails the second, he scores zero, and again no more tests need to be performed in that subtest;
- Otherwise he needs to complete all tasks within the subtest

SUMMARY OF SCORES

GRASP

Block, wood, 10cm cube (If score = 3, total = 18 and of Grip) ______ Pick up a 10 cm block.

Block, wood, 2.5cm cube (If score = 0, total = 0 and go to grip) ______ Pick up 2.5 cm block.

Block, wood, 5 cm cube_______

Block, wood, 7.5 cm cube______

Ball (Cricket), 7.5 __________

Stone 10 x 2.5 x1 cm ______

TOTAL GRASP SCORE: ______ TOTAL MAX SCORE: 18

GRIP

1. Pour water from glass to glass (If score = 3, total = 12, and go to Pinch) ______
2. Tube 2.25 cm (If score = 0, total = 0 and go to Pinch) _________
3. Tube 1 x 16 cm _________
4. Washer () over bolt ___________
5. TOTAL GRIP SCORE:___________ TOTAL MAX SCORE: 12

PINCH

1. Ball bearing 6 mm, 3rd finger and thumb

   (If score = 3, total = 18 and go to Gross mt)
2. Marble, 1.5 cm, index finger and thumb

   (If score = 0, total = 0 and go to Gross mt) _______
3. Ball bearing 2nd finger and thumb ________
4. Ball bearing 1st finger and thumb___________

ANNEXURE V

TABLES

Table 1: Age Distribution

AGE	No. of Subjects	Percent Mean SD
46-50	2	2.50
51-55	6	10.0
56-60	14	23.3
61-65	14	23.3
66-70	24	40.0
TOTAL	**60**	**100.0**

Graph 1: Age Distribution

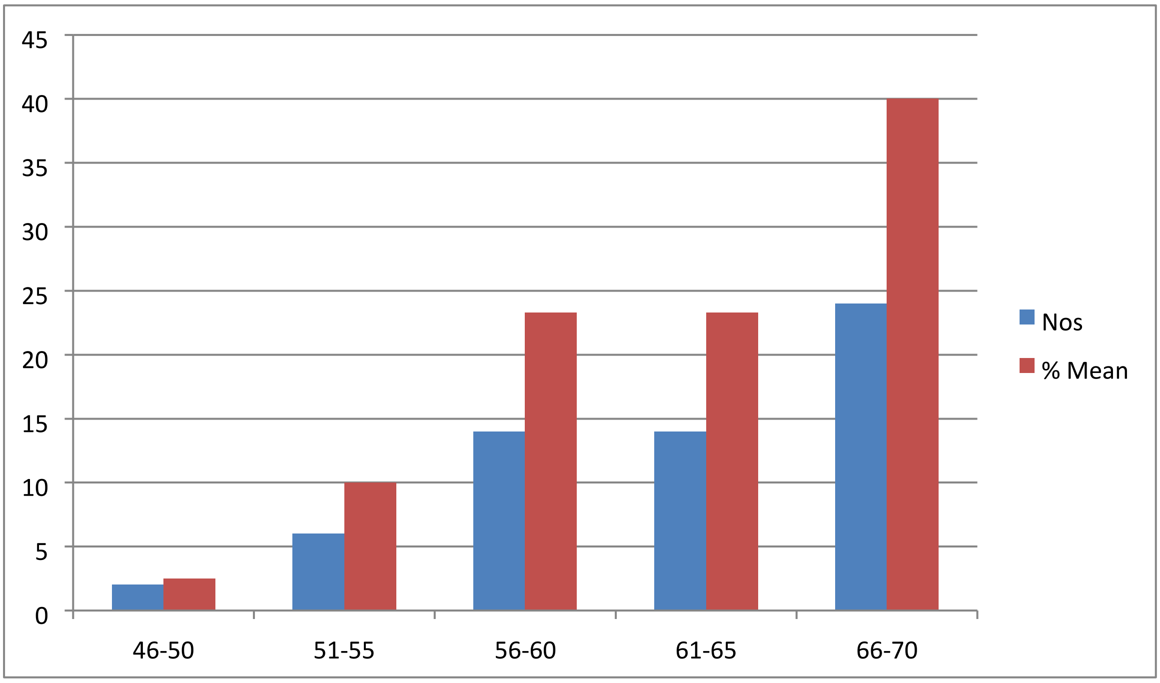


Table 2: Gender Distribution:

No of subjects	Percent	Gender
Male	41	68.3
Female	19	31.7
Total	60	100

GRAPH 2: Gender Distribution:

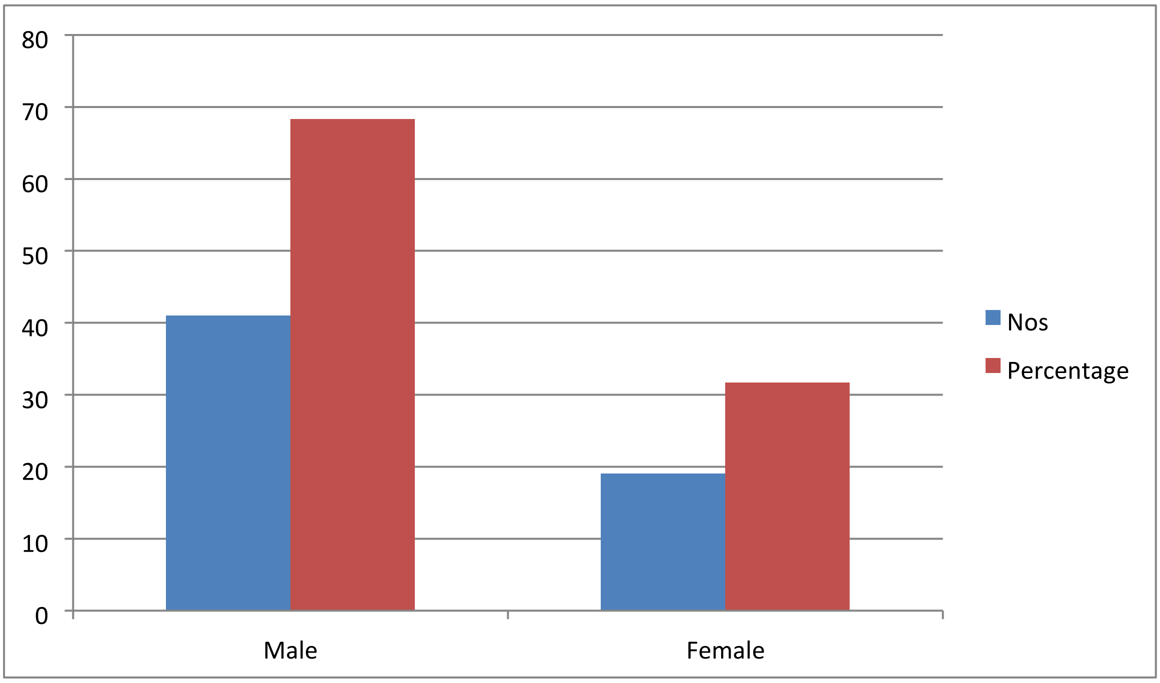
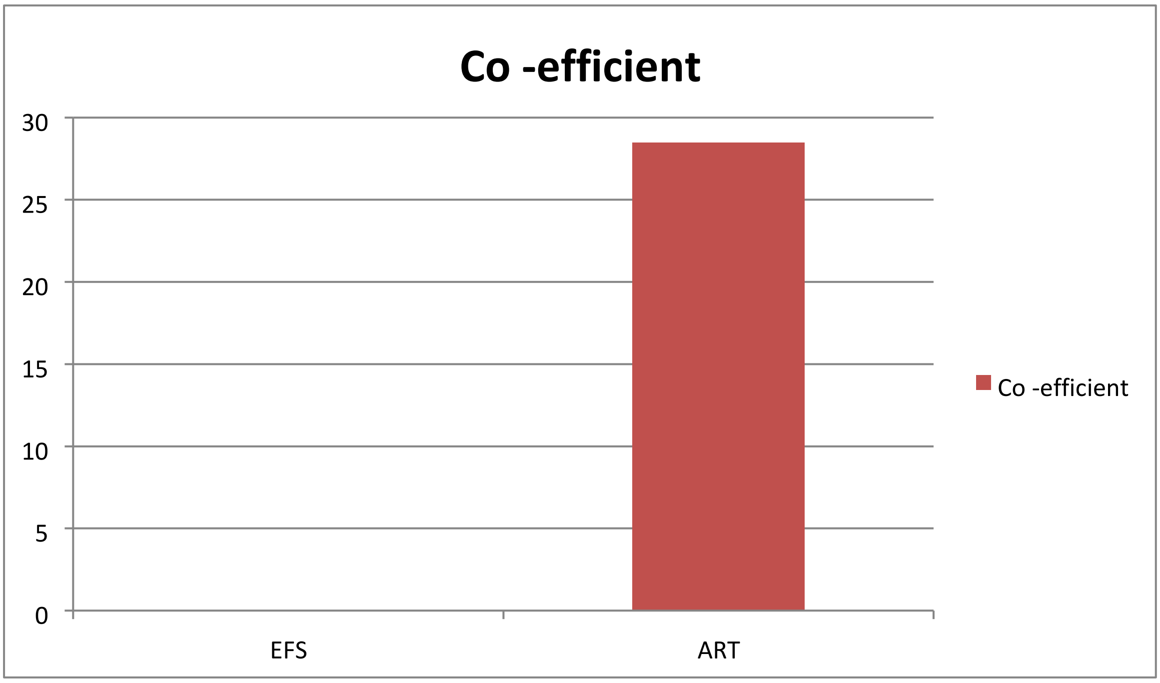


