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Duration Wise Analysis Of Hand Function In Patients With Stroke Using Jebson Hand Function Test

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Abstract –
Background *- Stroke Is A Persistent Impairment Of The Arm And Hand Due To A Hemiparesis, Which Has A Significant Impact On Performance In Daily Life Activities. Integral Arm-Hand Skill Training Approach, Accommodating Both The Heterogeneity Of The Patient Population And Its Associated Patterns And Levels Of Recovery Directly Post-Stroke Seems To Be Absent. Impaired Hand Function Is One Of The Most Frequently Persisting Consequences Of Stroke. The Fine Motor Activities Are Also Affected Due To Which The Patient Is Not Able To Hold Any Object In Hand Which Is Required To Perform In Daily Activities.*
Methodology*- An Observational Study Was Conducted. Total 60 Subjects Were Included In This Study Which Was Divided Into 3 Group's I.E Acute, Subacute & Chronic 20 Subjects In Each Group. The Jebson Taylor Hand Function Test Was Administered On Each Subject.*
Result*-The Study Shows In Jebson Taylor Hand Function, The Most Affected Component Is Writing, Followed By Lifting Heavy Objects And Stimulated Feeding. Whereas Less Time Is Required For Card Turning, Small Common Objects And Stacking Checkers And Less Time For Picking Up Light Objects In Stroke Patients.*
Conclusion*- The Study Concludes There Is A Positive Relationship Between Duration Of Stroke And Hand Function Recovery In Patients With Stroke.*
Keywords*- Jebson Taylor Hand Function Test, Brunnstorm Recovery Stages, Duration Of Stroke*

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I. Introduction-

A stroke is one of the leading causes of disability, many people lost their functional capacity and independence due to stroke. Stroke is long -term impairment of the arm and hand due to a hemiparesis, which has a significant impact on daily life activities. Arm-hand skill training approach, having both the heterogeneity of the patient population and its associated patterns and levels of recovery post-stroke seems to be absent. Regaining hand function and Activities of daily living (ADL) is particularly unable to affect therapy owing to fine motor control needed for the distal-joints. Impaired hand function is one of the most common affections of stroke. Paralysis of the upper limb occurs acutely in up to 87% of stroke patients. A bit of recovery of motor control after a stroke is most rapid during the first 3 months and usually at a plateau by 6 months. Approximately 80% of stroke patients have motor impairments of the upper limb that affect their ability to perform activities of daily living (ADL). Previously it was shown that the severity of upper limb paresis is an independent determinant of the outcome of basic activities of daily living (ADL) post stroke. [(5)] Motor and cognitive dysfunction are the most prevalent among the stroke abnormalities and have a high impact on the patients' life quality. [(6)] Severe stroke can be treated as a stroke resulting in a significant amount of brain tissue damage and multiple neurological impairments, which leads to a significant loss of function. Dependent upon how it is measured, it is estimated that between 14 and 31% of people having stroke globally have a severe stroke and this leads to stroke population experience worse outcomes compared to survivors of less severe stroke [(7)] The outcomes of upper extremity rehabilitation are influenced by cognitive function which affects the ability to acquire and execute functional skills [(8).] Motor anticipation is the key component of cognitive function which requires high brain cognitive process [(9)] whereas, severely weakened stroke patients are still able to imagine movements of the paretic hand and can attempt to move even in the absence of actual movements [(10)] Somatosensory and motor function, as well as the interplay between the two, are essential for performing skilled movements during activities of daily living (ADLs). like, when grasping a small object, proprioception is important to sense the current position of the limb. This sensory input is then integrated by the central nervous system to form the motor output, a process called sensorimotor integration. [(11)] Loss of independence of upper limb function contributes more to functional disability, affecting quality of life and independence in 'basic', (grooming, feeding, etc) and activities like (shopping, home/financial management, etc.) of daily living. A larger portion of stroke patients with that of severe upper limb paresis are moved to institutionalised care (63%) than are discharged home (37%). [(12)] The task of grasping a cup requires reaching for the cup, coordinating hand shape formation for grasping during reach, coordinating finger movements