Table 3: correlation between EFT with ARAT scores at the time of discharge in recovering Stroke patients

	N	Min.	Max.	Mean	Std. Dev.	Median karKarl Pearson correlation coefficient value .49788	P Value >0.05
EFS	60	12	1.5	.445	1.5	0.001	
ARAT	60	15	42	29.20	7.551	28.50	

GRAPH 3: Correlation between EFT with ARAT scores at the time of discharge in recovering stroke patients.



ARAT=15.56+8.44*EFT

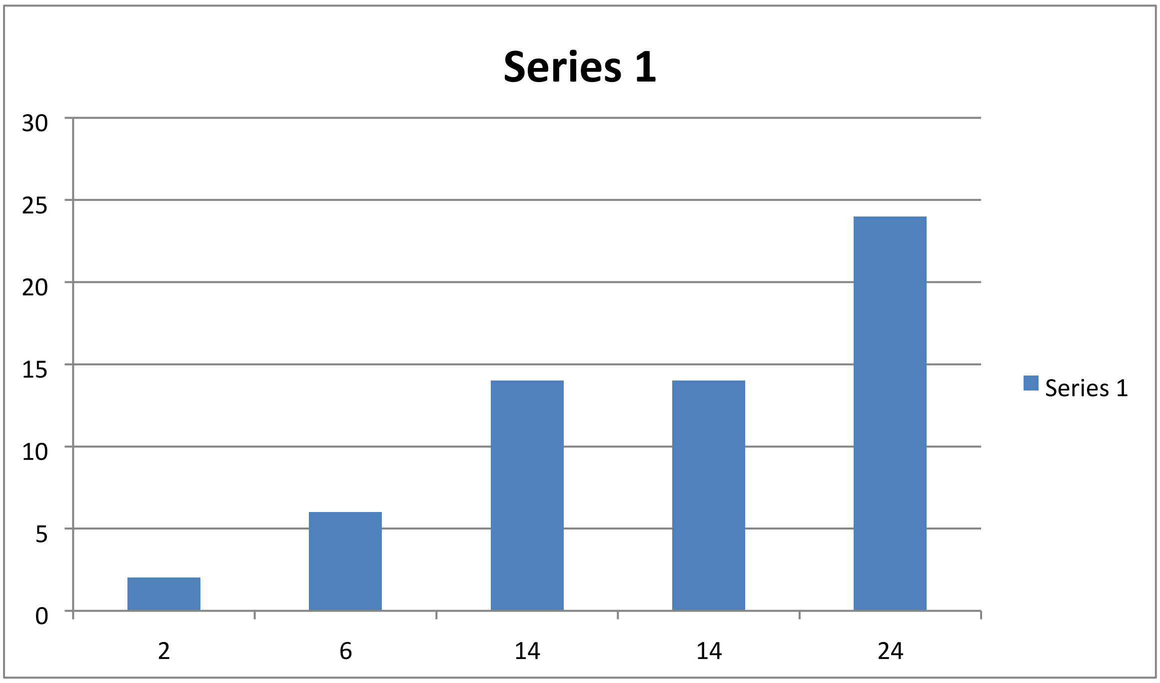
R-Square=0.25

Here 1+ is taken by 1.5

Table 4: Correlation between ES with ARAT scores at the time of discharge in recovering stroke patients.

	N	Min.	Max.	Mean	Std. Dev.	Median Karl Pearson correlation coefficient value .929hs	P Value 0.00
Grip strength	60	4	6	4.15	1.351	4.0	
ARAT	60	15	42	29.20	7.551	28.50	

GRAPH 4: Correlation between EFS with ARAT scores at the time of discharge in recovering stock patients.



EFS

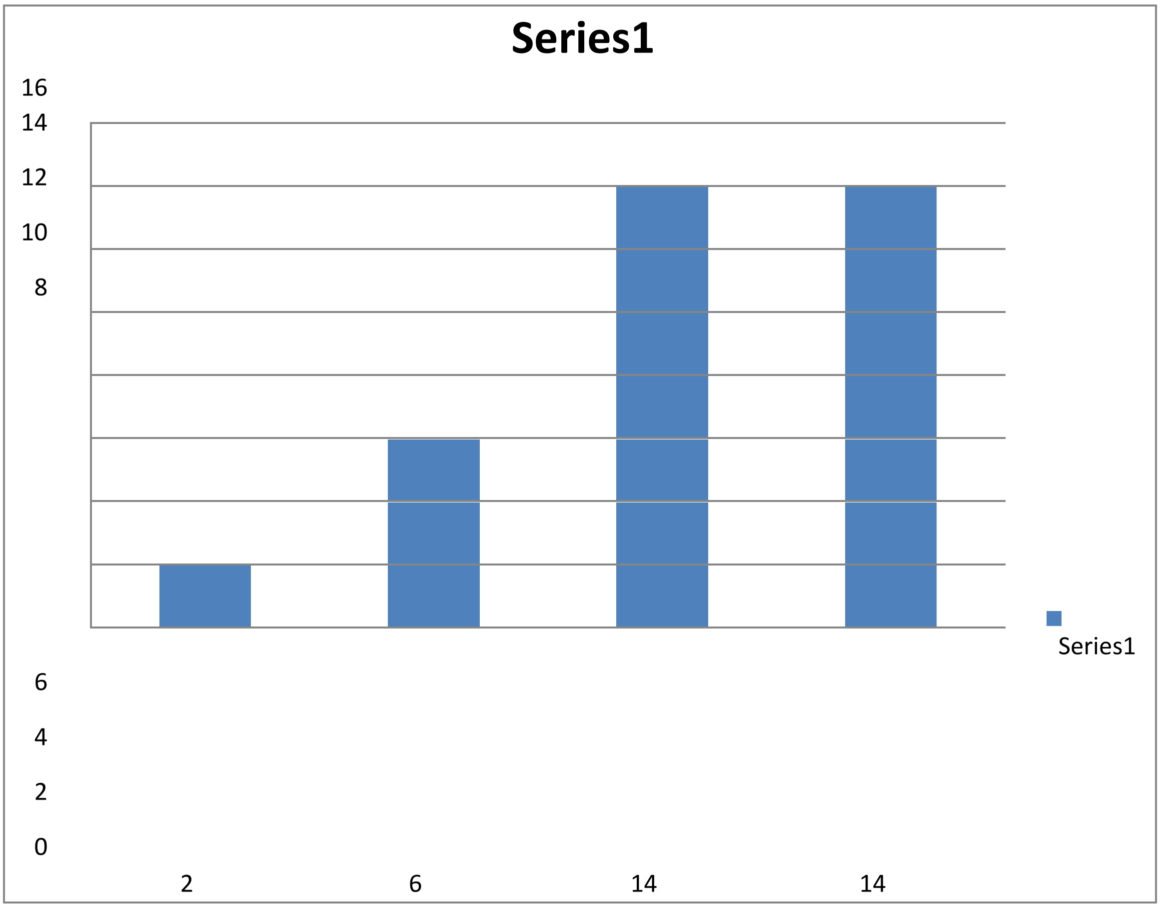
ARAT=7.64+5.19+EFS

-square=0.86

Table 5: correlation between grip strength with ARAT scores at the time of discharge in recovering stroke patients

	N	Min.	Max.	Mean	Std. Dev.	Median Karl Pearson correlation coefficient value .758hs	P Value 00
Grip Strength	60	4	11	7.03	1.594	7.0	
ARAT	60	15	42	29.20	70551	28.50	

Graph 5: Correlation between Handgrip Strength with ARAT scores at the time of discharge in recovering stock patients.



GRIP

ARAT=3.93+3.58*GRIP

R Square=0.58

Table 6: Regression analysis to assess the effect of EFT, EFS, and Grip on ARAT Score.

	Unstandardized Coefficients		Standardized coefficients	T	Sig
Model	**B**	**Std. Error**	**Beta**		
Constant	4.823	1.697	2.845	.006	
EFT	.833	.928	.049	.898	.373
EFS	4.529	.388	.810	11.664	.000
GRIP	.984	.302	.208	3.256	.002

Dependent Variable: ARAT

Model R R Square

941a. 886

Predictor: (Constant)Grip, EPT, EFS

ANNEXURE VI MASTER CHART

S. NO	AGE	SEX	EFT	EFS	GRIP	ARAT
1	54	M	1+	6	7	39