and fingertip forces during grasping and releasing, visuomotor coordination, tactile-motor coordination and finger individuation. Impairment in any of these abilities can lead to hand disturbed function, and successful rehabilitation may depend on the identification and treatment of each of the specific impairments. Also, recovery may depend on some processes that affect these interrelated abilities. [13] Hand function can be evaluated with help of impairment, such as abnormalities in measures of range of motion, grip strength, and other performance tests. Alternatively, hand function can be measured by patient-rated disability, or difficulty in performing physical activities, such as ADLs. [14] Factors characterising the difficulty in fine motor performance between stroke patients and controls. To confirm the relevance of the factors by analysing the power with regard to the Jebsen Taylor Hand Function Test (JHFT), a very commonly used clinical test of fine motor control [15] The MJT consisted of three timed subtests, which were carried out by the subject, seated in front of a table. First, the severely affected hand was tested and then, the least affected hand was tested. The items used in the test were of Jebsen Hand Function test kit [16]

II. Methodology -

It was an observational study. The purposive sampling method was used to conduct the study, about 60 samples were taken to come to the conclusion during the study duration of 6 months. The present study was conducted among the patients with stroke admitted in I.P.D and O.P.D at Dr. Vitthalrao Vikhe Patil Memorial Hospital , as well as camp patients were included in the study .written informed consent was taken from all the participants .A data collection sheet was designed which include demographic data like Name, Age ,Gender ,Duration of stroke , side of weakness, spasticity grade ,VCG grade and Jebsen Hand Function Test . We include both the males and females who were diagnosed with stroke. Cognitive impairment, Non-cooperative Patients, Psychiatric Illness, Severe Orthopaedic Condition, Brainstem Injury, Hand Deformity, Visual Field Deficit were excluded.

Procedure –

Patients who satisfy the inclusion criteria were selected for the study after the approval from the ethical committee of the institution. All the selected individuals were explained about the study and consent from them was obtained. Consent was taken from the subject. An observational survey was conducted in an area including 60 participants. The study was conducted by following all covid guidelines. The stroke patients are divided into 3 divisions that is acute, subacute, chronic.

The level of spasticity at Hand & wrist joint measured by modified Ashworth Scale (MAS 0-4), range of voluntary hand & wrist movement defined in terms of active range of wrist (AROM 0-70) & hand (AROM 0-60) as measured by goniometer

. In the case of hemiplegia, severe spasticity would make movements impossible, while moderate spasticity allow some slow movements but they would perform with too much effort and abnormal coordination but fine movements of the limbs especially involving the distal portion were difficult or impossible, these movements were then graded with voluntary motor control.

The jebson hand function test was taken on patient and accordingly the scoring was done. The jebson hand function test consists of 7 components and the scoring would allow to collect participation data and would impact assessment of intervention.

Fig:Patient performing lifting heavy objects

Fig: Patient performing stimulated feeding

The JHFT includes a series of seven subtests representing fine motor, non- weighted and weighted hand function in ADL, which includes:
1.Printing a 24-letter, third-grade reading difficulty sentence
2.Turning over 7.6×12.7 cm (3×5-inch) cards (simulated page turning)
3.Picking up small, common objects (e g. pennies, paper clips, bottle caps) and placing them in a container
4.Stacking checkers (test of eye-hand co-ordination)
5.Simulated feeding
6. Moving large empty cans
7.Moving large weighted [0.45 kg (l lb)] cans.

- Subtest score = time(seconds to complete task total score = sum of times for each sub test
- Maximum time allotted per subtests is 120 seconds
- Lower score equals to greater function
- Each item performed with each hand separately non dominant hand first
- Measure universal hand function. Asses speed, not quality of performance

Reliability-
Moderate responsiveness between 1-3 months post-stroke (0.69) & between 1-6 months post- stroke.
Validity:
Moderate responsiveness between 1-3 months post-stroke (0.69) & 1-6 months post-stroke (0.73)

JEBSON HAND FUNCTION TEST

- **Modified Ashworth Scale-**

Purpose: The modified Ashworth Scale (MAS) is a revised version of the original Ashworth scale that measures spasticity in patients with lesions to the central nervous system.
The Ashworth was designed to assess the effectiveness of anti-spasticity drugs on spasticity in patients with multiple sclerosis.
0-No increase in muscle tone
1- Slight increase in muscle tone, manifested by catch and release at the end of range of motion
1+ - Slight increase in muscle tone manifested by catch and release, less than half of range of motion
2-More marked increase in muscle tone through most of the range of motion, but affected parts easily moved
3 - Considerable increase in muscle tone passive movement difficult
4- Affected part rigid in flexion or extension

Voluntary Control Grading

- Grade 0: No Contraction
- Grade 1: Flicker of Contraction Present or Initiation of Movement
- Grade 2: Half Range of Motion in Synergy or Abnormal Pattern
- Grade 3: Full Range of Motion in Synergy or Abnormal Pattern
- Grade 4: Initial Half Range is Performed in Isolation and The Latter Half in Pattern
- Grade 5: Full Range of Motion in Isolation but goes into Pattern When Resistance Is Offered
- Grade 6: Full Range of Motion Isolation Against Resistance.

Data Management and Analysis Procedure-

Information collected with the help of a data collection tool that was stored in the Microsoft excel sheet in the form of a master chart in the demographic information along with the scores of the outcome measures was included.

Statistical Analysis

Descriptive statistics was used to express various demographic parameters and effect of hand function recovery in patients with stroke.

Unpaired t- test was used to compare the parameters between 3 subgroups and effect of hand function recovery in patient with stroke.

III. Result-

Table 1: Gender wise distribution of Acute, subacute and chronic patients.

	Acute patients	Subacute patients	Chronic patients
Male	12	13	15
Female	8	7	5

Figure 1: Gender wise distribution of Acute, subacute and chronicpatients.

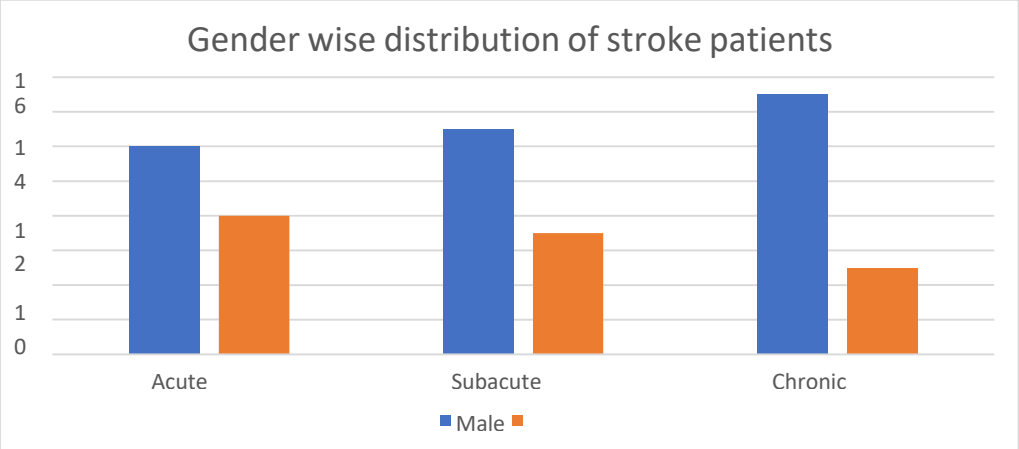

Table 2: Age wise distribution of Acute, Subacute and Chronic patients

	Acute	Subacute	Chronic
18-40	7	2	3
41-60	8	12	12
Above 60	5	6	5

Figure 2: Age wise distribution of Acute, Subacute and Chronic patients.

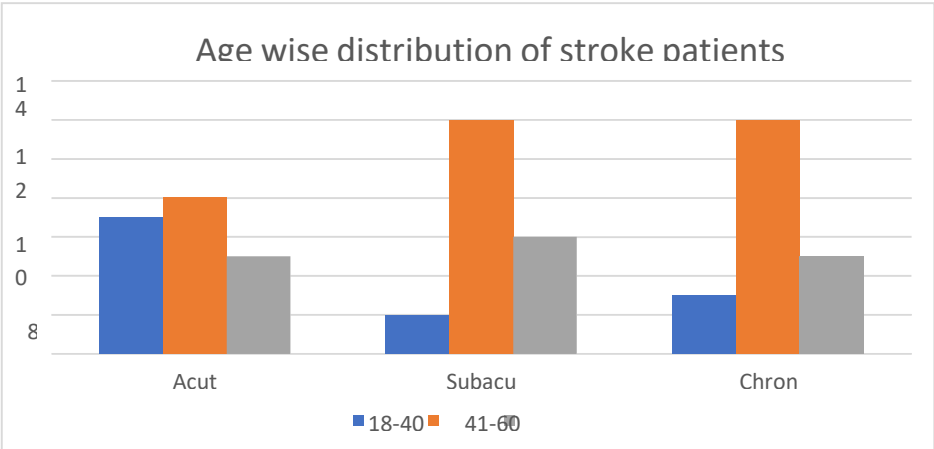

Table 3: Affected side wise distribution in Acute, Subacute and chronicstroke patients