2	50	M	1+	6	10	42
3	63	M	1	5	8	33
4	62	M	1+	5	8	36
5	70	F	2	2	5	18
6	58	M	1	5	10	27
7	65	F	2	3	7	24
8	55	M	1	5	9	33
9	61	M	1	5	8	30
10	63	F	2	3	7	21
11	57	M	1	3	8	27
12	54	M	1+	5	9	36
13	69	M	2	3	6	24
14	58	F	1+	5	8	36
15	66	M	1	3	6	27
16	69	F	2	2	5	21
17	58	M	1+	6	8	36

18	67	F	1	5	6	27
19	70	M	1	4	6	30
20	69	M	1+	6	7	39
21	70	M	2	2	5	18
22	66	F	2	2	5	18
23	57	M	1+	6	8	39
24	62	M	1	5	7	30
25	59	M	2	4	7	24
26	62	F	2	3	5	21
27	52	M	1+	6	10	42
28	68	F	2	2	4	18
29	62	M	1+	6	7	39
30	55	M	1+	6	9	42
31	49	M	1+	6	11	42
32	70	M	2	2	4	15
33	65	F	2	3	6	24
34	63	M	1	4	7	27
35	59	M	1	4	8	30
36	66	F	2	3	7	24

37	68	M	2	3	6	24
38	57	M	1	5	8	33
39	63	M	1	5	7	30
40	61	F	2	3	6	21
41	69	M	1	4	8	33
42		F	1+	5	8	36
43	66	M	2	2	5	18
44	69	F	1	4	10	27
45	58	M	1+	5	8	36
46	67	F	1	5	6	27
47	63	M	1	4	6	30
48	62	M	1+	6	7	39
49	70	F	2	2	5	18
50	58	M	2	2	5	18
51	57	M	1	4	8	27
52	54	M	1+	4	9	36
53	69	M	2	3	6	24
54	58	F	1+	5	8	36
55	66	M	1	4	6	27

56	69	F	2	3	5	21
57	58	M	1+	5	8	36
58	67	F	1	4	6	27
59	70	M	1	5	6	30
60	69	M	1+	6	7	39