Affected side	Acute stroke	Subacute stroke	Chronic stroke
Right	9	13	8
Left	11	7	14

Figure 3: Affected side wise distribution in Acute, Subacute and chronicstroke patients

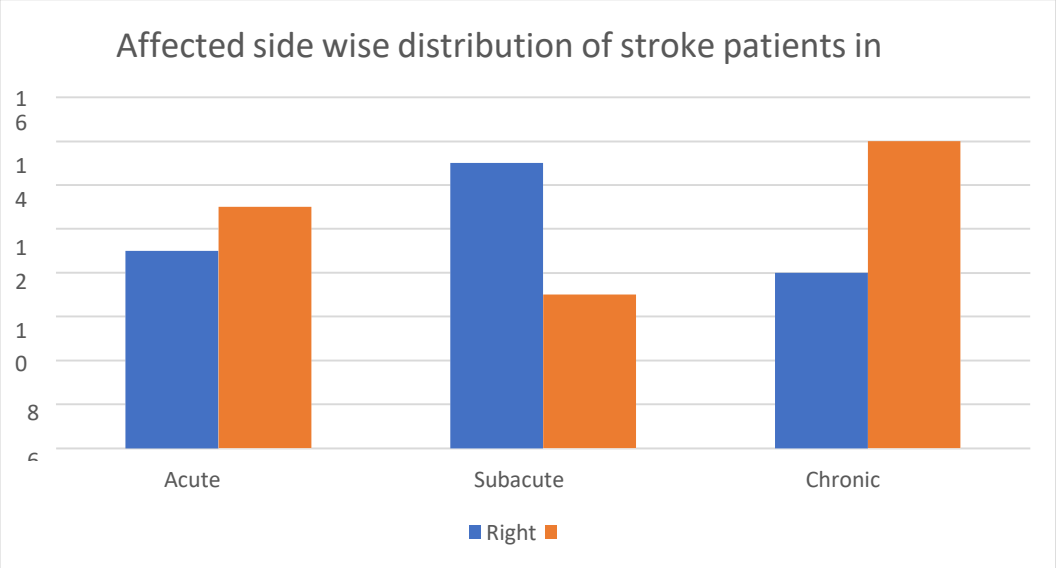

Table 4: Occupation wise distribution in acute stroke patients

Occupation	Total
Farmer	10
Driver	2
Accountant	3
Housewife	2
Shopkeeper	1
Govt. Servant	1
Factory worker	1

Figure 4: Occupation wise distribution in acute stroke patients

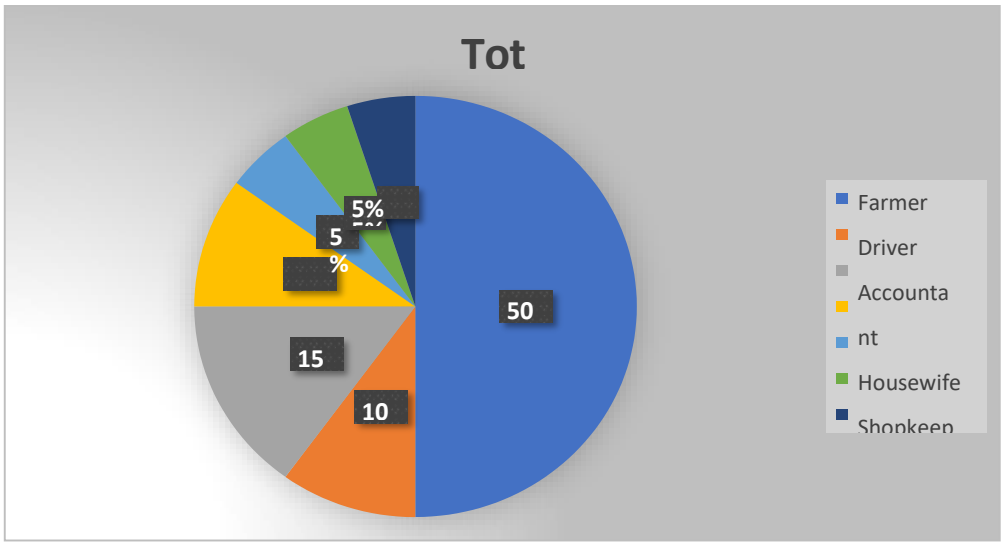

Table 5: Occupation wise distribution in subacute stroke patients

Occupation	Total
Farmer	11
Driver	0
Accountant	3
Housewife	3
Shopkeeper	1
Journalist	1
Army man	1

Figure 5: Occupation wise distribution in subacute stroke patients

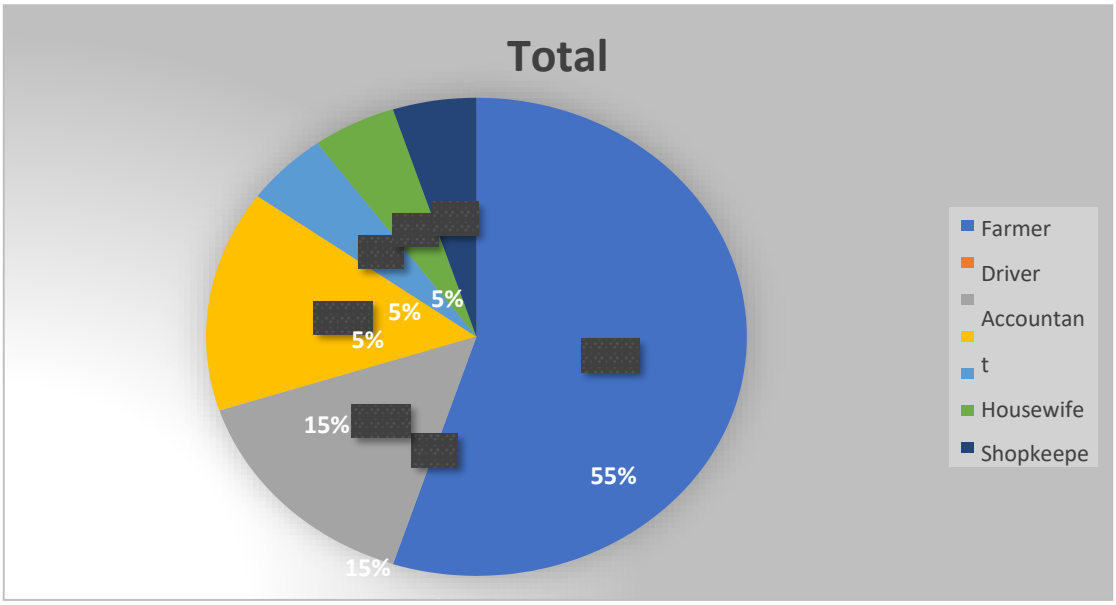

Table 6: Occupation wise distribution in acute stroke patients

Occupation	Total
Farmer	7
Driver	1
Accountant	2
Housewife	4
Shopkeeper	2
Doctor	1
Lift worker	1

Figure 6: Occupation wise distribution in acute stroke patients

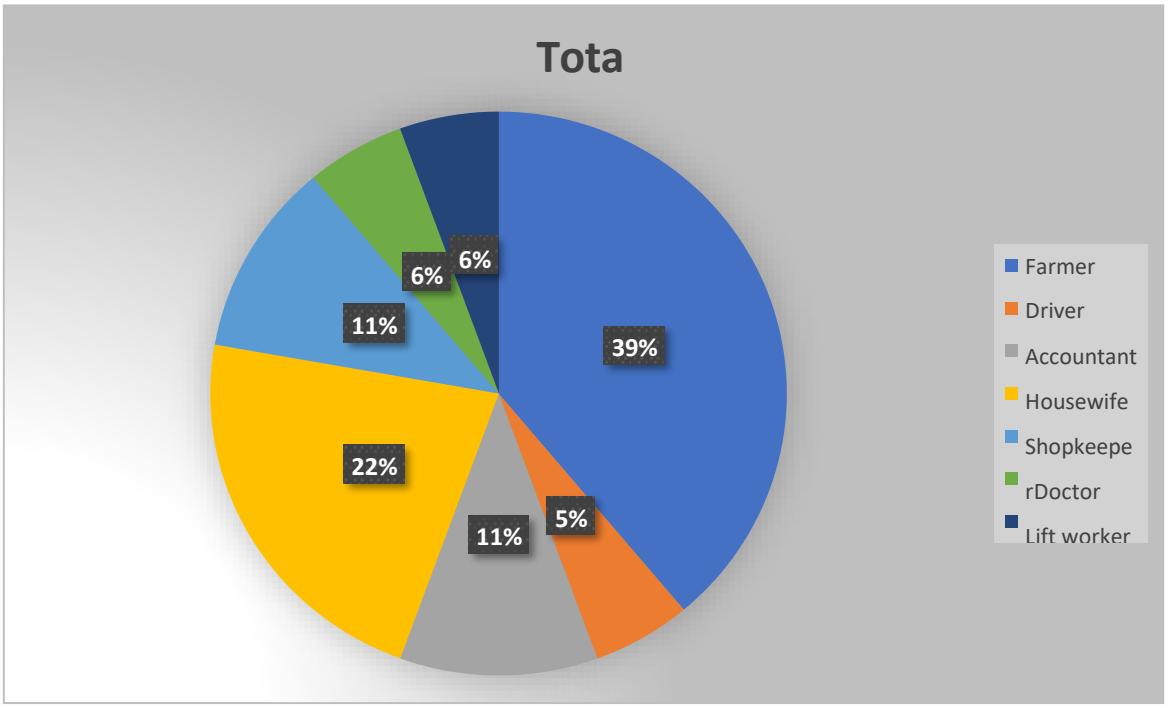

Table 7: Shows mean value of various parameters of impacts in acute,subacute and chronic patients with stroke.

COMPONENTS	Acute Stroke		Subacute stroke		Chronic stroke	
	Mean	SD	Mean	SD	Mean	SD
Writing	53.842	23.081	42.823	9.031	41.785	10.431
Stimulated pageturning	31.965	8.723	36.304	13.108	28.824	16.290
Stimulated feeding	52.211	22.125	49.931	21.503	40.793	22.072
Picking smallobjects	49.082	31.835	40.337	26.020	43.882	32.505
Stacking checkers	47.464	30.336	34.118	20.918	37.659	30.360
Lifting large emptyobjects	49.115	29.719	33.976	22.814	40.642	31.005
Lifting large heavyobjects	52.964	31.963	38.742	23.909	40.679	28.443

Table 8: Comparison of means of various parameters among acute, subacute,and Chronic patients with stroke.

Parameters	P value	Relevance
Writing	0.0069	Considered very significant
Stimulated pageturning	0.0045	Considered verysignificant
Stimulated feeding	0.0053	Considered very significant
Picking small objects	0.0033	Considered very significant
Stacking checkers	0.0099	Considered very significant
Lifting large emptyobjects	0.0111	Considered very significant
Lifting large heavy objects	0.0100	Considered significant

IV. Discussion-

The study describes the relationship between duration and hand function recovery using Jebson hand function test in patients with stroke. Hand function is evaluated by the Jebson Taylor test to measure the disability or limitation in activities of daily living. This is used to assess both hands separately. The time performance could be used to measure differently Upper Limb motor functions in patients with stroke. This study aimed for relationship between hand function recovery and duration of stroke.

Kathrin Allgower conducted study in (2017) on '**Fine motor skill predict performance in the Jebson Taylor hand function test after stroke**' They conclude that there is a structure behind fine motor impairments following strokeand showed that it explains JTHFT results to large extend.

Our study also shows that there is difference in time requirement for patients to complete the task in

different subgroups and showed that the most timerequired is for writing followed by lifting heavy objects and stimulated feeding.

B. Fabbri et.al. conducted study in (2021) conducted a study on '**A systematicreview on Psychometric properties of Jebson Taylor hand function test**' showed that the JTHFT is a useful measurement scale to evaluate manual dexterity in activities of daily living. It is important to use valid and reliable measures for evaluation. It has been suggested that performance-based outcome measures do not target the same constructs as patient-rated outcome measures, and are a vital part of comprehensive assessment.

In our study we have taken equal number of patients in each subgroups

i.e.20 patients and assessment was taken with Jebson Taylor hand function test and the time required for each component was noted .It was found that patients requires more time for performing fine motor activities from the affected side.

Anna Berardi et.al. conducted study in (2022) on '**Evaluation of PsychometricProperties of Jebson Taylor Hand Function Test (JTHFT) in Italian Individuals with Multiple sclerosis'** showed that the writing item, which requires much more time than the other items on the scale. Although no test usedin isolation can provide a realistic assessment of hand function, it is important toconsider the potential usefulness of JTHFT compared to other tests.

Our study also reveals that, in Jebson Taylor hand function test the most time required is for writing a sentence in patients with stroke which is followed by lifting heavy objects and stimulated feeding.

Daniel Simonsen et.al. conducted a study in (2017) on '**Design and test of an automated version of the modified Jebsen test of hand function using Microsoft Kinect'** the aim of the current study was to design and test a Kinect based system for automatic evaluation of the Modified Jebsen Test of Hand Function (MJT). the test showed that it is possible to use a Kinect based system to automate the MJT. the test-retest of the MJT demonstrated significant improvements in the performance time, indicating a practice effect.

The aim of our study was to find the duration wise analysis of arm-hand function and arm-hand skill performance in stroke using jebson hand function test. As we know , Stroke results in persistent impairment of the arm and hand due to a hemiparesis, which has a significant impact on performance in daily lifeactivities. The Jebson Taylor hand function test would help to know the requiredcomponent which is required to be focused on.

Mak MK et.al. conducted study in (2015) on '**Use of Jebson Taylor Hand Function Test in evaluating the hand dexterity in people with Parkinson's disease**'. They conclude that PD patients require more time to perform JTT whichsuggest that there is deficit in gross and fine functional dexterity.

Our study reveals that, in Jebson Taylor hand function test the most time requiredis for writing a sentence in patients with stroke. Then it is followed by moving heavy objects and feeding. In addition, the patients required a little less time for card turning. This is followed by small common objects and checkers stacking inwhich the time required is less and easy to performed and the least time requiredfor moving light object followed by stoke.

In our study we have taken equal number of patients in all the three subgroups i.e., Acute, Subacute, Chronic which is 20 patients each subgroup. Thecomparison between mean of affected side of each subtest show different relationin different subgroups. The study shows more time is required to write a sentencedue to spasticity in fingers and difficulty in two jaw chuck as patients are not ableto hold the pen or complete the sentence.

Secondly affected subtest is moving heavy objects that is due to the painor reduced strength. Then stimulated feeding requires to hold the spoon as there is spasticity in fingers the patients have difficulty in performing sub-tests. The patients take less time for card turning. picking up small common objects and checker stacking as this requires the whole hand and the spasticity of hands helpto perform this sub-test. The less time is taken by patients is in moving light objects as patient is able to perform even if spasticity is present.

As the study shows no or negative relationship between duration of stroke and hand function recovery in patients with stroke is maybe due to differenttype of stroke attack. Some patients may have mild affected area in the brain thanthe other patients. The factor is age group because the younger age group patientsshow good recovery rate than older group patients. Most patients with the strokeduration of more than 6 months shows more spasticity and recovery of hand maybe affected. The patients differ with brunnstorm recovery stage or spasticitygrade according to modified Ashworth scale and also in both gender the recovery may be different so this can also show different results of duration of stroke andhand function recovery in patients with stroke.

The study says that there is considerably significant relationship betweenduration of stroke and hand function recovery. There is positive relationship between duration of stroke and hand function recovery in patients with stroke.

V. Conclusion-

The study concludes there is positive relationship between duration ofstroke and hand function recovery in patient with stroke. The Jebson -Taylorhand function test shows that the most time required is for performing small dexterity movement which require fine movements and skills like writing, stimulated feeding. Also, the patients

find difficulty in lifting heavy large objects. The less difficulty is faced in performing task like card turning, stacking checkers, moving light objects, requiring use of all fingers and lessfine movement.
So, there is need to focus on small dexterity movements activities onpatients with stroke.

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